BY THE SAME AUTHOR

THE ORGANS OF INTERNAL SECRETION

A MANUAL OF NEURASTHENIA

AIDS TO ORGANOTHERAPY

HENRY VIII
(CASTLE HOWARD HOLBEIN)

[*Frontispiece*

THE
GLANDS OF DESTINY
(A STUDY OF THE PERSONALITY)

BY
IVO GEIKIE COBB, M.D.

SECOND EDITION

REVISED AND ENLARGED

ILLUSTRATED

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"I record, not history, but human destiny . . . I should be allowed to focus my attention upon those subjects which bear directly upon the spirit, selecting such matter as this to give my portrait from . . ."

PLUTARCH.

TO

MY FATHER

WHOSE KNOWLEDGE IS ONLY
EQUALLED BY HIS TOLERANCE

PREFACE TO SECOND EDITION

THIS book has been re-arranged and largely re-written. It has been divided into two parts, a plan which will enable the lazy reader, or one interested only in the conclusions regarding personality, to skip the first section and commence reading the book at p. 115.

Part I contains a summary of our knowledge of the Organs of Internal Secretion. It lays no claim to be a textbook of Endocrinology, neither does it aspire to more than a bird's-eye view of the subject. It is hoped, however, that sufficient detail has been included to enable the reader to understand the eight chapters which constitute Part II.

Among these chapters are some which were to be found in the original edition. There has been added a series of studies of eminent men and women, regarded in the newer light of personality. The task of selecting the subjects has been no easy one. The choice has fallen on those individuals whose types it has been possible to determine, and whose exploits have proved of sufficient interest to warrant their inclusion.

I am quite aware that many readers may question the deductions which have been arrived at; and I anticipate feeling once again the *mauvaise honte* which beset me after a lecture I had delivered to several hundred nurses, when questions were invited by the Chairman. There followed the usual rather uncomfortable silence; broken, after some minutes, by a young woman, who, stood up and asked: "I should like to know to what endocrine type the lecturer considers that he belongs?"

I can only assert that I have studied with care each character discussed in the chapter headed 'Personalities,' and that the conclusions arrived at have the balance of

probability on their side. Further than this, no one, in the present state of knowledge, can go. At any rate, it is considerably more than could have been accomplished at the time these worthies lived. The temptation to include a larger number has been strong: but, there is such a thing as an end to even a publisher's patience, so I have had to rest content with the modest portrait-gallery you will find here.

My thanks are due to Messrs. Heinemann for their generosity in allowing me to include the illustrations; to Dr. Donald Paterson for the photographs of a cretin; to Dr. Leonard Williams for that of a girl suffering from hyperthyroidism; to Mr. Bertram W. Mills for the excellent likenesses of a giant and a dwarf; and to the Rischgitz International Art Supply Agency for certain illustrations.

I. G. C.

Weymouth Street,
W. 1.
Jan., 1936.

PREFACE TO FIRST EDITION

THE following pages attempt to describe an important aspect of personality. What may be called the physical or chemical contribution to the individual is here discussed, albeit imperfectly.

It has seemed legitimate to emphasise that the personal equation is determined by tangible causes, as well as by factors which are more or less abstract. The psychological aspect of personality has been discussed in many works. It has only been possible to consider some of the physical factors which contribute to the formation of character; but of these, none contribute so vitally as the glands of internal secretion.

There are still many blanks in our knowledge of these structures and their work; but sufficient is now known to warrant a survey of their functions, particularly in relation to that psychological mixture which we know as personality.

It is hoped that surmise has not outrun its legitimate course in this book. Wherever possible, facts of physiology are distinguished from assumptions based thereon. References have been ruthlessly omitted, in the belief that the peppering of a volume such as this with countless footnotes and divers titles would do nothing to help the reader.

A bibliography has been inserted at the end of the book. This is by no means exhaustive, but contains the titles of some of the best-known works on the Internal Secretions, as well as books, leaflets, and journals consulted during the compilation of this volume.

To the authors of these works I offer my grateful thanks. I have tried to acknowledge the source of all

quotations, without burdening the reader by offering the chapter and verse of their origin.

It is hoped that this book will stimulate an interest in what must always be a subject of paramount importance, namely, personality. The workings of the human body are always full of interest; but a knowledge (however slight) of bodily mechanism makes them possess a wider and deeper significance.

I. G. C.

QUEEN ANNE STREET,
June, 1927.

LIST OF ILLUSTRATIONS

PROLOGUE

HOWEVER unusual it may be to find a Prologue in a work of this kind, the reader must regard it as an *apologia pro libro meo*. If, perchance, he has perused the Preface to this edition, he will already have realised that, in this book as in real life, the powder comes before the jam. In case he has not (and to render the previous sentence intelligible), I will repeat that Part I. gives a more or less literal account of the internal secretions: while Part II. is concerned chiefly with the manner in which these chemicals affect life. It may possibly be regarded as less uninteresting than its predecessor.

The pages which separate the Prologue from the Epilogue will, it is hoped, make the reader pause and dwell on that amazing machine—the human body. With the object of bringing about this happy state, I have tried to write Part II. in as simple words as I could find. I have also endeavoured to make it as interesting as a reasonable adherence to truth rendered possible.

The reader may wonder why a Prologue as well as a Preface is deemed necessary. My reply to this is that I wished him to be familiar with the *motif* of this book; and I have a shrewd suspicion that most people skip Prefaces. For this reason, I inserted a Prologue in the hope that such an unusual feature would at least attract sufficient curiosity to lead to its perusal.

Any reader, who has read as far as this, is now entitled to turn over the page, or to proceed to p. 115, just as the fancy takes him.

THE GLANDS OF DESTINY

CHAPTER I

INTRODUCTION

1

GLANDS may be divided into two groups, those which are concerned with the drainage system—the lymphatic glands—and those which *secrete* products for use in the bodily work. The lymphatic glands do not concern us here. The function of the second group is to contribute fluids which, acting in concert with each other, control and regulate the bodily processes; it consists of two subdivisions.

The first of these contains glands with ducts, down which they discharge their contents. The second possesses no ducts, and their secretions are absorbed directly into the blood stream. These are known as the *ductless glands*, or "endocrine organs," and their products have been called *internal secretions*.

The term "endocrinology" has been applied to the study of the glands of internal secretion. The chief among the endocrine glands are the thyroid in the neck, with its small neighbours, the parathyroids; the pituitary in the brain; and the pineal, which is situated close by. The adrenal glands are found in the abdomen, one above each kidney. In both sexes the genital organs have been shown to possess an internal as well as an external secretion. The thymus gland is situated in the chest, and is related to the great blood vessel, or aorta, which proceeds from the heart; it is generally counted among these glands.

It must be recognised, of course, that any tissue is

probably capable of forming some secretion which may be poured into the blood; but for our present purpose, we are considering those structures which, while they are glandular structures and possess no ducts, yet have been shown to influence the mental and bodily state of the individual. Their function has been worked out by experimental evidence; removal or suppression of the secretion of these glands leads to definite bodily and mental changes; and it is from evidence thus obtained that the proof of the existence of internal secretions has been established.

Destiny has been defined as that act or condition to which any person or thing is destined or fated. There can be little doubt that the glands of internal secretion play a most important part in the determination of the destiny of the individual; and the more we learn about the action and the function of these important structures the more do we realise the truth of this. For this reason, the phrase "glands of destiny" has been utilised for the title of this book.

In many works dealing with personality the influence of the physical side is entirely ignored. In some it is tacitly admitted, but very little emphasis is laid upon the ductless glands. In one book, where personality is defined "as the result of all those qualities, physical and mental, which are united in one individual," there is only the briefest of reference to the ductless glands, and their business is dismissed in a few paragraphs which mention their existence, but state that only to the sexual and thyroid glands can be attributed any appreciable effect upon mentality. In the past so little was known of their action that it was not possible even to recognise grave disorders of the glands, much less their effects on the personality. With the discovery of the ductless glands and their secretions some clear-cut types of personality can now be recognised. The thyroid, when in excess or deficiency, produces two different mental pictures; this is also true of the pituitary. Although we

are only on the fringe of the subject, there are other personalities which are worthy of consideration, although our descriptions must rest largely on surmise.

The purpose of this book is to show the relation between the internal secretions and the human being. The action of the glands in determining the bodily build is indisputable; and the mental outlook—the "behaviour complexes"—appears to depend to a large extent on the glandular pattern peculiar to the individual; while the physical well-being undoubtedly depends upon the successful action and interaction of the various internal secretions.

Many of the statements are put forward as hypotheses which have considerable evidence behind them. It is hoped, however, that the perusal of this book will enable people to think for themselves, and to realise that much which has hitherto been attributed in a vague way to the mind, is now capable of a more tangible and, perhaps, a more acceptable explanation. More and more are we beginning to realise that healthy life consists in the proper functioning and co-operation of the glands of internal secretion. Personality is moulded not entirely by, but with the co-operation of, these secretions.

2

We are all familiar with the term "personality" and with its everyday meaning. It is the sum total of the individual. It comprises the mental characteristics—the thousand and one tricks and mannerisms—as well as the general type of character which we attribute (sometimes wrongly) to the individual. The physical build, the facial appearance, the way in which he stands, laughs, and sits, are all parts of the whole.

It appears that there are types of personality in which one of the glands is the dominant factor in determining the personality of the particular individual. For example, there is a type in which the thyroid gland is the most active of the endocrine organs; and we may come to

recognise a " thyroid " personality as one whose destiny is controlled by the activities of this gland. Again, we can analyse, and place in groups, individuals who are as they are because they are controlled by their adrenals, pituitary or thymus.

From this a new terminology has arisen in the recent literature on the subject, which contains such phrases as " adrenal-centred," " thyroid-dominant," and " thymo-centric." These imply that the particular gland is controlling the individual concerned, and that it is, so to speak, the " top-dog " among his ductless glands. Looked at from another angle—one which we may term the psychological—we can speak of people considered from the viewpoint of their mental make-up ; and refer to them as alert, moody, taciturn, irascible, and a host of other types distinguishable by their general standard of behaviour.

We might regard a man of forcible character—one who knows what he wants and gets it—from the angle of mental characteristics, and refer to him as a " teleologist " ; if we attempted to classify him from the endocrine standpoint, he would be dubbed an " adrenal-dominant " personality.

So it is with other types. Deductions drawn from disordered states of the body and their accompanying characteristics, as well as information derived from experiments, have indicated the types of personality which emerge from particular physical conditions.

The definition of the term " personality " will help us to bear in mind what we mean by its use ; but our task here is to attempt to show what goes to the making of a personality. It is unnecessary to add that it is not possible in the present state of our knowledge to speak dogmatically as to the exact features which constitute each particular type of personality, neither are we yet in a position to assess in accurate detail the relative contributions which an individual's endocrine organs make to his personality. We can only say what are the

characteristics which we believe to accompany, in most instances, a deficiency or excess of one particular gland. We cannot even do this in every instance ; for, so complex is the balance, and so transitory is the response of these secretions to stimuli rising from within (as well as from sources outside) that it is impossible to define the relative activity of all such influences.

3

Personality has been defined as the individuality which makes a person what he is or differentiates him from all that he is not. We are not concerned here with the meaning inherent in the term from the philosophical standpoint. This relates the individual to the state, and lays stress upon the moral worth of the personality in this relation.

The psychological use of the term is, however, directly pertinent to our present purposes. This aspect concerns the facts of personality, and deals with the consciousness of the individual. The individuality consists in the recognition of the " I "—a man's consciousness of the unity of his " self." From this viewpoint the consciousness is in " the subject-object relation, in the distinction between the external world and the subjective processes of knowing and willing which that relation involves." " The most elementary form of human self-consciousness includes in the self not only the soul, but also the body, while to the developed self-consciousness the physical self is part of the external or objective world."

We are concerned, moreover, with something wider than the psychological conception of the " self," although it will repay us to commence by obtaining a clear grasp of the problem of personality, in order that what follows may be made clear. The self, it must be conceded, is a changing entity, in a world of change. " In short, we discover that in a world of change, the self is a changing thing, that it is continually taking in new and excreting old material, and that it never continues in one stay. . . ."

The definition given by William James will serve our purpose as well as any other: "In its widest possible sense . . . a man's life is the sum total of all that he can call his, not only his body and his psychic powers, but his clothes and his house, his wife and his children, his ancestors and friends, his reputation and works, his lands and horses, and yacht and bank account. All these things give him the same emotions."

If we regard the self as the centre of a wider personality, as a nucleus of a broader realm, we shall see that to the self there are attached many microcosms. Man's relation to the outer world is bound to be a changing one; but in general, the manner in which he reacts to his environment is more or less stable, certainly for a measurable length of time. This constitutes one aspect of the personality. Another relation of the "self" is also variable, and consists in the changes in the mental background of an individual.

Temperament, which we may regard as "a special type of mental constitution and development, or mixture of characteristics, supposed to have its basis in the bodily organism and to be transmissible by inheritance," may be contrasted with "character," which is the "individuality"—the product of nature, habits and environment.

To present the difference between character and temperament in another way, we might define the former as an entity which is the result of environment acting upon inherited tendencies, the latter as the mental disposition with which the individual is born.

Galen, who was responsible primarily for the development of the doctrine of temperament, recognised four varieties: the full-blooded, or sanguine; the phlegmatic, which is quiet and slow; the bilious, or choleric, which is energetic and predominantly objective; and the melancholic, "which is sentimental and with a marked tendency to subjectivity in excessive forms." In more modern days, we hear of the "extrovert" and the

" introvert " ; and of classifications of character which have emerged from the modern schools of psychopathology. Greater stress is laid nowadays upon the reactions of the mind to external stimuli ; the *state* of consciousness has given place to a *stream*.

The doctrines of Galen and his successors in the study of temperament have been replaced in recent years by theories which lay more stress upon the purely psychic nature of the personality, disregarding (or nearly so) any part which the body plays in its production. The disciples of these schools concentrate upon the concept of the mind and its reaction to stimuli, both those emanating from within and those reaching it from without. They believe that the character is built up by reactions of the mind *per se* to the ever-changing world without ; and that the complexes which result are what have most to do with the personality. This view, it must be noted, is purely psychological ; that is to say, it regards the whole question primarily as one of mentality. Mind comes first and foremost. Its workings influence the body, not *vice versâ*. A dislocation of its functions results in a " nervous breakdown "—a failure of adjustment of the individual " psyche " to its surroundings.

We must now turn to an entirely different viewpoint, and one which, strangely, takes us back towards Galen's classification.

The hypothesis which underlies the beliefs of the endocrine school rests upon the addition of much new physiological material to the tenets of Galen and his followers. But with this difference, that Galen recognised temperaments as falling into several classes, but he was not in a position to say what physical processes were concerned in the formation of these classes. That he recognised some of the underlying physical processes is shown by his choice of names. The *melancholic* (which means " black bile ") was obviously associated with the liver and its functions ; the sanguine was suggested by the full-blooded individual. All through the ages types

of personality have been described; and, in many instances, it will be recognised that these are associated with bodily configuration. Shakespeare's writings abound with such descriptions; and many of these show that he was fully alive to the more or less constant association of certain mental traits with certain bodily types—"fat, sleek-headed men and such as sleep o' nights" were regarded as safe and were contrasted with "Yon Cassius," who had a lean and hungry look; "he thinks too much: such men are dangerous."[1]

4

The science of endocrinology takes us many steps further in the study of personality; and this it is enabled to do by recognising the definite mental traits which accompany certain characteristic physical patterns.

The nature of the organs of internal secretion and their functions will be described in subsequent chapters. Our purpose here is to point out how the study of the ductless glands has linked up the older views of Galen with purely psychological conceptions.

Professor J. S. Huxley hints how it is possible nowadays for a man to mould his temperament. "There are scores of ways," he says, "in which biology can now, or will eventually, affect practical life. . . . Greater knowledge of physiology will doubtless enable us to modify the processes of our bodies more in accordance with our wishes—to stimulate our faculties when we need high-tension work, but without evil after-affects; to relax them without the use of harmful soporifics.

"It seems clear that temperament, even more important than pure intellect in achieving success, is largely an affair of the balance of the various glands of internal secretion—thyroid, pituitary, and the rest. It may well be that the applied physiology of the future will discover how to modify temperament.

"Many men of sedentary life came back from the war

[1] "Julius Cæsar," Act I., Scene ii.

with altered temperaments. Glands responded by increase of function, and a new equilibrium was set up which they preferred to the old; and consciously or unconsciously they refused to let it fade out when they returned, but adjusted their mode of life so that it was continued on a different plane."

This quotation suggests what may be achieved in the future; but it cannot be said that science is yet able to mould the personality. It is only in recent years that the existence and functions of these glands have been discovered. Attempts have been made (in certain directions successfully) to modify by treatment mental states which were considered abnormal to the individual; and this treatment has been carried out either by psychological methods or by purely physical procedures; in either case both mind and body have taken part in the changes.

Changes in the mental make-up have been correlated with altered secretions; and in the case of some of the glandular activities the associated mental side is now able to be recognised. In other words, it is now possible to define and recognise to some extent the mental characters which are associated with the predominance of a particular gland. That shock, mental strain, and physical diseases are capable of upsetting the endocrine balance is now universally admitted. The war demonstrated this fact in a superlative degree. We shall see in a subsequent chapter that one of the functions which is among the most important of the endocrine glands is to assist in the adaptation of the individual to the surroundings in which he finds himself at any one time.

The man engaged in a sedentary occupation was pitch-forked by the war into a life as different from his former as could well be imagined. One of two things happened. Either he adapted himself by means of his ductless glands to his new environment or he failed so to do, and a "nervous breakdown" resulted.

In both instances his personality changed: in the former, by virtue of the alteration in what has been called

the "endocrine pattern," and the successful adaptation which ensued; in the latter, the emotional strain made adaptation impossible for such an individual, and he was unable to keep pace with the almost constant demands which were made upon his nervous system. As a result he suffered from symptoms of this, which were generically labelled "neurasthenia" or "shell-shock."

It is now possible to describe certain definite personalities, which correspond, albeit roughly, with the preeminence of one endocrine organ. These results have been made possible by the study of excess or deficiency of one secretion in individuals where the diagnosis has been established. These conclusions, which have led to an attempt to sketch personalities depending upon an endocrine pattern, are, at present, merely tentative. There are instances in which an individual's general characteristics correspond closely to those known to be present in a disease of a certain endocrine organ. A good example of this is *acromegaly*, where the patient's features always conform to a certain type.

It is not, therefore, unduly stretching a point if, when we see a man with large hands and feet, bosses of bone over the eyes, large jaw and prominent nose, we decide that the same endocrine dominance is present, as is *known* to be the case in acromegaly.

It is not contended that all personalities are as definite as this. The majority rest, at present, more upon surmise than established fact.

If, however, you wish to consider a personality which is not indefinite, glance for a few moments at the frontispiece. Whatever faults Henry VIII. may have had, at least he was positive. Until his endocrine glands degenerated and he lapsed into senility, his mental equipment was evidence of what the psychologists call an "integrated personality." In plain words, he knew what he wanted—and what is just as important—knew how to get it.

His physical characteristics and glandular pattern are

dealt with in a later chapter. Here I wish to discuss very briefly his earlier life, and to draw your attention to the changes which had occurred by the time he had reached middle-age. The portrait you are, I hope, looking at, represents this monarch at the age of fifty-one, and is described by Dr. Paul Ganz—the greatest living authority on Holbein—"as the only ceremonial portrait of King Henry VIII. known to-day, painted by his celebrated Court painter, Hans Holbein." In a most interesting conversation I had with Dr. Ganz, he described the various layers of paint which had been superimposed on the original portrait, and which had to be discovered by means of X-rays, then uncovered by other means. Various owners of the portrait, finding that the colours were unsuited to the scheme of the particular room in which it was hanging at the time, had caused it to be touched up to match the furniture.

By the time Henry had reached the age of fifty-one, he was already showing signs of endocrine failure. Before he developed the appalling obesity which characterised his later life, and prior to the appearance of the ulcer on his leg, Henry was a fine figure of a man. Standing, perhaps, 6 foot 4 inches in height, he was physically powerful, excelling in the gentle art of wrestling, and able to throw most of those rash enough to accept his challenge.

His height bespeaks a pituitary which was extremely active during the years of growth, and suggests a puberty late to arrive. Although Henry was betrothed to his deceased brother's widow at the age of twelve, he did not marry her for several years. His early manhood was occupied with sport and war, further evidence that his tastes were those usually associated with an active pituitary, reinforced by those glands which create manliness and virility.

Soon after his succession to the English throne Henry crossed the Channel with his army, and took part in the successful sieges of Therouenne and Tournay. Even at this time, however, his interest in less vigorous pursuits,

such as reading and music, indicated the presence in him of another strain.

This other side of his character was to wax as his life proceeded, while (in spite of his matrimonial tragedies and their sequelæ) the essentially masculine waned. Although Henry flouted the Church, he was a religious man. He composed ecclesiastical melodies, played musical instruments, and supported the Arts.

It is interesting to compare the change in his character which old age produced. While advancing years invariably bring with them the desire for less exacting occupations, in Henry's case this was unusually well marked. His posterior pituitary—in submission during young adult life—gradually equalled, then dominated, the anterior. A further stage was reached where, I assume, both the pituitary and thyroid began to fail.

The last few years of his life—he died at the age of fifty-six—were marred by the gradual eclipse of all his endocrine glands. But—in his prime—Henry was an anterior pituitary personality, possesssing the powerful body which such a type invariably does. That he suffered from an inferiority complex is suggested in the more detailed study of Henry VIII., which will be found on p. 221.

CHAPTER II

THE DUCTLESS GLANDS AND THEIR SECRETIONS

1

In the previous chapter some of the aspects of personality were discussed, and it was indicated that the modern view of this subject rests largely upon the presence and functions of the ductless glands. In this chapter it is proposed to give a general outline of the glandular system, but to defer the discussion of the individual glands to subsequent chapters.

The ductless, or endocrine, glands consist of a certain number of glandular structures in various parts of the body containing no duct or passage through which the secretion can be poured. They have come into the realm of practical physiology only in the last few years. It is, however, plain that certain of them were recognised many centuries ago, but no definite function attributed to them. In other words, they were regarded as of no specific importance to the bodily functions.

The lymphatic glands are totally different in function to the endocrine glands. The former act as an infiltrating network which catch microbes or their products and prevent them from entering directly into the circulation. A cut or prick in the finger may be followed by enlargement of the glands in the armpit; more especially if the instrument which effected the injury was dirty. Were it not for these glands intercepting the poison it would gain direct entry into the blood. These glands, however, are nothing to do with those other structures whose function is to manufacture secretions which are necessary for some bodily activity.

The secreting glands are, in turn, divided into those with ducts and those without. Both consist of groups of cells which manufacture and supply substances needed by the body for some part of its work. In the case of the former there is a duct or passage, down which the secretion passes to reach its destination; while the latter organs have no such mechanism, and their products have to be absorbed directly into the blood-stream as it passes through the gland.

There are also in the body structures, of which the pancreas or sweetbread is an example, which manufacture both an external secretion (*i.e.*, one that is poured down a duct) and an internal secretion, which is absorbed directly into the blood.

The purely endocrine organs, of which the thyroid is an example, have no duct and give off their secretion to the blood as it circulates within the cells of the gland. An endocrine gland, therefore, is essentially one that has the power of taking certain materials from the blood and manufacturing a product specific to that gland (and which is not manufactured by any other gland in the body), and delivering it to the blood as it circulates.

Examples of the first kind of gland (namely, the lymphatic gland) are those present in the neck which undergo enlargement in infections of the throat, tuberculosis, etc. Examples of the second kind, as we have already said, are the pancreas or sweetbread, the sexual organs, and many others. Examples of the third kind are the thyroid, pituitary, and adrenals.

Endocrinology—that is to say, the science of the ductless glands—may be described as the study of the various secretions manufactured from groups 2 and 3 and their inter-relation in metabolism.[1]

There are certain terms in current use in connection

[1] Metabolism is the act or process by which, on the one hand, the stable non-living food is built up into complex and unstable living material, and by which, on the other hand, the living matter in protoplasm is broken down into the complex and more stable substances within a cell or organism.

with the study of the ductless glands, and it may be wise to define and deal with the meaning of the chief of these before we proceed to the description of the individual glands.

The ductless glands are sometimes spoken of as the endocrine organs, or the organs of internal secretion. These terms, however, are, strictly speaking, not interchangeable, for some of the glands with ducts possess also an internal secretion, and are not, therefore, solely ductless glands. For practical purposes, however, the term *ductless glands* includes any *gland* with an internal secretion, even if it also possesses another secretion which it delivers through a duct.

The secretions themselves which act through the blood are spoken of as hormones, from a Greek word meaning "to excite." As, however, some of these are inhibitors—*i.e.*, act as depressors—it has been suggested that the term *autocoid* should be used generally for all internal secretions, the word *hormone* being reserved for a secretion which excites, while *chalone* should be used for one which inhibits. In this book it will serve no useful purpose thus to divide the chemical products of internal secretory organs; and the term "hormone" will be used to connote any internal secretion.

It is becoming more and more apparent that the form of the human body and the characteristics which make it possible to recognise an individual from the hundreds who resemble but yet are dissimilar, are due to the particular arrangement of the endocrine glands which that individual possesses. Presented by heredity with a given pattern, and allowing for the environmental influence of climate, soil, and diet, the subsequent development of the child depends upon how his endocrine organs react to these influences. The ailments incidental to childhood leave their mark upon his ductless glands, and it is often possible to trace how subsequent development has been affected by an infectious complaint. The incidence of such a disease as rheumatic fever sometimes changes the

rate of growth, the functioning of the great systems of the body, and consequently the type of the individual. We hear that a certain child has never been the same since he had, for example, typhoid. The child may have been growing fast, and promising to be tall, thin, slow-witted and matter-of-fact. From the date of his illness he becomes slower—mentally and physically—and ceases to grow; alternatively, he may grow all the faster and develop different tastes. It all depends which of his glands are stimulated and what fresh endocrine kaleidoscope is instituted.

2

The thyroid gland has been called the "corner-stone of the endocrine system." Although it is considered in some detail in the following chapter, a few introductory observations will makes its importance apparent.

This gland is situated in the neck and can be seen and felt at either side of the prominent cartilage, which is known as the "Adam's apple." It has no duct, and its secretion is poured directly into the blood. Normal people, to remain normal, must always have a minute amount of the thyroid output in their blood. More is known about this gland than about any other of the endocrine system.

Congenital absence of the thyroid produces what is known as a *cretin*. Acquired deficiency results in a type of individual bearing a distinct resemblance to the cretin, but in a much less marked degree. We have most of us seen a cretin, and we must have observed the peculiar development which takes place as the result of this lack. Such a child looks prematurely old; he fails to grow, he is dry and shrivelled in appearance, and his mentality is either that of an idiot or at best is far below the standard. But he can be turned into a normal human being by the administration of thyroid extract manufactured from animals.

Berman draws a vivid picture of such a child rendered

A CRETIN BEFORE AND AFTER ONE MONTH'S TREATMENT

[*Facing p.* 18

normal by this treatment. He grows into manhood and is cast away on a desert island a normal individual, but with a limited supply of his medicine; gradually, as the supply wears out, the symptoms of deficiency emerge and he changes before the eyes of his wife into the condition from which he had been rescued many years before.

At the other extreme, we encounter cases where the thyroid secretion is overactive. The individual is blessed with an excess of thyroid substance, and the picture may be described as diametrically opposite to that of the cretin. Instead of a slow, small individual with a deficient mind, we encounter an alert, bright individual, one of a "highly-strung" emotional type. Something like this (but the exact picture has never been imitated) can be produced by overfeeding with thyroid substance. The administration of thyroid substance may be likened to pulling out the damper in a stove—the fire roars and combustion is increased. In like manner the general nutrition of the individual is altered; combustion of material in the body is increased, and there tends to be a loss of weight and a hastening of the processes of tissue waste.

In these two examples we get a glimpse of how this gland may affect the personality.

It is a well-recognised fact that overaction of the thyroid is associated with a change in the mentality of the individual. From a normal person (by this I mean one who does not stand out from his fellows), the unfortunate sufferer becomes irritable, unreasonable, and unduly emotional. Just such a condition can be observed where thyroid feeding is taking place. It may be that the medicine is prescribed for some reason other than an apparent lack in the blood; for it is possible to use this substance just as one uses any inorganic chemical—*i.e.*, as a drug, merely for its medicinal effects upon the body. For example, it is often prescribed for arthritis. Sometimes doses larger than the individual can tolerate are administered, and

the results may be seen in the change in the temper of the patient—which change, it must be added, is, mercifully, by no means permanent.

3

Above each kidney is situated a small ductless gland known as the adrenal body. The function of these glands is of great importance to the individual; the presence of their secretion in the blood is imperative to life, removal or destruction of both glands resulting in death, although man or an animal is able to survive with only one adrenal.

Until the time of Thomas Addison these glands were regarded as useless, and it remained for him to describe a disease affecting these organs and to trace its symptoms to their destruction. We now know that this gland is in intimate relationship with the thyroid, pituitary, and sexual glands. We shall be discussing the adrenals in greater detail in a subsequent chapter; they are mentioned here solely to include them in a general consideration of the relation between ductless glands and personality.

One of the chief functions of the adrenals is to supply energy in an emergency, and it is this secretion which enables a man in times of stress to put forward the strength of ten. Liberation of this secretion is intended for use, as it has been put, for *flight or fight*. The mechanism is somewhat as follows: An emotional stimulus originating in the mind, and travelling *vid* the sympathetic system to the adrenals, increases the output from these glands; this leads to the mobilisation of sugar (necessary for the production of increased energy), which, in turn, leads to a stimulus to the circulation and the possibility of rapid output of energy. For example, a man is crossing the road and he suddenly awakens to the fact that a motor-bus is bearing down on him. It is common knowledge that he "skips" aside under the stimulus of fright at a far greater pace

than he could do if he attempted that effort without the stimulus of fear behind him. It is the adrenals which produce the energy necessary for a sudden effort such as this.

Accompanying this increased energy there are signs (which are familiar to us all) such as increased rate of breathing, "bumping" of the heart, widening of the pupils, the look of fear, and in some cases the breaking out in a cold sweat. These are due to adrenal output in association with that part of the nervous system which is most concerned with emotion, namely, the autonomic.[1] According to the efficiency of this system in an individual so will his emotional life largely be shaped.

The adrenal glands are in close sympathy with the thyroid, for it is to them that some of the signs (which formerly were believed to be due to overaction of the thyroid) are due. In the disease known as *exophthalmic goitre*, there is, among other factors, overaction of the thyroid gland. This is shown by an increase in size of the gland, which can be noticed in the neck at either side of the "Adam's apple." Patients with this disease are always very much on the alert, they are quick "in the uptake," as the saying is; have a restless, fidgety expression, and are unable to settle very long at anything. Their eyes are prominent and have the appearance of a constant stare.

It will readily be admitted that these symptoms are similar to the symptoms of fear we have already discussed in connection with the adrenals. That there is a close connection between these two glands has been known for many years; and Trousseau describes a case of a lady who was suffering great grief for the death of her father and had been crying for a long time; she suddenly felt her eyes "swell and lift up her eyelids," and this was accompanied by throbbing and enlargement of the thyroid.

[1] See Chapter VIII.

That acute grief or sudden shock can affect these glands sufficiently to upset their normal working is apparent, and many of the cases of nervous breakdown encountered among soldiers during the war were due to a mental shock upsetting the endocrine balance.

4

At the base of the brain there is a small gland called the pituitary. It is situated in a little bony cup which, because it is supposed to be shaped like a Turkish saddle, is known by anatomists as the *sella turcica*. This gland is about the size of a green pea and is connected to the brain by a hollow stem. Its functions are many. It is concerned with the utilisation of food, with the processes of growth, and it bears an intimate relation with the sexual development. It is divided into two lobes, an anterior and a posterior. There are certain well-recognised diseases which owe their origin to disturbance of one or other part of this gland. Over-activity in early life is believed to lead to gigantism; when it occurs in later life, to a disease called *acromegaly*. Under-action of this gland produces very characteristic features. The best-known example is the fat boy of the "Pickwick Papers," who obviously suffered from the disease which now bears the formidable name of *dystrophia adiposo-genitalis*. The picture which Dickens drew is so clear that the physician of to-day would have no difficulty in diagnosing this boy's complaint if he passed him in the street.

Curiously enough, in many of these endocrine disturbances a slow and heavy body is accompanied by a like state of mind. We shall recall that Joe was always sleepy—in fact, his somnolence was one of his chief characteristics.

It is believed that the rhythm of sleep is in some way controlled by the action of the pituitary. An under-active thyroid leads to a similar condition; only the accompanying symptoms enable the physician to diagnose between an under-active thyroid and an under-

active pituitary. There is evidence to believe that certain diseases (of which one is called *diabetes insipidus*) are concerned with the pituitary.

Overgrowth, such as occurs in giants, is associated with enlargement of the pituitary, and it is said that the Irish giant, O'Bryan, had a pituitary gland as big as a hen's egg. His skeleton is preserved in the College of Surgeons in London, and the following account occurs in the catalogue :

" The articulated skeleton of Charles Byrne, who was exhibited in London as ' O'Bryan, the Irish Giant,' and died in 1783.

" The following record of the death of the individual to whom this skeleton belonged is extracted from the ' Annual Register or Chronicle,' June, 1783, vol. xxvi., p. 209 :

In Cockspur Street, Charing Cross, aged only 22, Mr. Charles Byrne, the famous Irish Giant, whose death is said to have been precipitated by excessive drinking, to which he was always addicted, but more particularly since his late loss of almost all his property, which he had simply invested in a single banknote of £700.

Our philosophical readers may not be displeased to know on the credit of an ingenious correspondent who had opportunity of informing himself, that Mr. Byrne, in August, 1780, measured eight feet ; that in 1782 he had gained two inches, and after he was dead, he measured eight feet, four inches. Neither the father, mother, brother or any other person of the family was of an extraordinary size.

" The above-named heights are evidently exaggerations, as the actual height of the skeleton, in which due allowance appears to be given for the intervertebral substances, is only slightly above seven feet eight inches . . . the bones of the cranium are thick and massive . . . the frontal region is low and retreating, and the cranial cavity small for the external size of the skull. The pituitary fossa was found to be large."

It is said that O'Bryan dreaded dissection by John Hunter, the famous anatomist, and had therefore arranged

with several of his countrymen, shortly before his death, to carry his corpse out to sea and sink it in deep water; and that Hunter bargained with the undertaker for the recovery of the body, which was taken to Hunter's house in Earl's Court. He is stated to have paid £500 for the body. The skeleton with one of the giant's boots can be seen at the museum in Lincoln's Inn Fields.[1]

5

Among the glands of internal secretion, none are more important than the generative organs or the sex glands. The word "gonad," which comes from the Greek and means "seed," has come into use in recent years to describe any of the sexual organs. The problems which attach to these glands are enormous and fascinating.

What causes sex, and what determines whether the child *in utero* is a male or female? According to Biedl, in some of the lower animals, there are two different kinds of male elements present, and it is thought that one of these produces a female and the other a male. In a small worm known as *Dinophilus apatris* eggs of two different sizes occur; from the larger of these females develop, while males proceed from the smaller.

These observations are highly interesting, and lead us to the consideration of some of the aspects of sex from the internal secretory point of view. In 1889, Brown-Séquard, who was Professor at Harvard, and afterwards at the Collège de France in Paris, studied the influence of sexual secretions upon man in general, and upon old age in particular. He had undertaken experiments, in the course of which he administered to himself extracts made from the sex organs of animals, and he claimed that the effect upon his vigour and health was highly beneficial. As the result of this, a widespread interest was aroused, in connection with the possibility of warding off old age by these means. Immediately afterwards, experiments were undertaken to attempt to verify

[1] See the Encyclopædia Britannica, vol. xiii., p. 941.

Brown-Séquard's conclusions. A good deal of contradictory evidence was forthcoming, many physiologists stating that they were unable to produce the effects that Brown-Séquard claimed to have done.

There is little doubt, in the light of our present knowledge, that Brown-Séquard had hit upon a truth. He was unduly optimistic, and his somewhat exaggerated claims led to the discountenancing of his ideas *in toto*. That he had grasped the principle of internal secretions is shown by his writings. He says that each tissue, and more generally each cell of the organism, secretes for its own use special products which are poured into the blood, and which influence through the blood and not through the mechanism of the nervous system all the other cells, but rendering them all mutually interdependent. This will show that physiologists who are working to-day on a similar subject are following out his belief; and it is largely to Brown-Séquard that we have got as far as we have in understanding the processes which accompany old age, and how they are produced, partly, at all events, by failure of the internal secretions of sex.

Dealing first with the male, we must recognise that there is an external secretion which fertilises the ovum of the female, and by means of which the species is reproduced. Certain glands, such as the testicles and the prostate, are concerned in this process; but were this all the work which they perform it would be a simple matter to understand. It is now certain that the testicles produce an internal secretion, which is poured directly into the blood, and which has far-reaching effects upon the body as a whole. Recent work, moreover, has established that the pituitary gland is responsible for a good deal which is included in the word "sex." Both male and female sex-organs require stimulus from the pituitary, in the same way that the charge in a cartridge requires a detonator. This aspect of sex will be discussed at greater length in Chapter IV.

Certain cells which constitute the " interstitial glands " are present in the substance of the testicle ; and it is to these glands that the internal secretion owes its origin. This secretion is responsible for what are known as the secondary sexual characteristics—that is to say, for those features which make man what he is and differentiates him from the opposite sex. The results of physiological experiments, as well as some of the customs of the East (which consist in the deprivation of the testicles), have demonstrated the changes which follow. The results are twofold : first, there is the loss of sexual power and the mental equivalent, namely, sexual desire ; secondly, there is the result on the physical build of the individual. This will be referred to at greater length in subsequent chapters ; suffice it to say here, however, that it is to the internal secretion of the testicle that the characteristics of man are due ; and when it is removed, whether by operation, religious ritual, or disease, these characteristics are profoundly altered. The analogous female organ, the ovary, possesses more than one internal secretion ; and this is just as well, seeing how diverse and diverting the feminine characteristics are, and bearing in mind that many of these characteristics depend for their existence on the contributions which the ovary makes to the blood stream. A well-known quotation from Virchow says : " Woman is woman by reason of her generative glands ; all the peculiarities of her body and mind, everything, in fact, which in the true woman we revere as womanly, is dependent upon the ovary."

Much information can be derived from the effects of the removal of the ovaries. Most of the data has been obtained from the results of this operation in adult life ; and the effects which follow this are well known, for the operation is frequently required for disease of these organs.

Taking a general view of the functions of the female sexual organs, we shall observe that there is

a periodical change leading up to what is known as menstruation.

Menstruation is one of the functions which is governed by the ovaries; for when the ovaries are removed, menstruation ceases. Again, the production of a secretion which prepares the uterus for pregnancy, and in turn governs lactation and the action of the mammary glands, as well as the interval after the birth of the child, appears to be in the hands of a part of the ovary. Another structure of the ovary is the "Graafian follicle," which contains the ovum. This rises to the surface, bursts, and leaves behind what is called the *corpus luteum*. If pregnancy results, this is known as a 'true corpus luteum'; if this is not the case, the scar left in the ovarian wall is known as the 'false corpus luteum.'

From this brief survey it will be apparent that sex, in woman and man, is largely controlled by internal secretory influences. The middle years of life (which include the years from twenty to fifty) are in the hands of the sexual glands. Damage to these organs is accompanied by profound changes. It is possible to overcome these by the administration of extracts of similar organs obtained from animals.

Thus we come back to Brown-Séquard's original experiment, and we see how much we owe to this brilliant, if erratic, pioneer.

Recently, the newspapers have been very full of rejuvenation operations and experiments in the grafting of glands from animals into the human being. There can be no doubt that some of these are perfectly successful; on the other hand, it is unlikely ever to become a widely popular process, if only for the reason that animals are difficult to obtain. The result must always be, to a certain extent, speculative; and the whole proceeding is not one which is possible for masses of people. Nevertheless, work which men like Voronoff, of Paris, and Steinach, of Vienna, have undertaken, has thrown fresh light on the functions and purposes which lie in sex.

6

Situated in the abdomen there is an organ known as the pancreas. The name is derived from two Greek words, *pan*, meaning "all," and *kreas*, "flesh." In English it is sometimes referred to as the "abdominal sweetbread," the sweetbread of the butcher's shop being usually the thymus gland. The pancreas has two secretions: an external, concerned with digestion, and an internal which has only recently been recognised as being vital to the metabolism of sugar. It is the second function of the pancreas with which we are here concerned. In the substance of this gland there are found isolated groups of cells known as the "islets of Langerhans," and these have been shown to be the source of its internal secretion.

In 1889, V. Mering and Minkowski, of Germany, and an Italian observer called de Domenicis, demonstrated that the removal of the pancreas resulted in the presence of sugar in the urine, accompanied by other symptoms of the disease known as diabetes. Experiments proved conclusively that in the absence of this gland, and, more particularly, in the absence of the portion of the pancreas which contained the islet tissue, diabetes occurred. Further experiments gradually narrowed the field of inquiry, and showed that, if small quantities of the pancreas were grafted into other parts of the body, it was sufficient to prevent the disease ensuing.

The external secretion of the pancreas is discharged into the first part of the small intestine. It is a pale yellow fluid, and contains ferments, the functions of which are to digest the food as it passes from the stomach. We are concerned here only with a brief account of the internal secretion; for the object of our present study is to consider the manner in which the different internal secretions contribute to the individuality, and no account would be complete without a reference, however brief, to the pancreas. Another reason for its consideration is

that evidence is very clear as to the internal secretion of this gland; whereas in the case of some of the others which we are studying this is not the case.

Diabetes may be defined as the appearance in the blood of larger quantities of sugar than are normally present and its overflow into the urine. In the pancreas there are found these small islands to which we have already referred, and the internal secretion of the pancreas is elaborated by these cells. When diabetes occurs, there is a failure to metabolise or deal with the starchy food, the symptoms of diabetes being directly due to this factor. The discovery of insulin has enabled the deficiency of the gland to be made good by injections of insulin, thus neutralising its lack in the body. Many attempts have been made to administer this substance by the mouth in the hope that it would neutralise the deficiency in the blood. So far, however, the results have been disappointing.

What is known as "carbohydrate metabolism" (the control of digestion of starchy foods) is largely governed by the pancreas and an adjacent large organ, the liver. Chemically speaking, carbohydrates (which are contained largely in such food stuffs as flour) are digested and altered in structure by the pancreas and are picked up by the liver, and stored there in what is known as "animal starch" or "glycogen."

As the work of the internal secretion of the pancreas is nearly all chemical (or perhaps we might say physical), we need not spend more time in discussing it here. There is a definite antagonism, moreover, between the pancreas and the adrenals; for excess of adrenalin in the blood increases the amount of circulating sugar. Too large a dose of insulin (which reduces the sugar in the blood to too low a level) can be neutralised by an injection of adrenalin.

We shall, in subsequent chapters, encounter examples of individuals whose characters are dominated by excess of adrenal secretion. Such people, whose drive and

ambition is well-nigh limitless, ought to be treated by a physiological antidote, and, perhaps, one day an accurate hormone-therapy for adrenal excess may be forthcoming. Alas ! that to-day we cannot forward to Geneva a series of injections which might settle the Italian-Abyssinian dispute.

CHAPTER III

THE THYROID

1

THE thyroid gland plays a part of great importance in the modelling of the personality. To understand properly the manner in which this is carried out it will be necessary first to study in some detail the gland itself and the secretion it manufactures for the blood.

The thyroid gland (from θυρεός, a shield) received its name on account of its close proximity to the thyroid or shield-shaped cartilage. In human beings it consists of two lateral lobes, one on either side of the trachea, generally connected by an isthmus. As a rule, the gland can be seen as an indefinite swelling on either side of what is commonly known as the " Adam's apple." The average weight of the gland is 25 to 30 grammes (about 1 ounce); it weighs a little more in the female than in the male, and usually enlarges during menstruation and pregnancy.

As well as the main gland, accessory thyroids are sometimes found, either in close apposition or in different parts of the body. In some instances these supernumerary thyroids function and supply an internal secretion.

The thyroid gland is supplied by branches from the sympathetic nervous system. In view of the important relations which this gland bears to the nervous system, and more especially of the part it plays in the formation of the personality, it will be necessary in a subsequent chapter to refer in greater detail to these relations.

2

Much of the knowledge which we now possess of this gland has been derived from the diagnosis of states of deficiency, and how they respond to feeding with thyroid

substance derived from animals. It has been shown that there is a definite type of personality produced by a congenital or acquired deficiency of this secretion; and this was first recognised by the train of symptoms which follows when the gland is removed in animals. In 1859 Schiff investigated the effects of such an operation, although the results he described were inconclusive owing to the fact that he removed the parathyroids as well as the thyroid. We shall see shortly that such a proceeding would go far to stultify his main conclusion. He went further in his experiments by implanting the thyroid into an animal and noticing how it was able to neutralise the symptoms which its removal had produced. We must realise that in these early days the whole theory of internal secretion had still to be born. Schiff, however, realised that the work carried out by the thyroid could only be done by the mechanism we now know as internal secretion, as in the widely read paper he published in 1884 occurs the following sentence:

"We may wonder if the thyroid body produces in its interior a substance which it delivers into the blood stream and which constitutes a nutritive element for another organ, or whether it acts mechanically by its anatomical position." He goes on to explain why the internal secretory theory holds the field. We now know, of course, that it matters very little in what part of the body a graft is placed so long as vascular connection is established. The grafting of thyroid glands into human beings and animals results in the re-establishment of the functions of the thyroid—at all events, for a time.

About 1890 fresh thyroid given by the mouth was prescribed for the first time to a patient showing the symptoms of thyroid deficiency; by 1893 dried thyroid could be bought from manufacturing chemists.

3

So much for the history of this gland. We must now turn to the symptoms of deficiency and excess of the

thyroid secretion. In 1878, Ord, an English physician, first introduced the word "myxœdema" for a disease which had already been described by Gull, and which he stated showed swellings of the surface of the body, which were not dropsical, but contained a substance resembling mucus. Associated with this symptom there was a shrinkage of the thyroid. We now know that myxœdema is due to a failure of the thyroid in adult life; and may be described as cretinism occurring in adults. Minor degrees of thyroid deficiency are recognised clinically, and there are many symptoms, perhaps trivial in themselves, but none the less definite, which yield to the administration of thyroid. The name "hypothyroidism" has been given to this condition, which is less severe than myxœdema, but resembles it in so far as the general picture is concerned.

The changes noticed in myxœdema are characteristic. The description originally given by Gull in recording one of his cases cannot be bettered even to-day. The following paragraphs contain some of this description, but altered slightly to make it easier to understand.

"Temperature normal, pulse 60. There has been a gradual and general increase in bulk, the features had become broad and flattened, the skin was pale, fair, fine and soft, the tissue about the eyes was thrown into folds, the lips thickened, tongue large, speech guttural. . . ."

In 1893 the following notes were added: "Lips large, tongue and features broad, skin and subcutaneous tissues lying in receding folds, hands broad and spade-like, mind generally placid and lazy." He adds: "It will be noticed that I have designated this state 'Cretinoid.' That it is allied to the cretin both in the form and features, the changes in the lips and tongue, the character of the hand."

If we now turn to a description of cretinism from a modern textbook, it will be interesting to compare this with the account we have just given.

"The cretins . . . have squat fat bodies and swollen

faces. The complexion is pasty or grey. Their low intelligence is shown by their learning to sit, creep, stand and walk at a late age or not at all. . . . The head is usually small and round and covered with scanty, brittle hairs; eyelashes and eyebrows scanty or absent. The ears are large and flabby, and the lobes often fixed to the head; the nose and face is small and retracted, as it were. . . . The cheeks may show myxœdematous swelling, the mouth is large, lips big and coarse, and from the open mouth protrudes a large tongue. . . . The chin is receding and often double through under-development of the mandible. . . ."

4

The secretion which the thyroid manufactures, and the absence of which produces the striking picture we have just drawn, is an organic compound of iodine.

Iodine is essential to life and is derived from many different sources. We are told that only 3½ grains of the thyroid secretion stands between intelligence and idiocy. It is a gruesome thought to realise that the absence of one chemical can result in a failure of development of the mind and body of an individual.

In 1918 Kendal isolated a substance which he named "thyroxin," which is a compound of three molecules of iodine with a protein, its chemical label being tri-iodo-tri-hydro-oxyindole-proprionic acid.

Only the thyroid is able to manufacture this substance; if it is deficient in an animal or a human being we cannot replace it by ordinary inorganic drugs.

The administration of thyroid substance is now exceedingly easy; it is manufactured to contain a standard percentage of iodine, and is available in many different preparations. One point of interest may be noted in connection with thyroid feeding. As we shall see in subsequent chapters, doubt is thrown upon the assimilation of some other of the glandular substances when administered by the mouth. It is, however, quite

certain that thyroid is absorbed readily. It has been suggested that the reason for this ready absorption may lie in the fact that the thyroid gland is developed originally from outgrowths of the alimentary canal. There is a duct in early life which runs from the base of the tongue down to the region of the thyroid. It is possible that this developmental fact has something to do with the ease with which thyroid extract is absorbed.

If it is an unpleasant thought that only a small quantity of a chemical stands between us and imbecility, the opposite side of the picture is encouraging. Suitable doses of thyroid substance will convert a cretin or myxœdematous subject into a normal human being. There are, of course, exceptions, and it must not be understood by this that all idiots and imbeciles can be rendered normal by thyroid feeding. Equally it must not be believed that every case of obesity or of mental sluggishness is dependent upon, and can be cured by, the same treatment. It must be understood that given the symptoms of thyroid deficiency either in children or in adults, and provided the treatment is promptly instituted, a deficiency of the gland can be made good by the feeding of thyroid substance.

5

Excessive or perverted secretion of this gland is known as *hyperthyroidism*. One variety of this, associated with swelling of the gland and prominence of the eyes, has been called *exophthalmic goitre*. In this complaint there is over-excitability of the nervous system. The heart's action is fast, there is a tendency to sweating on small provocation, the individual is thin, and there is a well-developed—often a magnificent—head of hair. Mentally, the subject of this complaint is irritable, unreasonable and unduly emotional. These are the people whose machine is set to run at a high speed; they use up, as it were, their fuel rapidly, and for this reason they are always thin. Such a condition is abnormal,

but there are many degrees between an individual with a normal thyroid output and the extreme degree known as exophthalmic goitre. We shall realise later on that, to the thyroid, the body owes its " petrol."

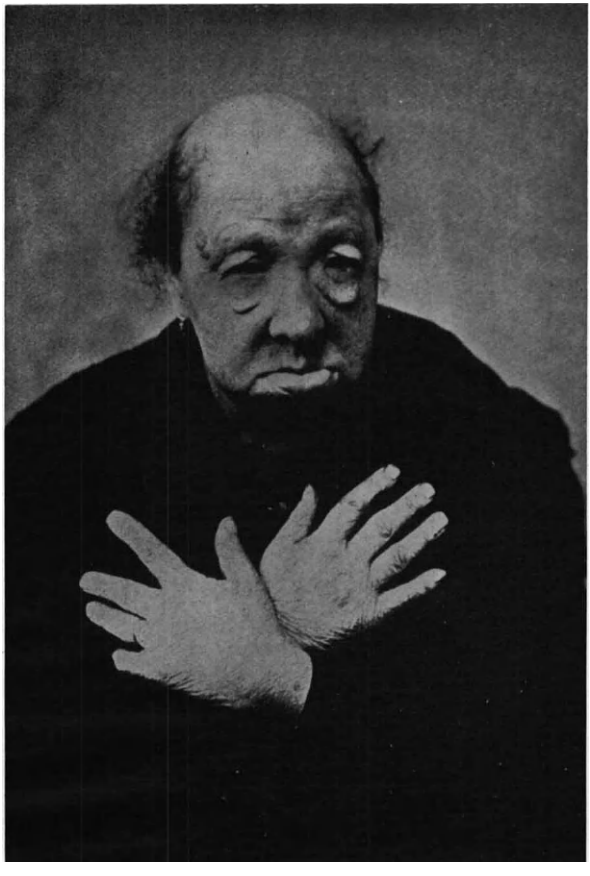
People with excessive thyroid tend to remain young, while premature senility is associated *inter alia* with failure of this gland. It has been said that a man is as old as his arteries and a woman as she looks. The modern equivalent of this dictum is that a woman is as old as she looks and a man is never too old to look. Whether this be true or not, the thyroid secretion is undoubtedly a gland associated with sex and virility.

The thyroid is relatively much less developed in the lower animals than in man ; and such thyroid as there is in fishes is intimately associated with the duct of the sexual glands. For this reason it is not surprising to find that in the mammalia the thyroid still works in connection with the internal secretion of the genitalia. An exuberant thyroid, therefore, produces a heightening of the sexual processes ; and those individuals who are possessed of excessive thyroid secretion often show abnormalities of the sexual impulse.

As years advance the signs of old age set in, among them a lowering of the sexual level. It is not the thyroid alone which determines old age ; if it were, it would be a simple matter to keep the hands of the clock from advancing.

6

It is now known that the structure of the thyroid can be modified experimentally, but it is not always easy to control these changes. Such a condition as *endemic goitre* is associated with infections from water supply and other factors. Overgrowth of the thyroid has been proved to result experimentally from diet; and one observer has shown that an unrestricted diet in an animal caused considerable overgrowth of the gland. And, although not proven, it was believed that it was



(*From Dr. H. W. Raven's case of Myxœdema, published in the British Medical Journal, October 4th*, 1924.)

[*Facing p.* 37

the protein fraction which was the particular food responsible for this overgrowth. On the clinical side there is evidence to show that enlargement of the gland can be controlled to some extent by a diet very poor in protein. It has also been shown that disorders of the gland can be produced by poisoning from various bacteria found in the intestinal canal. Feeding with glandular substance or the administration of iodine produces changes in the thyroid, certainly so far as experiments on animals are concerned.

We have already shown by our reference to cretinism that the thyroid is essential to growth. It will be apparent that it is also necessary to the proper nutriton of the skin, as the cretin (and myxœdematous subject) suffers from a dry and unhealthy skin. It is also concerned as a catalyst —that is to say, a substance which is necessary to enable other substances to act, although it may undergo no change in the process itself.[1]

The everyday work of the thyroid, then, consists in maintaining the sexual life of the individual in conjunction with the sex glands and others of the internal secretory organs: it is responsible for the nutrition of the skin and its appendages, such as the hair, nails, and teeth; and it acts in a more complicated manner as a catalyst to assist chemical reactions taking place in the body.

7

We have described the grosser types of thyroid personality, but as these are the results of definite disease, they are not representative of the variations in personality which (within the normal) result from alterations in the thyroid secretion. It must be understood that, from adolescence onwards, the type of personality which emerges is largely dependent upon the behaviour of the

[1] A chemical body which by its presence is capable of inducing chemical changes in other bodies while remaining unchanged itself (New Standard Dictionary).

thyroid gland. Many a child is a subthyroid until puberty, and can be seen to be so constituted by the general type of his physiognomy and of his bodily structure. Such a child is always sleepy; perspires but little, is generally tired and listless, and is backward at school. With the onset of puberty, however, and the activation of the thyroid and other glands by the new secretions, a change may take place. This is, of course, providing that the deficiency is made good. It may be, however, that puberty leaves the personality unchanged; in which case the characteristic traits continue into adolescence and even into adult life.

Should this happen, the unfortunate boy or girl remains as a type of hypothyroideic, and his or her characteristics will be plain to anyone with a discerning eye. There is a coarseness about such individuals which is shown by the lifeless hair, the rough skin, the eyes sunk deep in the head, and the slow, unattractive mentality.

On the other hand, the transformation which may be effected by the new glandular secretions arising at puberty is very striking. It is almost as if the magic wand of the fairy-tale had swept across the contour of mind and body. Everything improves. On the mental side there is increased power of concentration, quicker powers of observation, a better memory, and a livelier outlook on life. On the physical side the plump and stodgy child becomes like a colt, long and thin; the hair improves, and becomes more glossy and with less tendency to fall out. The eyes are brighter, the face is more alive, and even the complexion improves.

Such is the change which may take place once the thyroid supplies an adequate secretion.

At the opposite extreme are children who are over-endowed with thyroid secretion. These children are lively, nervous, and highly strung; they are thin, perspire readily, and are "live wires." On the mental side they sleep but little, are always "up and doing," and surprise their parents by their quickness of observation

and the manner in which they have picked up knowledge.

When adolescence comes to such children it is apt to be fraught with difficulties and dangers. Being on a razor edge (as it were) they are more likely to be upset by this change, and any disturbance of their endocrine balance which results from, let us say, an infectious disease, is likely to be productive of an abnormal state which, however, is often only temporary.

Needless to say, there are many other glands which take a hand in the "shuffling" of puberty, and some of these are able to make good sundry of the deficiencies, and to compensate for the misbehaviour of the thyroid. Once adult life is reached the course set for the thyroid is an easier one, and, in general terms, it may be said that, if the thyroid reaches maturity without any serious disorganisation, it is likely to succeed in its work during adult life. From this it would seem that the disorders of the thyroid met with in adults have oftentimes had their origin during the years of growth.

A condition is now recognised in which the thyroid in adult life "wobbles" from a state of under-action to one of over-action. An individual with this condition will be subject to changes of moods; he or she will have spells of brightness, happiness and mental acuity, but will easily pass into a characteristic depression.

The so-called *dysthyroidism* consists of this instability; and it may be that many people who are known by their friends to be very variable in their behaviour are, in reality, dependent upon what their thyroid is doing at the moment. To descend from a happy state of exhilaration to the abysmal depths of despair (without apparent reason) is exceedingly trying. It seems probable that if, in such people, the thyroid could be stabilised, such rapid mental changes might be avoided.

CHAPTER IV

THE PITUITARY GLAND

1

THE pituitary gland, or the *hypophysis cerebri*, is situated at the base of the brain, lying in a small fossa, which, from its shape, is known as the *sella turcica*, or Turkish saddle. This gland is of enormous interest in our study because it has a direct and important bearing on the personality. It is developed from the upper end of the embryonic canal and consists of two parts. One, the anterior lobe, is separated from the posterior lobe by a cleft; the former is the larger, and contains a small amount of connective tissue, being composed almost entirely of cells with blood vessels. The posterior part, on the other hand, is again subdivided into the *pars intermedia* in front and the *pars nervosa* behind.

Historically the pituitary is not without interest. Galen believed that it was concerned in the formation of the cerebro-spinal fluid, and that it was "distilled upon the palate." Other observers have suggested, in the age of guesswork, various functions for this organ. Descartes described it as part of a parallelogram, of which the pineal body was the seat of the soul.

We are to-day in a position to describe the functions of this gland with some degree of physiological accuracy. In the past few years it has been established beyond any doubt that many different hormones with widely varying functions are elaborated in the pituitary gland. These control growth, regulate sexual development, preside over the menstrual cycle in the female and have no small say in the metabolism of the body. Even the bronzing of the skin—such as occurs after exposure to the sun—is now

known to be controlled by one of the many pituitary secretions. It is impossible to say how many irons this gland actually has in the human fire. The French knew what they were about when they christened it "l'organ énigmatique."

In the following pages will be found a necessarily sketchy account of its more important functions.

2

Dealing first with the anterior part, we may describe this as mainly glandular in function; it is, moreover, now established that under-action of the anterior lobe results in a form of hypopituitarism which can be recognised clinically. Over-action of the anterior lobe results, it is believed, in gigantism; and many years ago Osler stated that the skulls of some giants show great enlargement of the sella turcica.[1]

Hyperpituitarism of the anterior lobe, ensuing in adult life, is productive of the condition known as *acromegaly*. Hypopituitarism of the anterior lobe is associated in children or young persons with a retarded physical growth and one type of infantilism.

There are conditions in which there is under-action of the pituitary, either of one or of both lobes, and it is difficult, at times, to say which lobe is mainly responsible. A disorder known as Fröhlich's disease is attributed by some to a partial under-action of both lobes of the pituitary.

It must be emphasised here that, so far, reference has been made only to those cases where marked disturbance has resulted in a definite disease with recognisable clinical signs. We must, however, realise that minor disturbances of the functions of these glands may and do exist, without the marked signs which characterise the major disorders. The pituitary works, of course, in conjunction with other of the ductless glands which regulate metabolism. For example, without the presence of a definite disease such

[1] See Chapter II., p. 23.

as Fröhlich's syndrome, there are many minor abnormalities of the bodily functions in which the pituitary is involved.

It may be as well here to emphasise that this gland is associated with the growth of the body ; with the regulation of the metabolism—in other words, the storage of fat ; that excessive action before growth is finished leads to overgrowth ; and that under-action tends to produce failure of development of the skeleton accompanied by excessive adiposity.

On the physical side this gland plays an important part in the control of the heart-beat and the tone of the blood vessels. Injections of extracts of this gland increase the tone of the heart and the pressure at which the blood circulates ; they stimulate contractions of the intestines, bladder and uterus.

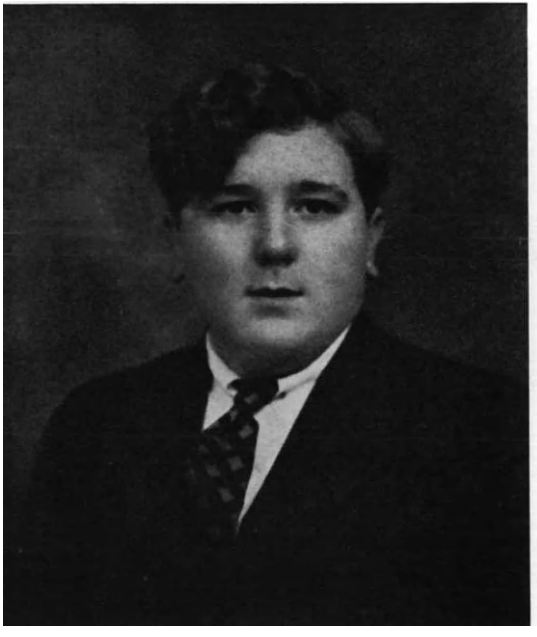
In history and literature it is easy to recognise types of over- and under-action of this gland. Giants such as O'Bryan and McGrath are instances of over-action ; Joe, the fat boy in " Pickwick Papers," is the best-known example in fiction of under-action of the pituitary during adolescence.

The accompanying photographs show a typical example of a boy of nearly fifteen years of age suffering from an under-acting pituitary. His weight was just under 18 stone. A careful diet, in addition to pituitary feeding, produced the changes shown in the second plate, and a loss of over 5 stone in six months.

The pituitary is also largely concerned in the development of sex. It has already been stated that it enlarges after castration, and no doubt the large size to which eunuchs grow may justly be attributed to the increase in the pituitary activity caused by the removal of the restraining influence of the sexual hormone.

In another chapter reference will be found to the relation between sexual development and the pituitary ; here we shall merely refer briefly to the fact that, where the pituitary is damaged by disease or operation (where these

I



A Boy suffering from Pituitary Deficiency

II

After Treatment

[*Facing p.* 42

processes take place before puberty), sexual maturity does not occur.

Over-activity of the pituitary, then, leads to a large frame, and, indeed, when other factors are favourable, to gigantism. This, however, can only take place before growth has ceased. If hyperpituitarism occurs in adult life, a disease known as *acromegaly* results. In this disfiguring condition the face grows large, with heavy bosses above the orbits and a massive jaw. The hands and feet become enormous, and the chest "barrel-like." The over-activity of a small gland in the brain renders the individual well nigh unrecognisable to his nearest and dearest. What causes the excessive secretion, and how it can be controlled is not known. Some day, perhaps, when our knowledge of the individual hormones and their inter-relationships has reached a degree of exactness at present unattained, growth will be regulated at its different stages, and it will be possible to add to the stature or prevent its increase by the judicious administration of endocrine products.

But to-day we are far from this stage. We can but pick up the scattered observations of normal and abnormal and begin to group our rough-cast types. The states in which there is definite under-action of the pituitary can be, and are, treated to-day. By feeding with pituitary gland adiposity can be controlled, and the somnolent fatness of Joe can be made to give way to the alert slimness of the average boy in his 'teens. At present we are unable to check exuberance of the pituitary with much success. There is a time in every growing child when, if the pituitary does not respond to the calls made upon it, the bodily growth lags. If, however, this gland is active, the boy or girl grows rapidly and becomes "all arms and legs." In all normal development there comes a year when the rate of growth begins to slacken, and the final size of the individual is determined. It is an interesting speculation to what extent the size of the individual is predestined by inheritance, and how much the adult owes

to environment. It is the old problem of *nurture versus nature*, but looked at from a fresh angle.

There can be no doubt that the endocrine pattern shows some constant features in families, but many examples of one unusual individual (such, for instance, as O'Bryan, none of whose relatives appear to have been of unusual stature) force one to the conclusion that the effects of environment are capable of so acting upon the endocrines as to produce unusual development.

As an example of the influence of the endocrines in families the following is striking: The father was a huge man, one of a family in which all the males measured well over 6 feet 3 inches; the mother was of normal size. The paternal grandfather, although a man of great size, lived to an advanced age. The grandchildren of this man were all more or less abnormal. One daughter, tall, thin, and always delicate, died of tuberculosis in early adult life (giants almost invariably die of tuberculosis). The second daughter was a thyroid deficient, and was subnormal, fat, and lethargic.

The history of the ancestors on the father's side all pointed to an abnormal endocrine balance. This was evidently stamped upon the immediate descendants, none of whom, looked at from the endocrine angle, could be regarded as ordinary individuals.

3

Many other functions, with which we are all familiar, have been attributed, in whole or in part, to the activities of the pituitary. The somnolence which accompanies under-action of this gland has led some observers to suggest that the phenomenon of hibernation in animals is due to a recession of the pituitary activity. Hibernating animals present many of the characteristics which we are accustomed to regard as under pituitary control. Zoologists agree that there is nothing specific in cold as a cause for the hibernation; and the phenomenon of æstivation,

or summer sleep, presents the same characteristics as are associated with the former retirement, but in the absence of cold. Marshall Hall concluded that cold acts in hibernation precisely as it does towards normal sleep—that is to say, as a predisposing factor. The vital functions are all suspended or diminished in a hibernating animal; in some, indeed, there is cessation of respiration. The animal lives upon its stored-up fat, for both alimentation and excretion are in abeyance.

The phenomena of hibernation, therefore, present several interesting features. First, there is the deep sleep. From this the animal can be roused; but if so disturbed, he is much more susceptible to such risks as immersion in icy water than when in the depths of his winter sleep. Secondly, there is a fall in the bodily temperature—a condition associated with under-activity of the pituitary. Thirdly, there is the storage of fats, upon which the animal exists during his quiescent period.

Now, it seems probable that the pituitary, which has long been suspected of taking part in rhythmical processes—an example of which is normal sleep—is concerned largely in the control of winter sleep. It is well known that all hibernating animals prepare themselves for the winter months, and that they avoid extremes of cold, which, indeed, prove fatal unless they have protected themselves by burial or some other means. As the winter months approach, the pituitary—and, no doubt, the other glands concerned with metabolism—prepares for the months, during which the animal must live without external support, by laying up a store of fat. This is achieved probably in the manner that it is in adolescents in whom the pituitary is deficient; or, as occurs in various other bodily states associated with an under-action of the thyroid, pituitary, and genital secretions.

The difference in the male and female skeletons gives one furiously to think when the subject of the pituitary is under discussion.

The female skeleton differs in many ways from the male, into the details of which it would be tedious to enter here. Suffice it to say that the female pelvis is so made that it enables the processes of childbirth to be carried out, and that the shape of the pelvis leads to such typical feminine characteristics as broad hips, and knees which are nearer "knock" than they ever are in the normal male. Now it appears that pregnancy is often accompanied by pituitary changes, and that these changes are not uncommonly accompanied by headache. This is, in all probability, due to the temporary enlargement of the gland, which, being embedded in a bony cradle, is unable to stretch itself with any degree of freedom. In this relation, it runs on parallel lines to the thyroid, which is known to undergo changes during such epochs as puberty, pregnancy, and the menopause. But with this difference, that the former cannot, owing to its anatomical relations, enlarge freely, while the latter can vary in size, according to its requirements, without any local discomforts.

Pregnancy produces changes in the faces of women, enlargement of the pelvis, and thickenings in various parts; while, as Cushing points out, the temporary diabetes and the occasional increase in stature suggest transient pituitary over-activity. It is equally probable that the subsequent period of lactation is largely governed by this minute but important organ.

There are certain "everyday" signs, which are regarded as suggesting pituitary insufficiency, and which have been described by Cushing. The first of these is the absence of the pale blue crescents on the nails. The second is the presence of little black moles dotted on the skin; while the third is the small size of the outside incisor teeth in the upper jaw.

Very little definitely is known about the presence or absence of the nail crescents. They undergo changes in acute illness, and tend to become discoloured or darker as death approaches.

4

Now that we have discussed the variations in pituitary activity, we are in a position to describe the so-called "pituitary types." These are now considerably clearer than they were ten years ago; and, if we bear in mind the effects which an active pituitary has upon the individual, it will not be difficult to see in what manner the details of the pituitary personality have been worked out. The following description is taken from Berman's "Glands regulating Personality":

The masculine pituitary personality, the man with a dominant anterior pituitary gland, in a roomy sella turcica with plenty of space to grow in, is the ideal virile type. They are generally tall (unless the growth of the long bones was checked too early by a social precocity of the testes), with a well-developed frame, large firm muscles, and proportionately sized hands and feet. The head is of the marked dolichocephalic type, flattened at the sides, face is oval more or less, with thick eyebrows, eyes rather prominent, nose broadish and long, lower jaw prominent and firm. Prominent bony points like the cheek-bones, the elbows, and the knees, the knuckle-joints of the hands and feet. The teeth are large, especially the upper middle incisors, and they are usually spaced. The arms and legs are hairy. High-grade brains, the ability to learn and the ability to control, self-mastery in the sense of domination of the lower instincts and the automatic reactions of the vegetative nervous system, the rule by the individual of himself and his environment, are at their maximum in him. The ante-pituitary personality is educable for intelligence, and even intellect, provided the proper educational stimulus is supplied. Men of brains, practical and theoretical, philosophers, thinkers, creators of new thoughts and new goods, belong to this group. The distinction between men of theoretical genius, whose minds can embrace a universe, and yet fail to manage successfully their own personal everyday lives, and the men of practical genius, who can achieve and execute, the great engineers and industrial men, lies in the balance between the ante-pituitary and the adrenal cortex primarily."

The same author divides pituitary types into two groups, according to whether the anterior or posterior part of

the gland is dominant. These he describes as the masculine pituitary type, where the anterior pituitary is in the ascendant; and the feminine pituitary type, which is the type found when the individual is dominated by the posterior pituitary. He regards the former as the ideal masculine type, "representing superlative brain tone and action, good all-round growth and harmonious general function, the ideal masculine organism. The feminine pituitary has an excess of post-pituitary, with susceptibility to the tender emotions, sentimentalism, and emotionalism, feminine structural lines. Ante-pituitary dominance in a male reinforces the general masculinity, while the post-pituitary depresses it. Post-pituitary in a woman augments her natural trend, ante-pituitary tending to counteract it. In other words, post-pituitary and ovary are conjunctive, ante-pituitary and ovary disjunctive; post-pituitary and testis are opponents, ante-pituitary and testis are allies."

While the types just described still rest a good deal upon surmise, there are certain assumptions which are justifiable, and a large number of facts upon which theories of a reasonable kind may justly be founded.

We have already referred to the anatomical characters of the pituitary gland, and the bony cradle in which it lies. We have likewise emphasised the fact that thyroid and pituitary have much in common; and that, between them, they do much of the work of the body, in so far as controlling the circulation, regulating the body temperature, and the utilisation of food is concerned. The fact that the thyroid is intimately concerned with the sex-life of the individual has been stressed; and it has been stated that the thyroid seems to be especially concerned with the female genital system, rather than with the male; while the thymus (it has been hazarded) acts in a corresponding manner in the male. The thyroid, we know, alters in size, more especially at times of sexual variations, and excessive thyroid activity in the female is associated with hyper-sexuality.

The thyroid and pituitary, then, appear to run on very parallel lines. Hypopituitarism is characterised by sexual apathy; hyperpituitarism by increase in sexual desire, at all events, in the early stages.

It is commonly held that an over-action of a gland of internal secretion is apt to lead to a subsequent under-activity, almost as if the gland had exhausted itself and partially atrophied. Certainly many cases of obvious hyperpituitarism show subsequent signs of hypopituitarism. If we assume, therefore, that glandular over-activity is associated with glandular enlargement, the pituitary is in a sorry state, unless perchance it finds itself in a nice roomy sella turcica, which allows it space for its needs.

We shall not be too far-fetched in our assumption if we accept the theory that the pituitary, in some types at least, requires to adjust its size in accordance with the needs of its possessor. It is at least likely that puberty, adolescence, pregnancy, and such-like milestones in the life of the individual call for increase in the activities of this gland. But this increase calls for enlargement, which, in turn, necessitates some spare room in its neighbourhood.

In individuals who have a small sella turcica, moreover, this enlargement is not possible, or only possible by the exertion of pressure on its bony bed, and this at the expense of headaches, disturbances of vision, and other symptoms of cranial pressure. That the bone yields to pressure is well recognised, and X-ray photographs sometimes show erosion of either the anterior or posterior parts. Berman believes that the particular type may be determined according to which part of the bone yields; if the anterior, then ante-pituitary excess is found; if the posterior, then increase in the activity of the posterior part of the gland occurs. In between the two extremes is a variety of mixed types, neither markedly ante- nor post-pituitary.

Sufficient has now been said to indicate that the

pituitary gland is concerned intimately with the build of the individual, with his character, and with his behaviour. One of the lessons which the study of the endocrine glands has taught us is that, until the influence of these secretions was recognised, we had failed to appreciate the enormous contribution which the blood makes to the formation of the personality. A little extra thyroid and the dynamic "drive" of the individual doubles. Increase in the adrenal content of the blood is necessary for any state accompanied by emotional excitement, with the quickening of those functions of the body which are concerned with emergency. The pituitary, on the other hand, is a steadier organ. Its powers are applied more slowly, and have a more lasting effect.

The inter-relation between the thyroid, pituitary, and adrenals, and the antagonism of the pancreas, with the sporadic interference of the gonads, all shape the character and conduct of the individual. The pituitary is, in some way, concerned with rhythm. This is the gland which is obviously the main cause of hibernation. This is the gland which we believe, to some extent, controls sleep.

No one has yet succeeded in discovering the origin of sleep. Its characteristics have been dealt with at length. The physiological changes which accompany it have been described, while its phenomena are familiar to all. But the actual mechanism still remains to be discovered. The phenomena of winter sleep enable us to see the underlying mechanism in closer perspective. This is essentially a hypopituitarism with its accompanying fat storage, fall of temperature, and cessation of many of the bodily functions.

During sleep the same functions are diminished which are in suspense during hibernation. Alimentation is at a standstill. Hence the evil effects which often ensue if a meal is eaten just before going to bed.

Many drugs, such as tonics, produce their effect by stimulating the adrenal secretion; strychnine is one of

these. It is possible that some of the sedatives and hypnotics which encourage sleep do so by diminishing the pituitary activity. It is a curious fact that sleep arrives periodically, in whatever manner the day has been spent. It is true that the metabolic changes which accompany muscular exercise are peculiarly productive of somnolence. But this is only a question of degree.

No one has yet explained—at all events satisfactorily—why a heavy supper should produce nightmare. We are told that the visceral contractions stimulate the sympathetic nervous system, and that this produces changes in the "silent" areas of the brain. But this, again, is only outlining the mechanism. It is not getting right down to the "rock bottom."

Much experimental work has been done on the physiological mechanism of sleep. Observations of the surface of the brain, made by Durham and others, have established the fact that the brain is anæmic during sleep; and that any increase in the blood in the brain during sleep is apt to disturb the sleeper and interfere with the depths of his sleep. Sleep is associated with a lowering of all the bodily activities; and thus it must be regarded as a rest, not only of the brain and nervous system, but of the entire physical being.

Certain data obtained from disorders of sleep are of interest. Loss of sleep, if prolonged, may lead to mental abnormalities, such as failure to concentrate, disorders of memory, and other signs of mental exhaustion. In a disease, which the French call *maladie de sommeil*, sleep is persistent, for days or even weeks at a time; and after the sleep is ended an exhausted condition supervenes, with pale skin and cold extremities.

When the pituitary is under-active, the usual rhythm of sleep is disturbed, and the patient can "drop off to sleep" at any moment. This is in contrast to the normal individual, who, when refreshed by sleep, has no desire for further sleep. Individuals who can "drop off to sleep at any time" would probably benefit by a stimulant

to their pituitary gland; for the amount of sleep people of this type can enjoy is quite extraordinary.

Again, as the bodily temperature drops during the sleep, and there is diminished oxidation, excess of fat is stored up. Hence the saying: "He who sleeps dines." Fat people are much more somnolent than thin; and fat people are usually deficient in pituitary. This type of obese person should cut down his sleep as drastically as he diminishes (or should diminish) his food. In this manner, he would tend to burn up waste products, he would prevent further lowering of his temperature, and he would keep the circulation at a less sluggish level than is the case when excessive sleep is allowed.

CHAPTER V

THE ADRENAL SYSTEM AND ITS TYPES

1

Two glands—one above each kidney—are known as the adrenal or suprarenal bodies. They are small structures, usually about the size of a bean ; or to describe them more accurately, we may say that they are about five centimetres in length, and less in width. They weigh about 2 grammes each in the adult male, the left adrenal being slightly the larger.

The chromaffin system, which includes the adrenals, is the generic name given to various tissues in the body because they stain more or less darkly with chromium salts. In addition to the central part of the adrenal glands, there are various situations in which chromaffin tissue is found. Certain ganglia of the sympathetic system, a gland in the neck, known as the carotid body, and one or two similar structures are the chief members of this system. It is intimately related to the sympathetic nervous system ; and a knowledge of its structure will help us to understand some of its functions.

Each adrenal gland is divided into two parts, an outer portion known as the cortex, and a central core to which the name *medulla* has been given. The cortex consists of two layers, an inner and an outer, the two being separated by a layer of connective tissue. The medulla is composed of large cells containing a plentiful blood supply. It is this part of the gland which pours out the secretion which has been called *adrenalin*. The nerve supply is derived from the sympathetic part of the autonomic nervous system, a fuller account of which will be found in Chapter VIII.

In lower animals the glands corresponding to the human adrenals differ according to the species. The analogous organs lie near the kidneys in certain fishes; in birds, the adrenal and inter-renal bodies are very closely related; while in mammals the two parts of the gland form a dual organ enclosed in a capsule. From the developmental standpoint, it is important to realise that the adrenal medulla develops from the same structures from which the sympathetic nervous system arises; this is the reason for the similar action which results from either stimulating sympathetic nerve endings or injecting adrenalin.

The action of the two parts of the gland—the cortex and medulla—are of special interest in connection with our present study. The cortex is composed of the usual chemical substances to be found in organs, and contains no trace of the secretion which is characteristic of the medulla. Certain comparisons with the gland as it exists in the mammals have resulted in the conclusion that the cortex varies in different species, *and that these differences may possibly account for some of the characteristics of various animals.* This subject will be referred to at greater length as we proceed with our study.

The adrenal medulla is that part of the gland which contributes a vitally important chemical to the blood. This substance, which is variously described as adrenalin, adrenin, suprarenin, or epinephrine, was originally discovered by Takamine and isolated in a crystalline form. Its action may be described in the words of Langley; "... it has a stimulating effect, specifically active for all the ramifications of the sympathetic nervous system." It has a tonic effect on the muscle of the heart and arteries, and raises blood pressure. Its action on the eye is to retract the membrane, protrude the globe, and to open the lid wider so that the eye appears unduly prominent. It dilates the pupil and, as we shall see when studying the eye in relation to the different types of personality, this feature is very notice-

able in individuals with an active sympathetic system. In animals it causes the hair of the cat to stand up and the quills of the porcupine to bristle. It is stated that it contracts the pigment cells in the skin of a black frog, thus producing a lighter colour. Its action is, in many ways, antagonistic to that of the pancreas (see Chapter VIII.). The action of adrenalin is similar to that of pituitrin in that both raise the blood-pressure, but pituitrin is slower and more lasting in its action. The adrenal cortex was until recently a *terra incognita*. In the last few years, however, some very striking facts have been discovered as the result of patient physiological investigations.

It is known that removal of both adrenal cortices in animals leads rapidly to death ; and, from this starting point, many facts of the first importance have been established. Active extracts of the adrenal cortex have been prepared by a variety of workers in a variety of ways. The so-called adrenal cortical hormone has been used both by injection and orally, and there is no longer any doubt that life can be prolonged in an animal (who has been deprived of both adrenal glands) by the administration of cortical extract. The evidence is absolutely conclusive, in that such an animal can be rescued from death by injecting this extract, and can be kept alive for a considerable time, death, however, occurring the moment the injections are stopped.

The signs of disease which are met with in these animals are weakness, loss of appetite, extreme prostration and convulsions. The astonishing fact can be recorded that within a few minutes of the injection, even though the animal has been nearly moribund, the symptoms improve, and he will become nearly normal within an hour.

The new light which has been thrown on the adrenal cortex has shown, therefore, that it is by no means an unimportant member of the endocrine group. The symptoms which constitute Addison's disease and which used to be thought to be due to the medulla, must now

be attributed to disease of the cortex. There appears to be a close relation between the suprarenal cortex and the sexual glands; and growths of the adrenal cortex almost invariably produce masculine changes in women, but only rarely feminine characteristics in the male. A girl developing a tumour of the adrenals may become almost male, even to the external changes in the sex gland, abolishing the essential femininity of the patient. One possible explanation is that there may be a dormant male element in the adrenal cortex which is normally checked by the ovarian secretion. Whatever the reason, women change their sex in these circumstances, men rarely do. It is at least certain that over-action of the adrenal cortex exaggerates masculinity.

2

The chemical substance found in the medulla, or centre of the adrenal gland, is known as *adrenalin* or *epinephrine*. As far as is known it occurs only in the medulla, and not in the cortex. Yet removal of the medulla does not necessarily produce death, while removal of the cortex is invariably fatal. Epinephrine is regarded as the active principle of the suprarenal medulla, but it does not follow that it is the only principle secreted by this gland. It is closely related to a substance known as pyrocatechol, and as this chemical and its derivatives are easily oxidised into dark-coloured products, and as epinephrine also yields such products, it has been suggested that the latter may be the source of the black pigment found in certain tumours, although epinephrine itself has not been found in such tumours (Crawford).

It has already been stated that there appears to be a somewhat close relation between some of the products of digestion (notably one called tyrosine) and epinephrine, although the meaning of this chemical similarity is not yet fully understood. It has been suggested that one function of the adrenals is to neutralise poisonous products formed within the body. There seems also to be

some association between part of the chemistry of epinephrine and a product found in a tropical toad, *Bufo agua:* and one observer thinks that cobra venom exerts a similar action on the heart and blood vessels to that of epinephrine. Epinephrine has also been isolated from one of the salivary glands of the same animal (the tropical toad). It is interesting, therefore, to recall the fact that toad ointment has been largely used in some parts of the world for the treatment of sprains and rheumatism. Also that the poison obtained from the skin of the toad has served as the lethal extract for the points of small spears and darts.

The symptoms of suprarenal insufficiency are now clearly established. Experimentally, removal of the suprarenals leads to characteristic weakness, inability to walk, loss of appetite, and general depression; and this syndrome is due to loss of the cortex, and not, as was at one time believed, the medulla. Perhaps the most characteristic feature is the loss of muscle power and the resulting weakness; cats which have been pugnacious develop apathy after removal of the cortical portion. Another suggested result is the accumulation of poisonous waste products in the body.

Experiments have shown that animals which have been deprived of their suprarenal cortex are much less resistant to the injection of poisons than are normal animals. It would appear, therefore, that the blood is definitely different after such an operation.

It has already been said that the pigmentation (*i.e.*, the diffuse bronzing) which occurs in the disease where the adrenals are slowly destroyed, never develops in experimental removal of these glands. It has been shown, however, that their removal does produce a marked lowering of the sympathetic excitability. It would seem that the secretion of the adrenals is necessary for the full activity of this part of the nervous system.

There is certain evidence of importance with regard to the probable action of the adrenals, more especially

the cortex, in regard to the neutralisation of toxins in the body. It is believed that prolonged intoxication produces increase in size of the ardenal cortex, the explanation being that it is an effort to neutralise the damage to the tissues which results from prolonged poisoning. Several observers have noted cortical changes in patients who have died of blood poisoning ; and similar diseases, as well as certain inorganic poisons, are stated to possess the power of damaging this structure.

It is believed, therefore, that the exhaustion that sometimes accrues after infectious diseases may be due to changes in the adrenal cortex. Excessive or prolonged muscular exertion appears to lead to changes in the normal constitution of the cortex, and " this indicates either an over-activity of the gland or else a reaction to the toxic products of fatigue, perhaps both " (Hartman).

It is interesting to note certain observations which have been made as to the effect of varying conditions upon the adrenals. A diet which, under normal conditions, produces scurvy also produces congestion and enlargement of the suprarenals (McCarrison). The same observer found that pigeons fed on polished rice developed enlarged suprarenals ; but that the addition of vitamin A in the form of butter prevented this result.

Again, both parts of the suprarenal gland increase during pregnancy, but it is stated that the increase in the cortex is the greater. In fact, the relation of the suprarenal cortex to the sexual glands and to growth is very suggestive. The suprarenal stimulates the growth and development of the gonads ; and it is believed that it is the cortical portion which produces this effect. It has been shown that the amount of suprarenal tissue seems to determine the size of a litter ; animals which have had one suprarenal removed produce a small litter. Furthermore, in animals the process of lactation appears to cause a continuation of the adrenal enlargement ; for if the animal does not suckle its young, the suprarenal rapidly returns to normal size. In the human species,

moreover, there is, during growth, an increase in the size of this gland which is out of proportion to the general increase in body weight.

3

A more interesting aspect of the work of the adrenals is that which relates to its emergency function. It has been shown that the adrenal gland deserves the name of "the gland of emergency." [1] This aspect of the suprarenals has been carefully worked out by a great physiologist, Professor C. B. Cannon, and in a fascinating book called "Bodily Changes in Pain, Hunger, Fear, and Rage," he has given us a lucid account of the behaviour of these glands in strong emotional crises.

As a preliminary to a discussion of this subject we must glance briefly at the behaviour of an animal or human being under varying circumstances.

Let us picture an individual quietly eating a meal, enjoying his food with abundant appetite. Suddenly he hears a noise, glances out of the window, and sees a repulsive accident, let us say, a child run over by a motor-car. The normal response would be failure of appetite, distaste for his meal, and, were he at all a sensitive man, actual vomiting might ensue. What exactly has happened here? What is the mechanism which produces these sudden physical changes? The answer is, obviously, emotion. Fear, disgust, pity, change the smooth working of the digestive juices and interfere with the movements of the stomach. Instead of digestion proceeding normally, the entry of fresh, strong, and antagonistic emotion switches off, so to speak, the energy from the normal digestive processes, and a cessation of "appetite juice" is the result.

Take another example. A man is walking across a street when suddenly he is aware that a motor-car

[1] This "emergency function" has recently been questioned, as it has been shown that the secretion of adrenalin is continuous. The fact remains undisputed, however, that its secretion is controlled by nervous mechanism.

is rapidly approaching. With an agility quite impossible save under the stimulus of fear he leaps aside. Having arrived in safety on the pavement, he finds that he is breathless, his heart is beating fast, and his knees tend to give way beneath him. What has happened here? In the first instance, the emotional outburst acting through the sympathetic nervous system has stimulated the gland of emergency. A greatly increased supply of energy has been immediately released, *and if this be not all utilised for its emergency purpose*, it produces the after-effects which we know as "nervous shock."

Although there have been oppositions to the theory that the adrenal is the gland which has the power of releasing additional energy in cases of emergency, there seems to be abundant evidence that, in some such way as we have described, the energy attaching to instinctive action is generated by the adrenal gland. It is clear that under the stress of emotion feats are capable which are quite impossible when the mind and body are not so stimulated. In Cannon's book there are some most interesting examples given of what he calls "the energising influence of emotional excitement." He quotes, among other interesting examples, the occurrence of religious manias during which large numbers of individuals become frenzied and undergo feats of extraordinary endurance. In 1374 such a mania occurred in Germany and other parts of Europe, in which men and women danced for hours on end without rest, uttering cries and careering in pairs or in a circle around the streets. Another instance occurred in Wales in 1740. The same kind of uncontrollable emotion was witnessed here, when thousands of people worked themselves into a fever of excitement.

Examples such as these, where the normal conduct of the individual is replaced by the uncontrollable impulse of the mob, must surely depend upon imitation. Now imitation is a power accompanied by a definite emotion, which the psychologists recognise as possessing very considerable power. Religious revivals owe much of their

power to the infectious nature of emotion. From the individual standpoint, however, we are unable to explain how it is that individuals are capable of these extraordinary feats of endurance and strength, unless it be that there is some mechanism in the body capable of releasing additional energy under the stress of emotion. That there is some such mechanism as this must now be conceded; for, without such an assumption, we are still as far from explaining such occurrences as these as we were in the old days of academic psychology. Everybody realises that the capacity for exertion is vastly increased under the influence of strong feelings; and that what is done in "hot blood" is often impossible under ordinary conditions.

Experimental physiology has shown us the effects which follow the administration of the hormone from the adrenal glands to animals. The results are similar to those which precisely occur in the human being under the influence of strong emotion. It has been shown that the resources at the disposal of the body are capable of being "switched off," in moments of crisis, from such parts as the digestion, and "switched on" to muscles and important viscera. The sympathetic nervous system and the adrenal glands bring about this change, and they do so for the purpose of providing energy at short notice.

Now that this aspect of emotion has received an explanation, and we are beginning to realise how the human being succeeds in reacting in the speedy and capable manner in which he does, we are better able to understand how the instincts still maintain control over the human being, even in these modern times.

4

From the dry-as-dust teaching of the nineteenth century there has emerged a psychology which deals with the human mind in a far more intelligible manner. This school teaches that each inherited mental tendency or instinct is supplied with an emotion peculiar to itself. Professor McDougall, in his "Introduction to Social

Psychology," outlines the main instincts and their functions. For example, he tells us that the instinct of self-preservation is accompanied by the emotion of fear; that the instinct of repulsion produces the emotion of disgust; that of curiosity, wonder; pugnacity, anger, and so on.

We have to assume that these instincts are present in the mind of everyone; that they lie, so to speak, dormant, but are constantly being brought to life by circumstances. Furthermore, we must understand that when one instinct is activated, the emotion suitable for that instinct is generated in the mind. Danger, which calls into being the instinct of self-preservation, is followed by the emotion of fear. What happens after this? Were the mind floating in space, and not connected to a reservoir of chemicals—such as the human body—it might well be that nothing would happen. As it is, however, a great deal comes to pass. For, once an emotion invades consciousness, it does not stop there; messages travel down the nervous system and its branches, and changes are produced in the organs of internal secretion, and through them in the great systems of the body.

To return, however, to the instinct of self-preservation. The individual is suffering from fear. Certain physical changes take place which, although well known, may bear enumeration. We are told that such a man may be "rooted to the spot." His pupils dilate, his heart palpitates, and a cold sweat breaks out upon his brow. These are the symptoms of *fear*, but they are also the exact results which follow suprarenal stimulation. It comes to this, then, that fear produces its bodily changes by stimulation of the adrenal glands.

It has already been said that when emergency arises, energy is diverted towards those parts of the body which require it at the moment. The mechanism which is available arranges at the same time to rob those parts of the body not requiring a free blood and nerve supply, and to divert it to the heart, muscles, and nervous

system. Were it not so, it would be impossible for an individual to adjust himself satisfactorily to the urgency of many of the situations in which he finds himself.

In one of the examples we quoted as to the disturbance of a normal function by sudden emotion, it was shown that the ordinary work of digestion can be, and is, interrupted by any sudden shock. It was pointed out that the movements of the muscles and the secretion of the digestive juices come to a standstill. This is an example of what happens in moments of crisis ; it is also one reason why people are apt to feel that their food is lying in a "lump," and causing them discomfort. This corresponds, in fact, to the cessation of the movements of the stomach, and is brought on by emotional disturbances, by worry, and kindred causes. Other instincts make use of other glands, but the general principle is the same. The instinctive reactions—which are brought into being by external stimuli—lead to a dominant emotion ; and this, in turn, produces its physical effect *vid* the nervous system and the glands of internal secretion.

For many years a belief has existed that worry and strain is capable of disturbing such functions as those of digestion and elimination. And although it has been recognised in everyday life, a good deal of disbelief has attached itself to such theories. They have been considered good enough for old women of both sexes, but they have been received with a certain amount of incredulity by better-informed people. The work which has been done of recent years has afforded conclusive evidence that interference with digestion and elimination actually *does* take place under the stimulus of emotion.

Life has become even more interesting than it used to be, now that the pieces of which it is made are gradually being unfolded to the astonished gaze of the twentieth century. We are now able, by means of an X-ray examination, to see the contractions of the stomach and intestine, and to watch the manner in which these organs

grapple with the problem of digestion. Modern methods of examination can tell us the percentage of sugar which the blood contains at any one time. Bacteriologists have christened the various inhabitants of our innermost economy; while physiologists describe the part which the various glands play in the body, and explain how it is that we can undergo feats of endurance of no ordinary kind without fatigue.

But even more interesting than all this is the territory which consists partly of mind and partly of body. The communications are the nerves and the ductless glands, and they link up the mind and its functions with the body. How they achieve this is just beginning to be understood. It makes the working of the machine we know as *homo sapiens* more easy of comprehension; and explains many factors which experience recognised, but the workings of which we were unable to understand.

As the science of endocrinology develops, as fresh facts come to light, the psycho-physical mechanisms become clearer. For this study deals with as vital a subject as exists in the world. It discusses the physical basis of behaviour and the reasons for conduct. But it has this great advantage over psychology, that it can go many steps further and show how instinctive reactions are carried out in the body.

5

So far we have discussed the adrenals largely from the standpoint of their daily work and their probable relations to other of the ductless glands. We must now study in a little more detail their work under ordinary conditions and under conditions of severe stress. The types which are known as "adrenal," their characteristics, and (so far as we are able) the influence which these glands exert on the endocrine hierarchy, will all bear a little closer investigation.

The adrenal glands have justly earned the title of glands of emergency, and for us to be able to understand

their main features we must appreciate that it is not in everyday life, when the machine is running smoothly, that we make urgent claims upon this part of our system, but essentially in times of stress and when an immediate response to the urge of emotions is required.

Now it will be quite apparent that the individual capable of a speedy response is, in all probability, one who has an active adrenal medulla, and therefore a sympathetic nervous system equally capable of quick adjustment. Such a one may be regarded as a "live wire." The individual who is "quick in the uptake," is the one whose emergency powers are well developed. At first sight it may seem that this is a purely psychological question; for it may be said that it is a mental rather than a physical trait. But the question is a deeper one than this. For not only does the mind require a physical brain for its work, but the response which the brain requires from the body implies a physical co-operation.

We may say, then, that the adrenal type is a quick, alert, and successful one. But, when we are discussing the adrenal type, are we thinking of the gland as a whole or of the cortex or medulla as separate organs? Obviously the alert mind must depend upon the medullary secretion; for it is this hormone which releases energy for the use of the body, and which stills the turbulence of the digestion in order to divert the nerve and blood supplies to those parts of the body in more urgent need of them. But the influence of the cortex is, in its way, equally important. Its hormone is a necessary ingredient for physical strength, a companion to the sex-gland in producing virility.

What are the other characteristics of the adrenal type? Can we, with some degree of probability, say that the adrenal type is always tall or always short, fat or thin, dark or fair? The problem is not as easy as this, for, of course, the adrenals are not alone concerned with the formation of the body. Nevertheless, there have been various attempts to describe the "adrenal type." It may

be instructive to quote one such attempt and try and analyse the basis upon which this description rests. Berman describes one adrenal-centred type as "hairy, dark, masculinity marked, with tendency to diphtheria and hernia," and he adds that variants of this depend upon the influence of other glands, especially the sex glands.

At a later page of the same book, this author makes the following statement: "An adrenal personality is one dominated by the ups and downs of his adrenal glands. In the large, the curve of his life is the curve of secretion by this gland, both of its cortex and medulla. . . . The skin is one of the chief clues to the adrenal personality. The relation between the adrenal and the skin dates way back in the evolutionary scale, for adrenalin has been isolated directly from the pigment deposits from the epidermis of frogs. . . . In an adrenal personality the epidermis is always slightly, somewhat, or deeply pigmented. . . . There are often black spots, deep pigmented birthmarks, or the lighter ones of freckles. . . . The hair of the adrenal type is characteristic, ubiquitous, thick, coarse and dry. It is prominent over the chest, abdomen, and back, and has a tendency to kinks. Often its colour is not the expected: an Italian's will be yellow, a Norwegian's jet black. It has been stated that most red-haired persons are adrenal types; such persons also have well-marked canine teeth, which is another adrenal trait. They also have a low hair line."

Here is an outline of an adrenal personality; many readers will at once call to mind individuals who have one, or possibly two, of these characteristics. But can any reader think of one among his acquaintances who possesses all the points mentioned in this description?

The adrenal-centred type is hairy, the nature of this hair being similar to that described in Part II. as typical of the negroid race. The adrenal type has a low hair line—that is to say, his hair comes low down on his forehead. The adrenal type is also one with marked

masculinity, and Berman states that among women the adrenal type is always masculinoid.

From what we have seen in an earlier section, this would imply an active adrenal cortex; for when this is the case in men, it produces marked masculine characteristics. Extreme examples of this in women are the cases to which we have already referred under the name of virilism. It is no doubt from this fact (namely, that tumours and overgrowth of the adrenal cortex are associated with masculinity in man, and absence of the essentially feminine signs in woman) that this characteristic of the adrenal personality has been determined.

If we regard the cortex as the part of the gland responsible for vigour and virility, we should expect it to show signs of damage by a lowering of the physical strength, capacity, and energy. The adrenal cortex is relatively larger during growth—that is to say, in children and adolescents—than it is during adult life. That this is so is not to be wondered at; and its close relation to the interstitial gland suggests the explanation. After infectious diseases, and in individuals who have died from such diseases as peritonitis and blood poisoning, changes have been found in the cortex. This shows that probably the cortex plays some part in the defence of the body against infection.

The adrenal gland is that part of the endocrine system which contributes virility, speedy response, and sex determination. The cortex contributes the sex influence and the pugnacity, while the medulla is responsible for the quickness of response. When the medulla is over-acting, and the sympathetic nervous system is highly responsive, a condition of nervousness, characterised by apprehension and undue fear, is the result. When the cortex is over-active, pugnacity and an over-sexed condition results. The charging buffalo possesses a generous supply of cortical substance, the timid deer but a trace. What a different aspect the riddle of per-

sonality shows when we realise that courage may, in spite of what philosophers tell us, be the outward and visible sign of adrenal cortex, rather than the inward and invisible sign of spiritual grace.

In writing these lines there is no attempt to decry either mental control or spiritual forces. The time has come when it is necessary for us all to realise that the workman cannot work without his tools, and the mind cannot work without a brain. The brain cannot work without its blood, and the most important factors in the blood are the products of the internal secretory organs. This physiological "House-that-Jack-built" is little grasped by the average man. One frequently hears it said that such disorders as neurasthenia are to be despised because they are simply the result of "weak will." Who knows what this means? It is perfectly apparent that the will does not act in a void or space, but is in relation with mental forces, on the one hand, and physical agents on the other. As fatigue brings with it temporary weakening of the will-power, so is chronic fatigue—*i.e.*, neurasthenia—associated with *aboulia*, or weakening of the will. Many authorities believe that neurasthenia is nothing more nor less than adrenal exhaustion, and there is a good deal to be said for this view.

Beard, who invented the term "neurasthenia," described the condition as one of "irritable weakness." Irritability is often a sign of inefficiency; as if the individual was being constantly irritated by non-success. Weakness is the classical sign of adrenal under-action. It should be realised, in justice to the many sufferers from nervous disorders, that bricks cannot be made without straw, and that without the necessary hormones the mind cannot function adequately.

To know all is to understand all. While we are very far from claiming omniscience with the endocrine glands, the scientific world is getting glimpses into the workings of the human machine; and these make us realise how

intricate is the machinery. True, the easiest course to pursue is to dismiss all functional disturbances as being due to the individual's lack of will-power. The appearance on the human stage of the ductless glands, and the dawn of understanding of their functions, makes it appear, however, that this is an inaccurate viewpoint.

CHAPTER VI

THE INFLUENCE OF SEX ON THE PERSONALITY

1

ALL the ductless glands combine to make the personality. Some of these are essential to life. Remove them and death ensues. Others are different. Their removal is followed by symptoms, but not by death.

Among the latter class are the sexual glands. They are not essential to life, but necessary for reproduction, and for the formation of a normal personality. Removal of the male or female sex organs results in two deficiencies—the loss of power to reproduce the species, and the failure of those manifestations of sex which are known as *secondary sex characteristics*. But the life of the individual proceeds ; a hampered and an incomplete life, but nevertheless (with the exception of certain changes to be enumerated shortly)—life.

The sexual glands have two functions to perform. They are primarily the organs which manufacture the secretions necessary for reproduction—the spermatozoa in the male and the ova in the female. A second, and just as important function, is the formation of an internal secretion which is responsible for the characteristics which differentiate man from woman. This is brought about by the presence of certain groups of cells with a specialised function, known as the *interstitial cells*.

The third function—which is really a relation—is to act in conjunction with other of the endocrine organs in the regulation of the upkeep and repair of the body. If the testes are removed—as is done to cockerels—there is an increase in the storage of fat, and a " nice table-

bird " is the result. If the testes are removed from a young male, normal development fails, and what is known as a *eunuch* results. If the testicular internal secretion is absent, one of the regulators of metabolism is deficient, and obesity is the result, a condition nearly always present in eunuchs.

These, then, are three aspects of the sexual function, and each one plays an important *rôle* in the formation of the personality. Virility, however, is not dependent upon the presence of the genital secretions alone. Rather is it only one of the ingredients, although a vastly important one. Studies in development show that the internal secretory cells of the sex glands and part of the adrenal gland are near neighbours. Tumours of this latter structure have been found in association with sexual precocity and hypersexuality, an example of the complex nature of the sex impulse.

Failure of the thyroid or pituitary is associated with under-development and an absence of sexual life. Without the thyroid there is no normal growth and no sexual development.

From this it will be obvious that vastly different personalities may emerge from the endocrine cauldron. All degrees of sexual development may result from excess or deficiency of the secretion of the interstitial cells, and from excess or deficiency of such parallel hormones as those contributed by the thyroid, pituitary and adrenals.

Accompanying such varying types will be the mentality, which can—up to a point—be recognised as the invariable companion of this or that endocrine pattern. To illustrate this point we may give one example here, although the subject is referred to again in a subsequent chapter. We have already said that the eunuch, deprived of his testicular stimulant, grows fat. But the change does not stop here. He loses his sexual desire, his pugnacity, energy and " drive." He is content to sit about and guard the harems of his master. His is a different per-

sonality to that which it would have become had he not been robbed of one important link in the chain which forms manhood. Such a being is capable of recognition in other ways. He grows tall. The removal of the sexual secretion acts like the removal of a brake, and rapid and excessive growth ensues.

In the ordinary course of development, however, only a few years of growth remain after puberty has been reached. It seems as if the testicular hormone inhibits growth, perhaps by swamping the thymus gland, although the view is usually held that it is the other way round. The thymus (being the gland of childhood) is usually regarded as exerting a restraining influence upon the development of sex. With the onset of puberty, the thymus atrophies.

The changes which occur at puberty are widespread. The results of castration before puberty have been studied under many different conditions, and have added considerably to our knowledge of the problems connected with sex. It is plain that between the two extreme degrees of over- and under-sexuality there must be a wide range of variation, dependent upon the activity of the sexual internal secretion and its coadjutors. We have already described what happens in the complete absence of the testicular hormone. Extra testicles grafted on to a ram by Voronoff produced an enormous exaggeration of the secondary sexual characteristics, with the development of huge horns, larger than are ever seen in the males of this species.

2

In recent years the word *gonad* (from the Greek word meaning "seed") has come into general use to indicate the generative organs of either sex. From the endocrine standpoint we are concerned chiefly with the internal secretion of the testes in the male and the ovaries in the female.

At one time it was considered that the sexual glands

remained dormant until the onset of puberty. This view has been replaced by an opinion which obviously fits in better with the observed facts. It is true, however, that it is not until the onset of puberty that the secondary sex characteristics appear. In the male they consist of the breaking of the voice, the appearance of the moustache and hair on the face and body, and the development of the typically masculine frame. In the female, the development of the breasts, the appearance of hair on the body, as well as the establishment of the menses, mark the onset of puberty.

A great deal of information has been derived from the effects of removal of the male and female glands, either by operation or disease. Until recently, in some countries the mutilation of the male has taken place either as the result of a religious ritual or for some definite purpose, such as the preservation of the boy's treble. Such procedures proved that interference with the development of the sexual glands is always followed by the suppression of the principal signs of puberty.

From observation of these cases much material has been obtained which has thrown light upon the part played by the development of the interstitial glands at puberty. If this operation has been performed, or if definite disease of these glands (or, indeed, of some other of the ductless glands) occurs, the signs characteristic of sexual maturity do not appear. Accompanying this, there are indications which point to the implication of other glands; for instance, there is weakness of muscle and obesity; and a type of personality, which can best be described as sluggish, ensues. We shall see from this, and from what is described in the following pages, that in the development of the adult of the human species the glands of sex play an important part.

3

It was only when the pituitary gland received the recognition which it deserved that it came to be regarded

as the detonator of sex, or, if you prefer it, as the motor which drives the sexual impulse. For many years now an association between the pituitary and the gonads has been recognised. Extracts of the posterior lobe are a routine method in use to stimulate uterine contractions after labour; and this fact alone turned the attention of investigators towards the relation between the two glands. Again, it has long been known that destruction of the pituitary (or its deficient secretion) leads to lack of sexual power. But so does deficiency of thyroid; and this fact suggested that perhaps both the thyroid and the pituitary hormone were merely ingredients in the sex compound.

It is now recognised, however, that the pituitary is the master organ of sex. It influences both male and female by means of a secretion which has received the terrifying name of the *gonadotropic hormone*. More astonishing still, this hormone, or something very like it, can be isolated from such unlikely sources as the urine, showing that its circulation in the body is established. Moreover, it is thought that this hormone could be subdivided into the moiety which stimulates ovulation, *i.e.*, the formation of the egg, and that which controls the opposite condition, *i.e.*, luteinisation.

For this reason the older view, which regarded the sex organs as almost independent hierarchies, has had to give way to the newer facts as they have been established. While the pituitary secretion could do nothing towards sexual life in the absence of the sex organs themselves, it is equally true to say that without the direction of the pituitary there would and could be no sex-life.

4

In view of the facts to which we have just referred, we may pause to consider for a while the sexual impulse, and its relation to physical sexual development.

Psychology steps in and emphasises the sexual impulse as if it were primarily and solely psychogenic—that is

to say, produced in the mind. Endocrinology, on the other hand, claims that no sexual desire can be present in the absence of the internal secretions concerned with this *rôle:* and experimental observations support this view.

For our present purpose, however, we are concerned mainly with the relation of sex to the personality. Many of the sentiments to which psychologists refer are profoundly altered on the arrival of the child at puberty. We are told that such sentiments as modesty, shame, affection and love are merged in the sex instinct. The outlook of the child before puberty is uncoloured by the physical side of sex. It may be true, as the followers of Freud tell us, that from the mental standpoint, sex peeps out from the child's mind by sublimations and complexes; that there is suppression of sexual manifestations until adolescence, but that, nevertheless, sex in some disguise or another is present in the childish mind.

While the primary sexual differences are recognisable from birth, the secondary sexual characteristics make their appearance at puberty. It is then that the boy becomes a young man; and the girl develops those changes in mind and body with which everyone is familiar.

There are certain experimental and other observations which throw some light upon the metamorphosis of puberty. The changes in the male have been more thoroughly understood than those in the female, owing to the customs to which we have referred in the preceding pages. It has been shown more recently that when the ovaries are removed from young female animals, the secondary sexual characteristics fail to develop. This suggests strongly that a stimulant to the bodily chemistry has been removed by the operation. Essentially feminine characteristics are impossible if the ovaries are removed before puberty.

What happens, then, to such an animal? The general bodily configuration gradually takes on male characteristics. The explanation of this astonishing change is

suggested by studying an interesting account of freemartins which Lillie has given us.

"Freemartin" is the name given to the female of the bisexual twins of cows, and freemartins are generally barren. The twins develop independently in the cow's uterus, but are so placed that the blood of the two can communicate. The fact that the female twin is *sterile* suggests that the hormone of the male has dominated the potential sexual hormones of the female and produced sterilisation.

Several experiments have shown that the implantation of an ovary into a young male animal has resulted in a modification of his physical characteristics and behaviour. But more certain is the fact that experimental grafting of the testicle in young female animals is productive of striking physical changes veering towards male characteristics, accompanied by the typical active pugnacity of the male.

It must be assumed, therefore, that each sex has its hormone, or chemical controller of sex, and all that this entails. The male hormone, for the reason described above, must be secreted during intra-uterine life; as, if this is not so, what possible explanation can there be of the well-established fact of the freemartin? Moreover, it is in keeping with the fact that other hormones are known to be manufactured during fœtal life.

We might safely proceed a step further, and suggest that the absence of the female hormone, with the resulting failure to stamp the sexual characteristics, leads to the production of a bodily and mental state which is neither masculine nor feminine, but rather neuter. But is this really true? Is it not probable that, when the ovarian hormone is removed—either by operation or by the advent of the change of life—there is a tendency towards the production of male characteristics? In the human species even, in the latter decades, many women develop male characteristics when the secretion which guides the sexual life is no longer active. It would appear, therefore,

that there is an underlying "maleness" which is restrained from activity so long as the ovarian hormone is in being, but which becomes dominant once this inhibition is removed. That this does not invariably happen to every woman after the menopause is explained by the assumption that other of the ductless glands take on that part of the work of the gonads which is concerned with the preservation of feminine characteristics.

5

Professor Sigmund Freud was the first to point out that we must assume the sexual impulse to be present during infancy, and that the view previously held that it "dropped from the clouds" about the age of fourteen was inconsistent with the facts.

Unfortunately for the serious study of this subject, the whole question of sex has been absurdly clouded by moral and ethical considerations. The coat of whitewash which has been given to this impulse, in a praiseworthy effort to make it appear respectable, has resulted only in making it appear ridiculous.

Modern psychology teaches us that the two fundamental instincts are those which deal with the preservation of the self and the preservation of the species. The emotion attached to the first of these instincts is fear; while the second is associated with such emotions as love, affection, and modesty.

There is nothing foolish or shameful in the sexual side of life. There is no real need for the giggles and blushes of youth. Modern parents have discovered that unless sex is made mysterious or deceptive, adolescents grow and adapt themselves to the new factor. In other words, the dangerous age of puberty has to a large degree been shorn of its perils by the frank recognition of its existence and utility; while the ebbing of sex, which has led in the past to much unhappiness, is now a less hazardous period, owing to the modern view taken of the necessity for

sublimating such emotional activities as are unable to be utilised directly.

Freud is largely responsible for the education of us all in the psychological aspects of sex. He suggested that the sexual impulse was " polymorph perverse " ; that it consisted of several parts, one of which became dominant, and eventually guided the destiny of the individual. By this reasoning he attempted to explain the psychological aspects of sex, and both normal and abnormal sexual impulses.

The physiological facts described in the preceding section run (in many ways) on parallel lines to the views held by the Viennese school. The presence of a genital hormone in the fœtus certainly suggests a potential, if not an actual, sexual factor very early in the life of the individual. It may be, of course, that it is only operative in exceptional circumstances, such as occur in the free-martins ; or that its main work in prepubertal years is concerned with growth, and that it is deflected on to its direct work from then onwards. Certain is it that the rate of metabolism is greater before puberty than it ever subsequently is ; and that much material required in the first few years of life can be dispensed with once adolescence has been reached.

The functions of the sex glands in man are in many ways simpler and more easily understandable than they are in woman. The male instinct for reproduction is more dynamic in its urge than is the case in woman ; but the maternal instinct (which includes the instinct of sex) is a more widespread impulse, and more far-reaching in its consequences. The interstitial cells of the male are responsible for sexual desire, but only in co-operation with thyroid and pituitary. In the absence of any one of this triad, normal sexual life cannot exist.

In the female, however, there are probably more internal secretory agents contributing to sexual life, and responsible for the cycle which occurs periodically and which is known as menstruation. With the onset of

puberty the ovarian secretion begins; menstruation commences, and the secondary sex characteristics appear. Dealing first with the menstrual cycle, it is obvious that this is controlled entirely by endocrine influences. This function is regular and rhythmical. The ovary contains a collection of small nests containing ova. Periodically a follicle enlarges, bursts, and expels a ripe ovum. If pregnancy occurs, the ruptured capsule develops into a relatively large yellow body known as the *corpus luteum*. Should, however, this event not take place, the ruptured follicle shrinks, and a scar is formed which is known as the *false* corpus luteum.

With pregnancy and the formation of the placenta (or "after-birth") the endocrine picture changes; many of the features of pregnancy are directly dependent upon the introduction of fresh endocrine influences into the body. Among these must be reckoned a specific secretion from the corpus luteum; changes in the thyroid; hypertrophy of the pituitary; and enlargement of the breasts.

To return to the menstrual cycle. This consists of four more or less clearly defined stages, and these may be called the pre-menstrual, occupying a few days before the actual menstrual period; the period itself constitutes the second; the time immediately following, which may be called the post-menstrual; and the remaining time before the onset of the next pre-menstrual stage. Associated with the pre-menstrual period there are various bodily changes which, if they are excessive or ill-regulated, rise to the surface as disordered sensations. The menstrual flow itself is to be regarded as one of the eliminatory agents of the body; and the post-menstrual stage covers the time of recovery of the ovaries and the uterus from the actual menstrual period.

The endocrine influences which control the menstrual cycle are as follows. First, the stimulus from the pituitary, then that from the interstitial cells of the ovary—the cells which are generally regarded as responsible for the secondary sexual characteristics of womanhood.

There are also the influences exerted by the ripening follicles of the ovary; and lastly, there is the corpus luteum of pregnancy. It has been suggested that the interstitial cells maintain the normal nutrition of the uterus as well as contributing to the secondary sex characteristics. The ripening follicles are regarded as being largely responsible for sexual desire, the corpus luteum being the active agent governing the enlargement of the uterus and of the breasts during pregnancy.

6

The personality is incomplete without the quota of sex, and in individuals who are not definitely sexed there is always an element of incompleteness. Puberty is the first of the great epochs of life. Physiologically it corresponds to the arrival of fresh secretions; psychologically it represents the change from immaturity to maturity.

Let us consider first the case of the male. In the prepubertal period the boy is much less distinguished from the girl than is ever the case again.

The *interstitial gland* is regarded as being the prime mover in the metamorphosis of puberty. The hormone which it secretes is responsible, in all probability, for the gradual shrinkage of the thymus. It activates the adrenal cortex in determining masculinity.

Its relation to the thyroid, however, is much less dominant than is the case in the female. Some observers believe that the thymus is to be regarded as having a special relation to the male gonads, much in the same way that the thyroid influences the female sex glands. Sir Edward Schäfer says: "The mutual relations that appear to be established between it [the thymus] and the generative glands in the male sex, perhaps entitle it to occupy a place among them (*i.e.*, the internal secretory organs)." At any rate, the thymus appears to co-operate with the male generative organs more than with the female.

The adrenal cortex has already been described as the organ of distinctive masculinity; and it has been

impeached as one of the endocrine influences which produce premature sexual development (in the male), masculinity in the female, and courage and aggressiveness in both sexes. It must not be understood by this that the adrenal cortex is an exclusively male organ; for it hypertrophies in the female during pregnancy. It is probably mainly masculine when left to itself, uncontrolled by the ovarian influence.

Adrenal cortex *plus* male interstitial cells appears to be the most probable combination to produce masculinity and sexual potency. Feeding young animals with adrenal cortical substance has been stated to stimulate the growth of the testicle; but increase in the ovaries has also been found in young female animals similarly fed.

The entire glandular system changes at puberty. The "storm and stress" period, as Wheelan has called it, is ushered in by alterations in the emotional outlook of the child. The nervous system undergoes profound changes, and this is shown by the appearance of new nervous reflexes, by the awakening of sexual desire, and by the irritability and moodiness which is a not uncommon accompaniment of this epoch.

In animals the arrival of the rutting season is productive of much nervous excitement and bodily activity. This season also shows animals at the height of their vitality. So violent is the sexual impulse at this time that many animals abstain from food, concentrating on the battles they fight for their females. At the end of the breeding season the males of certain species are thin and exhausted; and, during the remainder of the year, recoup from the tremendous expenditure of energy which has accompanied the periods of sexual activity.

In the human being, however, the activities of sex are not regulated in the same way as is the case in animals. The stimulus to sexual activity is largely psychical; and impulses from the higher cortical centres appear to initiate an increase in the physical activities of the gonads. It is equally probable that an increase in the contents of

the organs of sex sensitises the nervous system and leads to a heightening of mental stimuli. There is an action and a reaction in which the mind plays upon the body, and *vice versâ*.

Following upon puberty, there are certain changes which are characteristic. The emotional alterations have already been described ; but, in addition to the instability of the mentality which constitutes " moods," there is an appearance of a consciousness of self, an increase in the elements of self-consciousness, such as shame and modesty, and a reticence and reserve which are directly traceable to the appearance of sex-life upon the scene.

The interstitial cells are stated to be " conspicuously numerous " in children ; and to vary in adults according to such factors as arise in the course of life. These cells have been shown to be responsible for the internal secretion of the testes ; and, while they are present and undamaged, sexual life is normal (in the absence of abnormalities in the other organs which control the genital function).

During advanced life—and in conditions of ill-health—the interstitial cells are less numerous ; and with the decline in their activities, another gland in the male undergoes characteristic changes. This gland, known as the prostate, often becomes a mass of fibrous tissue in old age, and in many men increases greatly in size ; but this enlargement cannot be regarded as a normal procedure, in view of the fact that all the other generative organs tend to become smaller as age advances. It has been suggested, therefore, that " hypertrophy of the prostate in senile individuals results because of an over-production of the testicular hormone in combination with a reduced external secretion " (Wheelan). This would help to explain the markedly increased sexual desire which not uncommonly appears in elderly men, and which is often associated with enlargement of the prostate.

The influence of the genital internal secretion on growth

is shown by the fact that late maturity increases the growth of the skeleton, and particularly that of the long bones. Early puberty on the other hand is associated with closure of the epiphyses (the growing ends of the bones), and consequently a short stature.

The condition known as *eunuchoidism*, described by Griffith, and subsequently by Tandler and Grosz, is regarded as a developmental disorder directly due to defect of the interstitial cells of the testicle. This leads to faulty development of the secondary sexual characteristics, with abnormal persistence of the epiphyses and increase of the fat of the body. In other words, a modified picture of a eunuch. Eunuchoidism is associated with long extremities, such as are seen in the eunuch. Where there is great increase in fat, the individual usually belongs to the hypophyseal group; those with marked skin changes and carious teeth, to the group of thyroid deficiency (Bassoe).

Premature removal of the testes is responsible for changes which are directly traceable to the loss of the testicular hormone. When castration has been undertaken in early life there is an under-development of the entire genital apparatus, the various sexual glands remaining in a partially developed or immature condition. The general build of an individual deprived before puberty of the testicles is typical. There is an increase in the length of the bones of arms and legs, while the hands and feet are often long and slender—in fact, the entire skeleton is delicately formed. The pelvis often approaches the female type. The union of the growing ends of the bone remains unclosed, often for several years beyond the normal period. One of the characteristics of such an individual is the high voice; and this is caused by the fact that the larynx resembles that of a large boy.

The hair of eunuchs tends to turn grey early; the eyebrows are well developed, but usually bodily hairs are scantier than on a normal man, and conform more

to the feminine distribution. It is usually admitted that there are two types of eunuch—the tall and thin, and the fat type. The typical distribution of the fat is round the abdomen, hips and upper part of the face. While adiposity is generalised in the fat type, these areas are the most marked. The muscles of these individuals are, as a rule, weak.

Mentally, eunuchs show a lack of those characteristics which are generally regarded as typically masculine. They are inert, without ambition, sleepy, and lack the drive and courage of a normal male.

A study of a secret religious sect of Russia, known as the Skoptsi (from the Russian word *skotets*, a eunuch), affords a good deal of information on the effects of sexual mutilation. This is the main feature of this sect, and they refer to it as " the baptism of fire." The motive which prompts the behaviour and tenets of this remarkable sect is apparently a desire (however misguided) to arrive at individual perfection. Among their religious ceremonies, hymns and addresses take place ; and frenzied dancing, not unlike that seen in the manias of the Middle Ages, is witnessed during their gatherings.

From a study of the Skoptsi, information has been acquired as to the effects of mutilation on the physical and mental state of the individual. Tandler reports a case with full details. The individual was thick-set and well proportioned, but his arms were unusually long, the appearance of the face was wrinkled and furrowed, the thyroid cartilage was soft, while the sexual development was that of a boy at puberty.

Some cases, which show less sexual alteration than would be expected from such procedures as castration, suggest that other of the internal secretory glands (such as the adrenal) are capable of acting, to some extent, for the testicles, in so far as sexual life is concerned.

There are individuals whose general build points to a congenital lack of development of the entire sexual system ; others, whose deficient development follows

injury to the sex organs, infectious and inflammatory diseases, and damage to nerve centres.

There is abundant evidence that the internal secretion of the testis is necessary for normal development; but, from much of the data now available, it is apparent that the whole question of sex is determined, not by the sexual organs alone, but by their collaboration with others of the endocrine hierarchy, whose influence upon sex and metabolism is necessary for normal growth and development.

7

In 1863 Pflüger described the interstitial cells of the ovary. These are found as large, roughly spherical cells, arranged without definite order, but generally grouped together in small clumps.

Much controversy has raged, and is still raging, about the meaning of these cells and their exact function. The data in connection with their work is in many ways very conflicting. The analogous interstitial cells in the male are variable; so also are the cells in the ovary. It appears that the interstitial cells of the ovary develop much earlier than the lutean cells, and it is believed that they reach their greatest development before puberty. They persist throughout sexual life, and increase during pregnancy. Curiously enough, they have been found to be reduced in number during hibernation.

It is believed that the interstitial cells of the ovary are active in the physiological sense, for, in certain circumstances, they vary in number. The fact that the interstitial gland of the ovary is not met with in all species makes it very difficult to estimate its function; although some authorities believe that its apparent absence is to be explained by the fact that it may be very poorly developed in certain species, and that its presence was overlooked during the examination. Physiological experiments suggest that it exerts an influence upon secondary sexual characteristics, uterine function, and possibly mammary overgrowth.

The results of the removal of the ovaries have been referred to in an earlier chapter. It is not known for certain what part of the ovary is responsible for the changes which follow their removal; but certain facts, which have come to light in the course of investigations, make it possible to formulate some scheme to explain them.

Pflüger's original theory was that the ovaries exerted their influence on the bodily functions by means of the nervous system; but this belief became untenable when it was shown that the functions of menstruation could continue after removal of the ovaries, provided they were transplanted into some other part of the body. This, of course, establishes the fact that their influence is exerted through the blood.

There is very little information available as to the results of removal of the ovaries in early life. Removal in animals appears to produce changes similar to those already described as occurring in the male skeleton after this operation.

The results of ovarian removal in later life appear to differ very little from those of the normal menopause. Both conditions owe their origin to the physiological changes following upon the removal of the internal secretory functions of the ovaries.

No doubt many of the symptoms of the menopause are to be regarded as due to changes in other internal secretions, produced by the removal of the ovarian hormone. Some writers consider that there is over-action of pituitary and thyroid when the ovarian secretion ceases; and that such symptoms as the "flushes" are really due to this factor.

Atrophy of the genital apparatus occurs after removal of the ovaries. Obesity is often a sequel; while various changes of a less definite nature occur, both under these conditions as well as after the natural menopause.

In some female animals removal of the ovaries has been stated to lead to the appearance of male characters.

"Such cases are difficult to explain on any other hypothesis than that the secondary male characters are normally present in a latent form in the female, and that the ovaries exert an inhibitory influence over their development. But castration in the male does not lead to the assumption of female characters" (Swale Vincent).

Following removal of the ovaries in animals, there is sometimes found a condition of fibrosis in the uterus. The occurrence of fibroid tumours in the human uterus has, up to date, received no explanation. It is a pure speculation, but it seems at least possible that these fibroid growths might be determined by a diminution of some hormone normally secreted by the ovary. It is at least likely that "fibroids" may one day be explained on endocrine grounds.

From what has been said, the importance of the various secretions of sex will be obvious. Man is what he is by virtue of his gonadal secretion. Woman has been described as being feminine by virtue of her ovaries. The presence of the sex characters is essential for normality.

A study of the manifold agencies which contribute to the formation of the personality teaches us that, while it is undesirable to emphasise unduly any aspect of sex, the importance of this side of human nature can hardly be over-emphasised. Men may come and men may go, but their descendants only live to recognise this fact by virtue of the instinct of reproduction, and all that goes to its being.

CHAPTER VII

THE LESSER GLANDS OF INTERNAL SECRETION

1

We have already dealt with the more important among the endocrine organs. The thyroid, pituitary, adrenals and sexual glands constitute the leaders among the glands of internal secretion.

There are, however, certain other glands which are concerned either in the metabolic processes of the body or in the formation of the personality. Among these we may undoubtedly place the pineal body, the thymus, the parathyroids, and certain others whose primary functions, however, are concerned with digestion. The pineal body we will consider first as its bearing on the personality is of particular interest.

This gland is situated in the brain attached by a short stalk to the dorsal surface of the third ventricle. It makes its appearance early in fœtal life, and, like the thymus (to be discussed subsequently), it appears to attain its highest development in children. In this way we may perhaps find an analogy between these two glands. The pineal gland is characterised by groups of scattered cells in a framework of connective tissue. A pigment is found in this gland as well as sandy material, which is known as *acervulus*. The organ is about the size of a pea, and has received considerable attention in a desultory sort of manner for many years. Descartes believed that it was the seat of the soul; it has likewise been held to be the remnant of a third eye, and this is based upon the condition found in certain reptiles. The *sphenodon*, a lizard found in New Zealand, possesses a

pineal body which closely resembles an eye ; and in many lizards there is a hole in the skull in the region of the pineal body which is believed to have operated at one time as an orbit.

No definite hormone has been isolated from this gland ; but upon the known facts in connection therewith many speculations have been founded. It is stated that removal of the pineal from animals has resulted in overgrowth of the testes ; and one observer, who has performed this operation upon guinea-pigs, states that the development of the testes has been markedly increased.

There have, moreover, been cases recorded in which tumours of the pineal body have been found in association with premature sexual development. The influence of age and sex on this gland is not without interest. The weights of the pineal glands have been given by Berblinge. His table shows that the male gland weighs considerably less than the female up to the age of twenty ; from then onwards it gets heavier until, in middle life, it is considerably heavier in the male than in the female. Furthermore, tumours of this gland have been found almost entirely in males ; while sexual precocity has also been noted in the subjects of pineal tumour. Von Hochwart was the first to draw attention to the secretory aspect of this gland. He reported a case, which has subsequently been quoted from book to book. The patient was a boy, aged five, who presented the symptoms of a brain tumour which was accompanied, however, by extraordinary bodily growth, intellectual development, and sexual precocity. The post-mortem examination revealed a growth of the pineal body.

There have been numerous other cases recorded of pineal tumour associated with sexual precocity. We are, therefore, justified in concluding that enlargement of the pineal is one cause of premature sex-development.

It has been reported that feeding with pineal gland in calves and bullocks accelerates the normal growth of animals. It has also been stated that backward

children, who yet present no signs of definite organic disease, are often benefited by pineal feeding.

A brief reference may be made to the metabolic side. The chemistry of the gland shows that the usual nucleo-proteids are found, but no active principle has been isolated. The knowledge that we have of its chemistry is still very scanty.

At present it is not possible to do more than speculate as to the *rôle* of the pineal, either in relation to the bodily economy or the part it plays in connection with the personality. The established fact remains that its influence is most active during childhood, and that it has some relation to the development which takes place at puberty. It is most interesting from the angle of history, as the distinguishing organ of the Cyclops, as an additional eye, and as " the seat of the soul " !

2

The gland which next merits our attention is the thymus, and this gland, like the pineal, is primarily a gland which is essential to normal growth. Developmentally, the thymus, in company with the thyroid, is an outgrowth from parts of the alimentary canal, and thyroid tissue is occasionally found embedded in its substance.

The thymus is a glandular structure of varying size situated behind the sternum in the upper part of the chest. It is surrounded by a dense capsule, and is supplied freely with blood. Its structure consists of lobes and lobules, the connective tissue between containing the vessels and nerves. The outer part of the gland is densely packed with small cells which look like white blood cells ; whereas, in the centre of the gland, these cells are less abundant, but large corpuscles, which are the characteristics of this gland, are here found. It appears from the effect of certain experiments that the thymus is not essential to life, but that definite changes take place after its removal. Certain illnesses appear to cause an atrophy

or diminution in its size: wasting diseases, notably tuberculosis, being associated with such changes. Post-mortem examinations show that this gland is one of the first to suffer from inanition. Prepubertal castration in young animals has been shown to cause thymic enlargement.

An enormous amount of research has been undertaken upon the thymus in recent years. The net result is that no hormone has been established. One observation—carried out scientifically upon a large number of animals—led to the conclusion that this gland is not essential to life, and that its removal resulted in no noticeable change in the general metabolism, muscular strength, or intelligence of the animals. Neither did this operation appear to have any deleterious effect upon other of the ductless glands. It is always believed, however, that this gland is the dominant gland of childhood, and that it slowly but surely regresses after puberty. In other words, the thymus wanes as the gonads wax. According to some authorities, the thymus is enlarged in eunuchs; and this is what might be expected, if the sexual hormone has been removed before puberty, and if the thymus has a restraining action upon sexual development.

The thymus has been regarded by many observers as being concerned with blood-formation and growth; for, while removal of the thymus alone is not necessarily fatal, removal of both the spleen and thymus is followed by death. It has also been suggested by various experiments that the thymus is concerned with the retention of lime in the body; and the theory has been advanced that this gland is responsible for the formation of the eggshell. It is almost unthinkable, in spite of the absence of proof, that a gland of this size is useless; and it cannot be regarded entirely as a vestigial relic, although it appears to have served a more definite function lower down in the evolutionary scale, possibly pouring its secretion directly into the alimentary tract.

It is believed that the thymus, being well supplied

with the blood cells concerned with the defence of the body against infection, is concerned with this *rôle;* and that the widespread opinion that it atrophies or shrinks after puberty is really fallacious. It has been pointed out that much of this data has been derived from the post-mortem room, and from subjects who have died from inanition or wasting diseases.

Recently, an aqueous extract of this gland has been prepared, which, when administered to rats, appears to accelerate their growth. It has been named "thymocrescin."

When we turn to other aspects of this gland we find ourselves in a more interesting environment. Everything concerning it is dubious, and its relation to personality can claim little which can be proven; but there is much which is suggestive about its influence upon the growing child and upon the formation of the adult. Before discussing the "thymus-centred" individual, we must stress one important fact, and that is the anatomical position occupied by this structure.

We have already said that the thymus is situated in the chest behind the sternum, and that it bears a close relation to the heart, great blood vessels, and nerves which are found in this position. Enlargement of the thymus leads to pressure upon these structures; and the relatively thin-walled veins feel this constriction most. Consequently there is interference with the return of blood from the brain and other all-important structures in the skull.

Enlargement of the thymus is found in those distressing cases of sudden death which are known as *status lymphaticus*. The cause of this condition is unknown; but it is associated with enlargement of the spleen and of lymphatic tissue in other parts of the body.

There are certain circumstances, however, in which sudden death (in children thus constituted) is most likely to occur. One of these is when the head is violently thrown back or drawn backwards, as sometimes occurs

during play; then the gland is compressed, and interference may take place with the important nerves in the vicinity.

The anatomical position and the results of thymic enlargement will explain, or at all events partly explain, the personality which is believed to result when the thymus dominates the child. Such a child has been dubbed an "angel-child," and is described as fragile, fair, with silky hair and transparent cheeks, through which the blue veins show in marked contrast to the white skin. These are the children who never reach maturity, or do so with difficulty. They are delicate, prone to catch infection, and liable to tuberculosis.

It has been pointed out that there is a definite relation to be recognised between the activities of the thymus and the genital organs, but that this relation is more marked in the boy than in the girl. Leonard Williams refers to this and says that, just as the thyroid is linked up to a greater extent with the gonads in the female than in the male, so the thymus is essentially a masculine organ, although neither thyroid nor thymus is to be regarded as exclusively feminine or masculine.

We have already referred to the changes which the thyroid undergoes at the menopause and during times of sexual excitement. It is also known that accessory thyroids are sometimes found embedded in the substance of the thymus; and, *vice versâ*, portions of thymus tissue are, according to Sir Edward Schäfer, often present in the thyroid. Williams suggests that perhaps the thymus is to the male sexual apparatus what the thyroid is to the female; and that, in certain circumstances, it is capable of enlarging and diminishing much as the thyroid does.

We might expect from these considerations that the child with a dominant thymus—a thymus-centred individual—would exhibit certain characteristics, dependent upon the activities of an unruly thymus. Such, indeed, appears to be the case; and, if we may believe

one school of endocrinology in its assumptions, the individual dominated by his thymus is now a recognised type.

It is, perhaps, easier to recognise the thymus-centred child than to describe the same individual, once puberty has produced the violent changes which it does in this type. The " angel-child " is delicate, fragile, like a piece of Dresden china. The adult, who is still dominated by a gland which should have, but has not, " taken a back seat " in the endocrine council, seems to be distinguishable by certain physical configurations ; but these, it must be admitted, rest more upon surmise than upon established facts.

If the thymus is unduly self-assertive, it will have produced some changes—either towards excess or deficiency—in other of the endocrine organs. The resulting pattern will be by no means so easy of recognition as the simple type we have described as the " angel-child."

The adult thymus-centred individual, therefore, is an abnormal one, in that he is suffering from deficiencies or excesses, directly dependent, no doubt, upon the persistence of his thymus. This type tends to be obese, with relatively hairless face. The countenance of the adult thymocentric is often but little marked by the distinguishing signs of sex. It is said that his sexual life is equally undifferentiated, and that it is amongst this endocrine type that the abnormally-sexed are frequently found. Be that as it may, the adult who is controlled by his thymus is, in many ways, a child still.

Picture a large man, but one whose face is smooth, hairless, and fleshy, and you have the general characteristics of the thymocentric. It has already been stated that other glandular secretions are affected by the activity of the thymus, and that the resulting picture is probably a complex, rather than a straightforward one. The thymic hormone has not yet been isolated ; indeed, the existence of such a secretion has not so far been established. But even had it been proved that this gland poured

forth a specific hormone, it by no means follows that we should be able to state dogmatically the exact personality which results from such an addition.

The deductions we are drawing arise from certain evidence (to some of which reference has already been made) which points to the fact that the thymus is concerned in the transition from the child to the adult; and that it sometimes overdoes its work and causes what may be called a "perseveration" of its functions. Thus it produces a type which is often regarded as closely resembling the "artistic temperament."

The vagaries and vacillations, the uncertainties and moods, the emotions and childlike impatience, which are usually excused (when accompanied by artistic ability), may owe much of their existence to a thymus which has remained active unduly long. We need not wait for the time when its hormone has been isolated to adopt the view—borne out by many justifiable assumptions—that the thymus, with its large glandular spaces, exerts some specific action, in years of so-called discretion, even if its size is, in normal individuals, relatively less than in childhood.

How fascinating it is to speculate upon the type of personality which emerges from the lucky dip of childhood. How interesting, in the light of modern views, to ponder upon the manner in which a child will become an adolescent. And what an anxious time all parents pass through when youth is settling into the stride of manhood.

Into these processes the thymus pokes its nose. Its superintendence during infancy and childhood may be a beneficent one. During the period which follows puberty, its control may be an interference which the individual would be better without.

Whatever its part may be in the formation of the personality—and this time alone will tell—it is certainly no negligible one.

3

The parathyroid glands have been left for discussion to this chapter mainly because the physiology of these glands is still in a very unsettled state. A brief glance at the history will suffice to show that there has been much difference of opinion as to their physiology, and as to the part they play in the bodily processes. Sandström was the first investigator to give a complete account of these glands, both in man and in certain animals. Further work has been done notably by A. Cohn, Blay, Vincent, Jolly, and other physiologists.

We shall, therefore, confine our remarks to a brief account of the anatomy and physiology of the parathyroid glands, and, in a subsequent chapter, we shall discuss their inter-relationship with other of the ductless glands.

The parathyroid glands are usually four in number, placed in close relation to the thyroid. At one time it was considered that they were part of the thyroid, and that they had no separate function. There are still observers who hold this view, but the majority of authorities are definitely of the opinion that, while they bear a relation to the work of the thyroid, they yet have independent functions.

Microscopically the general arrangement of the cells of these glands is similar to that found in the anterior pituitary or adrenal cortex. There is also a colloid found inside the small lumen formed by groups of cells. Collip and his co-workers have isolated from the parathyroid a substance as powerfully active in its way as is insulin; and it is claimed that when this substance is injected into animals suffering from tetany (a state associated with parathyroid deficiency), it arrests the disease and causes an increase in the lime salts of the blood.

Some observers who have undertaken investigations of these glands are of the opinion that their main function

is concerned with the retention of lime salts in the body. When the parathyroids are removed from animals, a condition known as *tetany* results. This disorder is associated with convulsions, shivering, and eventually death. In this disease Noel Paton found a chemical substance known as guanadine, and he stated that by injecting animals with guanadine he was able to induce symptoms similar to those found in tetany following removal of the parathyroids. The two views as to the cause of tetany, namely, first, that the lime metabolism of the body was interfered with, and secondly, that the presence of guanadine was responsible for the symptoms of tetany, have been held by various observers. The latest views, however, based upon recent experiments, are against the latter theory.

A condition of so-called idiopathic tetany—*i.e.*, a condition arising apparently spontaneously—has been linked with parathyroid deficiency; and Vines, who has done valuable work on the subject, states that "tetany is associated with a variety of acute and chronic toxæmias. It is an open question how far there is justification for associating all types of tetany with parathyroid failure, and until experimental and clinical evidence is more concise the question cannot be answered."

This disease, however, although not common, is seen from time to time in many countries; and it is stated that in the Himalayas it is endemic, especially among child-bearing women. The symptoms consist of increased excitability of all nerves, and the occurrence of spasms which are brought on by the smallest stimulus. General tonic convulsions may occur which last for hours. It appears that the predisposing causes are pregnancy and digestive disturbances, such as gastric dilatation; and it is recommended to give parathyroid extract, as this remedy is regarded by many as the most satisfactory treatment. This latter point is mentioned solely to show that the connection between this disease and the parathyroid glands is sufficiently established to warrant

the utilisation of this remedy by physicians of experience.

There are other diseases in which these glands seem to be involved, but, with one exception, they are not germane to our subject. This exception is known as paralysis agitans, or Parkinson's disease.

This is the condition in which tremors of a particular kind are associated with difficulty in walking and a change in the facial expression, the latter being a very striking sign. The face has been described as "mask-like," and is so characteristic that persons with this complaint can be diagnosed from the face alone. It becomes absolutely expressionless, the head is moved slowly to look at the questioner, the movements of the eyes are sluggish, the expressions which usually connote different emotions are lacking, and in severe cases there is dribbling of the saliva and alteration in the speech.

The exact causation of this condition is not known, but it has been suggested by competent observers that it is in some way associated with insufficiency of the parathyroid glands.

Without going into more detail or offering views for and against this theory, we may emphasise that, assuming the parathyroid to be implicated in this disease, it is exceedingly interesting to note the relation which would then exist between the expression of the emotions and the influence of these small glands we are now considering. We ought, perhaps, to add that there are other opinions held, in which parts of the nervous system are impeached as being responsible for this disease.

It seems fair to state, however, that the belief that a parathyroid insufficiency is at the bottom of this disease is gaining ground.

4

A large organ placed in the abdominal cavity, and known as the spleen, may be mentioned at this stage. It is not certain that the spleen is an endocrine organ at all; but a gland of this size must be of some use in

the bodily economy, and a few facts in connection with it are here given.

The first is that the spleen can be removed without fatal consequences; in fact, it has been known for years to be an organ which is not vital to the bodily processes. It is possible for people to live in good health without a spleen; and, for this reason, it hardly deserves to rank among important glands such as those we have just described.

In bygone years, there were many theories to explain this large organ. Hippocrates believed that it drew the watery part of the food from the stomach. Galen thought that it kept the body warm, and Aristotle that it acted as a prop to the stomach. There is evidence that the spleen is connected with the liver in some of the processes of digestion; but it is by no means certain that it is dependent on the liver, or that it manufactures an internal secretion.

In spite, therefore, of many experiments on animals, no evidence has been forthcoming that it produces any products which influence metabolism. Certain changes have been recorded in human beings who have had the spleen removed, but it must be realised that these may depend upon the disease for which the operation was done, and not upon the removal of the spleen. The function which is most clearly understood is its relation to the blood. In early life, some of the blood corpuscles are produced in the spleen, and there is also evidence to show that the spleen destroys red blood cells (probably when old and worn out). But even so, this appears to be a small function for so large an organ. Although no definite internal secretion can be traced to the spleen, it is certain that it bears some relation to the blood: beyond this it is not at present possible to go.

CHAPTER VIII

THE INTERNAL SECRETIONS AND THE NERVOUS SYSTEM

1

THE Central Nervous System consists of the brain and spinal cord, and the nerve-roots and trunks attached thereto. In addition to this system, there is found in the body a group of nerves and cells known as the Autonomic Nervous System. As it is this structure which has close relations with the internal secretions, it is proposed in this chapter to consider the inter-relation of the autonomic nervous system and the glands of internal secretion.

In primitive organisms there is no nervous system, and messages are conveyed by changes in the blood. Such a procedure is slow, and, as evolution proceeded, a speedier method was required. This was provided by the development of a nervous system. The brain may be likened to the General Post Office, the spinal cord to the main distributing centres; while the nerves, which run from the spine to the various parts of the body, correspond to the telegraph wires. In addition to this organisation, there is developed a second "nervous system," which differs in many ways from the main system. Whereas the central nervous system is the "voluntary system," and concerns itself with carrying to their destination messages originating in the brain and spinal cord, and dealing with sensations and the response of the muscles to stimuli, the accessory nervous system deals with involuntary messages, and controls those parts of the body which are automatic—that is to say, not under the control of the will.

The name "autonomic" has been given to this part of the nervous system. It is likewise referred to as the "vegetative" nervous system; and is divided into two parts, the sympathetic and the parasympathetic or vagus division. There is the closest possible relation between the autonomic nervous system and the glands of internal secretion; and they may be said to act together in so far as the secretory functions of these structures are concerned. It is through the autonomic nerves that stimulation of these glands takes place, and the presence of some of their chemical products in the blood in turn reacts upon the autonomic system by heightening its response to stimulation. Thus we get an action of one system which begets additional response in the allied system. Langdon Brown, in speaking of the relation between certain of the ductless glands on the one hand, and the autonomic system on the other, says: "This association is reciprocal, as not only does the sympathetic nervous system stimulate the secretion of these ductless glands, but their secretion increases in turn the sympathetic response. Thus the sympathetic nervous system, the endocrine glands, and the gonads form a basic tripod, entrusted with the duty both of the preservation of the individual and the continuity of the species."

So widespread is the work of this specialised nervous system, and so important are the functions which it performs, that we must pause to enumerate its chief duties.

First of all, it controls the heart, all the unstriated musculature (involuntary) of the body, the blood-vessels, the secreting glands, and the work of digestion. It is through this system that the emotions express themselves, but this they can do only by acting in co-operation with the various internal secretions. As Pottenger puts it: "The importance of these two subjects can be fully appreciated only when the fact is grasped that every normal action expressed in the unstriated musculature

of the body, the heart, and the secreting glands, must be brought about in response to stimulation by the chemical substances secreted by the glands of internal secretion, or by the vegetative nerves. There cannot be a single sensory or physical impression which does not, at least theoretically, affect the vegetative nerves and endocrine glands."

As well as their sensory activities, the vegetative nerves and ductless glands are profoundly affected by bodily changes. Infectious diseases, with the consequent poisoning, affect both these important systems; and alterations in the behaviour and feelings which occur after such illnesses are to be attributed to the action of toxins, which upset the autonomic nerves and their associated glandular secretions.

The autonomic or vegetative nervous system consists of two parts: the sympathetic (the thoracico-lumbar portion) and the parasympathetic or vagus division. The second group is also called the "cranio-sacral" division, on account of the sites from which it originates in the spinal cord. Other names have been given to the two parts of the autonomic system, but for the sake of clearness the two terms "sympathetic" and "parasympathetic" will be used here.

The autonomic system is in close relation with the brain and spinal cord, and frequent communications exist between these two systems. There are sympathetic centres in the brain, and these appear to act as centres which regulate and control the co-ordination of nervous impulses. In addition to these cerebral centres, there are other stations in the ganglia (nerve centres) of the spinal system, so that inter-communication is freely established throughout the voluntary and involuntary nervous systems.

The two divisions of the autonomic nervous system—the sympathetic and the parasympathetic—are often mutually antagonistic; for the sympathetic division will stimulate action in a certain muscle, while the parasym-

pathetic will inhibit it. In some instances, however, fibres of the sympathetic will stimulate, while other branches of the same division will act in the opposite manner.

Dealing with the sympathetic division first, we shall see how widely the functions of the body depend upon the integrating action of this and its companion in the autonomic system. The control of the blood vessels of the entire body is in the charge of the sympathetic nerves. Normally the tone of the vessels is kept more or less steady by the balance between sympathetic fibres having opposing action. Constriction of the vessels, that is, a narrowing of the lumen by increase in tone, as well as dilatation, or increase in size, is brought about by means of the sympathetic. There are a few other nerves, not belonging to this system, which cause dilatation of certain vessels, but for practical purposes the vascular supply is regulated by this branch of the autonomic division.

The activity of the sweat glands is also under the control of the sympathetic ; as only fibres of this division have so far been traced to these structures, although stimulation of the parasympathetic appears to produce sweating. The small muscles of the skin, the action of which produces contractions (leading to the condition known as " goose flesh "), are also activated from the same source. Certain of the sexual organs, as well as the thyroid, anterior lobe of the pituitary, and the suprarenal glands, are dependent upon sympathetic supply.

Certain structures are believed to be supplied solely by the parasympathetic, such as the upper part of the stomach, the gullet, and the ciliary muscles of the eye. There are also organs which receive *stimuli* from the sympathetic, and *inhibition* from the parasympathetic. Among these are the sphincters (ring-like muscles) of the intestine and bladder, and the muscles of the bladder and urethra. Structures which receive *stimuli* from the parasympathetic and *inhibition* from the sympathetic

include most of the muscles and glands of the digestive tract, the respiratory tract, including the windpipe and lungs; the liver, gall-bladder, and pancreas; the prostate and that part of the bladder not included in the last section. In addition to these organs, the lachrymal glands, which supply the tears, the salivary glands, the muscle of the pupil, and the glands and unstriated muscles of the nose and mouth, are stimulated by the parasympathetic and inhibited by the sympathetic.

It has been shown that the character of the individual is determined by the nature of his autonomic system. In some people, the sympathetic division appears to be very active, and symptoms of sympathetic irritability result.

On the other hand, parasympathetic predominance leads to undue activity of those structures supplied by this branch of the autonomic system.

The individual suffering from *sympathetic* irritability, or one in whom the sympathetic is relatively over-active, presents the following signs: the eyeball is prominent and gives a staring expression to the face; the pupil is dilated; the mouth tends to be dry, due to the lessened secretion of the saliva; other secretions, such as those of the nose and throat, gastric juices, etc., are diminished. The sphincters of the intestine (that is to say, the ring-like muscles placed at intervals along the digestive tract) are contracted, while the muscles of the bowel are relaxed, leading to one type of constipation. The pulse is rapid, the increase in the rate of the heart being due to sympathetic stimulation. The pressure at which the blood circulates tends to be raised, while the bodily temperature is often above normal. There is contraction of the blood-vessels in the skin and increase in the metabolic processes of the body, produced by over-action of the suprarenal, thyroid, and anterior pituitary.

The picture presented by parasympathetic excitability is very different. There is a sunken eyeball, with widening of the space between the lids, and an increase in the flow of tears. There is likewise a free supply of secretion

in the nose, mouth, throat and lungs, with a tendency to spasm of the muscles. The movements and secretions of the digestive tract are increased, which leads to such symptoms as heartburn (excessive gastric juice) and diarrhœa. The heart's action is slow, the temperature subnormal, and symptoms of deficiency of the thyroid, suprarenal, and anterior pituitary may complete the picture.

It is clear, however, that these two opposite states are not always as clearly defined as these descriptions might lead the reader to suppose. The over-action of the particular system may presumably be confined to one area or even one organ, while the corresponding endocrine gland may or may not be markedly involved. Without the activity or quiescence of the thyroid, for example, some of the factors just described as belonging to one or other of the types would be absent. It must be understood, therefore, that the *sympathetic-tonic* type may be clearly marked (as in the descriptions we have given) or may be but a faint picture of this; and that the *vagotonic* individual—that is, the parasympathetic type—may present all the symptoms we have described or only one or two characteristic features.

The duality of the autonomic system—that is to say, the antagonistic action between the sympathetic and parasympathetic—is further shown by the fact that one part seems to act hand-in-hand with one set of endocrine glands, while the other co-operates with another group of secretions. It will be quite apparent from this that any cause which upsets this state of balance does so by disturbing either the sympathetic control or the endocrine balance.

Earlier in this work reference has been made to metabolism (see Chapter II., p. 16). Now metabolism is divided into two parts, one of which is a building-up process, while the other is concerned with the breaking-down and excretion of waste products. Constructive metabolism (anabolism) comprises the processes by which

the substances taken in as food are converted into protoplasm; while katabolism denotes the process by which the protoplasm breaks down into simpler products, such as the excretory or waste members.[1]

It has been shown that certain of the ductless glands correlate with the sympathetic division of the autonomic nervous system, while others ally themselves with the parasympathetic or vagus group. Among the first, we find the adrenals, thyroid and pituitary; they are *katabolic*—that is to say, they assist in the breaking-down rather than in the building-up processes. They are, therefore, the glands of energy production, for it is to them that the body looks to *release* available energy. The second group, which may be called anabolic glands, concern themselves chiefly with building up and assimilation; they are, therefore, opposed to the first group, certainly in so far as this aspect of their work is concerned, and they act in collaboration with the parasympathetic or vagus division of the nervous system.

One school, therefore, has attempted to divide the endocrine glands into two main groups, according to this plan. The first contains the thyroid, adrenals, and pituitary, and constitutes the group of katabolic or *dissimilatory* glands. The second comprises the internal secretion of the pancreas—*i.e.*, the hormone which deals with the conversion and storage of sugar—the parathyroids, and possibly the anterior lobe of the pituitary, and these are regarded as the anabolic or *assimilatory* glands. It is unnecessary to enter into any detail in this connection, but perhaps a few examples of the work done by the two parts of the autonomic nervous system will make the subject clearer.

Take, first, the action and inter-action which exists between the sympathetic nervous system and the adrenals. This relation is a very close one, mainly because both spring from the same source. The secretion of the adrenal glands influences all tissue that is supplied by the sym-

[1] "New Standard Dictionary."

pathetic (as opposed to the parasympathetic). Adrenalin produces the same result as stimulation of the sympathetic nerves. Again, stimulation of the sympathetic fibres which run to the adrenal glands causes an increased secretion of adrenalin; and it has been shown that severe emotion, such as pain and rage, leads to sympathetic discharge and an increased flow of adrenalin. This is what happens, then, when violent emotions stir the individual. Obviously it has a useful purpose, as it releases energy which enables the individual to prepare, as it has been said, for *fight* or *flight*. Stimulation of the sympathetic produces an increased flow of adrenalin, but it has also been observed that adrenalin increases the sensitiveness of sympathetic response.

A fact of interest in this connection is observable in the disease known as diabetes. In this condition sugar, which should be stored up, fails to be retained in the body. It is known that diabetes is associated with mental disturbances and worry. One authority has said that, in New York, "when stocks go down, diabetes goes up." This is explicable when we understand that strong emotions produce strong sympathetic stimulation; but this can only upset the digestion of sugar *when the adrenal glands are intact*. In other words, the sympathetico-adrenal action successfully defeats the pancreatic control and prevents it from carrying out its work of sugar storage.

This is but one example of the balance which exists in the body; and it is also an interesting example of the effect of the mind on the body. The devastating effect which worry has upon the individual is recognised everywhere, and such a phrase as "he is worried to death" is frequently heard.

It is now believed that an individual belongs to one of two classes. In the first the sympathetic is dominant (the sympathetico-tonic), in the second the parasympathetic or vagus is the ruler (the vagotonic). By

some it is thought that the nervous type is determined by which set of glands is dominant ; while other observers are of the opinion that this is " putting the cart before the horse," and that it would be more true to say that the glands are in the ascendant because the individual possesses a dominant sympathetic or vagus, as the case may be.

An active sympathetic produces flushing, prominent eyes, rapid heart-action, and a dilated pupil. The vagus-dominant type is characterised by pallor, narrowing of the pupil, and slow action of the heart. Perspiration is characteristic of the first group, and a dry skin of the second. Equally, we might say that sympathetic over-action corresponds with an active adrenal and thyroid combination, and that these glands are less active in the second group. Strong emotions produce reactions which will differ according to the group to which the individual belongs. Meredith says that there are only two kinds of human beings, those who turn white and those who turn red when enraged (Fridenberg).

The sympathetic nervous system sends branches to the heart and blood vessels all over the body. The heart and arteries behave as do other structures controlled by the two branches of the autonomic system. In the case of the heart, the sympathetic proper is the accelerator nerve, while the vagus is the nerve which retards the heart's action. Stimulation of the sympathetic leads to an increased rate of the heart; and it will be remembered that this is one of the symptoms in the sympathetico-tonic type of individual. The effect of the adrenal glands is similar in this action, as the tone of the blood-vessels depends upon the amount of adrenalin in the blood. During vigorous exercise or emotional excitement more blood is required to circulate rapidly through the body, and it is adrenalin which enables this to be done. The blood-supply of the body is regulated by the autonomic nervous system. During sleep and relaxed conditions, the muscles and skin contain relatively little blood,

while such organs as the liver, heart, and lungs are comparatively freely supplied.

The relation between the thyroid gland and the autonomic nervous system is a very close one. This gland gets its nerve supply from sympathetic nerve fibres. Over-activity of the thyroid is one of the symptoms of the sympathetico-tonic type; and it will be recalled that the other features of this type are closely allied to those seen in a "thyroid state."

On the other hand, under-action of the thyroid is accompanied by a lowered excitability of all nerves, which is shown by the sluggish mentality, the general lethargy, somnolence, and tendency to obesity.

The relation between the pituitary and the sympathetic system is not so readily determined. As the pituitary secretion increases the blood pressure and stimulates functions such as the kidneys, it can be regarded as belonging in this connection to the same group as the thyroid and adrenals. On the other hand, the effects which follow injection of pituitary extract being partly vagotropic, it must be looked upon as belonging to some extent to both parts of the autonomic system.

Those small glands known as the parathyroids seem to have some action in controlling the lime-salts in the body. In an earlier chapter it was pointed out that experimental removal of the parathyroids leads to the condition known as *tetany*, and that this is accompanied by sympathetic excitability. It has also been suggested that the parathyroids, like the pancreas, assist in the storage of sugar.

The pancreas contains two essential parts. The first is the formation of an external secretion, which it pours down the duct into the bowel, where it takes part in digestion. The second is the formation of an internal secretion which is essential to the proper utilisation of sugar in the body, and the absence of which causes diabetes. This hormone is secreted by certain cells in the pancreas, which are known as the ***islets of Langerhans.***

From what we have already said, it will be plain that the adrenals and pancreas are opposed to one another; for, while the pancreas prevents sugar passing into the urine, the adrenals tend to facilitate its passage, unless controlled (as they are normally) by the internal secretion of the pancreas. For this reason the sympathetic system (and those glands grouped as allies) is antagonistic to the pancreas.

2

It will be apparent, therefore, that one cannot consider the endocrine glands without knowing something of the structure and behaviour of the sympathetic nervous system. For this system acts by and through the endocrine organs; and equally these organs are controlled to some extent by this system. The involuntary muscles of the body are unstriated; the voluntary striated. This means that the muscles we use in raising an arm or walking, being striated muscles, are under the control of the will; whereas the unstriated muscles (found in various parts of the body, notably the intestines) are under the control of the autonomic nervous system. We cannot regulate the contractions of our intestines by volition, nor can we vary our heart's action at will. Both are controlled by sympathetic nerves, which are, however, so much on the alert that they are able to vary the rate of the heart-beat to the requirements of the body at any particular moment.

What are the signs that the sympathetic system has been stimulated and that a state of sympathetic excitability exists? A frightened animal such as the cat has widely dilated eyes, its hair stands up and its tail becomes erect. A terrified man is always pictured with his hair standing straight up. The picture of fear also includes signs such as an anxious expression, a dry mouth and a shrinking posture of body. These are all the outward and visible signs of a *sympathetic activity*. Adrenalin produces similar symptoms, so that the individual with

an active adrenal secretion has the features of this activity stamped all over him. For centuries poets have told us that the heart is the organ most concerned with the emotions; and we all of us realise to what extent the eye expresses those emotions which the heart is said to feel. In Biblical times, however, the bowels were said to be the seat of compassion.

Modern science has demonstrated that all three of these organs are important seats of sympathetic activity. In the case of the eye, the dual control exerted by the two branches of the autonomic system is beautifully shown. The sympathetic causes a dilated pupil, the vagus a contracted. States of offence or defence are mirrored in the behaviour of the eye; the emotions of rage, fear, and affection find expression here.

The general excitability of the autonomic system which accompanies emotion may lead to activities in both parts. Thus, the dilated eye is a sympathetic, the shedding of tears a parasympathetic act. The "goose flesh" which is said to result from fear owes its existence to the action of the small skin muscles, which are supplied by the sympathetic. Many students are familiar with the bodily discomforts which are the direct result of examinations. Apart from the immediate effects which the presence of the examiners produce, "highly-strung," sympathetic individuals are prone to suffer from such signs of irritability as vomiting, diarrhœa, and the frequent passage of urine.

Thus "nervousness" may now be regarded as a general autonomic excitability with special sympathetic and adrenal over-action.

END OF PART I

CHAPTER I

PERSONALITY AND THE DUCTLESS GLANDS

1

THE first part of this book is concerned with the anatomy and functions of the ductless glands. In the following chapters will be found an account of how the internal secretions influence the personality.

Lord Beaconsfield said, "It is the personal which interests mankind." There can be little doubt that this is true. One has only to glance at the daily papers to see the prominence given to light-hearted chatter about the habits and plans of individuals whom the vast majority of readers know nothing whatever about. The popularity of these gossip-columns depends upon a psychological mechanism known as *projection*.

The underpaid typist, reading the exploits of some member of the plutocracy, pictures herself enjoying similar luxury on the Riviera, in Switzerland, or amongst the hills of Scotland. She projects her own personality, so to speak, into that of the much-envied individual, thus deriving a little pleasure from the work of her imagination.

Personalities are discussed in Chapter VII. of this Part, a chapter which, had it dealt exclusively with living persons, would probably have been considered libellous. Fortunately, there are only two individuals alive to-day whose glandular mechanisms are discussed; and, at the time of writing, both of them are too fully occupied to object to their respective analyses, even were there anything to object to, which there is not. Some of the great figures of the past are dissected and discussed from the angle of their glandular systems.

Anyone who has glanced through the preceding chapters will have gleaned enough of the rudiments of endocrinology to understand upon what these studies are based. Even if the reader has skipped Part I., it is hoped that the succeeding chapters will not be altogether unintelligible.

This Part, then, is concerned with the ingredients of personality, how it is formed, of what it consists, and how various types of personality are determined.

We cannot study personality, however, without attempting to answer the question "What constitutes the mind?" For "personality," in the sense in which it is used in this book, includes all those factors which, when combined, constitute an individual, separating him markedly from those of his fellows who possess a different kind of personality.

We must, therefore, at this stage, glance, however superficially, at some of the facts of psychology.

2

Many, if not most, of the older conceptions of mind consisted in attempts to prove that it was a "something" outside, and independent of, the body. Metaphysics, with its daughter ontology, discusses the principles of "being," but the study of life in metaphysical language is an abstruse and often well-nigh impossible matter for an average intelligence, so complicated is the language in which this science is discussed. A metaphysician has been wittily compared to a blind man in a dark room looking for a black cat which is not there. A lecturer on this subject once interrupted his discourse to scratch his head and remark that, "when he had written the sentence he had just read, he had thought that it meant something, but now he was not so sure."

It is, of course, easy to scoff at such an abstract study as metaphysics, and to lay stress upon, and adopt as the theory of our choice, some conception which assumes that mind is inseparable from brain action, and that without the brain there can be no mind. The mechanistic theory

of mind (which regards it as dependent upon brain working) is opposed to the metaphysical, to the animistic (which postulates the existence of the soul), and all that this theory entails.

This is not the place to enter into a discussion as to whether the materialistic theory of mind necessarily involves us in an atheistic attitude, and makes us deny the existence of a God. In many works, such, for example, as Professor McDougall's " Body and Mind," the theory of Animism is discussed at length, and the arguments in its favour are dealt with. The ultimate *guiding force* may be assumed to be able to control either an independent " soul " or a psycho-physical compendium —the warp and woof of which is to be found, *inter alia*, among the chemical constituents.

Parallelism, which assumes that the mind and the body work on parallel lines, and not as cause and effect, is another way in which the nature of mind can be regarded.

It is open to us to say :

1. That mind is nothing but the product of physical workings : the materialistic view.

2. That mind is an independent unity.

3. That mind and body are associated in parallel variation, the so-called " psycho-physical parallelism."

The mind, as we recognise it, is concerned with the formation of thoughts, with the association of ideas, with the regulation of conduct, and with the control of actions. The sum total of these processes, and the manner in which, individually and collectively, they are performed, constitutes the mental contribution to personality. We need not, moreover, confine the term " personality " to human beings. Scientists are willing to acknowledge the presence of a personality in animals. Shaw Bolton says : " . . . Nevertheless, the study of an old experienced dog and of a young one of the same variety readily demonstrates the presence of a definite, if lowly-developed, personality."

Lovers of animals quote the behaviour of their pets as characteristic of them individually, and speak of them as

if they would respond invariably in a definite manner. This implies the existence of what we may call a definite mental structure in animals as well as in human beings. To what extent this pattern is determined in animals by the particular type of endocrine organs they have inherited or acquired, it is impossible at present to say.

There is a vast and interesting field of inquiry in this direction. If we were able to say that a certain species of animal showed invariably a certain type of personality, and that in this species a fixed endocrine pattern was always found, we should be possessed of information of the most valuable kind. It has been stated (and quoted in earlier parts of this work) that courageous and pugnacious animals, such as the buffalo, have a large adrenal cortex, while timid animals, such as the deer and rabbit, only possess a small strip of this endocrine organ. If this is true, it makes a commencement of this study ; but a great mass of information is still required in this direction. Writing on this subject, Fridenberg says : " Influence of nutrition and mode of life on endocrine balance may well account for the disposition of the tiger, the ox, the horse, and disposition here means that one tends to produce adrenalin and the other thyroxin."

So recent is our knowledge of the endocrine system, that at present it is almost entirely concerned with the human individual. It is quite true that in the laboratory much of our information has been obtained by experimental work on animals, but this only helps us up to a point. No conclusive information has yet been gathered as to the variation in size of the different endocrine organs in the different species. When this has been done, we shall have more data upon which to dogmatise as to the influence of these glands on the personality of animals.

3

Whatever view we choose to adopt as to the nature of mind, we shall be none the worse for knowing some of

the facts in connection with the brain and nervous system. The unit in the nervous system is called the neurone ; and this consists of a nerve-cell from which a process known as the axon proceeds; while other processes—called dendrons—also leave the cell. The dendron, however, conveys impulses *towards* the cell-unit, while the axon leads impulses away.

In man there is (compared with other mammals) a remarkable development of that part of the brain known as the " cerebral cortex." In this area there are centres for voluntary movement; for speech, hearing, taste, smell, and sight. Connection between the brain and other parts of the body is made up by neurones, there being one neurone between the brain and spinal cord, and another between the spinal cord and the limb or other destination of the nervous impulse.

Every neurone is a unit by itself, connected with another neurone by its axon. There is, however, no actual contact, there being a gap (or synapse) between one neurone and another. It is much, as it were, like two trees growing close together, whose branches intertwine or perhaps almost touch in places. The synapse is the junction at which the messages from neurone to neurone are delayed or blocked. The fact that repetition of an action makes this action easier has been attributed to a speeding-up of the impulse through the neurone.

Images of sight or sound result from stimuli conveyed to the brain, and images act, in turn, as stimuli to concerted muscular action. If my name is called, I turn my head in the direction of the sound, and my subsequent behaviour is dependent upon what I see.

The materialistic theory of mind holds that there can be no thought without a brain, and that the more the brain and nervous system are understood, the clearer becomes the conception that mental workings depend upon cerebral activities.

4

All thinking must take the form of unspoken words; all gestures must be the result of mental processes grouped as ideas. Inhibition is the "handbrake" which pulls up a nervous impulse. We speak of a "stimulus" as some message which incites action, and an "inhibition" as the reverse. It is obvious that a man may be tempted to pursue some course of action, but may be restrained by the recollection of the results of such an action. In this case, the stimulus is inhibited by other cells called into being by the memory of a former experience.

This is well illustrated by Dorsey, who says: "I left a dark kitchen in a hurry and nearly split my head on an outstretched pump handle. The pump was removed. Twenty years later I returned to that house. Leaving the dark kitchen that night, I ducked the pump handle and was conscious of a tingling sensation on my forehead. I had forgotten the pump; my body had not forgotten the handle. Even now I sometimes feel queer when I leave that kitchen in the dark. There are two kinds of memories: one is built into the body reaction system, and generally is beyond recall; the other is conscious memory and presumably entangled in the meshes of the neurons of the brain cortex."

The psychologists teach us that memory may be divided into three parts—impression, retention, and recall. For successful and conscious memorising, all three parts must be intact. It is impossible to retain what has never been impressed, or to recall what we have failed to retain.

Physiologists have shown that reflexes can be developed —trained, as it were—to an almost unlimited extent; and that behaviour depends upon the type of reflexes we have acquired in our journey through life. Thus behaviour is partly due to reflexes, "conditioned" and otherwise; and personality is mirrored outwardly by individual behaviour.

5

Of all the organs which express the state of affairs in the mind, none is more interesting than the eye. And the eye was not the first sense to be developed. Taste came first, smell next, then hearing. Sight arrived later, with the development of higher cerebral faculties (Mayo).

In " The Expression of the Emotions," Darwin describes the ocular demonstrations of the different emotions, and he draws attention to the fact that cretins never shed tears. The reason is to be found in the state of the vegetative nervous system in hypothyroidism.

The eye is controlled by the vagus and sympathetic, which means a variation in the appearance of the eye, according to the type of nervous system. And this, in turn, means that the eye reflects the state of the nervous system, and therefore of the endocrine organs. The large pupil of over-active thyroid and adrenals (the glands of emotion) ; the small pupil of the sluggish vagotonic type ; the pigmented eye, the eye between wide lids, and that showing but little between heavy lids ; all these variations are indicative of a particular kind of underlying nervous control. " Defensive states and defensive reactions are mediated by recognition of danger at a distance by the eye, and, conversely, the eye is the index of the emotional state, fear, rage, or desire. Habitual emotion means temperament and character, as habitual gesture becomes expression, and the glance or look is, finally, looks (*cf.* visage, vultus, gesicht, prosopor) " (Fridenberg).

This author, in the same article, makes some interesting statements as to the eye in relation to the various internal secretory glands. Thus he describes the thyroid eye : " This type has a smaller and generally less massive orbit. . . . The lid-fissure tends to be wide and the pupil large, the ocular motions frequent, brisk, so that the glance is alert and the gaze concentrated, giving a sharp, wide-awake expression. There is decided vascularity of conjunctiva and lids . . . and this condition, associated

with a plenitude of orbital fat, causes a prominence of the eyes. . . . Pigment is not abundant and may be deficient. Albinism is noted predominantly in this type, which characterises the blonde Nordic races, such as the Saxon and Scandinavian."

About the pituitary eye he says: "Pituitary dominance is indicated by a roomy and massive orbit with unusually thick, bony margins, resulting in large, widely spaced eyeballs (Negro, Polynesian). This unusual interpupillary distance . . . gives to the facies a characteristic detached expression. . . . This dreamy gaze has been noted by travellers in the racial types mentioned. . . . This type of eye, peculiarly enough, is found in two races which are liberally marked by high pigmentation." This author proceeds to describe this type of eye as recessed, as in Mongolians and Amerinds, or but slightly prominent, when both globe and orbit are roomy, as in Negro types.[1]

These quotations indicate that there is, at least in the writings of some authors, a recognition of the conjunction of racial and endocrine characteristics. The association of a particular type of eye with an endocrine type, and their relative frequency in certain races of men, is of great interest and importance, even if we are only at the stage where we get glimpses of such correlations.

The dark-skinned races are usually regarded as possessing their pigment on account of some adrenal influence. Crookshank says: ". . . The pigmentation and genital gigantism of the Negro are suggestive of adrenal assertion." Keith is quoted as saying "that the Caucasian and the Malay, akin to the orang, show the predominance of hyperpituitarism, the Negro and the Mongol, akin to the gorilla, of hyperadrenalism and hyperthyroidism respectively."[2]

Pigmentation (and the lesser condition of darkly stained areas in various parts of the body) would indicate

[1] Quoted from an article by Fridenberg in "Endocrinology and Metabolism," vol. ii., pp. 782 *et seq.*

[2] Quoted from an article by Garrison in "Endocrinology and Metabolism," vol. i., p. 70.

an adrenal trait; not adrenal domination, but adrenal failure or strain in an individual, who, when in good health, is largely dependent upon his adrenal system for his efficiency.

Thus, under-action of the pituitary is associated with diminution in the sexual life. The acromegalic, once the initial stage has been passed, is in this state. He has been likened to the Neanderthal man, " who was probably, as the gorillas are, hyperpituitary (Keith); to eunuchs, who are excessively tall when not over-corpulent; and to the tall, raw-boned, heavy-jawed peoples of the Western countries, who are often sexually cold. . . . The logical opposites of acromegalics are, therefore, not the fat patients of the Mohr-Fröhlich type, but the short, swarthy, goat-legged achondroplasics, who often exhibit great muscular strength, unusual sexual precocity, and general salacity, or the dark-skinned people of the suprarenal type. These have been assimilated to the satyrs of mythology, to the short, swarthy, troglodyte peoples, such as the Iberians, or the Euskarians, the primitive inhabitants of Britain. . . ." [1]

Hair, eyes, teeth, colour, skin, skeleton on the one hand; intellect, emotions, moods, temper, and instincts on the other; each and all appear to be determined by the particular endocrine pattern which the individual has inherited or built up in his own lifetime.

Personality peeps out from behind the face, and shows us how much it depends both upon nature and nurture.

6

If we attempted to sum up all that is known as to the relation of the internal secretions to personality we should find ourselves committed to a large volume. For, in the relatively short time which has elapsed since the anatomy and physiology of these structures first engaged the serious attention of students, enormous strides have been made in these subjects. Once the main functions

[1] *Ibid.*

of the several glands had been established, at least part of their relations to their glandular colleagues became apparent. Thus, the absence of the thyroid necessitates an idiot mind in a stunted body. It also leads to a typical mal-development of skin, hair, nails, and teeth, and to disorders of the circulation and assimilation.

How simple subsequent deduction as to the rôle of the thyroid would be were this the only organ of internal secretion. But we know, of course, that the pituitary controls growth, and another factor enters into the calculation. Excessive growth entails pituitary over-action; deficient secretion appears to lead to adiposity, somnolence, and failure of sexual development. When, in considering anomalies of growth, we remember that there are apparently unimportant glands (such as the pineal, tumours of which appear to hasten the onset of puberty), as well as important but still largely unknown territories (such as the thymus, which is probably concerned in the production of manhood), we begin to realise both the magnitude and the fascination of the problem.

Such facts as are already known lead, quite naturally, to assumptions, which stretch, as is always the case in a new subject, well beyond the realms of proof.

As an example of established fact, we may take the cretin; and here we are on sure ground.

The cretin suffers from general failure of bony development, and especially is this the case where the bones of the skull are concerned. As these are under-developed, the root of the nose is flattened and gives a characteristic appearance to the face. This is one of the signs which makes it possible to distinguish such an individual from the facial appearance alone.

So far so good. But it can be taken a step further. And this Keith does, when he points out that this is one of the features which gives the Mongolian face its characteristic appearance; and the thyroid face can be traced farther afield, as far as the Bushmen of South Africa.

The protruding lower jaw, the widely spaced teeth,

the beetling brows, all contribute to the *facies* typical of *acromegaly*. This picture, moreover, has been associated with the pituitary, and we may, perhaps, take this connection one step further and say that individuals with these features are " a pituitary type." Whether we can say dogmatically that such men are " pituitary dominant " is still an open question. It is not unreasonable, however, to say that in them the pituitary has stamped itself plainly in their features, *and, to this extent, they are pituitary types*. It is beyond dispute that over-action of the pituitary before puberty leads to the growth of the long bones, and therefore to tall individuals; equally that pituitary under-action is usually admitted to be an important factor in dwarfism.

Again, we may say that the pituitary stands convicted of helping to control the individual so far as growth is concerned. Destiny, therefore, points at the thyroid first and the pituitary a little later, and the result is shown in the adult stature. So far as the stature of races is concerned, we may quote R. G. Hoskins: " A relative preponderance of hypophyseal function, then, if it occurred as a racial characteristic, might well result in augmented average height, just as depressed functioning might lead to pygmy types."

So we see that the field of inquiry is vast, and the researches required immense, before we can place the various races of man into their accurate endocrine departments. A commencement has been made, and the cruder racial characteristics already suggest the probable endocrine bases. No doubt, now that the internal secretions are better understood, we shall be able before long to place the denizens of the various countries in separate physiological pigeon-holes.

CHAPTER II

THE INTERNAL SECRETIONS IN EVERYDAY LIFE

1

NOT the least interesting lesson which endocrinology teaches us is the everyday work of the ductless glands. Resting or working, eating or fasting, asleep or awake, changes are constantly occurring in these small glands and their secretions.

It has been said that it is an "awful thought" how dependent we are upon these chemicals. A few milligrams of thyroid secretion is all that stands between an individual and his sanity. A change in the output of the pituitary and our entire physique undergoes drastic alterations. A stimulus of an unusual kind may produce such an upheaval in the endocrine balance that our personality becomes altered to an almost unrecognisable extent.

But is this thought really so terrible? Life seems equally fearful looked at from a completely different angle. If we imagine, for example, that we are a prey to invisible micro-organisms (as, indeed, appears to be the case), it is no more alarming. We may walk out of our front-door one morning and pick up some death-dealing microbe which we may not have the resistance to repel. It is perfectly true that we are dependent for many functions upon stimuli or agents outside ourselves, and that some power over which we have no control may produce changes in us which we are unable to prevent. So it comes to this, that the endocrine organs are simply the structures through which agents outside ourselves influence us.

In the light of modern physiology, we are learning how these agents act, the methods which they employ, and the routes in the body through which they make their influence felt. For example, sudden fear is capable of producing violent over-action of the thyroid and adrenal systems. The effect of violent emotion has been known to produce the state known as *exophthalmic goitre*, which is characterised by dramatic changes in the personality.

Generally speaking, individuals with prominent eyes belong to the highly-strung type, but this characteristic is usually found only in the third, fourth, and fifth decades of life. In old age, the tendency is for the eyes to sink back into their sockets. It would appear that it is mainly during adult life—that is to say, neither in childhood nor old age—that signs of sympathetic and thyroid over-action are seen. To put this in another way, it may be said that it is only during sexual maturity that the forces of the body are at their keenest.

The sympathetic system produces, when active, an energetic and adaptable individual. The vagus type (that is to say, the opposite to the sympathetic) is recognised as the slow, sluggish individual. Towards old age, as a rule, the fires of life burn less brightly, and the enthusiasm and capacity for emotion die down. Much attention has been drawn lately to what is known as "rejuvenation," and perhaps a brief reference to this subject will not be out of place in this chapter.

Rejuvenation aims at retarding the degenerative changes which are usually lumped together under the heading "Old Age." These are, unfortunately, only too familiar to everyone, either in his own person or in the persons of others. Obviously, the physical signs of old age are directly due to changes in the tissues and in the secretions of the body. The most marked change which occurs in senility is the dying down of the sexual secretion. In woman, the sexual life has a definite closing period; whereas in man, the change is more gradual and less definitely marked. Associated with old age in both

sexes, there are certain more or less characteristic features. First of all, there is the change in physical configuration. Secondly, there is the loss of hair, or its change to grey; the decrease in visual power, and the degenerative changes which take place in the epidermal structures—*i.e.*, skin, hair, nails, etc.

It may be argued that some of these are the result of disease rather than senility, and that the age at which such changes make their appearance varies enormously in individuals. It is, of course, impossible absolutely to separate the processes of natural decay from the changes brought about by disease; but it should be possible to differentiate premature senility due to disease from the equal decay of the various organs which we know as old age.

The processes which have been called "rejuvenation" are designed to arrest senile decay and to provide the individual with chemical material which will re-establish some of the functions which he has lost with the onset of old age. It will be obvious that there are many reasons which contribute to the arrival of senility.

In the chapter on "Giants and Dwarfs," we discuss some of the abnormal conditions which are seen in the human being. There is a condition, for example, which produces senile changes during adolescence, and in which a small, wizened child presents all the features of an old man. The exact cause is not understood, but it is obviously due to some endocrine disturbance.

The thyroid is one of the first glands to which our attention must be turned in any discussion on old age; because the signs which accompany thyroid deficiency are so similar to those which characterise senility. The old man has a dry and irritable skin which has lost its elasticity; and the itching which so often accompanies old age has its counterpart in that which disturbs the sufferer from thyroid deficiency. The dry and thin hair, the early decay of the teeth, the ridged and grooved nails, are equally common to both states.

The average individual has become thoroughly confused in his mind as to what exactly is meant by rejuvenation. He reads in his newspaper of " monkey gland," and how it can be injected or grafted or otherwise administered, with the object of staying the onset of old age.

Professor Voronoff, whose work on rejuvenation is known throughout the civilised world, has contributed considerably to our knowledge on all aspects of rejuvenation. Voronoff has found that the implantation of part of the glands of a monkey is able to restore strength and virility to a human being. This is not necessarily claiming that it happens in every instance, but that it has happened in some instances at the hands of this authority. He has also produced many weird and extraordinary changes by grafting experiments on animals. Thus he has rejuvenated by these means an elderly ram in the last stages of senile decrepitude. Again, by a grafting operation, he caused the horns of an ordinary ram to grow to such enormous proportions that the animal resembled some weird monster from prehistoric times.

These experiments are extremely valuable because they show that these glandular secretions play a very large part in the control of the processes of adult life and their decline into old age. Whether it will be possible to rejuvenate human beings by these means, so that once decay has set in it can be stopped and the *status quo ante* restored, we do not yet know. There seems every reason to think, however, that as our knowledge of the ductless glands increases, it will be possible to retard the onset of senility. There seems to be no reason why human beings should necessarily die in the sixth or seventh decade; and it is obvious that most individuals die from disease and not from old age. With the modern methods of preserving life, it should be possible so to prevent those diseases which are directly due to civilisation itself, that man dies neither from violence, epidemics, nor abuse of nature's functions, such as occurs in wrong feeding, absence of fresh air, or physical inertia. It has long been

said that a man is as old as his arteries, which means that old age is associated with disease. Old age should be the equal wearing out of all parts of the body, and not the destruction of one part by microbes or chemicals.

It has been found, by those observers who have studied this subject, that certain glands in the body undergo changes in old age. It is to prevent these changes (or rather to keep alive the functions of these glands) that rejuvenation is attempted. We need not discuss the various methods which are used to achieve this desideratum. It does not seem, however, that surgical procedures of this kind will ever become widely adopted, neither does it appear altogether desirable that this should be so. It is obviously better to prevent premature old age than to attempt to cure it by means so opposed to nature as these. One thing is quite certain, that if life is prolonged, it will be by preventive methods rather than by the purloining of glands from monkeys.

2

The question of fatigue is intimately concerned with the ductless glands. There are certain signs of fatigue which are well recognised; the early onset of fatigue in elderly people is characteristic, and extreme fatigue is often expressed by such a phrase as "I am feeling old." In old age the activity of the ductless glands is reduced, and this time of life has been described as the period of "hypo-endocrinism." This rather terrifying word is intended to express an under-action of all the glands which regulate the bodily processes. There can be little doubt, moreover, that in old age there is considerably less energy at the disposal of the body; and that many of the characteristic features of this epoch are directly traceable to a lowering of the activities of such glands as the thyroid, the pituitary, and the adrenals.

It is a curious thing that in certain individuals fatigue shows itself by such signs as dark rings under the eyes and an increase in emotional excitability. It has already

been suggested that the appearance of pigmented areas on the body is due to the adrenal secretion; and it is possible that fatigue involves the adrenal cortex, and that such a well-recognised sign of fatigue as this is due to chemical changes in the cortical area.

It will be remembered that certain changes are recognised as occurring in the cells of the adrenal cortex following septic and other severe illnesses; and it is to the cortex that we have to attribute much of the energy which characterises good health.

We all know that mental work produces fatigue of a different kind to that which follows hard physical labour. Everyone is familiar with the fact that the sensations which result from a long day in the open air, associated with more or less vigorous physical exercise, are quite different from those which accrue from an equal time spent in brain work.

It is always interesting to try to find the mechanism which underlies established facts. Physical exercise increases elimination, and the excretions from the body carry away chemicals which are better out of the system. Mental work, on the other hand, has no such action; and the fatigue which follows is generally known as "nervous fatigue," the associated sensations being far from pleasant.

Again, while both forms of work are likely to produce sleep, physical work produces a sleep of a deeper, more restful kind, while brain work results in a sleep which is frequently of a worried and broken nature. In other words, the result of physical exertion is healthy "wear and tear"; while the penalty for mental overwork partakes more of a worried, nervous, restless exhaustion.

In both these forms of fatigue the endocrine glands are concerned, although it is not possible to state dogmatically exactly what occurs. It may be assumed, however, from the chemical changes which are present after exercise, that the stimulus to the circulation, the muscular contractions, and the increased elimination which follows,

rids the body of waste products, and in doing so assists such glands as the thyroid and pituitary (as well as such depositories as the liver) to excrete stored-up chemicals.

In mental work, however, there is none of this entailed ; the effect of prolonged brain work is to cause changes (of a temporary character) in the cells of the nervous system, and it is known that these changes disappear after sleep. It may be inferred, therefore, that the mind, being essentially the attribute of civilised man (and therefore closely linked with such glands as are concerned in the expression of the emotions), makes claims upon the internal secretions which will result in a temporary lowering of their potential for work. Sleep, however, enables these glands to be restored to normal. To put it in another way, the reservoirs are more depleted by mental than physical work, and the resulting sensations and sleep are therefore different.

It has already been said that adrenal under-action is supposed to be the basis of such states as post-influenzal debility, and of the exhausted conditions which supervene upon long illnesses. From the facts we have outlined, there seems to be ample evidence for the assumption that long illnesses interfere with the endocrine balance ; and that it is not too much to hazard a guess that fatigue, when caused by work, is similar in nature to the condition which characterises convalescence.

" Nervous breakdown " has taken on a new meaning in the light of modern physiology. There was a time when every disorder for which an organic basis could not be discovered was regarded as functional. The word " functional " was regarded by many as identical with " imaginary." As an example, if an individual complained of certain sensations in any part of the body for which no physical cause could be discovered on examination, a diagnosis of " functional disorder " was made, and as often as not the term was meant to convey that the disease was imaginary. What is the real meaning of

the word " functional " ? What is the difference between a functional and an organic ailment ?

An organic ailment is one in which structural changes occur in some organ of the body. A functional disorder is one where the work of an organ or organs is not being properly carried out—in other words, the organ is not " functioning " properly. If it is wished to indicate that the trouble lies primarily in the mind, the old-fashioned term " hysteria " is used.

There is probably no disorder which can be regarded as solely mental or solely physical. In the complicated mechanism which constitutes the human being, mind and body are woven together, and their action and interaction is so intimate that it is impossible to separate them. Functional disorders, however, have come to mean " nervous derangements," and to be synonymous with hysterical or neurasthenic states.

In the light of modern views, the term " hysterical " is used to connote a disorder due primarily to mental or nervous disturbance ; a functional disorder being one where the function of an organ is disturbed. No doubt prolonged functional change may lead to organic or structural alteration, and there is a stage in every organic illness where functional disorder changes to organic disease. It follows that, if we can recognise functional disturbances sufficiently early we ought to be able, at all events in theory, to rectify such abnormal working, and to prevent the occurrence of organic changes.

What, then, is meant by " nervous breakdown " ? Such a disturbance of the functions of the human being may be regarded from two opposite angles. First of all, there is the mental—that is to say, the point of view of the psychogenic school, as it is called. The view of this school is that mental strain, worry, anxiety and fear produces conflict in the mind which leads to a disorganisation of the mental functions. Any changes in the bodily workings which accompany nervous breakdown are to be regarded as secondary and not in any sense causative.

The other school of thought regards nervous breakdown from the opposite angle. It finds, in such cases, abnormalities in the bodily functions. These are regarded as being the causes of the condition, and any mental symptoms as dependent upon them.

It is impossible to say that either school is always right, if only because of the impracticability of separating the mind and its workings from the body and its workings. The hypo-adrenia which is stated to be so often present in these cases has been regarded by the latter school of thought as the important abnormality, and treatment has been prescribed accordingly. It is only fair to add that, even if the physical changes are effects rather than causes, none the less, it may be very helpful to treat them.

We often read in the papers that "Mr. So-and-so" has been ordered by his doctors to cancel all his engagements and to have an entire rest. What is probably the condition of "Mr. So-and-so"? We may assume that he is an overworked professional man, a barrister, politician, or member of the Stock Exchange; in any case, his work is carried out with his brain and not with his biceps. He is surrounded by anxiety and worry, which are only polite equivalents for fear. Worry and anxiety, fear and nervousness, are names for the same emotion which constitutes "overwork"—and overstimulation to the adrenal and thyroid mechanism. "Mr. So-and-so" may be primarily suffering from too many figures and too little fresh air; and it is at least possible that the nervous breakdown is due primarily to emotional causes rather than to physical disturbance. But there is a condition almost analogous to this which is seen following infectious diseases, with their consequent poisoning. This condition is not uncommonly seen to follow, for example, an attack of influenza in an individual who had been perfectly fit beforehand, and such a case is therefore much more likely to be primarily physical.

In everyday life the ductless glands are intimately concerned with the feelings, behaviour, and capacity

of the individual. The benefit which follows a change of climate, or a week or two at the sea, cannot be due entirely to cessation from work, but is obviously to be attributed to the effects of such a change—and all that it implies upon the entire physical organism. The blood, which has rather nastily been called " the brains in solution," is known to be profoundly influenced for the better by fresh air, sunshine, altitude, and so on. Without doubt, the improvement in the blood benefits the ductless glands as it does every part of the body. We have already seen that rest improves the workings of the endocrine organs. In fact, there are some endocrine disturbances in which rest is an essential to recovery. An overworked thyroid and a tired adrenal system imperatively demand a cessation of strain.

Whatever, then, is the exact cause of " Mr. So-and-so's " breakdown, it is obvious that cessation of mental strain and the placing of the body under the best possible conditions for recovery, is the most rational treatment.

3

Many of the features of mental breakdown have been traced to endocrine disturbance. In the adrenal type of individual, where instability exists, strain, more especially if of sudden onset, is sufficient to produce mental illness. Prolonged toxæmia is capable of altering profoundly both the cortex and medulla of the adrenals, and many people believe that chronic toxæmia is one of the most common causes of insanity.

The general " sensational " life of an individual depends upon the sum total of stimuli reaching the brain, and these are to a large extent dependent upon chemical factors present in the body. Again, sudden changes in the sensations of an individual are apt to be very disconcerting and to generate undue anxiety as to their cause and meaning.

Few people realise how dependent our comfort is *upon the fusion of sensations into a homogenous whole.*

We are usually unable to detect any splitting of sensation, apart from local stimuli applied from outside to different parts of the body. There are, however, conditions in which much discomfort is caused to the individual by a consciousness of some part of his body ; the vague aches and pains from which neurasthenics suffer come into this category, as does also what is technically known as " paræsthesia." This is the presence of a sensation, such as tingling or numbness, which may bear no apparent relation to outside stimuli.

There is a story told of a visitor to a mental hospital who observed one of the patients vigorously beating himself over the head with a piece of wood. He asked the man why he was doing this, and added : " Is it not very painful ? " " Yes," replied the lunatic, " but it is such a lovely feeling when I leave off ! " Few of us realise that half the fun of pain comes from its cessation.

The sensations of everyday life are woven together and presented to us as what we may call a " mental background." In health this should be pleasant, and we should not be more conscious of any one part of our body than another. In disease, however, the life of sensation varies, and any degree of interference, from a sensation that is unusual up to actual pain, is an indication of the failure to fuse all sensations into one.

In everyday life, then, we find that the endocrine organs are among the most important contributors to the life of sensation ; the mental torpor which characterises thyroid deficiency, and the over-anxious state which is characteristic of excessive adrenal action, are both equally disturbing to the everyday work of the individual. Any sudden variation in what may be loosely called " endocrine stability " is productive of altered sensation.

Many people are prone to a sudden access of flesh or to an equally precipitate loss of weight. It is next door to impossible to fatten some individuals, while others appear to make flesh out of air. Sudden changes in weight are apt to occur after infectious diseases, at puberty, at

A Case of Hyperthyroidism
(An Over-acting Thyroid)

(*From Dr. Leonard Williams' article on Exophthalmic Goitre, published in The Practitioner,* 1915.)

[*Facing p.* 136

the change of life, and after great mental strain or shock. These appear to occur without either excessive eating or ascetic abstinence. The fact that they are seen at times when the endocrine balance is liable to upset, is strongly suggestive of the fact that it is to the internal secretions that we must attribute sudden changes in the bodily girth. It is good for no one suddenly to change his habits, neither is it wholesome for a man to alter his measurements precipitately.

It is perfectly true that most people recognise that their neighbours eat too much; and there has never been a case of obesity recorded in a famine. And yet the fact remains that one type of endocrine personality can put on fat on half the quantity of food upon which a different type remains stationary in weight.

Just as the internal secretion of the pancreas makes it possible for sugar to be stored in the body and not to pass into the urine, so in these cases are the regulators of metabolism able to monopolise a larger proportion of the food than they should do and cause it to be stored up as fat. In this work, thyroid, pituitary, adrenals, gonads, and, of course, pancreas, take part.

Alterations in weight are important, for they signify alterations in the workings of the internal secretions. In middle life greater care is required than in healthy youth; for, by this time, the body has to fight against more toxins and less adequate elimination. The dissimilatory endocrine organs—*i.e.*, those concerned with elimination—are likely to need assistance in the middle decades of life. Organotherapy deals with the administration of products elaborated by the different endocrine organs and their place in medicine.

The future should show us how to prevent those diseases which are so commonly seen in middle life, and which arise primarily from disturbances of the endocrine organs.

The changes of middle age are imperceptible apart from definite disease, but they often take the form of

vague ill-health and ill-defined discontent. This is amusingly put in one of Somerset Maugham's plays, where the middle-aged heroine sends for her doctor to discuss her feelings with him. After listening to her recital, he tells her that she is suffering from middle age. When she demands upon what he bases his diagnosis, he replies by asking her whether she has not noticed that the policemen in the street look much younger to her than they used to. It is a sure sign that we are relatively older when we notice how young the policemen appear to be.

One of the minor inflictions with which middle-aged women have to contend is the appearance of hair on the face. This is due to the failing of the ovarian hormone, and the relative ascendancy of the adrenal cortex. It will be remembered that this latter organ is a masculine determinant, and that it is more in the ascendant in virile men and in those animals who are pugnacious and fearless. In the normal female it appears to be neutralised and controlled by the ovarian secretion. When this fails, signs of masculinity are liable to occur, and among these the incipient moustache must be classed. In some young women of the adrenal type—*i.e.*, dark-skinned brunettes with the hair low on the forehead and ill-developed figures—a thin dark moustache tends to make its appearance as early in life as the "twenties," or even the "teens." This is indicative of the activity of the adrenal cortex in relation to the ovarian secretion. It is said that brunettes show signs of chronic disease of a toxæmic nature much more readily than blondes. If this be true, it can best be explained by assuming that the adrenals are very sensitive to the action of toxins in these individuals, and that those types less dependent upon adequate adrenal functioning, show signs of toxæmia less readily.

Prescribers of medicine are taught that blondes require larger doses than brunettes, and that Indians, and the dark and yellow races, react to half the doses which the

Anglo-Saxon requires. This, again, probably means that the lighter races are more resistant to the action of drugs by virtue of their pituitary domination than are the adrenal-deficient negroid types.

In the climate of Northern Europe, with its sudden changes of temperature, relatively frequent disorders occur which are loosely labelled "chills." These are associated with rises of temperature, and the bodily and mental discomforts consequent thereon. We all know most of these by bitter experience, but it makes them more easy to understand if we grasp the mechanism which is at work. The centres which control the bodily temperature (which we must realise rarely varies a degree in health whatever the temperature of our environment may chance to be) are situated in the brain. These are disturbed by many causes, the commonest of them being the production of toxins by bacteria. The average chill, to take a concrete example, is due to the introduction of bacteria and their toxins from such common places as the nose or throat. These toxins disturb the control of the bodily temperature by the higher centres, and lead to disorganisation of the autonomic nervous system. These factors are responsible for the dry skin, the highly coloured urine, and the invariable constipation.

But not even in a short illness such as influenza do the endocrines escape. Post-influenzal debility is, unfortunately, too well known to many people by practical experience to be regarded lightly; and post-influenzal debility appears to depend upon under-adrenal action associated with sympathetic disturbance.

The internal secretions in everyday life are as important (if not more so) as they are in emergency. The seven ages of man are the seven epochs of the endocrine organs. In our everyday life we are dependent upon the chemical messages which travel about the body from one gland to another.

The discovery of the endocrines and their work is a fitting corollary to a long-distant discovery of a similar

kind, namely, Harvey's discovery of the circulation of the blood. For, in the blood are the products which each endocrine gland contributes as it passes through its tissues.

4

The twenty-four-hour day has been divided into three periods—eight hours for sleep, eight hours for work, and eight hours for play. It is interesting to speculate in what way the various endocrine glands function during these three periods. Dealing with sleep first, we realise that all the bodily activities are lowered during this time ; the entire mechanism is working at low speed.

On waking in the morning, most people lie in a comatose condition for a few seconds. This is especially so when sleeping in a strange bed, for it takes us a few seconds to grasp the fact that we are not in our familiar surroundings. The circulation is sluggish, the supply of blood to the brain is deficient, and it is only by the early cup of tea or by such a stimulus as a cold bath, that a return to waking life is accomplished.

All the bodily processes have been lowered during the hours of sleep, and there is consequently little need for a large meal on waking. Sleep and food, to a certain extent, both serve the same purpose, for " he who sleeps dines." Sleep is, in many ways, similar to old age, for in both conditions bodily metabolism is low. The endocrines enable the individual (recently awakened from sleep) to take up his life anew.

For the individual with a low pituitary or thyroid supply, the morning is the worst time. Such individuals are slow, sluggish, and unable to work ; and they will tell you that their best time is the afternoon or evening, for by this time exercise has stimulated the circulation and awoken their dormant glandular secretions.

More people are nowadays engaged in mental than in physical work ; and it is interesting to study what constitutes the successful brain-worker. The first

necessity is concentration; a wandering mind prevents good mental work, and a mind can only be kept on the work in hand provided it is supplied with adequate blood. Adequate blood-supply necessitates a properly functioning adrenal, thyroid, and pituitary system; and in the eight hours devoted to work, we must ensure that this important system is functioning adequately.

The hours of play are different. Their requirements depend upon the form the play takes. Most sensible people spend it in physical exercise, if they have had to work in an office during the day. If they do not, they tend to put on weight as middle age advances; alternatively, they may become excessively thin. In either case, they are suffering from disordered endocrine functioning.

There is good reason to think that the pituitary governs sleep; and, in hibernating animals, changes have been noticed in this gland. Therefore, this gland has been regarded as being connected in some way with the *rhythm* of the body. For sleep is a rhythmical function and comes at regular intervals; it is not necessarily dominated by fatigue, for people who have been in bed all day become sleepy at night, and, other things being equal, sleep throughout the hours of darkness. It is no exaggeration to say that this function of the pituitary is the most important endocrine function connected with the eight hours of sleep. The ante-pituitary-adrenal-thyroid mechanism is the most important for the hours of work. Play spent in outdoor pursuits requires a vigorous circulation; a vigorous circulation suggests a sympathetic system easily adapting itself to the needs of the moment; and this in turn necessitates an active adrenal medulla. The adrenal cortex (concerned as it is with courage and aggressiveness) is necessary for the hardier games. We may assume that Rugby footballers are possessed of a fine adrenal cortex. It is hardly possible to watch the scrum in a Rugby match without realising the

similarity between the "forward" and the charging buffalo.

A very common symptom in civilised life is headache; and while the causes of headaches are many, it may be justifiable to refer briefly to the pituitary as one cause. It is now realised that the pituitary (like the thyroid) changes its size from time to time, and that enlargement of the pituitary is definitely associated with many variations in the bodily economy. But, unlike the thyroid, this gland is surrounded by a bony boundary, which causes compression to the swelling gland. Eye-strain, which is well recognised as productive of headache, may possibly achieve this end by interference with the nerve or blood supply to the pituitary, as the optic tract lies in very close relation to this small gland. The correction of eye-strain is frequently followed bybenefit to some forms of headache; and many clinicians believe that this is partly due to the relief of pressure on the pituitary.

Another everyday action of the endocrine system (in its widest sense) is concerned with digestion. We have already seen that the autonomic nervous system controls all involuntary muscles, and amongst the most important are those of the digestive system. While hunger is a physical sensation, appetite is a mental urge. Let us assume that a hungry man sits down to an appetising meal. Suddenly he hears a cry, and going to the window, sees some repulsive sight—for example, a small child run over and badly damaged by a motor-bus. It is unlikely that he would be able to sit down with the same gusto to his meal; probably he would turn with disgust from his food; and were he a sensitive individual he might even retch or vomit.

This change is produced, of course, by emotional and autonomic influences. Strong emotion affects both the contractions and secretions of the gastric juice; and appetite disappears after violent emotion.

This example is quoted to show the influences which

are present in everyday life, and how normal appetite is dependent upon glandular and autonomic influence. The everyday worries which we meet with, the questions we have to decide, the problems which are placed in front of us, are all capable of so disturbing our functional equilibrium as to rob us of appetite, and consequently of satisfactory digestion. Everyone knows that "appetite juice," as it has been called, is necessary for proper digestion; if, for any reason, this is absent digestion is interfered with.

To conclude this chapter, let us mention a subject which is dangerous to discuss—namely, temper. On the stage, Anglo-Indian Colonels are invariably portrayed as choleric; they are unapproachable in the morning, are difficult until lunch time, and at any time are subject to violent reactions to mild stimuli. Now, why is this? Popular opinion says they have "tickled up" their liver with too much chutney and curry and whisky; but this could hardly alter them unless the changes in the liver had upset other of their organs, and this, of course, is what has happened. Irritable individuals are individuals with irritants in their blood, over-stimulating their nerve centres and, of course, their minds. The quick response (which the choleric individual has) depends upon some such mechanism as this; for without the co-ordination, or, at all events, the inter-working of these organs, it would hardly be possible to get a quick alteration in the mental reaction.

Unreasonable temper and loss of control is frequently attendant upon ill-health. The late Sir Lauder Brunton said: "I have seen as naughty a little girl as you wouldn't wish to see turned into a perfect angel by a blue pill and a black draught!"

The placid individual is the individual who belongs to a type in which the autonomic nervous system is less highly sensitive than in the opposite type of individual. No doubt the best treatment for the choleric Anglo-Indian is that prescribed by Sir Lauder Brunton for the irritable child.

What is the mechanism by which so-called "liverish ness" can produce moodiness, irritability, and bad temper? The answer is to be found in the internal secretions. Everybody who has suffered from jaundice knows by bitter experience the depression and misery which accompanies this condition. Now, in jaundice the bile circulates in the blood, instead of being secreted into the digestive tract; and the circulation of bile produces a temporary "personality" which is quite distinct. There is lethargy, somnolence, sluggishness, and a low temperature. The vital processes are lowered, there is increase of sleep and increase in the *depth* of sleep, and the picture is exactly opposite to that which is seen in over-action of the thyroid. In fact, it has been suggested that the subcutaneous injection of bile salts might help to overcome the hyperthyroid state.

These are interesting speculations, but they are little more at present. The time may come when it is possible to regulate temper by glandular extracts, but needless to say we have not as yet reached this stage. The ancients attributed envy, hatred, malice, and all uncharitableness either to the liver or the spleen. We have seen that there is evidence to indict the liver of being concerned in the production of temper, but there is less evidence that the spleen is involved.

Unfortunately, the poor spleen can have no functions attributed to it beyond the few referred to in a previous chapter. In spite of its size, no one really knows the work of the spleen; but that poets use it to signify emotions of the baser sort is known to us all. Perhaps one day some observer will take the spleen and place it on a higher level; it may turn out to be an organ worthy of our interest, rather than one which only breeds base emotions.

If only we were able to indict some endocrine organ as being responsible for "bores," the subject of endocrinology would be extremely popular in social clubs.

CHAPTER III

RACIAL CHARACTERISTICS AND ENDOCRINE INFLUENCES

1

As the reader begins to grasp the nature and functions of the endocrine glands, he will perceive how widely they influence life. Not only in determining the build of the individual, his physical and mental characteristics, his behaviour and his reactions to environment, are we helped immeasurably by a knowledge of these secretions; but we pass from this aspect to an even wider study, which takes us into such sciences as ethnology (the study of man as a racial unit), anthropology (the science which studies man as a unit in the animal kingdom), and even ontology, which discusses the nature of "being."

The history of man dates from the time of his appearance on this globe and describes how he first arrived here. His differentiation into the bewildering variety which exists to-day, and the reasons for this "sorting out," must be glanced at in this chapter. Why the racial characteristics appeared, how they arrived, and what they mean, are all pertinent to our present study.

What part do the endocrines play in the determination of type? There are a few outstanding facts, some of which have emerged in the previous chapters, which will help us to understand the endocrine pattern which underlies any particular build. Why is the Negroid type characterised by relatively long arms and dark skins? Can we answer this question by saying: "Because the adrenals are relatively deficient"? Or, if the Caucasian can be recognised by fair skin and broad skull, can we affirm that this is because the pituitary

has emerged triumphant and superior to other of the endocrine organs? If we could be as dogmatic as this it would be easy to take the argument a stage further and trace the causes—soil, air, water, food, etc.—which have produced pituitary domination. Finally, we could, with certainty, aver what type of man would be found in any one climate if we knew the combination of factors just mentioned.

Unfortunately (whatever the future may achieve), this is quite impossible at the present time. There are so many factors to be taken into consideration that the most which can be attempted is to study man and his characteristics; to familiarise ourselves with the groups into which anthropologists have placed him, and to learn the characteristics of these types. We have no clear-cut descriptions of types, based upon the various factors upon which anthropologists lay stress, which are so conclusive that we can say: "This was the primary man!" We do not know, moreover, what kind of face, trunk, or extremities may be regarded as high up in the evolutionary scale, and what as stigmata of "low races." In other words, we cannot so delineate a type as to be able to say, "A man of such-and-such a height, whose arms are equal to his trunk in length, with a brachycephalic skull, thin lips, straight forehead, curly hair, and fair skin, is the 'highest' type." One or more of these characteristics may be found in the lowest (from the angle of civilisation) as in the highest. What is civilisation to-day may be savagery—in comparison—in a thousand years. Centuries ago the Anglo-Saxon was a *parvenu*, the North African firmly established.

There are, of course, many factors to be reckoned with in attempting to discover the causes which have made the Nordic what he is, and have produced the Pygmy, Caucasian, Scandinavian, and Alpine types. Somewhere in the bricks which go to the making of "types" is found the endocrine influence. Size, hair, eyes, relative length of extremities and trunk, all show endocrine action. It

is interesting, therefore, to see how the patterns differ, and what are the characteristics which have been selected as differentiating one type from another.

To do this, then, we must adopt one of the classifications of races, which are to be found in works on anthropology. We must study their characteristics, and learn the physical traits which differentiate one group from another. If, in addition, we can correlate certain mental characteristics with certain physical configurations, we shall have acquired a knowledge of types from which we shall be able to form some idea as to the glands which are dominant in the various races.

2

Geology has shown that man must have been on this planet not less than twenty thousand and not more than one hundred thousand years. This apparent antiquity is as nothing compared with the length of time in which vegetable and animal life has existed. Archbishop Usher was responsible for the belief that the world was created in 4004 B.C., and this belief held sway until well on into the twentieth century. To-day, the age of the world is computed in millions of years, and the older chronology, which was founded upon the genealogical data of the Pentateuch, has given place to the facts which have emerged as the result of archæological enquiry. Anthropology, ethnology, palæontology (the study of extinct forms of life) have each and all contributed to the knowledge of the age of the world. By the middle of the nineteenth century Sir Charles Lyell had published his "Principles of Geology," which had shaken to their foundations the older belief that the world was but a mere few thousand years old.

It is now a matter of general concurrence that man existed in the Quaternary period—that is to say, the era which immediately followed the Glacial Age; and this means that his history goes back at least tens of thousands

of years. We can do no more here than glance, for a brief space, at the evidence upon which this assumption is based.

Various excavations, borings, and explorations have shown that human beings must have existed for many thousands of years; at deep levels, relics of brick and pottery have been found buried beneath many feet of silt, the work of centuries before Roman civilisation existed. Egyptologists have proved that civilisation existed in the Nile Valley some 7,000 years ago; and others have affirmed, with every reason, that vast numbers of years must have preceded this epoch, during which the inhabitants of North Africa were arriving at the high degree of civilisation which they subsequently attained. Further data are available from the study of language. The Aryan, or Indo-European group of languages, dates back to a far remote era; and authorities believe that the modifications of this now extinct language (from which all the modern tongues of civilisation are derived), can only have been achieved in many thousands of years.

Anthropologists have come to lean upon the science of language for many of their views as to the antiquity of man. The similarity of speech, the varieties in grammar, and the existence of groups and allied languages, with intercourse between different groups, offer much data which is available for the estimation of the passage of time since the appearance of man. From language alone it is unsound to infer the age of man; for the adoption by one race of a language belonging to another, the modifications which are introduced by a conquering tribe, and the mixtures which result from intermarriage, are apt to lead to misconception. It is therefore imperative for chronology, archæology and palæontology to work hand-in-hand with philology.

It is assumed, then, that man existed in the post-glacial drift era. Was he the same, or were there several different species? That he was a "one man type" all

over the world is shown by the fact that all the remains found in various countries are more or less alike.

Additional proof is obtainable by studying the evidence which anthropology and physiology offers. Darwin supported the belief that one species cannot breed with another. If, therefore, palæolithic and neolithic types are to be regarded as distinct species, they would remain differentiated, which, in fact, is not the case. Skulls of all types—extreme dolichocephalic examples, modified long-headed skulls, and brachycephalic and round-headed types, are all encountered in the caves which exist in Belgium, Italy, and Great Britain.

Breeding between the early types is thus demonstrated, resulting in the mixture of primal races which is found to-day throughout the world. Originally, therefore, man must be regarded as from a single pattern, and there must have been a " cradle-land " " whence the peopling of the earth was brought about by migration." Assuming a common ancestor, a proto-human type, " each division of mankind would thus have had its pleistocene ancestors, and would have become differentiated into races by the influence of climatic and other surroundings. As to man's cradle-land, there have been many theories, but the weight of evidence is in favour of Indo-Malaysia."

Geology helps us to explain how man's migration from his original cradle-land was effected. The alteration in the earth's surface brought about by the disappearance of continents, and the submergence of land which has been replaced by sea, suggests, what is now usually admitted, that there was an Indo-African continent, and, in all probability, an Eur-African continent as well. A submarine bank stretches from Scotland through the Faroe Islands and Iceland to Greenland, and by land where the Behring Straits now are. This suggests that " the Western Hemisphere was more than probably connected with Europe and Asia, in Tertiary times, by a continent." The migration and peopling of the globe took place in pre-glacial ages, when the climate was much

milder; the objection to this theory, namely, that pleistocene man would be hindered in his migration by encountering excessive cold to which he was unaccustomed, is therefore unconvincing.

The after-history of man is, however, affected profoundly by climate. The so-called "higher races" are confined to temperate zones, while tropical countries are inhabited largely by semi-savage peoples. The primary divisions into which mankind has been divided took place in neolithic times, "not consecutively in one area, but simultaneously in several areas. A Negro was not metamorphosed into a Mongol, nor the latter into a white, but the several semi-simian precursors under varying environments developed into generalised Negro, generalised Mongol, generalised Caucasian."

3

Man may be divided into three primary divisions (and numberless subdivisions), the Caucasian, or white man, the Mongolian, or yellow man, and the Negroid, or black man. Huxley divides the first group into Xanthochroic ("fair whites") and Melanochroic ("dark whites"). Boas divides man into two groups, the Mongoloid and the Negroid. Kroeber describes four subdivisions, namely, Nordic, Alpine, Mediterranean, and Hindu.

(*a*) The Caucasian, or white man, is the inhabitant of Europe. The Xanthochroi are tall, with fair skin, tow-coloured hair, bluish eyes and skulls which vary in size. This subdivision may be traced into North Africa on the one side, and into India on the eastward, but it is essentially the type of Northern Europe. The Melanochroi have a darker complexion, black hair and eyes, are of smaller stature and slighter build. They belong to Southern Europe, and include the Celts, Spaniards, Greeks, Arabs, and (by some authorities), aberrant types as the Samoans, Hawaiians, the Dyaks of Borneo, and the Battoks of Sumatra.

Among the most important signs of race are the colour and quality of the hair, type of skin, colour of eyes, and, to a lesser extent, the stature. The type and size of skull, the prominence of the bony ridges over the eyes, the protruding or receding lower jaw, and the size of the orbit, are all indicative of the type to which the individual belongs.

(*b*) The Mongol, or yellow man, constitutes the second group into which man is divided. If the reader glances at an atlas, and draws an imaginary line from Lapland in the north to Siam in the south, he will see the area which lies to the east. It is here that the Mongoloid type is located. Among the Mongolic races are the Finns, Samoyedes and Ostyaks, the Chinese, Tibetans, and Siamese, the tribes north and west of Manchuria, the Turkic peoples, the Japanese and Koreans. The characteristics of this group are a coppery complexion, lank, straight and black hair, small nose, broad skull, short squat body, and slanting black eyes. The ridges above the eyes are not prominent, and the jaw is not protruding.

(*c*) In Africa, between the Sahara and the Cape, is found the third, or Negroid division. The physical build of this type is very characteristic. The skull is narrow, the jaws protrude, the lips are thick, and turned outwards, while the nose is flat and broad, and the ridges over the orbit are not marked. The skin of the Negroid is dark brown, the eyes are dark, the hair black, crisp, and curly. In this group are included the Bushman of South Africa and the Negritoes. The Hottentot was held by Huxley to be the result of a cross between the true Negro and the Bushman. The latter are diminutive in size, and yellowish-brown in colour; they have slightly slanting eyes and prominent cheek-bones, these two features being largely responsible for their inclusion in this division. Another suggestion as to their origin, which has been made of recent years, is that they are connected with the Pygmies. This has probably arisen because of their diminutive size. Their average height is 4 feet 9 inches.

The Bushmen possess a long, low skull, deeply set eyes, and large and prominent cheek-bones. Their expression is crafty, their mouths wide, with lips somewhat everted, while their figure is extremely spare. The skin is dry, and hangs in folds around the joints; the hair is thin, and in old people it becomes grey. We shall have occasion to refer again to this tribe when discussing the probable endocrine patterns which are found in the various races.

If a line be drawn through equatorial Africa, through the Belgian Congo, and the Malay Peninsula, it will cut through Borneo, leaving the Philippine Islands to the north-east. In the countries through which this line passes will be found the people known as Negritoes or Pygmies. They are coal black, and are divided into African Pygmies (Negrilloes) and Asiatic Pygmies (Negritoes). They are interesting from many view-points.

The name "Pygmy" is derived from a Greek word signifying the distance between the elbow and knuckles, and was used by Homer to describe a race of tiny men. Mythology makes frequent use of the Pygmy; Aristotle refers to a race of men of small stature, and Philostratus describes the "sleeping Hercules beset by swarms of Pygmies." Pliny refers to races of dwarfs both in Asia and Africa; and a Chinese author of the thirteenth century describes a tribe of dwarfs dwelling in the Philippine Islands.

The Negrilloes, or African Pygmies, extend across Central Africa, north and south of the Equator. The Negritoes, or Asiatic Pygmies, are to be found in three situations: in the Philippine Islands (the "Aetas"—a word meaning black), in the Andaman Islands, and in the interior of the Malay Peninsula.

The Pygmies of both divisions are small: the average height is stated to be 4½ feet, although they are sometimes considerably smaller. They have crisp, black curly hair, flattened noses, long upper lips, prominent lower jaws, large "ape-like" mouths, short skulls, long arms, short legs, and "a general Simian appearance." They have

large feet, and toes relatively larger than Europeans, there being sometimes a divergence of the four smaller toes from the great toe. They are skilful climbers ; and make great use of their feet, holding branches between the great toe and the other toes. They are wanderers, moving to different parts of the forest in search of food. Their exact lineage is a matter of difficulty for the anthropologist, as they do not fit easily into any one group.

4

In considering the characteristics of the various races and their subdivisions, we find that certain characteristics are more marked in one group than another. It cannot be said, however, that one individual feature, such, for example, as a prominent lower jaw, is solely confined to one race. But it can be said that such a feature is characteristic of the Negroid type, while, in general, it is absent from the Mongoloid type. In those instances, where one feature is more or less characteristic, it is of distinct help in estimating the underlying endocrine pattern.

It will be obvious, moreover, that the number of subtypes, into which it is possible to divide the human race, is almost unlimited ; for, assuming as we have done, that man started as one species and migrated across the world from his original cradle-land, he would obviously have intermixed and inter-married and produced a variety of types. Take, for instance, the question of colour. There is no absolute border at which the colour changes, and it is not possible to say that all Europeans are lighter than, for example, the inhabitants of Asia.

Starting, therefore, from the three primary divisions (and this is sufficiently far back as a genealogical pedestal), we shall see that the subtypes to which we are now referring have gradually evolved as the race has become more widely spread.

It will be remembered that Huxley originally divided the human race into four types and a fifth variety. Other anthropologists have chosen other ways of describing the

races: Blumenback describes five races—Caucasian, Mongolian, Ethiopian, American, and Malay. Cuvier classified the races into three—Caucasian, Mongol, and Negro; in other words, white, yellow, and black races. Pickering chose eleven, and Desmoulins sixteen.

Huxley's division really amounts to Australoid, and the two groups fair-whites and dark-whites, in addition to the Negroid and Mongoloid.

We have already decided here to adopt the three main groups—Caucasian, Mongolian, and Negroid—but it will help us when we come to discuss the endocrine aspect of the race question if we now refer briefly to certain of the subtypes.

Huxley's Xanthochroic (fair-whites) and Melanochroic account for the two "white divisions." Nordic is a term Kroeber uses to describe a race found in North Germany. Alpine is applied to the South Germans. The Mediterranean type is found in Europe in the countries bordering on the Mediterranean Sea. In Asia a Hindu type is recognised, and is characterised by dark skin and long head.

The Negroid type possess the following characteristics: the people are dark-skinned, the arms are relatively long in comparison to the trunk, their hair is curly, crisp and dark, and they have strongly developed jaws. One point of interest arises in relation to the hair—namely, that it is flat in transverse section. It is spirally twisted, and differs, microscopically, from the hair of other types. The eyes of the negro are dark-brown, whereas the cornea or clear part of the centre of the eye is yellowish. The teeth are large, and usually very white. The nose is broad and flat, and forms a characteristic feature of the face. The term "Negroid" refers to the dark-skinned inhabitants of the regions stretching from Senegambia to the Fijian Islands in the Pacific; the term "Negro" being reserved to designate an individual with the characteristics which are typical of this variety. The true Negro is distinguished by length of arm (in which the forearm is pre-eminently long), smallness of calf and length of leg.

The Negro possesses a prominent jaw; the capacity of the cranium (which is estimated by filling it with sand), shows that he has a smaller cranial capacity than the white man. The Negro skull is also distinguished by narrowness. The lips typical of the Negro race are well known.

In passing we may refer to the fact that the Negroid races are largely vegetarian, due mainly to the fact that meat is a rare delicacy and one which it is difficult to obtain. Among the Negroids of Africa cannibalism is, of course, found; and it appears that the cannibal tribes choose human flesh in preference to game, for example, which appears plentiful just where cannibalism is rampant.

We have already referred to the Negritoes and described their main characteristics. The Mongoloid type is found chiefly among Chinese, Finns, and the arctic Asiatic group, the Malay peoples, and the American races from the Eskimo Fuegians. The physical characteristics of the yellow man consist in a broad skull, without prominent jaws or prominent brow-ridges, which gives a flattened appearance to the face. The skin varies from light yellow to coppery-brown. The hair is straight, black, and without any curl; the eyes are dark in colour, the openings between the lids oblique in shape.

The Mongolian possesses relatively short arms and a short squat body. Geographically speaking, this race is found mainly in the land which surrounds the Pacific Ocean.

5

"Internal secretions of the five important endocrine glands, pituitary, suprarenals, gonadal, pineal, and thyroid control racial characteristics of the great divisions of man. . . ." Certain characteristics are traceable through the same race; but there are exceptions to this rule. The main points to be considered are stature, hair-colour, eye-colour, and shape; proportional length of arms and

legs to each other and to the trunk, as well as any peculiarities of build which are confined to a particular race. The colour of the iris is characteristic of the different races ; the shape of the eye, and of the aperture through which it looks, differs in the various races.

It is said that the brown iris is a dominant Mendelian characteristic ; it is also suggested that dominant features such as black hair and eyes, and even some of the disorders and malformations associated with the eye, are found more in one particular race than another. The general colour of the Caucasian race, more particularly the fair-whites, is at the opposite extreme to the colour-scheme of the Negroid race. The shape of the head, and the degree of prominence of the lower jaw and of the ridges over the eyes varies with the race. The relation of the particular skull-form to such factors as the shape of the orbit is an important distinguishing feature.

In Europe the Nordic type is long-headed, the Alpine subdivision broad-headed ; the Hindu skull is long like the Alpine, but its possessor is dark-skinned. The shape of the skull and the configuration of the face depends upon, among other factors, the pituitary gland, but it also depends upon the gonads. Negroes have strongly developed jaws and prominent ridges over the eyes. The large teeth of a Negro and the broad, flat nose may be regarded as depending to some extent upon an active pituitary ; but then the adult Negro is a highly-sexed individual, and this suggests that in him the secretion of the gonads is more powerful than that of the pituitary.

It is possible that the production of long eyes leading to short sight, or short eyes leading to long sight, is due, in some way, to the development of the pituitary. It is very likely that the activities of this gland during growth may influence the shape of the entire skull, and through this such organs as the eyes.

Underlying the characteristics of the Caucasian is an active pituitary. The colour found in this group, the large skeleton and the long bones of the extremities, point

to an active anterior pituitary. The energy and drive which is so marked in the typical Caucasian (and usually deficient in the Negroid) is another characteristic for which the pituitary is responsible.

If this gland is partly responsible for the racial characteristics of the Caucasian group, it is obvious that we must look elsewhere for an explanation of the general characteristics of the Negroid group. The characteristics which we have to account for are as follows : dark skin, relatively long arms, strongly developed jaws, typical hair such as is seen in no other type.

It is said that hair is controlled very largely by the sexual secretions. The adrenals increase greatly during childhood, and when this increase becomes abnormal there is sexual precocity and general hairiness. The adult Negro is dominated more by his sex glands than by any other single internal secretion; although the character and texture of his skin, the quality and shape of his hair, and his mental characteristics all point to the adrenal gland. Furthermore, his mentality fits in very well with this conclusion; he is simple and rather childish, and of relatively low intellect. Easy to deal with as a rule, he is liable to be swept off his feet by sudden gusts of emotion. When this happens he is liable to " run amuck," his adrenal medulla and sympathetic nervous system temporarily changing his personality.

It is believed that the adrenals, in company with the sex organs, determine the hair in the male; dominance of adrenal influence leads to the masculine type and distribution of hair. Removal or disease of the female sexual secretion leads to the appearance of hair of masculine type.

Why are the people found around the Indian Ocean dark-skinned and the Northerners pale ? Why are the Mongolians yellow and the Negritoes as black as they can be ? The Negritoes are found along the Equator; they are nomads and very short, and represent the extreme type from the Caucasian in so far as stature,

development, colour, and mental characteristics are concerned.

Some of the Pygmies are interesting from the standpoint of mental characteristics; those which are found in Melanesia are the blackest of the black, while certain pure-blooded Akkas only run to colour of a dirty reddish-yellow. The eyes of the pygmies are often large and staring, giving a wild appearance. They are very daring and bold hunters, and capture their prey by shooting with tiny poisoned arrows. The Andaman pygmies live by the result of their hunting; that they can be very ferocious is well known, and there is a story by Sir Arthur Conan Doyle in which a small Andaman islander is employed to encompass the death of a European by shooting tiny poisoned darts through a blow-pipe at the bed on which the victim is lying.

To return, however, to the question of colour. We have already said that the skin is an organ upon which the endocrine influences are widely felt, the actual colour of any particular skin being determined by the proportion of colouring matter and its blend.

There are one or two facts in connection with the ductless glands which bear upon the question of skin colour. First, exposure to the sun's rays produces a gradual bronzing of the skin, which may vary from a pale yellow through orange tints to a sepia; some people react by producing freckles, while others tan uniformly. The failure of the adrenal system, which is the cause of Addison's disease, is accompanied by a bronzing of the skin. *Deficient adrenal action presumably leads to a darkening of the skin colour.* The moisture of the skin depends upon the state of the sympathetic nervous system, the activity of the thyroid and pituitary, and their interrelation with the adrenals. It seems probable that the amount of fat found beneath the skin is an important factor in determining the nature of the skin. Where the blood supply and nutrition of the body is good, the skin possesses the normal soft velvety characteristics. Changes

in the skin occur very readily with changes in the bodily health. At the same time, we have to explain the varieties of skin colour that exist, and this we can only do by understanding how colour is produced.

The colouring matter which lies under the second skin is found not only in the Negroid, but is common to all human races; it is, of course, more abundant in the Negroid and Mongolian types than it is in the Caucasian. This is explained by various factors, amongst these being the stimulating action of the sun, excessive vegetable food, and the fact that hot and damp countries favour the darkening of the skin. It has even been stated that the hotter the climate the darker the skin, which is borne out by the geographical distribution of colour. The deviations from this general law are explicable by the migrations of dark people to cold climates, and light people to tropical countries. Inter-breeding, moreover, is bound to have the greatest influence on this question; and it is interesting to note that the skin of coloured races is always lighter in the new-born child. Dark pigment is absent in the Negro fœtus, and at birth the baby is a light grey colour; it is said that on the eighth day or even earlier the skin of the infant begins to darken. Elsewhere in this book, reference has been made to the theory that a pigmented skin is evidence of a relative failure of the adrenal glands.

The effects of the sun vary in the different races; the dark Europeans change uniformly in colour and become more the tint of Mulattoes. The Chinese, it is said, turn darker in winter than in summer.

It is obvious, therefore, that as a test of race the skin cannot be relied upon. We must assume that, according to the various influences referred to (sun, moisture, diet, etc.), so does the skin adapt itself and alter. To put the same thing in another way, we must regard skin colour as largely adaptation to environment, and in this adaptation the influence of the adrenals cannot be over-

looked. That changes in the skin colour, accompanied by such signs as moles, freckles, and brown patches, are the result of disease is well recognised; and it has been said that marks of this kind make their appearance after diseases which have led to adrenal deficiency.

The Negrito, or Pygmy, is blackest near the Equator; he does not possess the long bones of his taller brother, but displays daring, audacity and initiative to a much greater extent than the Negro. Why exactly the Negrito should exist in the form he does, and what are the factors which have caused his differentiation from the Negro, is not known.

6

It must not be thought that all the credit is being given to environment while heredity is accorded a back seat. In the past the reverse has happened. Heredity has been in everyone's mouth, while even unrecognised traits and fancies have been thrust on to heredity. In a modern play one of the characters refused hock at dinner on the plea that "As a family we hate hock!" I have been asked whether, because a man lost one arm in the war, his children would be born with only one arm.

It has been taken for granted in this chapter that heredity will be given full credit for the obvious influence it possesses, and stress has been laid rather upon the adaptation of an individual or race to environment. It is obvious, of course, that the main characteristics of the various types are handed down from father to son, and therefore we need waste no time in a detailed description of what is known of heredity. Our present purpose is to indicate these main characteristics, and to show, so far as we are able, which endocrine influences are responsible.

The Caucasian is as interesting a study in his way as either of the other groups. To the influence of climate—the bracing effect of cold and its hardening qualities—have been attributed both the mental initiative and the

bodily vigour which characterise dwellers in Northern climes.

The Caucasian, more particularly the subtype known as the Nordic, is fair-skinned, generally speaking fair-haired, with a minimum of pigment. Accompanying this physical configuration there is ambition, alertness of mind, and a larger cranial capacity than exists in the Negroid. It has already been said that adrenal failure (such as is present in disease of these glands), is characterised by bronzing of the skin.

Can we correlate the apathy of the Negro and his dark skin as a partial adrenal failure, possibly due to over-strain on this glandular system due to environment, and contrast it with the absence of pigmentation, the energy and drive of the Northerner, and say that this is due to adrenals that are efficient and have not been nearly exhausted ?

To return to the Caucasian, however, it may justly be said of him that he represents a type which has come to the top and led the world ; and that he has done this because he has possessed the requisite power which he has derived from his endocrine organs. The Caucasian has been described as tall, with light skin, blue or grey eyes, straw-coloured hair, and a skull which is not typical and, therefore, cannot be counted as a racial characteristic. The second division of Caucasians, the so-called dark-whites, differs from the fair-whites only in the darker complexion of the eyes and hair, while on the whole the stature is slightly lower and the build less heavy.

It is interesting to note that the colour deepens as we travel from North Europe to the Mediterranean and Africa. The fair-whites are large-boned, but the proportion between trunk and extremities is normal ; the skull is of varying but proportionate width, the facial prominences being moderately well marked, the lower jaw generally well defined. The Caucasian, taken as a whole, is possessed of abundant drive which speaks for

the efficacy of his pituitary. He is less subject to emotional outbursts than is his more Southern neighbour, which may justly be ascribed to the balance which exists in his endocrine hierarchy. The activity of the pituitary during adolescence is responsible for his stature; while the regulation of the sex life in the Caucasian is a testimony to the control of the gonads and adrenal cortex by an active pituitary.

The stature of the dark-whites is slightly smaller than that of the fair-whites; growth, therefore, has been relatively less active. The Latin races round the Mediterranean belong to this type, at least some of them do. The drive and energy characteristic of the North-European is less conspicuous; the everlasting *mañana* of the Spaniard is more in evidence. As we approach the African continent, we see on the whole an increase in the pigment, a tendency to diminution of stature, and the prevalence of what may be called the *laissez-faire* type of mind.

7

What then determines the characteristics of race? It seems that heredity plus environment, and the action of the latter upon the endocrine pattern of the former, is as nearly accurate an answer as we can give. All that has been attempted in this chapter is to draw the attention of the reader to the part played by the endocrine glands in producing the features and characteristics of the various races.

The control by the endocrine system of the body has developed, no doubt, in response to stimuli reaching the body from without. The internal secretions preceded in point of time all kinds of nervous control, and these messengers have, undoubtedly, always been present in the blood. The more primitive nervous system is the sympathetic; and it is this, as we have already seen, which is intimately associated with the endocrine organs. Crile refers to characteristic "activation patterns"

produced by the stimuli of the special senses; and the dual control exercised by the two parts of the sympathetic system (namely, the vagus and the sympathetic) is to be found in almost every part of the human system.

This fact applies to the changes which the features, expressions, and behaviour have undergone. Crile says that the importance of a gland of internal secretion is measured in part by the degree of its control by the sympathetic. As an example, the staring eye of the man who is afraid, is under sympathetic control, while thyroid over-activity likewise produces a staring eye; and, as has been shown in such a disease as exophthalmic goitre, the entire facial expression is one of fear. The psycho-analysts have, therefore, regarded the cause of this disease as purely psychological.

The bearing of factors such as these upon race may be instanced by the bold blue eye to be found in some parts of Northern Europe; the so-called "pig-slit" of the Mongol; and the curious congestive eye of the Negro. The first of these depends upon an active thyroid; the second is similar to that seen in recognised subthyroid conditions (note the eye of the cretin); while the eye of the Negro is in keeping with the pigmentation which is found in this type. It is stated that most of the transmitted defects of the eye follow Mendelian rules. There is little doubt that some of these depend more upon chemical factors than was formerly believed to be the case. It has been pointed out, that the fold of the eye seen in Mongols which is normal to the Chinese child (but a sign of constitutional degeneration in a Caucasian) is, in both, "an evident endocrine marking which may be assumed to be of uniform provenience." (Fridenberg.)

In the Nordic race blue eyes are the rule—that is to say, they may be regarded as a thyroid characteristic (it is stated by Fridenberg that they are more common in myopia). The dark eyes of the brunette races are associated more often with small pupils.

There are some interesting facts in connection with the pigmentation in and around the region of the eye. In the dark-skinned races darker areas are frequently found in the flexures of the body—the groins, the armpits, etc.; and around the eye, dark lines or rims have for generations been regarded as a sign of fatigue. In the Northern races it is fair to assume that the more or less sudden appearance of these dark signs corresponds to some temporary failure of the adrenal mechanism, and that this leads to the deposition of pigment. Another possible explanation is that such rings appear only relatively dark in contrast to the whiteness of the tired face.

The colouring of the Albino represents an hereditary condition which is said to be Mendelian recessive, for there is a lack of colour in those parts of the body such as hair, eyes, and skin, which are usually coloured. This leads to a failure of function, as is exemplified by deficient sight, caused by the absence of the normal pigment. The cause of Albinism is not known, but it is suggested that it is associated with developmental arrest.

The Albino stands at the opposite extreme to the deep pigmentation which is characteristic of the Negro race. In the darkest individuals of this type, moreover, pigment is found in layers of the eye where it is usually absent, and pigment spots or patches are frequently present of an even deeper nature than the surrounding tissues. In over-action of the thyroid, as we have already seen, there is dilatation of the pupil, flushing of the eyes and lids, prominence of the globe of the eye, and an increased formation of tears. The opposite picture is seen in the cretin, where the eye is deeply sunk with a small pupil and a narrow opening of the eye. Cretins, as Darwin pointed out, may cry, but they are incapable of shedding tears.

The manner in which an individual reacts to emotion depends upon which of his endocrines are dominant, and which parts of his nervous system are affected. As

Fridenberg puts it : " The individual reaction, vagotonic or sympatheticotonic, to strong emotion, particularly anger, may depend upon whether there is a basic, pituitary-adrenal, or thyroid dominance, indicated by stature and complexion as well as by other features, such as hair distribution. The very dark type would react with pallor, bradycardia, muscular contractions, narrowing of the pupil and lids ; the blonde types with flushing, exophthalmos, rapid heart action, and a dilated pupil."

It is interesting to realize the different manner in which the Nordic and the Negro would react to emotion. We can hardly tell, in the latter case, whether the individual is blushing or not.

CHAPTER IV

FROM INFANCY TO OLD AGE

1

THROUGH infancy, adolescence, and the years of discretion, to the evening of life, our destiny is largely in the hands of our internal secretions. We have already pointed out that certain of the hormones are known to be secreted before birth, so that, at birth, part of the future of the baby has been determined. It is relatively easy to describe a type of personality when one gland is manifestly and pre-eminently predominant. It is hard, however, to give an exact chart of the characteristics of any glandular picture until we know the exact functions of each gland. Bit by bit, however, the pieces of the puzzle are falling into place; and it is now possible to appreciate the work which is contributed by the chief glands which regulate personality.

A great deal of the work of the ductless glands concerns itself with the regulation of the bodily needs of the individual; and this is especially true of such organs as the liver and pancreas. The spleen, although a large and imposing organ, appears to play a less important part: for, life is possible without it, and this is not the case where liver and pancreas are concerned.

Such glands, however, as the parathyroids (although they have a metabolic activity in relation to the lime salts of the body and their retention in the system) have indirectly a very important bearing upon the personality. Lime salts are essential to the nervous system; absence or diminution of lime salts (in animals) leads to a condition known as "tetany." It is, at least, probable that some such condition underlies the

extreme jumpiness of "highly strung" individuals, and that the excitability of their nervous systems is similar to that which occurs in animals who have been deprived of their parathyroids. If, on the other hand, excess of lime salts is the physical analogue of imperturbability, it may be assumed, perhaps with some degree of justification, that the inhabitants of Scotland are blessed with an excess of parathyroid secretion.

The best-known example of a disease in which deficiency of lime is the characteristic feature is rickets. Children with rickets are thin, sweat freely, and are liable to night terrors; in other words, their nervous excitability is increased. The modern treatment of this condition relies largely upon the ultra-violet ray—treatment by natural or artificial sunshine. The action of this agent is *vid* the ductless glands. It produces bronzing of the skin, an increase in the red corpuscles of the blood, and a retention of lime salts in the body.

The relation between the endocrine organs and vitamins is of great importance. Vitamins are now in everyone's mouth—both literally and metaphorically. It would seem that an inadequate supply of vitamins results in some degree of failure of the endocrine system as a whole. Children who show signs of endocrine disorder should be given the benefit of the doubt, and fed on a diet rich in vitamins. The parathyroid glands are of great importance, as much in infancy as in later life. It may be that the action of the sun helps these organs to function adequately.

From infancy to adolescence growth proceeds rapidly, and it has been estimated that an infant increases its weight 200 per cent. in the first year. At puberty one of the most important milestones of life is reached. The interstitial glands in both sexes commence to function, and the secondary sex characteristics make their appearance. It used to be thought (as an example of the blindness of some of the older theories) that the appearance of spots on the face and body was a necessary and normal

part of puberty. It is difficult to follow the reasoning underlying this hypothesis. Spots are obviously due to the invasion of the blood stream by poisons originating somewhere in the body.

During later childhood and adolescence there is rapid increase in the size of the adrenals, and this increase is intimately concerned with the development of the sexual or interstitial glands. Premature development or tumours of the adrenals are associated with sexual precocity, general hairiness, and an abnormal ripening of the intellect. As an example, tumours of part of this gland have produced puberty and its accompaniments as early as five or six years of age.

What the future holds for the individual child who has reached puberty, it is impossible to say with exactness. Even though we are only beginning to understand the functions of these glands, this knowledge helps us to watch over a growing child, and to hazard a reasonably good guess as to the type into which he or she will ultimately develop. There are many factors which will determine development, and some of these are no doubt outside the control of the parents. We must reckon that environment, reacting upon the inherited characteristics, the soil on which the child is brought up, the diet on which he feeds, the strain of education, and of sudden emotional disturbances, the care with which he is rested and allowed to sleep, and finally the presence or absence of infection, will all affect his ultimate development.

There are several factors of interest in this connection. Most people know that certain localities are associated with the development of a swollen thyroid or goitre, and that this is believed to be in some way connected with the water supply, although there is also reason to think that many of these goitres are in reality due to our old enemy—intestinal poisoning. It seems more than probable that other agents (which we may include under the heading of soil) are equally deleterious to one or more of the endocrine organs. It is unlikely that

any sudden case of glandular upheaval could logically be regarded as other than due to a cause acting on the individual in the time immediately preceding the appearance of the disease. In other words, we must blame *nurture* not *nature*. Take, for instance, exophthalmic goitre, the disease associated with enlargement of the thyroid, bulging of the eyes, and nervous restlessness. There are many cases on record in which sudden shock has precipitated this disease. We know that thyroid types are what is called "pop-eyed"; we also know that the "wires" along which emotional messages travel from the mind lead to the adrenal glands. Many of the symptoms which characterise exophthalmic goitre are now known to be due to disturbance of the adrenals. Certainly the nervous phenomena of this disease are far more adrenal-produced than they are thyroid.

It will be apparent from the foregoing paragraph that mental shocks are believed to be a fruitful source of endocrine disturbance at any time of life. This is much more likely, however, to occur during epochs such as adolescence and the middle decades of life; for, in the first of these periods, the endocrine hierarchy has not yet settled; and in the second, certain of the secretions are undergoing change and tending to upset the orderly pattern. Moreover, hardly any shock of importance but can fail to upset the smooth working of the ductless glands—at any rate, temporarily. Mercifully, an all-wise Providence has arranged for considerable compensation in this scheme. Vicarious working can and does take place, by which means (given time) the organism can readjust itself. Failure of readjustment results in mental or bodily breakdown.

It is, therefore, of the greatest importance that during the period of adolescence the condition in which the child lives should be as perfect as possible. Due allowance should be made by those in charge of children for the inevitable upheaval of puberty. There are certain ways in which the toll taken by fortuitous circumstance

during adolescence can be lessened; and reference has already been made to the close relation existing between the ductless glands and those little-known constituents of the diet which have been called vitamins. Custom has almost entirely excluded fresh fruits and vegetables from the *menu* of almost every class; gradually and imperceptibly cooked foods have replaced nature's own dietary with the laudable purpose of keeping the cook employed. Salads have been squeezed out to make room for examples of the culinary art; and puddings of a poultice-like consistency have been considered more filling at the price than what the child would really rather eat—namely, apples, oranges, and bananas.

This is not the place for a diatribe on vitamins, but in considering how to avoid the strain consequent upon puberty, it is fitting to emphasise that the growing child requires uncooked fruit and vegetables in abundance if he or she is to avoid a vitamin starvation. Incidentally he will keep a cleaner intestine and a less spotty complexion. If we avoid cooking vegetables and fruits, it enables these important articles of diet to retain their constituents in the form in which nature originally arranged them. There is little doubt, moreover, that many of the minor endocrine disturbances are quite capable of being put right by diet, provided the diet selected is rich in vegetables and fruit and considerably poorer in flesh foods than is considered genteel.

Another point of interest, which crops up in discussing this stage of life, throws a curious light upon the relation of the sexual glands to other of the endocrine organs. In the male, deficient development can sometimes be startlingly remedied by administering thyroid extract; and another example of inter-relation is shown by the fact that disappearance of the menses, or their failure to develop can be countered, often successfully, by the administration of pituitary gland tablets. Here are two concrete examples of how disturbance of this side

of development can be helped by stimulation from other of the dynamic secretions.

The age of twenty-one is the age at which the law says that we cease to be infants; it is also the age at which growth ceases, for the last bone ossifies at this age.

Seven, fourteen, twenty-one. There is an old saying that the body changes every seven years. It is a little difficult to trace the origin of this myth, but it certainly is true for the ages of seven, fourteen, and twenty-one. At seven, the thymus is in full sway, and may be regarded as the man at the helm; at fourteen, the interstitial glands (with their retinue of secondary sexual characteristics) appear upon the stage and dominate the next seven years; at the age of twenty-one, the endocrine pattern is complete, and growth for practical purposes is finished. The lawyers tell us that the infant has now become a man; common sense tells us that in the twentieth century he has been a man for some years; but endocrinology maintains that the pattern is not settled until growth has finally ceased, and not even then.

Assuming, therefore, that the adolescent passes through the earlier years of his existence and reaches the age of twenty-one without undue or abnormal stress and strain, we may regard the "twenties" as presenting us with our first clear-cut personality; in fact, the individual has ceased to be a "yearling" and has become a "personality." We can try, therefore, to describe the different personalities as they emerge from the melting-pot of youth.

2

The period of growth being completed, we can now consider the pattern which emerges, and can study personality as it falls into its different types. In the following descriptions it must be understood that each type depends upon the dominance of one particular

gland. But this is not all, for the type remains as it is described, only so long as the particular gland remains dominant, and is able to work harmoniously with its fellows. We may describe the following types :

(*a*) Thyroid personalities.
(*b*) Adrenal personalities.
(*c*) Pituitary personalities.
(*d*) Thymus personalities.
(*e*) Sex-gland personalities.

(*a*) THYROID PERSONALITIES.—There are two types of thyroid personalities : one where the outstanding features are due to a definite deficiency, and the second where the thyroid is over-active in comparison with the control exercised by the other endocrine organs.

Dealing with the first type, the characteristics are plain. In the extreme type we encounter the *cretin*, but we are not here concerned with him because he falls into the definitely abnormal. Rather are we dealing with the normal individual who is sufficiently deficient in thyroid secretion to stand out as a definite " thyroid " personality. Such a child presents a coarse appearance ; the hair is dry and straight, the nose is broad, the skin is rough and dry, and he retains many babyish characteristics beyond infancy into childhood. Bed-wetting is common in this type. He develops thickenings in various parts of the body. This is the child who is likely to suffer with adenoids and enlarged tonsils.

He is dull mentally, and heavy physically ; slow in development, requiring a great deal of sleep and a long time in which to wake up. There is a tendency to perpetuation of the infantile traits ; such children appear undeveloped and less than their real age.

It is, however, when puberty is reached that the deficiency of thyroid makes itself more noticeably felt : there is delay in the establishment of the sexual function,

and, unless the thyroid secretion is stimulated, the dominating signs of the adult thyroid-deficient begin to appear. It is possible, however, that with the entrance of the sexual secretions a natural stimulus arises which makes good the stigmata of thyroid deficiency.

These are the children who may grow suddenly. If they are below stature before puberty, they may shoot up at an alarming rate when they arrive in their "teens." All the bodily processes seem to be energised by this change, and the sluggish, slow child develops into a restless, excitable adolescent.

If, on the other hand, the change from under- to over-activity does not take place, the adolescent remains an individual in whom the signs of thyroid inadequacy are the outstanding characteristics.

* * * * *

Louis Berman, to whose book, "The Glands regulating Personality," I am indebted for this and some of the other descriptions in this chapter, gives the following characteristics of the adult thyroid deficient: "Height below average, tendency to obesity, complexion sallow, hair dry, hair line high, eyebrows scanty, eyeballs deep set, teeth irregular, extremities cold and bluish, circulation poor."

It must be pointed out that an individual with a deficient thyroid is like a furnace with all the dampers in; the fire burns slowly and poorly, and but little heat is given out. The subject of thyroid deficiency, whether lifelong or acquired (for example after an illness), is below par mentally and physically. This is not to say that this type of personality is necessarily subnormal intellectually, because other glands may well take on a compensatory action. But, unless this ensues, the individual is left with one, and that a very important secretion, which is below adequate working requirements.

Elsewhere in this book we have described the effects

which a dominating thyroid will produce on an individual, and we have referred to the abnormal thyroid activity which accompanies exophthalmic goitre. We are concerned here with the thyroid personality in which a high degree of thyroid adequacy, can be recognised, or, in other words, where the striking features of the personality are those contributed by the thyroid. In childhood this type can be easily recognised; he is the lively excitable child; "quick in the uptake," resistant to infection, and generally healthy. These children are liable to be discontented, inasmuch as their minds often grow faster than their bodies, and they tend to become individuals before their parents think proper. They learn well; they are easily influenced, enthusiastic, keen on new ideas, and usually artistic.

Adolescence means for them a time of stress; in many cases, however, with their ready adaptation, they are capable of adjusting their outlook with comparative ease; but this is by no means always the case. In contrast to the opposite type, they are attractive to look upon, their hair is plentiful, wavy, and glossy; their teeth are bright and white, their features are characterised by narrow, thin noses, clearly marked eyebrows, and pink and white complexions.

It is obvious that such a personality will suffer a good deal during the period of adjustment to adolescence. Their emotions are vivid and easily aroused; and, being essentially feminine or masculine, as the case may be, their affairs of the heart are apt to be frequent and noticeable. Their life-history depends upon the effects which are produced by their environment during adolescence.

Their life-history, is in fact, the history of the vicissitudes of their thyroid secretion. These are the individuals whose thyroid, after a period of stress, may pass through a stage of relative deficiency; during such a crisis they will sink unwillingly into a slough of despond—depressed,

inert, and yet beneath it all kicking against the pricks. A stimulus to their thyroid, even such as may be afforded by a new hat to the girl or a motor-cycle to the boy, produces a response out of proportion to the gift. And all the more so because the state of mind in which it finds them is in very marked contrast to their real personalities. This type of individual is one who keeps his youth a long time; grey hairs come slowly; he uses his own teeth longer than most people, and very much longer than the thyroid-deficient. There is no tendency to adiposity, and the "middle-aged spread" holds no terror for him. His sexual life is an active one and continues into advancing years; and, provided that a period of thyroid deficiency does not ensue, he remains a man with a persistent youth; he has been born, or has acquired, the elixir of life.

This is in marked contrast to the later history of the thyroid deficient; for him adiposity is a constant dread, and premature senility is the rule rather than the exception. The reason for this is not far to seek. An adequate thyroid is one of the best defences against infection which a human being can have; for in some mysterious way microbes can flourish but little in an individual whose thyroid is active. Where the reverse is the case, premature degeneration of tissue is the rule; the teeth decay early, the skin, which has never been healthy, becomes dry and scaly, and such necessary aids to beauty as the eyebrows gradually but consistently become sparser.

As middle age is reached an increasing girth points to the deficiency of thyroid and the consequent lack of stimulus to pituitary and adrenals; corpulence arrives. This is even more marked by reason of the short stature which is usually the rule with this type. Puffiness is noticed beneath the eyes, a thick neck with a prominent boss at the back (a "cassowary" neck) gives a characteristic protrusion to the head on the shoulders. Thickening of the lens of the eyes interferes with sight; in

middle life these individuals take to glasses before their fellows.

Life is not all beer and skittles to the elderly thyroid deficient; but modern science can help him, perhaps to a greater extent than any other endocrine deficient. A small tablet containing part of the thyroid of the sheep is all that is needed to remedy many of these defects. It is wonderful to observe the unsightly thickenings and the unpleasing bulges disappear under such a simple procedure. The figure of such a man before treatment may well be described in the language of a well-known comedian: "There are bumps where there should be dents."

Such, then, are the two thyroid types and such is their brief life-history. The two types are fairly easy to distinguish even when no gross lesions are present.

(*b*) ADRENAL PERSONALITIES.—Many cases are on record in which tumours of the adrenal cortex in children have produced a startling development of the body with all the secondary sex characteristics in a child of, it may be, six years old. Or, as Berman puts it, "a boy of six or seven may suddenly in the course of a few weeks or months become a little man, robust, rather short and stocky, but moustached, with the muscular strength and sexual powers of a man and thinking as a man. . . . It suggests at once that maturation, the transformation of the child into the man or woman, must be due to the pouring into the blood and the body fluids of some substance which acts like the yeast in the fermentable solution."

Disorders involving the adrenal cortex, and ensuing after puberty, have a peculiar power of altering and transforming an individual. For instance, an adult woman suffering from a tumour of the adrenal cortex will develop signs of masculinity to which the term *virilism* has been given. An abundant growth of hair

appears on the body, beard and moustache may grow, and the feminine form takes on masculine characteristics. Even the voice breaks and becomes deep, as it is in males.

Apart from these characteristics which are associated with the adrenal cortex, this particular gland plays a part of the greatest importance in the development of the brain and intellect. It is believed that where the adrenal cortex is deficient the brain in the human being fails to develop; it is to the cortex, moreover, that the keenness of the intellect is due.

The adrenal medulla, on the other hand, although part of the same gland, is a totally different structure to the cortex. Developmentally, it is part of the sympathetic nervous system. It is characterised by containing large cells which stain with the chromium salts and are therefore known as *chromaffin* cells. The extract which is manufactured by this part of the gland is known as *adrenalin*, or *epinephrine*.

It is only in recent years that the nature, composition, and function of this secretion has been determined. Adrenalin has been isolated and its formula determined. It has the remarkable property of keeping the blood-pressure stable. Emotions interfere with the normal flow of this secretion; it is altered after muscular exertion, pain, excitement or in toxæmic conditions.

There are some curious facts in connection with adrenalin. It is found, for example, in the skin glands of toads found in the Upper Amazon, and is used to smear on arrows as a poison for the natives. There is also a curious recipe, quoted by Abel, for making toad ointment which is "good" for sprains, rheumatism, or dropsy. The recipe is as follows: "Good-sized live toads four in number; put into boiling water and cook very soft; then take them out and boil the water down to half-a-pint, and add fresh churned, unsalted butter, one pound, and simmer together; at the last add tincture of arnica two ounces." We may remember, perhaps,

that Shakespeare referred to a kindred prescription in "Macbeth":

> "Fillet of a fenny snake,
> In the caldron boil and bake:
> Eye of newt and toe of frog,
> Wool of bat and tongue of dog,
> Adder's fork and blind-worm's sting,
> Lizard's leg and howlet's wing,
> For a charm of powerful trouble;
> Like a hell-broth boil and bubble."

This was the mediæval precursor of organotherapy.

Adrenalin itself is an extraordinarily powerful drug and is used in medicine, just as any other drug is used, for its physiological effects on the body. It has been worked out that one part diluted in 330,000,000 is sufficient to act on the intestinal canal.

From the foregoing it will be realised that a gland such as the adrenal, possessed of two distinct but important parts, must exert a very powerful influence on the entire individual. With the facts at our disposal, and some reasoned assumptions arising therefrom, we should be able to deduce in what way it produces a definite type of personality.

To commence with, however, it must be realised that the adrenal glands are far more glands of emergency than the pituitary is. The adrenal glands are an integral part of the mechanism which enables the individual to adjust himself to his environment; without them the instincts of self-preservation and that of preservation of the species would be dead letters. The instinct of self-preservation depends upon the quick response of the adrenal medulla; for without the adrenal response the reaction by "fight or flight" would be impossible. Equally certain is it that the co-operation of the adrenal cortex is essential to the efficacy of the sexual life. It appears, as we have already said, that pugnacious animals, like the buffalo, are blessed with an abundance of cortex; while the rabbit, deer, and other timid animals are

characterised by a relatively narrow area. Pugnacity and the sexual instinct are obviously intimately bound together; and it seems likely that the cement which welds them together is to be found in this gland.

We must study the adrenal personality from two points of view: first, where it is adequate to the needs of the individual—the so-called compensated type; and, secondly, where the needs of the individual are inadequately met, and relative insufficiency is present.

The picture of the compensated adrenal type is characteristic. In these types such stigmata as dark moles, black spots, or dusky patches are of importance; they appear to correspond to some disorder which has acted upon the adrenal glands; and they have been observed after illnesses such as influenza. The hair line, that is to say, the line at which the hair commences on the forehead, is low; the face is dark-skinned; the hair is often dark. This, however, is not necessarily and exclusively so, as Berman states that most red-haired persons are adrenal types.

Although the adrenal type, when well compensated, is sometimes a virile and successful individual, he is rarely the possessor of a large frame; the small, hairy individual is more typical of this endocrine personality. The size to which the individual grows must depend upon what co-operation is forthcoming from other of the endocrine organs, particularly the thyroid and pituitary.

The adrenal type among women is a milder edition of the type to which we have referred under the name of *virilism*. This is the type of woman who is liable to develop masculine signs as life progresses; very often a brunette, a small dark moustache appears in middle life, the voice sinks, and the tastes become more aggressive than is customary.

The adrenal glands—both cortex and medulla—are most important to the adaptation of the individual to his surroundings; when efficient reactions are forth-

coming from these glands the compensated adrenal type emerges. Such a man is successful, and, if helped by an adequate thyroid, possesses the drive and the energy which go to the making of the successful business man, the administrator, or the practical man of affairs (Berman).

What happens, however, to the uncompensated adrenal type ? We must visualise such individuals as possessing the characteristics which we have already described, but with this difference, that they fail to keep level with the demands which their individual life makes upon them. The stigmata of illness is written on the skin ; the lines under the eyes are dark, the eyes seem to be deep-set, the various ailments, as they come along, leave such persons a little less efficient, a little more chronically tired, with periods of depression, not helped by the repeated failures which follow on the inefficient adrenals. One comes to think of such an individual as of a battery that is past its prime ; with frequent rests the current in the battery will return, but at each period of work it runs down ever more quickly. In such an individual each illness or ailment takes an undue toll of his reserve. It is said that this type is very common at the present time, and that it constitutes the bulk of the neurasthenics who emerged from the maelstrom of the war. The characteristics of such a personality are those of adrenal exhaustion—namely, extreme fatigability, cold hands and feet, an uneven mental level, and periods of depression. The uncompensated "adrenal" is always a moody person ; he is unable to rationalise successfully or to feel cheerful. He is ineffective because he possesses not the wherewithal to respond to a sudden call on his strength ; everything to him is an effort, and an effort which is out of proportion to the strain involved.

Adrenal insufficiency is, no doubt, at the bottom of many of the difficulties with which the schoolboy has to contend. It seems quite certain that children possessing any of the characteristics which we have described in this section, require especial care after so-called childish

complaints. If this fact is recognised, there is no reason why they should not get "on top" of any ordinary strain, either mental or physical. It seems probable that most adolescents showing signs of adrenal exhaustion are able to get the better of times of stress and strain with a little help and common sense.

(*c*) PITUITARY PERSONALITIES.—The pituitary personalities have already been discussed in Part I. We shall here content ourselves, therefore, with outlining very briefly the types which emerge (1) when the pituitary is sufficient, and (2) when it is deficient. We can hardly do better than borrow Berman's two tables, for they succinctly describe both types.

Pituitary sufficient and dominant :

Large, spare, bony frame.
Eyes wide apart.
Broad face.
Teeth broad, large, unspaced.
Square, protruding chin and jaws.
Large feet and hands.
Early hair growth on body.
Thick skin, large sex organs.
Aggressive, precocious, calculating, self-contained.

Pituitary inferior :

Small, sometimes delicate skeleton.
Rather adipose, weak muscles.
Upper jaw prognathous.
Dry, flabby skin.
Small hands and feet.
Abnormal desire for sweets.
Subnormal temperature, blood pressure and pulse.
Poor control of lower vegetative functions.
Mentally sluggish, dull, apathetic, backward.
Loses self-control quickly, cries easily, discouraged promptly, psychic stamina insufficient.

No doubt many readers will at once be able to bring to mind examples of both these types. They are not difficult to place, for, as we have seen in the chapter dealing with racial characteristics, the pituitary is a gland which stamps its mark very definitely upon the personality. When it is adequate, and its neighbours in the endocrine circle are pulling their weight, a successful, if not brilliant, personality results; but, as is often the case in life, too great a strain upon the pituitary—whether it be from mental sources or of physical origin—is very apt to upset the endocrine balance. It is a common saying that men of genius are often eccentric and sometimes near the border line. It is probably true that the pituitary is the gland responsible for brilliant conceptions, and that the adrenals are responsible for the carrying out of these conceptions. If we attempt to differentiate pituitary personalities, according to whether the anterior or posterior part is dominant or deficient, we find ourselves faced with a more difficult task. The anterior pituitary is the masculine secretion producing the successful, persevering, forceful personality; the posterior, when dominant, imparts to its possessor the more gentle, artistic attributes. It follows from this, that a plentiful supply of anterior pituitary produces the individual with capabilities and dominance, and *vice versâ*. The posterior pituitary personality will be retiring, shy, gentle and artistic.

In general, a blend of the two will produce an individual whose character will depend upon the relative preparations of the secretions from the two parts.

In view of the description in Chapter IV., Part I., there is little to be added to this, and we may pass on to a study of thymus personalities.

(*d*) THYMUS PERSONALITIES.—There is considerable doubt whether the thymus is to be regarded as having an internal secretion. About this there are two schools of thought: the first believes that, as no hormone has ever been isolated from this gland, and as removal of the

gland does not lead to death, the thymus should not be regarded as an organ of internal secretion. The second school, however, holds the opposite opinion, and even goes so far as to describe a personality governed by the thymus.

Perhaps the best angle from which we can regard this problem is that of the mental defective, and I cannot do better than quote part of an article by Dr. Sajous. In the course of this he says: "The thymus is so important an organ in this connection that it may be said to stand, in respect to idiocy and dementia præcox, as the thyroid does to myxœdema and cretinism. It is the gland upon which, from my viewpoint, the brain cells depend for their developmental supply of phosphorus-laden nucleins; if it fails, through organic disease, defective development or premature involution, to furnish its product, the organ of mind remains undeveloped and idiocy results. So evident is this connection that Bournville found the thymus absent in twenty-eight idiotic children examined *post-mortem*, while the organ was found normal in sixty-one children of normal mentality who died of various diseases. Clear evidences of idiocy are also obtained in animals deprived early of the thymus."

This is the opinion of an eminent endocrinologist, and it certainly helps us to imagine one way in which the thymus could affect mentality. The thymus is clearly the gland of childhood, and, should it fail during early life, or should it be absent or the subject of organic disease, the resulting symptoms would be very different from those which might be expected from its atrophy after puberty. There is a general consensus of opinion that the thymus is in some way connected with the passage from childhood to adolescence, as if the thymus is more or less in control of the child up to puberty; and that, having brought its charge within measurable reach of adolescence, its work is accomplished and it then hands over the reins to the endocrine mechanism which is to be found at this epoch. There is also good

reason to believe that the thymus remains active, in some instances, during adolescence and even in later life; and it may be fair to assume that in these cases it still acts in some way as a guide to the personality. Little is known about this beyond the fact that, in many instances, the thymus does not atrophy at or around puberty as was formerly thought.

It is on this assumption, or some assumption like it, that a hypothetical thymus personality has been sketched. It is not difficult to see how this type of personality has come into existence, if we remember that the thymus keeps a child from developing (acts, in fact, rather like a break upon the development of sex). We should, therefore, expect to find thymus-centred individuals perpetuating some or many of the attributes of childhood into adult life.

It would seem that the thymus is responsible for the production of a personality that is childish in many of the characteristics, and one which has failed to establish a definite sex type. When puberty is reached the secondary characters should appear. It is now that the child who is indefinite up to, or about this time, so far as sex differentiation is concerned, should become a definite male or a definite female; but for this to happen it must be assumed that the thymus retires from control. If it does not do so, the development of the individual is unable to proceed smoothly. We should expect, therefore, to find an individual who possesses a persistent thymus to be lacking in the striking characteristics of sex. This has led to the belief that individuals who are not definitely male or female in appearance are probably still being controlled by their thymus gland, and this might be very well the case with the effeminate boy and young man.

Such a type is known to all. The physical build does not follow the usual lines of budding manhood; the body may be singularly feminine in appearance; the cheeks remain smooth, the razor is not needed so early as in

more normal types; and the tastes of the individual tend to veer towards the peaceful pursuits of art rather than to the more virile occupations associated with games and sport.

It has been alleged, moreover, that the sexual build of these individuals is unusual, and that their *vita sexualis* develops along abnormal lines.

What has been said is admittedly theory, based upon relatively few scientific data. The part played by the thymus in the formation of the personality is much more difficult to discover and describe than that of the thyroid, pituitary, or adrenals. It is fair to assume, however, that the chemistry of the thymus, the results of pathological lesions and *post-mortem* examinations, suggest that the abnormal thymus is productive of a delicate child, and one who is possibly deficient in some of the chemicals which make for robust health.

The condition known as *status lymphaticus* is definitely associated with persistent enlargement of the thymus and other lymphoid tissues of the body. Individuals who suffer from this condition are definitely abnormal so far as their physical build is concerned; they are liable to sudden death from some relatively slight cause, their heart and blood vessels are inferior, and early in life they find that they are unequal to the strain of athletics and that they have to take life easily. The result of this, from the psychological standpoint, is that they turn, quite naturally, to what may be called more feminine pursuits. Much of their subsequent development may be regarded as partly due to this fact; and the development of feminine traits in such characters is hardly to be wondered at.

Here we will leave this type of personality, believing, as we do, that much more work is still required before we can be dogmatic about the personality associated with, or governed by, a dominant thymus.

(*e*) Sex-gland Personalities.—No account of endocrine personalities would be complete without a reference

to sex-gland personalitites. It must be understood, however, that so important are the glands of sex that every personality is controlled, to some extent, by these organs. Even the negative is true. For the absence of the glands of sex, even of their internal secretion, is productive of changes of the most striking nature.

There are certain facts which may form an introduction to this section. First, we may remind the reader that vital as these glands are to the development of a normal human being, they are not essential to life. In both sexes they can be removed and life continues; which is in marked contrast to many of the ductless glands, which are so essential to life that their removal is followed by death. The removal of either the male or the female sexual glands may be followed by very striking changes in the personality; but the particular changes which follow depend upon the age at which this operation takes place.

From this point of view we are concerned with the *internal secretion* of the testis in the male and the ovary of the female. In Chapter VI., Part I., the main physiological facts of the sexual organs are discussed in detail; it will suffice, therefore, if we refer here to the facts as they apply to what has been called the sex-gland centred personality.

In males, the removal of the sex organs before puberty results in the retention of an infantile type of body and a tendency to the development of the characteristics of the opposite sex. This is, to some extent, what happens if the thymus fails to atrophy; and it would seem that such removal allows the thymus to proceed unchecked, either throughout the life of the individual or, at any rate, until such time as it has effectually checked the establishment of sex. This may be put in another way. If we consider that the establishment of sex is dependent upon the rise of the sexual secretion, and that this rise inhibits the activity of the thymus, we shall not be very far from the truth. Experiments on animals support

such a belief. When the ovaries are completely removed from a pullet, she takes on the secondary sex characteristics of the male, and furthermore the typical behaviour of a cockerel. The assumption has been made, therefore, that there is a latent male sex character in hens which, however, is inhibited by the ovarian hormone. The implantation of a piece of ovary in a young male guinea-pig resulted in the appearance of feminine characteristics. The transplantation of the male gonad into a young hen led to the production of typical male characteristics, in that she became quarrelsome, aggressive, and masculine.

What happens, then, when the gonads are removed from the male human being? Provided this is done before puberty, the changes which take place are what we should expect when we realise the interaction which exists between these secretions and other of the endocrine organs. We have seen that the pituitary becomes relatively or absolutely over-active; the skeleton, therefore, particularly the long bones, becomes overgrown; a large man is the result, but he varies in many particulars from the virile type of normal man. Adiposity develops, the muscles are soft and the hair on the body and head is modified; and sexual life is, of course, absent. It is certain, however, that normal development consists of thymus control in infancy and childhood, and the usurping of this power by the sex glands before or at puberty; from that time onwards the testicular secretion in the male and the ovarian hormone or hormones in the female should take control and make their influence forcibly felt in the formation of the personality.

When the ovaries are removed from an animal there is a tendency to reversion to the male type; and what has been shown to hold good in animals is, in all probability, equally true for the human species. At the menopause, when the active functions of the female sex-glands cease, there is a tendency for the essentially feminine characteristics to become gradually less well-marked.

The artificial menopause, as it is called, or the creation of this condition by the operative removal of the ovaries, may produce this change at an earlier date. But if only a small portion of the ovary be left in the body with its blood supply intact these changes do not take place.

The differentiation of sex, therefore, is a matter not only for the sex-glands themselves, but for the sex-glands working in harmony with their fellows. The eunuchoid personality, as it has been called, is one that is deficient in sex-gland secretions. The virile masculine type must be regarded as one with an active adrenal cortex, pituitary and thyroid, working in conjunction with the testicular hormones.

The "womanly" woman is one with an active ovarian secretion, aided and supported by a vigorous thyroid. The thyroid, it has been stated in an earlier part of this work, is more essential to the feminine personality than it is to the masculine. This is by no means suggesting that it does not play its part in the production of sex in the male. For we know that under-action of thyroid in both sexes is associated with deficient development of sex-life. What is meant is that the woman with an active thyroid, working in conjunction with the ovaries, is the woman with a markedly feminine personality.

The individual whose thymus fails to regress remains, in many ways, infantile. Mentally he is inclined to be petty in outlook, to be pleased with small things, to be easily amused and equally easily dejected; while physically he retains many of the characteristics of boyhood. The smooth contour of the face is at once striking, the deficiency in hair—it is said the eunuchoid personality has a sparse beard, deficient moustache, and otherwise no facial hair—is so marked as to be at once apparent.

The thymus personality, as we have seen, remains immature. Such an individual does not "grow up," although he may attain normal stature. This condition, however, must be sharply defined from infantilism and dwarfism,

a discussion of which states will be found in a succeeding chapter. The absence of normal sex stimulation by no means retards *growth*, but produces an individual lacking in the normal *adult* constitution. There is a definite relation between individuals governed by a persistent thymus and the type of personality which we have described under the heading of " the eunuchoid personality." Injuries, infections, and diseases of the sex organs may be followed by atrophy ; and a change of personality, much upon the lines we have just outlined, may take place in a few weeks.

In the case of an infection (for example, mumps) attacking the gonads, atrophy may result. In this case the personality may alter, and the character and sex-life of the individual may undergo a change.

Finally, there is the question of over-secretion on the part of the sexual organs.

Such excess must lead to a heightening of sex-life, to an increase in sexual desire, and a relative exaggeration of the essentially sex-determining features. It is probable that the type possessing adequate pituitary, in company with unbalanced sexual internal secretions, will be what is known as " over-sexed."

Curiously enough, the negro race are, taken all round, often examples of this type. Whether it is more obvious on account of a lack of control and an absence of any sense of shame, is a matter of opinion. But the great stress which is laid by negroes upon the sexual instinct and its gratification, suggests that there is a relative excess of the hormone elaborated by the interstitial cells.

3

So much, then, for the types of personality found in adult life. It is hardly necessary to add that these are but rough sketches of personalities where one gland is obviously " ruling the roost." It has been said that, just as there is no clear-cut temperament—a temperament which can be defined as one does an expression—

so there can be no absolutely clear-cut endocrine type. This is, of course, perfectly true.

The types we have described, however, are based upon the characteristics which have been found as the result of experiment or observation in the *post-mortem* room. An ebullient thyroid leads to certain very obvious features. In like manner we can deduce the thyroid personality, when we know the type that emerges from an abnormally active thyroid gland.

There are many degrees and qualities, which range from a definite and recognisable type, to a mixture in which it is difficult to say which is the dominant gland. It may be stated that the majority of people are characterised, not by one dominant gland, but by a condition in which the influence of two or more glands is more or less equally balanced.

Adult life is the time during which an individual should be at his best and ripest. The day dawns when one or more pieces of the machinery—in themselves small and insignificant—begin to wear. It is said that the lens of the eye begins to degenerate at the age of twenty-one; we know that the thymus has already begun to retire; and all through the so-called middle decades various parts of the machine imperceptibly ease off in their stride. The rate at which this happens depends upon the life which the individual leads, and upon circumstances connected with his reaction to his environment.

The middle two or three decades represent, or should do, the period at which all the endocrine glands are working harmoniously together. This co-ordination should lead to a perfect working of mind and body; it is only when there is damage to some part of the machinery—damage which rest cannot by itself make good—that the symptoms emerge and make themselves plain. It is obviously impossible for one part of a complete machine like the human body to be damaged without others following suit. If we realise this fact, it will be

plain that many of the diseases we recognise as organic have started as deficiencies or excesses of some part of the human machinery. Adult life, then, is the epoch when the machine should be running at full speed.

Gradually the activities of the adult merge into the easing-off of advancing years. Old age has been described as the period of "hypo-endocrinism," by which horrible word is meant the deficiency of many or all the organs of internal secretion. Old age is imitated in some degree by many of the deficiencies which we have discussed under their appropriate headings. Deficiency in thyroid is characterised by a shedding of the hair, by a dry skin, and by a lethargy which is the rule in old age. Hypopituitarism is characterised by adiposity, more particularly of the middle part of the body; old people who run to fat nearly always do so about the abdomen or hips. Many an old person who is regarded by the casual onlooker as corpulent is in reality possessed of a tubby trunk, but such thin extremities that they appear almost emaciated. This, of course, is largely due to the absorption of fat which takes place in old age; but the relatively stagnant nature of the circulation around the trunk, (due to the fact that most people never move the muscles of which this part is composed), allows adipose tissue to rest in this vicinity unperturbed by exercise.

Another feature of the elderly is the definitely subnormal temperature. This, again, is a feature of underaction of the dynamic glands of the body; and it would seem that old age must be regarded as a period in which the supply of those stimulating juices, the hormones, is running short. The arteries become less elastic, which, in turn, throws more work upon the heart. This, naturally, is felt by the individual who eases off the amount and violence of his exercise, which, in turn, leads to deficient oxidation and elimination.

In our passage through life it is difficult under modern conditions of living to keep even with our waste products, and the system that does not get loaded with toxins

by middle life is relatively lucky. Our ancestors recognised this to the full, and countered it by the free use of bleeding and purging. To the regret of many physicians the fashion of bleeding has died out. Admittedly it was, in some hands, carried to a ridiculous length, but it had its uses where over-eating and over-drinking was the rule rather than the exception. Some physicians, however, recognised that it was unwise to bleed their patients when they were already anæmic. So ingrained, however, was the habit of bleeding in the centuries that are passed, that it was no uncommon thing for a poor unfortunate, who had had an accident and lost much blood, to be relieved of a little more by the first surgeon or apothecary he encountered. One authority, however, said that they bled " not pale and delicate persons, but those who loved meat, generous wines, and choice dishes. . . . Such have much blood . . . and some ebullition of humours is to be feared in them."

Which was a delicate way of implying that they were loaded with the products of their own faulty metabolism. In modern parlance, they were thoroughly toxic.

CHAPTER V

CIVILISATION AND WARFARE

1

As man has progressed from the days of savagery to these more enlightened times, he has had to adjust himself to conditions, radically altered in many respects. We have merely to imagine the days before articulate speech, to appreciate the vast change which has come over mankind.

Our ancestors of the early savage epochs were very different in their lives and habits to the inhabitants of the so-called civilised world to-day. Morgan divides man's progress into six periods, which he calls the older, middle, and later periods of savagery; and the older, middle, and later periods of barbarism. It has been suggested by ethnologists that the change from savagery to culture may be partially explained as the result of changes "That found their initial impulses in a half-dozen or so of practical inventions." Looked at from this standpoint, it is an astonishing fact that, in spite of the change in habits, the development of intellect, and the controlling of the primitive instincts which man has now attained, the same individual existed in the tropical territory of centuries ago as walks down Throgmorton Street to-day. There is, of course, a good deal of difference between our ancestor of the older period of savagery, who existed upon nuts and fruits in a restricted tropical area, and the civilised being of to-day, who is able to traverse the world in a few weeks, to fly from Europe to India in a few days, and to telephone from America to England in a few minutes.

Assuming that these changes have been brought

about (as the ethnologists tell us) mainly by relatively simple inventions, we have yet to admire the manner in which the human system has adjusted itself to these changes.

It is obvious that no one of us would return to savagery, however much we may deplore the drawbacks which civilisation possesses. We are always being told by health reformers that the diseases with which we are blessed in the twentieth century are due to the distance which separates us from Nature's laws. There are many interesting facts to be considered in this connection. We have already seen, in a previous chapter, how man has migrated in the course of centuries from his original cradle-land. Wherever he went, he had to adjust himself to the changed conditions which he found in his new abode: not only changes of climate, for from the Pleistocene onwards, poor primitive man must have been hard put to it at times to survive.

As the centuries passed, and the human being developed his frontal lobes at the expense of his biceps, and learnt how to cook while his tail atrophied, his nervous system and endocrine organs were called in to aid in his adjustment. There is little question that the white man has lost his pigment, not that the negro has gained something.

The different races into which mankind is divided are characterised by different builds. This fact represents the reaction of the individual to his environment, the production of the different types being roughly the survival of what was fittest for the particular zone.

To come to the days of civilisation, we find that the inhabitants of Northern Europe are undergoing a curious regressive stage; they may be becoming brainier, but they are certainly losing muscular development. What effect has this upon the ductless glands? Or is it the result of primary failure of these same glands?

In the middle of a century of European peace arrived the ghastliest war of all time. Once again man was called upon to adjust himself, not only to new conditions, but

to conditions undreamt of in his wildest dreams. It is nothing short of a miracle, not that the individual did adjust himself, but that, even with the best will in the world, he was able to. The memory of man is short (and it is perhaps best so), but the experiences of the soldiers who took part in the European war were all the more unique on account of two factors: the first being that they entered for the first time into a warfare of high explosives, poison gas, and aeroplanes; the second being that the conditions of that warfare were such as man had never before had to face.

If we pause for a moment to consider the psychology of war, it will lead us to a better understanding of the degree of adjustment which the individual had to make from A.D. 1914 onwards. So elastic is our constitution, and so admirably does it respond to the demands which we make upon it, that we sometimes fail to appreciate how beautiful a machine it is.

The instinct of self-preservation lies deepest in the mind; it is the most fundamental of man's mental mechanism. When this instinct is aroused, emotion is generated in the mind. Now this emotion is what is popularly known as *fear*. But fear has an object. The dynamic force which this emotion looses in the body is the best means of self-preservation we possess. Conflicts in the olden days were matters of hand-to-hand fighting; the primitive man, when aroused by his instinct to defend himself, used up his energy by violent physical exertion. This is what the instinct and its emotion were provided for; consequently, having finished his "rough and tumble," he had utilised the energy provided by the excitation of his instinct and was none the worse for it. Certainly there is no record that he suffered from nervous shock after his periodical differences of opinion with his neighbours.

Contrast this with modern warfare. For weeks at a time man has to lie in a trench, suffering discomforts that he in his own lifetime had never known, and which

his early Victorian ancestors had never dreamt of. He is fully aware of the danger which surrounds him; his instinct of self-preservation is constantly alert. Death may come at any moment from any direction, even from the sky. There is no hand-to-hand scuffle about it, simply a grim, silent waiting. . . .

No wonder, therefore, that we hear of "shell-shock," "neurasthenia," and worse things. Is it not apparent what the underlying physiology was? The individual, with his senses all alert, and his emotions whipped up, almost to breaking-point, waited. . . . After a time the further waiting became impossible and oblivion was often the merciful end to the tenseness. Many a case of unconsciousness in the fighting-line was emotional, that is to say, due to pent-up emotion that found no outlet. Such patients were labelled "shell-shock" or "neurasthenia," according to whether they were near the concussion of a shell, or not.

What would happen if the engine of a motor-car was started, the clutch let in, and the car moved away by its own power? Nothing abnormal; it is what the motor is provided for. But what would happen if the engine were started and was allowed to "race" indefinitely without any use being made of its power? It would, of course, quickly wear out and knock itself to pieces. It was this latter factor which produced "shell-shock" and nervous breakdown—namely, the production of large quantities of emotions designed for an effective purpose but unable to be utilised owing to the exigencies of modern warfare. (Needless to say, this does not refer to cases of actual shell-concussion, where damage was sustained to the organic structure of the brain or skull.)

In view of what we now know as to the mechanism of the adrenal system, it will be apparent that the over-action of the gland of emergency was at the bottom of many of these cases. Over-action of any gland tends to lead to subsequent under-action; this is true, so far

as we know, for all the ductless glands ; and the adrenal gland is no exception. It is the adrenal gland which is most overworked during the emergency and scares of warfare. Its over-action leads to nervous excitability, emotional outbursts, and other signs of " strain."

The aftermath of war brought with it, as it always does, a medley of discontents and disorders. In the last war, however, so far-reaching were the consequences, and so large were the numbers involved, that a " post-war neurosis " stretched across the world. It is impossible to take men from a groove in which they have grown, and into which they have settled, and expect them to return to it after having lived in conditions diametrically opposite for a number of years. Consequently one hears it said that the world will never be the same again, which, of course, is profoundly true and very obvious. After every war there is a period of post-war depression—a kind of national hypoadrenia. After the party comes the penalty.

2

The mechanism of adjustment has enabled man to change and adapt himself throughout the ages. Without such a mechanism, the various changes which have taken place, and which have finally resulted in civilised man, would never have materialised. This factor has enabled man to retain such parts of his anatomy as he found he required ; to develop and alter existing structures, and to increase enormously the brain. It is this latter factor, of course, which enables man to outwit his competitors in the race of development.

We live now in an age of specialisation ; and we often hear specialisation spoken of as if it were a more or less new development. This is, of course, not so. Man has been specialising for very many years, and has been casting away structures no longer required while acquiring fresh and more specialised tissues. Bergson says that man only realised himself by abandoning part of himself

on the way. As life goes on in the twentieth century, specialisation increases, but it is no new thing.

In acquiring fresh structures and new functions, man has lost organs and functions which have no longer been required. Many possessions, such as highly developed scent, aggressive tusks or useful tail, have been abandoned, and man has specialised in brain. Once he arrived at the stage of reasoning he was miles ahead in the race.

It is to the mechanism of adjustment, therefore, that we owe such powers as we possess, in contra-distinction to the lower animals, who have remained with one marked characteristic—an aptitude for some particular action. With a highly developed brain we can train ourselves or others along certain paths ; and this was shown markedly during the Great War. A mind which had been brought up, perhaps from early years, to think in terms of a peaceful profession, was converted to an entirely different use.

Civilisation specialises in the saving of life. With improved sanitation, the prevention of disease by legal and individual methods, and the development of laws which protect the individual from danger, life should be, and is, becoming longer. War trains men to kill. A reversal takes place in the motives of the individual. He becomes a fighting unit, and is taught to excel in attack and to concentrate upon methods of destruction. The soldier undergoing training is instructed in such exercises as bayonet practice, and is urged to attack with ferocity and eagerness.

If the adrenal system has been known as the " system of emergency," it might equally be regarded as the system with which speedy adaptation is encompassed. Obviously the martial atmosphere, the combativeness which is encouraged by drilling and training, all tend to speed up the adrenal and sympathetic systems. It is this " speeding up " which converts the easy-going citizen into the smart and efficient soldier. The instinct of self-preserva-

tion is brought very much into the foreground; and the "tensing" of the nervous system which fighting produces is only possible by means of the increase in the speedy responses of the body. The essential nature of this process rests upon the fact that the awakening of self-preservation and the emotion of fear is associated with increased response from the bodily mechanism; and this results in the freeing of material for greater energy. It has been shown that, if this energy is not utilised, certain results follow, which may best be put in the words of Cannon: "If the results of emotion and pain are not 'worked off' by action, it is conceivable that the excessive adrenin and sugar in the blood may have pathological effects."

Civilisation, then, produces a minimum of stimulus to the instinct of self-preservation. Warfare encourages this instinct and discourages relatively the development of many sentiments. Repression, in the psychological sense, means the "pushing back" of emotions rather than their full expression. From the endocrine standpoint repression means the non-utilisation of energy which the emotion has called into being.

From this sequence of events, the endocrine changes which occur in modern civilised warfare take their origin.

3

The changes which follow upon warfare are, however, more widely spread than this. It is practically impossible —at least, there is much evidence to the contrary— to upset one internal secretory gland alone. Warfare, as we have already seen, stimulates the instinct of self-preservation and produces fear in the mind, which in turn reacts upon the adrenal glands. The adrenal glands and the sympathetic nervous system work together in close contact. The sympathetic system is the channel through which emotions produce their physical changes. The adrenal, however, is only one of a triad, the other two members being the thyroid and pituitary.

We shall expect, therefore, that individuals subjected to the strain of modern warfare will be likely to suffer from the effects of over-stimulation of the sympathetic nervous system and of those ductless glands which act in close co-operation.

The degree to which these disturbances in the endocrine harmony take place depends upon the individual and the particular arrangement of the "endocrine pattern" which he may possess. In the sympatheticotonic type the disturbance to psycho-physical harmony is much more readily produced than is the case with a different type of individual. The so-called "anxiety neurosis," which is always associated with an over-active adrenal and thyroid mechanism, was produced in thousands of individuals by the events of the Great War. When one thinks of the strain to which the fighting man was subjected (not forgetting the real cause for anxiety which existed among a large part of the civil population), the wonder is that any individual escaped from a "nervous breakdown."

The term "nerves," which is so often in people's mouths, and which possesses no scientific value whatsoever, can only be discussed adequately by an understanding of the physical basis of the emotions. A "nervous" individual (using the term in its widest sense) is an emotional individual, and the emotion in question is fear. The light which endocrinology can throw, both upon the emotions of an individual in normal health, as well as upon those which are associated with an abnormal state of health, is very instructive. In a previous chapter some of the aspects of this subject have been discussed in detail; and in Chapter I., Part I., Huxley's reference to the changed conditions which have resulted from the war is quoted at some length. The outbreak of war necessitated considerable and rapid adjustment of the personality; the advent of peace called for equally prompt reorganisation and readjustment.

During the war there were hundreds of thousands of cases of nervous breakdown among the British alone; and it was often said that the advent of peace would be such a relief to the pent-up emotions of these sufferers that their symptoms would disappear. Had their troubles been confined purely to the mind (if, indeed, there ever are such conditions), this might have happened; that it did not when the armistice was signed, shows plainly that the root of these troubles lay deeper, as, indeed, anyone taking a wide enough view of the cause of these conditions could have prophesied. The endocrine pattern which may serve very well for peace is not necessarily ideal for war.

A curious example of a sudden uncontrollable excitement is instanced by the condition known as *latah*. This consists in an attack of homicidal mania, in which a native will "run amuck" and attack all and sundry. In a moment, and without warning, he will, perhaps, seize a *kris*, striking at anyone he may encounter.

The fact, however, that this complaint has largely died out in the British Possessions since the culprits were tried and punished in cold blood, points to the fact that, even in the wildest emotional storms, the idea of punishment has some deterrent effect.

It is interesting to compare such disorders as *latah* with the crimes of violence which are so commonly met with even in the civilised world. In America, for example, there are large numbers of murders every year, the percentage per head of the population being quite considerable. In Europe, statistics show that crimes of violence are considerably less; and the deeply-rooted knowledge that punishment is speedy and condign goes a long way to contribute to this result.

There can be no doubt, therefore, that inhibition may operate in the mind, although it may not be consciously recognised by the individual. How much inhibition is a chemical rather than a primarily psychic factor it is difficult to say. That the balance between the assimi-

latory and the dissimilatory glands is necessary for perfect mental function, is a point about which there can be no question.

4

In 1729, Dr. Thomas Sydenham published a work which is full of interest to students in the twentieth century. This book was entitled "The Whole Works of that Excellent Practical Physician Dr. Thomas Sydenham," and possessed as a sub-title the following sentence: "Not only the history and cures of acute diseases are treated of, after a new and accurate method; but also the shortest and safest way of curing most chronical diseases."

The author's preface commenced as follows:

"As the human body is so framed by nature that by reason of a continual flux of particles, and the force of external things, it cannot always continue the same; upon which account there have been great numbers of diseases in all ages; so without doubt the necessity of finding out the art of healing has exercised the wits of men for many ages, not only before the Grecian Æsculapius, but the Egyptian too, who was a thousand years his senior."

The art of medicine has passed through many vicissitudes. From the time of Hippocrates, certain elements have been laid down for the maintenance of good health, and the treatment of those diseased conditions which interfere with the enjoyment of health. Hippocrates has justly earned the title of "Father of Medicine." He was born in Cos in 480 B.C., and was reputed to be in direct descent from Æsculapius. There is no question that the influence which he exercised over the intellectual life of his time was profound; in fact, his teachings have left their mark on the practice of medicine even up to the present time. One of the great things which Hippocrates did was to separate the practice of medicine from priestcraft and wizardry. Hippocrates believed in the existence of the *vis medicatrix naturæ*,

and maintained that the physician could help by his recognition of this ally. From this age to the time of Sydenham is a long step, and yet one finds that Sydenham harks back in his writing to the time of Hippocrates; and in his preface he says: "The excellent Hippocrates arrived at the top of physic who laid the solid foundation for building the art of physic upon, viz. Nature cures diseases."

In the light of modern medical knowledge, it is apparent that the weapons through which nature works are humoral—that is to say, that her messages are transmitted through the blood. The work which the nervous system carries out in the bodily economy has been very fully recognised for years; but, until the work which the pioneers in physiology carried out within the last fifty years, due stress was not laid upon the influence of the blood. Sydenham recognised to the full what was called the "humour" of the patient, by which he meant the blood and what it conveyed. But, of course, he did not know that, in its course through the body, the blood picked up specific chemicals from the different regions it visited. Modern endocrinology teaches us that the influence of these specific hormones is of the greatest importance to the individual from very many aspects.

Not the least of these is the power of adjustment to his environment. Throughout the ages this power has been exercised as occasion arose, and the individual (as well as the race) has had to adapt himself to new surroundings and to sudden changes in his environment.

Among the functions which are performed by the endocrine organs, none is more important than this. If we contrast the life of the primitive savage with that of the highly civilised human being of Western civilisation, we shall realise that the difference is enormous. The savage is guided by his instincts and emotions. It may be truthfully said that the higher man is in the scheme of evolution, the higher up in his body does

development proceed—in other words, the development of the brain changes the anthropoid ape to man; while the broader development of mind, especially the intellect or reasoning part, raises the primitive man to the higher ranks of human-beings.

The requirements of the urban dweller of to-day are very different from those of the savage; equally are his methods of livelihood different. For civilisation has introduced many factors which are absent from the surroundings of primitive man.

The urban dweller of to-day suffers less, it is true, from many of the enemies which attacked his prototype, but in their place he has to contend with the diseases which civilisation brings in its train. In mediæval times men died of poisoning introduced by outside agencies into their food. To-day the poison manufactured inside the body is of infinitely more common occurrence, but just as deadly in its way.

This is one of the factors, if not the most important factor, against which modern man has to contend. Amongst the first organs to suffer are the ductless glands. The thyroid has been called a "vital antiseptic," because one of its many functions is to defend the body against poisonous material circulating in the blood. This is why it enlarges in some cases of chronic poisoning. It calls to its aid the adrenal and pituitary secretions. Medical science is beginning to recognise that it is to this factor that many disturbances of the ductless glands owe their origin.

The requirements of the individual in times of peace are mainly for weapons directed against the collection of toxins or poisons which are manufactured within the body. There is, as well, the rush and hurry which urban life entails; while the strain under which the modern brain-worker lives undoubtedly takes its toll. This factor is shown very markedly among those professions in which anxiety and uncertainty play an important part. Many writers emphasise the fact that the American

nation is riddled with nervous instability; and the increase in insanity in the United States is causing great anxiety to thoughtful Americans. "Neurasthenia," which its inventor described as synonymous with "American nervousness," is thought by many to be due to a disturbance of the adrenal glands.

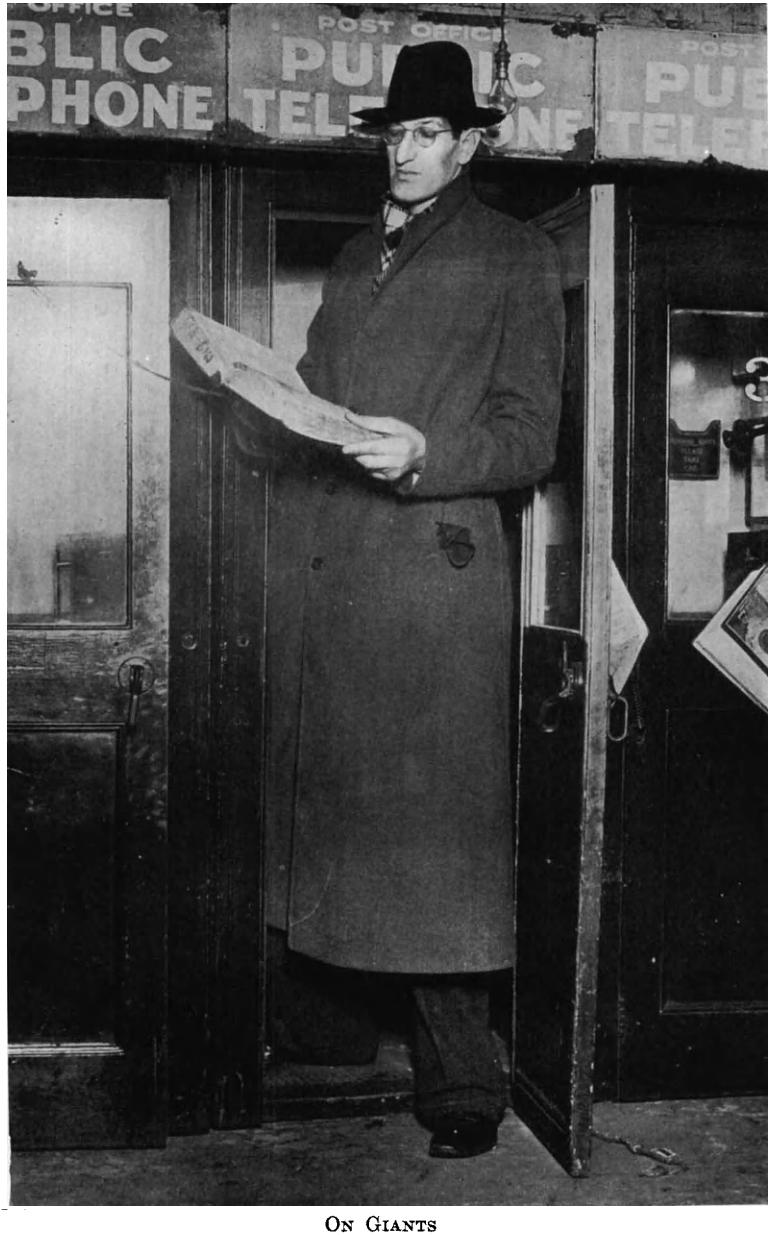
Many factors, no doubt, contribute to nervous instability, and among these it is legitimate to quote, first and foremost, heredity. Two healthy parents, in whatever climate they dwell, are likely to beget healthy offspring. Two insane parents rarely, if ever, produce sane children. In between these two extremes are encountered the various offspring with some degree or other of neuropathic taint.

Next in importance to heredity—and all wise children choose their parents with great care—comes food. The nourishment of the infant and growing child determines the structure of the adult body. Without a healthy body, a healthy mind is impossible. It may appear that many an invalid is capable of magnificent mental work. But records show that this is often but a "flash in the pan," and that sustained mental work throughout a reasonably long life is usually accompanied by a healthy physique. The healthy adult is only produced when the growing child has received adequate nourishment.

"What Miss T. eats becomes Miss T."; and what "Miss T." eats determines the subsequent behaviour of her endocrine equipment. It is unnecessary in this place to enter into dietetic detail; but laboratory experiments have shown that changes in the different ductless glands can be produced by different schemes of diet.

After heredity and diet, we may consider such additional items as climate, soil, and water. All these factors have an influence upon the endocrine balance, and perhaps they go a long way towards explaining the racial distribution (from the endocrine standpoint) which is found in the world to-day.

Civilisation, then, makes many demands upon the individual. These demands test the internal secretions in a different way to those of warfare; nevertheless, the strain to which these factors subject the individual, is as important to the study of personality as the more violent upheavals which characterise warfare.



ON GIANTS

[*Facing p.* 207

CHAPTER VI

ON GIANTS AND DWARFS

1

UNUSUAL development—either in the direction of excessive or deficient growth—has only been studied comparatively recently. Giants have figured prominently in fairy tales and books for children, and the ogres of our childhood days formed an important part of our fiction. More recently, however, excessive growth has been studied from the scientific standpoint; and with the recent interest in the internal secretions, there has come a better understanding of the factors which produce these abnormalities.

The term "giant" is kept for an individual of unusually large stature whose proportions, however, are normal. The term "gigantism" is used to describe development to abnormal size, accompanied by disproportionately large extremities, alteration in the features, and other abnormalities. It is not too much to say, however, that a close scrutiny of all individuals of giant size discovers definite abnormality of the endocrine glands; the normal giant of our fairy tale does not exist in real life. To our childish fancy he appeared unduly savage, probably by reason of his enormous size. Instances of gigantism which have been investigated show that individuals of abnormal size are just the reverse. They are usually poor, diseased creatures, who die young, and are often battling with a variety of ailments depending directly upon their disturbed endocrine action.

Omitting the creatures of myth and legend, instances of gigantism have been described with a wealth of detail, only in the last forty or fifty years. In even more recent

times investigations have been undertaken with the object of ascertaining any disorders of the endocrine glands which may enable a scientific classification to be made of such individuals.

One condition associated with bony overgrowth is that which has been called *acromegaly;* this term, meaning "large ends," was invented by Pierre Marie in 1886 to describe "a peculiar non-congenital hypertrophy of the upper, lower, and cephalic extremities." As acromegaly is intimately associated with bony overgrowth, the following brief description will help us to understand and recognise its main features. It will also clarify our views as to the relation of this disease with gigantism.

Acromegaly is a disease occurring in all climates; apparently no race is exempt. It comes on, as a rule, between the ages of twenty and thirty years; and there is good reason to think that it is not hereditary, but is due to acquired endocrine disturbances. There have, however, been cases of relations suffering from the disease; one observer reports that it occurred in a father and son, another in a father and daughter. There are several causes which are regarded as possibly predisposing to the condition. Professor Harvey Cushing, who has published a masterly monograph on this subject, has succeeded in making the causes and abnormal functioning which are present in this disease, comparatively easy to understand. He has shown that acromegaly is the result of over-action of the anterior lobe of the pituitary, with or without a mixture of symptoms produced by some under-action of the gland occurring earlier or later in the disease. The condition is complicated by disorders consequent upon the increase in the contents of the skull and pressure upon neighbouring structures. As a rule, the first changes to be noticed are those which take place in the features; the nose and lips become thick and coarse, there is enlargement of the tongue and lower jaw, while the bony ridges over the eyes become more

prominent. There is thickening of the skin, which frequently becomes darker and rougher; and a marked increase in the hair on the body.

In women, there is a coarseness and a general tendency to male configuration of the body, and the menstrual periods cease; while in men, there is sometimes an increase in sexual activity followed by impotence and absence of sexual desire.

There is enlargement of the bones which form the face, especially the lower jaw. The features in consequence assume a heavier character, caused largely by the massive forehead over the protruding jaw.

Now to return to gigantism. A recent classification divided the condition into three groups:

(1) Gigantism with infantilism.
(2) Gigantism with acromegaly.
(3) Gigantism with infantilism and acromegaly.[1]

(1) GIGANTISM AFTER INFANTILISM.—If we regard all cases of unusual growth as being abnormal, we should expect to find instances of gigantism presenting features of abnormal endocrine functioning. Just exactly what is meant by normal growth it is difficult to say, but among the recognised races of the world any height over 6 feet 3 or 4 inches, or under 5 feet, must be regarded as abnormal. It is, of course, well recognised that certain races present variations in height; but, with the exception of the Pygmies, no race possesses normal adults of less than 5 feet in height, and no race whose members exceed 6 feet 3 or 4 inches can be regarded as within normal size.

In this group occur giants characterised by infantilism, which state has been defined as "a developmental anomaly characterised by the persistence in a person past the age of puberty of morphologic features belonging to childhood." Among these features is a delayed union of the cartilages, rudimentary and useless generative

[1] Bassoe, article "Gigantism," "Endocrinology and Metabolism," vol. ii., p. 808 *et seq.*

organs, and absence of secondary sex characteristics. Infantilism *per se* may be present in people of normal size, or it may be seen either in giants or dwarfs.

Attention has already been drawn to the relation between the pituitary gland and the organs of sex. Once more it must be emphasised that the intimate relation between these two secretions would lead us to expect that few giants could be normal in their sexual life; and this, indeed, is the case, for most are impotent and have very poorly developed sexual organs. The following characteristics have been described as typical of the infantile giant: excessive length of the extremities, the trunk being of nearly normal size; lower extremities relatively longer than the upper; thigh and upper arm bone relatively less increased in length than leg and forearm.

(2) GIGANTISM WITH ACROMEGALY.—In this condition the symptoms present are those of acromegaly complicating the features of gigantism. The following characteristics would be expected in this condition: there is overgrowth, as in acromegaly, but it is not confined to the last division of the limb; the features of the face are enlarged out of all proportion to the cranium, particularly the lower jaw. The general health of these individuals is distinctly below par, and there is diminution of sexual power. The enlargement of the pituitary body is common to both conditions.

One authority has stated that when pituitary over-activity commences in youth, gigantism results; when, however, it comes on during adult life, acromegaly is the result. Should it commence in youth, but continue during adult life, a combination of the two conditions results. Cushing has pointed out the reason for simple gigantism changing into acromegalic gigantism; and he has stated that this only occurs if over-function of the pituitary continues after growth has ceased. The fact that this over-activity is liable to be intermittent, and even to alternate with periods of under-activity,

goes a long way towards explaining the curious mixture of symptoms that is sometimes present. In Chapter II. an account is given of Charles O'Bryan, the Irish giant, and it is obvious, in the light of what we have just said, that this man was an instance of gigantism associated with acromegaly.

(3) GIGANTISM WITH INFANTILISM AND ACROMEGALY.—This group contains instances of giants who have also developed acromegaly, but exhibit signs of infantilism. Two authorities describe the case of the giant Constantin, who measured 194 centimetres at the age of fourteen, and finally reached 259 centimetres in height. He showed the following infantile features: disproportionate length of the lower extremities, failure of proper ossification of the epiphyses—that is to say, the condition that is present in growing children—and undeveloped sexual functions. The signs of acromegaly present were large hands and feet, huge pituitary and sella turcica, and marked overgrowth of the lower jaw.

Into one of these three classes all instances of real gigantism will fall. It has been necessary to describe the three different types in order that the endocrine characteristics of these individuals may be made clear. There are certain associated conditions not without interest. A condition, to which the name *leontiasis ossea* has been given, seems to be in some way related to acromegaly. These are the cases known as "lion-faced" men, because the overgrowth of the bones of the face and of the head is supposed to give a lion-like appearance to the features. One case is reported, for example, in which rapid growth commenced at the age of nine, and is said to have followed a kick on the cheek by a horse. Some years after large bony outgrowths appeared on the face and head. The patient died at the age of twenty-five, his height being 7 feet 3½ inches.

Historically, the idea of giants is much less prominent than that of dwarfs. The belief that the size of the human race has steadily diminished, and that originally

the world was inhabited by men of gigantic stature, is now no longer held. There is no evidence to show that such men ever existed, and it is probable that any exceptionally large men encountered by travellers were magnified unconsciously into ogres. The fact that many cities have examples of large men, goes a long way towards proving that, when an individual well above the average size *was* seen, he was sufficiently unusual to be placed on record. The City of London possesses the effigies of Gog and Magog, who are supposed to be descended from a race of giants originating from the thirty-three wicked daughters of Diocletian; that of Antwerp, Antigonus; Douai, Gayant; and so on.

In addition to the Irish giant O'Bryan, there are many instances on record of individuals who have measured over 7 feet. Machnow, a Russian, was exhibited in London in 1905, in his twenty-third year. His height at that time, is said to have been 9 feet 3 inches. Josef W. M. Kelmair, also on show in London in 1887, measured 8 feet 9 inches; while Patrick Ostler, who died in Bristol in 1802, was 8 feet 7 inches high. The Englishman, Robert Hales, measured 7 feet 6 inches; it is said that an ancestor, who lived in the reign of Henry VIII., was 8 feet 8 inches tall. The Chinese giant, Chang, who reached a height of 8 feet, is stated to have had a sister who was 8 feet 4 inches tall.

It has never been possible to breed giants, as the majority are sterile, another instance of the abnormality which accompanies unusual stature. One married couple, Captain Bates of Kentucky, who measured 7 feet 1 inch, and his wife, who was 7 feet 9 inches tall, had a child who measured 2½ feet in length and weighed 23¾ pounds at birth. Their first child is stated to have weighed 19 pounds (Bassoe).

Many of the so-called "giants" who figure in Eastern tales are, in reality, eunuchs; some, no doubt, acromegalics; others, examples of simple overgrowth, with or without under-development.

On Dwarfs

[*Facing p.* 213

2

Meige's definition of a dwarf is "a person of a very small size as compared with average individuals of the same age and race."

Dwarfs have been divided into two main groups: (1) Proportionate dwarfs, and (2) disproportionate dwarfs. These two groups have again been subdivided, the first into three classifications and the second into four. We need not enter here into the details of these subdivisions as we are only concerned with the main characteristics of the dwarf.

(1) PROPORTIONATE DWARFS.—As this name implies, the dwarfs falling into this group are normally proportioned, and do not exhibit any features that are definitely out of keeping with a small individual. Among what are called primordial dwarfs are found many of the "Tom-thumbs" and miniature men who are met with at country fairs. Meige describes this kind of dwarf as a normal human-being, viewed through the large end of a telescope; all the organs are normal, and there are no symptoms of infantilism. The mind and body are normal; the development of the endocrines is, so far as the evidence goes, up to standard, and the genital organs, as a rule, show no lack of development.

In the next division we may place dwarfs of pituitary origin. These individuals are of normal size and weight at birth, but in childhood their development lags behind and their growth appears to cease altogether. The development of the skeleton may go on into late life, as the lines of the growing end of the bones do not close. This form of dwarfism is associated with damage or disease of the pituitary gland. They remain children in mind and body. Sexual development is deficient, and although they may live into old age, they never, in the strict sense, grow up. There is now evidence to show that failure of the anterior lobe of the pituitary is the cause of the cessation of growth and

the perpetuation of miniature size and infantile development.

In an earlier chapter the condition which has received the name of Fröhlich's syndrome has been described. We may remind the reader that this is a condition of obesity and sexual under-development associated with deficient pituitary activity. The relation to the condition we are now describing is therefore a close one. What exactly the difference is has been a matter of speculation; and it has been suggested that pituitary dwarfism is the result of pure disease of the pituitary, while lesions in the neighbourhood of the pituitary cause the additional features which are seen in Fröhlich's disease.

Many of the cases of pituitary dwarfism, however, present abnormalities which are obviously due to failure of the pituitary secretion; while some cases have been shown to possess destructive lesions of the pituitary. Clinically, they have shown such symptoms as failure of bony growth, absent or deficient sexual organs, absence of secondary sexual characteristics; while frequently the individual reached a height of only 50 inches.

Dwarfs have frequently lived to old age, and one case is reported of a man 52 inches high who lived to the age of ninety-one.

(2) Disproportionate Dwarfs.—There are, of course, many diseases of childhood which interfere with growth. but these do not come within our consideration here, The most striking type of dwarfism in this group is that known as *achondroplasia.*

Achondroplasic dwarfs are characterised by having a body of normal size, but short arms and legs out of proportion to the size of the body. They have also relatively large heads of the brachycephalic type (the transverse measurement of the head being unduly large in proportion to the longitudinal). There is in this type of individual good muscular development and more or less normal mentality. There are also present abnormal

features such as hollowing of the spine, shortness of the forefinger and toe, and deep insertion of the nose; which, in company with the shortening of the antero-posterior line of the skull, give such individuals a characteristic appearance.

This type of dwarfism is associated with over-development of the genital functions, as well as a premature cessation of bony growth. It will be recalled that the development of puberty plays a part in the normal human-being by slowing down the rate of bony growth; this type of dwarf, where the excessive sexual activity is associated with premature cessation of growth, is contrasted with the eunuch, where there is deficient sexual activity and abnormal growth of the long bones. No doubt the pituitary, in keeping with the other glands which contribute to growth, is responsible for both these conditions.

There are many instances of dwarfs in history and mythology. In Scandinavian literature the word was used to describe smallness associated with deformity, and was applied to the goblins who were supposed to live on the mountains and to be the kings of the mines. History also relates that dwarfs figured prominently in the courts of kings, and were frequently allowed a liberty of speech which would have been regarded as *lèse majesté* in individuals of normal size. About 330 B.C., at Cos, there lived Pheletas, who was tutor to Ptolemy. He was said to be so small that he had to wear leaden shoes in order that he should not be blown away! Julia, the niece of Augustus, had a dwarf named Coropas who was 2 feet 4 inches high.

There have been various recipes for the production of artificial dwarfs which have been in vogue at various times: "The most effective according to report was to anoint the backbone with the grease of moles, bats, and dormice." There are also many instances of real dwarfs in English literature. Perhaps the best-known example is Jeffery Hudson, who lived in the middle of the seven-

teenth century. This individual appears to have belonged to the class of proportionate dwarfs, for he is described as gracefully proportioned, although at the age of nine years he measured barely 18 inches. It is said that at a dinner given to Charles I. by George Villiers, first Duke of Buckingham, he was brought to the table in a pie out of which he stepped. He fought two duels, "one with a turkey cock, a battle recorded by Davenant, and a second with Mr. Crofts, who came to the meeting with a squirt, but who in the more serious encounter which ensued was shot dead by Hudson who fired from horseback, the saddle putting him on a level with his antagonist." This dwarf lived to the age of sixty-three. And it is stated, that while in captivity, when he had fallen into the hands of Turkish pirates, he grew steadily until he was 3 feet 9 inches. This, of course, is by no means impossible, as, provided the epiphyseal or growing parts of the bone do not ossify, there is always a possibility of further growth.

Other dwarfs celebrated in their time have been Nicholas Ferri, who measured 2 feet 7 inches, and was one of three children; and Richebourgh, who lived to the age of ninety, and was only 23 inches high. He was a servant in the Orleans family. It is said that during the French Revolution he passed in and out of Paris as an infant in nurse's arms, with dispatches wrapped in his linen. A Polish dwarf, Borulwaski, was 39 inches high, and was born in the reign of George II., to die in the year 1837 in the reign of Victoria.

Charles Stratton, generally known as "General Tom Thumb," was born in the year Borulwaski died. He was 31 inches high at the age of twenty-five. Other dwarfs of the nineteenth century measured 29 inches, 28 inches, and 35 inches; the last was a woman known as the "Dwarf Giantess," presumably because her circumferential measurements were enormous. She was 2 feet round the leg, and 4 feet 3 inches round the waist!

George Prout, who was less than 3 feet high, acted as a messenger at the Houses of Parliament.

3

A condition which has been called *infantilism* has already been referred to in this chapter. This can best be described as the persistence of childish characteristics, both physical and mental, into adult life. This does not necessarily imply that the subjects of infantilism are dwarfs; in fact, we have already seen that this condition can be combined with a normally-sized, or even over-sized, body. "Partial infantilism signifies the abnormal persistence of one organ or organ-system or its part in the stage of development that normally is only temporary." Various types are described. One "is characterised by a small larynx, cartilaginous, with a high-pitched voice and an infantile pug nose. The retention of infantile proportions of the skeleton or its parts . . . small infantile genitalia and other abnormal development."

It will be seen, then, that infantilism in its general aspect is a disturbance of development in which the whole organism retains its infantile type. It is characterised by conditions similar to those which characterise normal childhood. In childhood there is a non-closure of the epiphyses, a head large in proportion to the rest of the body, comparatively short legs, and the psychic qualities of immaturity. "The principal features of infantilism as enumerated are smallness of stature due to the delay or arrest of the growth of the skeleton, delay of ossification . . . under-development of the musculature, and failure of development of the *vita sexualis*, with the persistence into adult years of the childish mental characteristics."

Infantilism is of very considerable importance. The subjects of this condition frequently die young (especially of tuberculosis), and individuals of this type are very often of weak resistance, which makes all illnesses more

dangerous than in a person of normal development.

As with giants and dwarfs, there are various classifications of different types of infantilism. One of these considers infantilism under two main headings, the first of which deals with infantilism due to true ductless glandular diseases, the second with infantilism of different varieties.

It is sufficient for our purpose here to refer briefly to those types which are associated with disturbances of the internal secretions.

The first amongst these is that seen in cretins. This is due to under-action of the thyroid, and possesses the symptoms associated with this condition. Thus, a child of this type may be under size and under weight; there will be the facial stigmata of subthyroidism—a large head with a puffy face, swelling of the subcutaneous tissue, with the typical cold, dry skin. Mentally, these children are well below average intelligence. They lack attentive control, find lessons difficult, and are unable to reason clearly.

There is also a type of infantilism described in connection with the pituitary. Disturbance of this gland during childhood is followed by interference with the normal progress of growth. The shape of the head, for example, is that of a child; the total height of the head in comparison with the body is greater than in the adult, and the general contour of the body gives a definite impression of immaturity. In this type of infantilism there is found a wide variety of alterations from the normal, and this would appear to depend on two or three different factors. First, the age at which the pituitary disorder commenced; secondly, whether the anterior or posterior lobe is mainly affected; and thirdly, whether there is disease of the base of the brain in the neighbourhood of the pituitary.

There are various other varieties of infantilism: a multiglandular infantilism, in which a complex clinical picture is present, and in which there is a combination of pituitary, thyroid, adrenal, and sex gland disturbances.

A type of infantilism was described by Lorain in 1871.

In this type the individuals are small but graceful, the extremities are long, there is no tendency to adiposity, and the other characteristics we have described in connection with the hypothyroid type of infantilism are absent. Other varieties of infantilism are those due to heart disease, developmental abnormalities, and infantilism resulting from chronic infection. Finally, this condition has been seen in connection with the malnutrition which results from disorders of the digestive tract.

CHAPTER VII

PERSONALITIES, INTRODUCING:—

THE features of many of the greatest personages in history have, fortunately, been preserved for use. From paintings and sculptures it is possible to form some estimate of their characters.

With the advent of endocrinology, we can look at the giants of the past from a new angle. We may possibly be able to conjecture why they behaved as they did in certain situations; and to hazard a guess at what was going on in their minds and bodies when they were faced with a particular crisis.

It has been said, for instance, that Napoleon lost the battle of Waterloo because he had a stomach-ache. The newer view, however, blames the Emperor's pituitary gland, which, at that time, was unquestionably failing. Julius Caesar was an epileptic, an affliction in which the same gland plays a part. Who knows, moreover, what the subsequent history of Russia would have been had Peter the Great, Ivan the Terrible, and Catherine the Second possessed different endocrine arrangements ?

It is hardly necessary to state that the following sketches claim to be little more than reasoned assumptions as to the characteristics of the individuals described. If it is ever possible to estimate a man's temperament from a knowledge of his parenthood, his appearance and behaviour, we are certainly going to derive additional help from the knowledge which a study of the ductless glands gives us.

In perusing the following sketches, the reader may wonder whether such a factor as free-will can be said to exist. And he might be pardoned for asking whether the subject of one particular sketch (such for instance

as James II.) is deserving of censure for behaving as he did.

The answer is not difficult. A man's glands—just as the other ingredients which go to make his character—are arranged partly by nature and partly by nurture. The life he has led (and this is possibly to some extent under his own volitional control!) affects the development of his endocrine glands, just as, through them, it affects his character. The individuals shortly to be described are dealt with as finished products, although their early life is touched upon, to enable the reader to understand the sequence of events which has moulded their characters.

He is requested, therefore, to regard apparent dogmatism, as merely brevity: and to approach these historical characters in the same spirit of inquiry which prompted the writer.

And so—from the general to the particular.

HENRY VIII.

I doubt whether public interest in the Tudors will ever wane. Henry VII.—possibly the least interesting—was followed on the throne by a series of forceful, dynamic, and explosive monarchs, who, moreover, lived in an age when they were able to give full rein to their wayward fancies. So striking were their personalities, and so deeply have they left their mark on England, that ever since they have been the subject of romances, and are now the heroes of Hollywood.

Of the Tudor sovereigns, Henry VIII. is especially interesting from the endocrine point of view. His elder brother, born five years before, was his exact opposite, and died six months after his marriage to Catherine of Aragon. As all the world knows, Henry succeeded his brother, both as heir to the throne and husband to Catherine. Owing to his subsequent matrimonial adventures, Henry has been handed down in the history books as a kind of Bluebeard; and the interest of his life and times

has largely been masked by the unusual nature of his domesticity.

Henry VII. had intended his second son for the Archbishopric of Canterbury; primarily, in order that its revenues might save this parsimonious monarch expense. His plans were altered by the death of his elder son. In the European situation, as it then was, it was of vital importance to England that she should be linked with an important ally. Spain, France, and the Holy Roman Empire held between them the balance of power. In the distance lay the ever-present Turk: while Rome and the Papacy figured only as pawns on the European chess-board. To Henry's scheming brain it appeared a sound move to affiance his second son to the widowed Catherine, in order to retain a link with Spain. He was, moreover, hurt in his most tender feelings by the fact that Catherine's dowry had never been fully paid.

* * * * *

Henry VIII. is described as a jolly little boy, who, even in his early years, showed his fondness for music by playing the flute. Later on we are told, he was a handsome boy with "odd, expectant eyebrows." He had golden hair and a creamy complexion, with a round face.

At the age of twelve he was betrothed to his brother's widow, but he did not marry her until he became king. After he reached man's estate, he is described as being very tall, very fair, and admirably proportioned.

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In order to understand Henry's character and subsequent actions, we must realise two important facts. The first is that his marital ambitions were centred round the *acquiring of a male child, who could inherit his crown.* The second is that he *suffered from a form of inferiority complex.*

At the time of Henry's accession, the throne of England was looked upon by the older European powers as an extremely unstable commodity. Had Catherine of Aragon produced a male child who had lived, all might have been well, and Henry's subsequent excursions into the marriage-market would probably not have taken place. We must remember that his first marriage lasted twenty-one years: and there is ample evidence that he was fond of, and on good terms with Catherine, for a large part of that time. Furthermore, Henry was an idealist; and, although this must appear strange in view of his later life, he held strong views as to the sanctity of marriage. "Who does not tremble when he considers how he should deal with his wife, for not only is he bound to love her, but so to live with her that he may return her to God pure and without stain." This remarkable statement was penned by Henry when he had already been married a few years. What, then, caused him to have six wives and behead two of them?

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The answer is to be found in the European situation. Henry, a few years after he had written this touching testimony to marriage, was in the welter of negotiations with France and Spain. One year he was backing the French King; the next, opposing him and supporting Spain.

Catherine stood to him for Spain and Spanish interests: and when Henry became bitterly hostile to the country of her birth, some of his wrath overflowed on to his Spanish wife.

By the time he was twenty-six, Henry had become involved in various love affairs: but we must remember that, in those days, this was not necessarily a barrier to happy matrimony, neither was it considered unusual. It is even said that some of the happiness he derived from an irregular liaison caused him to take more pleasure in his wife's company.

The second part of the answer concerns Henry's burning desire for an heir, and it is here that we get a glimpse of one of the strong factors underlying his character.

The Tudors were *parvenus* among European sovereigns, and deep down in Henry's mind was a sense of insecurity, which gave him reactions altogether out of proportion to the causes. When all was plain sailing, Henry was genial and jovial, on good terms with everyone, and entering with avidity into the sports and recreations of his court. But if Henry sensed danger, his entire attitude changed and his conduct became merciless, as is so often seen in the conduct of the timorous. When the Duke of Buckingham was known to have said that if anything happened to the king, "he should be next in blood to the crown," these words were sufficient for Henry. Buckingham was summoned to London, ordered to the Tower, and executed. The birth of an heir to Henry would have meant increased security.

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There is no doubt that Henry showed courage in manly sports, such as wrestling, and that he delighted to parade his skill as a horseman and to break a lance before the ladies. The other side of his character is shown by the timidity he displayed when danger was abroad. Take the case of the rising of the apprentices. Henry was all threats and vengeance; but he kept out of the way until the rising was subdued, only appearing when the accused were paraded in front of him with halters round their necks. At the first sign of an epidemic Henry was afoot, and remained in safety until it had abated. He was, in fact, pusillanimous, and not the lion of courage he has so often been represented.

There was too much of the artistic in his nature for him to have been successful as a soldier. The music which he loved as a child he continued to love throughout his life. He was a supporter of learning, being himself well-read and a capable linguist.

The secret of Henry's character is to be found in his inferiority complex. He felt himself insecure, and deep down in his mind was the knowledge that his dynasty was unstable. This aspect of his character was hidden from his contemporaries by the swagger and bluster of his outward life, which formed a compensation to the underlying inferiority.

Is the popular conception of this king as an over-sexed monster justified? If we admit that his frequent matrimonial *encores* were prompted mainly by his desire for an heir, we shall hesitate somewhat before accepting this view. In some ways, Henry VIII. was a much maligned man. His behaviour is attributed to syphilis: his declining years to disease of various organs brought on by venereal infection. Yet Chamberlain, after exhaustive research, is unconvinced. It is so easy, after this lapse of time, to predicate syphilis as a cause of mental and physical abnormalities: and diagnosis in the sixteenth century was scarcely reliable. The ulcer on Henry's leg may have been syphilitic, in other words a gumma; but equally it may have been varicose in origin.

What is our estimate of Henry's character if we attempt an endocrine analysis? How was his conduct determined by his internal secretions?

First of all, he was "very tall, very fair, and admirably proportioned." That part of the pituitary which presides over growth had evidently not been idle: and, moreover, his emotional life—his love of music and the arts—is proof that his post-pituitary was not entirely subordinated to the essentially masculine moiety. An active thyroid is suggested, both by the magnificent hair as well as by the full eyes, and the "odd, expectant eyebrows."

Henry's sex-life was, so far as can be estimated, adequate and normal to the type we are postulating. The student of history will not be misled into regarding him as a satyr, merely because he was married six times, or because he was attracted to a pretty face. In that age

of licence, and with the opportunities which a man in his position enjoyed, it is not surprising to read that he flirted with a lady-in-waiting or had an assignation with a wench of lowlier birth.

Interest in this astonishing man was stimulated, a year or so ago, by the discovery at Castle Howard of a portrait, believed by many to have been painted by Holbein. This portrait, no matter who painted it, is of unusual interest to the student of personality, for it gives a remarkable picture of Henry in his later years.[1] As the present writer pointed out in a letter to *The Times*, one fact stands out pre-eminently, namely, that when the Castle Howard portrait was painted, Henry VIII. was suffering from failure of his thyroid secretion. Apart from the obesity, the distribution of which was typically "thyroid," the facies denoted plainly that he was, at that time, an example of sub-myxœdema. The hair was falling out—the eyebrow was deficient in the outer-third—and puffiness underneath each orbit strengthened the diagnosis.

Like most kings, Henry was an enormous and gross feeder. When in his prime, the excessive amount of food was, to some extent, utilised by his physical activities, and by the fact that his dynamic endocrines—thyroid, pituitary, and adrenals—were working overtime. Once, however, these began to fail, he became less capable of bodily exertion, and more liable to the failure of metabolism which results in the storage of fat.

A dry skin, spots, and even ulcers, are liable to develop in a subject whose thyroid secretion is deficient; and ulcers have been known to heal when thyroid extract has been administered. It is at least possible, that the ulcer which so hampered Henry's later life may have been due to his hypothyroidism rather than to his hypothetical syphilis.

The endocrine pattern of this Tudor King is, then, that of an active thyro-pituitary combination during

[1] See Frontispiece.

QUEEN ELIZABETH AS A GIRL

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adolescence and young manhood, with relatively early failure of these hormones. The anterior pituitary was probably somewhat countered by the posterior: otherwise the artistic element would not have been so marked. Pre-pituitary predominance suggests masculinity, especially when harnessed to powerfully acting sexual secretions. Henry's artistic tastes—his musical compositions exist to this day—show that the anterior pituitary did not have it all its own way. It is at least possible that his endocrines were over-taxed by his manner of life: and, having reached middle-age, Henry developed symptoms which were due to their premature failure.

This is probably the reason why the last of his six wives found him relatively easy to manage.

QUEEN ELIZABETH

It is just four hundred years since Elizabeth Tudor was born to Henry VIII. and his wife Anne Boleyn. Her entrance into this world was the bitter end to a nation-wide longing for an heir, and to the passionate craving of her parents.

Note this: all the longings of her mother (who felt that her position, if not her very life, depended upon producing a male child) were for *masculine* issue. The girl child who was born, was to suffer more in the first fifteen years of her life than falls to the lot of most children. She was to know that her father had taken her mother's life. It isn't difficult to imagine the terrible effect of this knowledge on a child; nor to realise how Elizabeth's stormy early life laid the foundation of her subsequent character. Elizabeth suffered persecution at the hands of the Catholics, and was suspected and imprisoned by her sister. No one with less character and control could have steered with success through the difficult years through which she passed before she ascended the throne.

Her first experience of love was at the hands of the gallant and ambitious High-Admiral Seymour, who did

not allow the fact that he was married to her father's widow, or her own extreme youth, to deter him from approaching Elizabeth.

Seymour, in due course, lost his head, and Elizabeth her character, at all events for the time being. It does not appear that she was deeply attached to him: but the affair landed her unwittingly in a morass of political and treasonable charges. At the age of fifteen she was capable of steering a middle course through the complicated intrigues which then existed. This was the time when her adult character was in process of formation.

Throughout her reign, Elizabeth was a firm believer in the policy of "wait and see." She had the power of putting out a feeler to see what would happen. She hated making decisions. There were two sides to her policy—the active and aggressive, and the passive or diplomatic.

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There were also two sides to Elizabeth's character, which, for convenience, we will call masculine and feminine. I believe that Elizabeth's character was originally essentially a feminine one: but there was in her nature a strong masculine strain. Historians comment upon the marked contrasts which existed in her character; but my belief is that if Elizabeth had not been born into a world of strife and personal danger where she had to fend for herself from her very childhood, she would have developed upon totally different lines.

The male side of her character is shown by her power to dominate all and sundry. Had Elizabeth been swayed by the masculine side always, she would have been much more consistent in her behaviour. The feminine side of her nature is shown by her inability to make up her mind, her dislike of finality, her petting of her many favourites, and her enormous love of finery and flattery.

Those around her realised that they were dealing with a dual personality. Their queen had, so to speak,

QUEEN ELIZABETH IN LATER LIFE

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masculine and feminine days. History shows that my Lords Leicester and Essex could never estimate the reception they were likely to meet with. She might be irritable, quarrelsome, and unreasonable: or she might be docile, winsome, and ready to receive all the flattery her courtiers could offer.

Look at the portrait of Elizabeth in her teens. A broad forehead with hair brushed firmly down. Large eyes with an inquiring expression. A distinctly feminine picture.

And now look at a later portrait. The first impression is one of hardness and determination with the hawk-like nose, the firm mouth, and the challenging expression in the eyes. The needs of a Queen had called forth those glands which help to fight and to govern. As these came into the ascendant, so did the feminine glands—those which make for gentleness and passivity—sink into the background. She formed the habit of subordinating personal desires to the requirements of the ruler.

On the feminine side there were certain causes worthy of record. She had no active sex-life. The few scandals which have attached themselves to her name have been shown to depend upon the slenderest possible threads. If we start from the assumption that Elizabeth was prepared to, and did in fact, subordinate all her normal impulses to the one dominant urge to serve England, we shall understand how her mind and body developed as a result. It is more than likely that the constant attempts to mate her with some suitable prince (which efforts continued practically throughout her reign) were carried out purely as a political move to balance the influences exerted by France and Spain. Elizabeth, it is believed, was willing to put up with the scandals whispered abroad (or even to support them) if they, in turn, helped her in her diplomacy. Regard this as a sacrifice of the woman to the Queen, and then realise that the woman's life had become dominated by the ruler's. A ruler's life is

essentially masculine; and Elizabeth, who had started with a potentially feminine character, finished up with that side of her nature repressed, only occasionally to peep out when in converse with her favourites.

There seems little but idle gossip to support the belief that Elizabeth was malformed and incapable of a normal sexual life. The failure to materialise of the ever-recurring rumours that she was about to be married to this or that princeling; her favourites, with whom she was extremely feminine, *on her feminine days*; the coarseness of her language; all helped to swell the scandalous stories which circulated.

Elizabeth knew of these scandals and referred to them in more than one interview. Her reputation suffered temporarily; but no serious-minded contemporary ever believed that she was other than chaste. Rumours, however, were rife in ambassadorial and other correspondence; and it is this fact more than any other which has led historians, even at the present day, to assume that she was a lecherous woman, who allowed young and handsome courtiers to make love to her in and out of season.

Chamberlain has collected, with an infinity of patience, all the data which bear upon the private character of Queen Elizabeth; and he, more than any other man, has shown that the libels on Elizabeth's character were the result of political strife, and often had their origins in chance conversations of a lewd character.

We can rest assured that Elizabeth of her own free will subordinated the feminine side of her character to the necessities of ruling her kingdom. Throughout her long and glorious reign, she played a waiting game, which completely baffled even the intrigues of the wily Spaniard. There was this great Queen, with foresight and vision second to none, meeting craft with craft, and guile with guile. She outclassed the Frenchman and the Spaniard, the turbulent Scotch and the distant Pope.

For a success in statecraft, such as she enjoyed, every-

JAMES I.

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thing else had to go, and it is quite certain that, from her early days to the time when she laid down her sceptre for her long rest, Queen Elizabeth had one thought, and one thought only—the good of England.[1]

THE STUART KINGS

JAMES I.

The reader has but to glance at the print of James I. of England to believe that he, in very truth, suffered from the amazing number of ailments which history records. The face is that of a man rendered sorrowful by ill-health, of a king grappling with all the anxieties of the state, of an individual who knows not the *joie de vivre*.

James Stuart started life badly, due, it is stated, to a drunken wet-nurse. In adult years he suffered from vomiting, diarrhœa, a running nose, and divers other afflictions, none of which can have made him an attractive companion. One can well credit this list of symptoms, when one studies his portrait. The expression is that of a man whose digestion, as the saying is, has gone back on him, and who is looking and feeling bilious. The cheeks are livid; the deep furrows, so commonly seen in sufferers from chronic digestive disturbances, indicate the absorption of fat. The chin, although covered with a beard, is obviously pointed, and the lips somewhat full and loose.

Now, apart from his physical health, what is known about James Stuart? In early life, that is to say when he was still in Scotland, he appears to have shown courage and a certain skill in diplomacy. His health, however, must have been better than when he occupied the English throne: for his various troubles were such as always increase with advancing years.

As James I. of England, he was the subject of hostile

[1] For a sympathetic account of Elizabeth's diplomacy, see "The Courtships of Queen Elizabeth," by Martin Hume (T. Fisher Unwin).

criticism upon almost every aspect of his character. He vacillated: he had favourites: he was a valetudinarian. (No wonder. He insisted on being bled every day!) Even his moral character was reputed to be as unwholesome as his body was diseased: and his sexual life was the subject of much criticism. Whether he was, or was not, a moral pervert is a matter of opinion; but, before arriving at a judgment on this point, it is well to remember that the English had not taken this unfortunate man to their hearts and were, perhaps, a thought too ready to interpret his actions in as base a manner as possible. As Maclaurin says, "There were Puritans about!"

His features and his character point, so far as we are able to judge, to a post-pituitary-thyroid dominant type. The feminine trend in this type, unless swayed (as is usual) by a well-acting adrenal and sexual system, may submerge the masculine, and all it should mean to the individual. Add to this the constant ill-health which dogged him from infancy, and Heaven alone knows what untoward happenings may not have taken place in his ductless glands.

Every physician is aware that chronic poisoning—such as occurs from septic teeth, from infected tonsils, and from other localities—is a fertile source of damage to the internal secretions. James I. probably suffered from enlarged tonsils and, in later life, decayed and carious teeth. He was an enormous feeder, which did little to help an already disorganised digestion.

I cannot believe it possible to consider the character of such a man apart from his health. What he would have been had he lived to-day, is an altogether different matter. One thing at least is certain: he would have parted with his tonsils, his teeth, and, I suspect, his appendix.

CHARLES I.

The well-known painting by Van Dyck is of considerable value in considering the character of the next Stuart

CHARLES I.

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King, for it shows the face of Charles I. from three positions. There is, therefore, every opportunity to study the character of the martyr-king and to endeavour to analyse his endocrine make-up.

The full face brings out the melancholy which is also seen in Van Dyck's portrait in the National Portrait Gallery. Like his father, Charles I. was a man whose actions were largely governed by his thyroid gland. A certain, although vicarious, strength of character is explained by the large nose and the eyes placed widely apart. Such an individual is sometimes weak, at others stubborn. His moods probably depend upon what his pituitary gland is doing ; Charles I. was a highly nervous man, and, as is by no means uncommon, could—and on occasions did—develop a tenacity of purpose where a stronger man would have yielded gracefully. All his life he stammered, although in adult life he is supposed to have controlled this symptom by forcing himself to speak slowly. He was an enthusiastic collector of everything artistic : and the possessor of considerable artistic judgment. Looking at his sad countenance, with the high forehead, the magnificent head of hair, the prominent supra-orbital ridges, and the full lips, one sees the artist rather than the man of action, the dreamer rather than the man of affairs. A little less of the posterior-pituitary, and an increase in the adrenal-cortex, and a stronger, more masculine man would have resulted.

CHARLES II.

Perhaps the best record we possess of the features of the " Black Boy," is to be found in the wooden head of Charles II. carved after death by Grinling Gibbons. His bust, by Pelle, which is in the Victoria and Albert Museum, shows the face in semi-profile. Both the head and the bust emphasise the stern, dark face, the shrewd eyes, and the firm chin.

King Charles II. was a man—in every sense of the

word. "Beneath that lined face, so dark and stern—its shrewd, unwrinkled eyes, the high, harsh nose and determined, delicately moulded chin—lurked a spirit, kindly and merciful and yet unaccountably puck-like, that was a contradiction to every known rule of physiognomy."[1] But was it? Were not the features seen in the death-mask exactly those which might be expected on the face of a man, born with his heredity, and nurtured through the tragedies and uncertainties of Charles's adolescence and early manhood?

It is recorded that he was a large, ugly baby, dark, and swarthy, and that he was early trained by his mother to please and to exhibit that grace and tact which is the monarch's strong suit. The Queen was anxious that her son should be brought up to avoid the many errors which his father had committed, by stubborness and weakness masquerading as strength.

His early life among the delights of the Kings' palaces was to be succeeded by years of sorrows and wanderings. The happiness of Whitehall and Greenwich was followed by a decade of tragedy, uncertainties, and flight. It is a marvel that his good-humour and sense of fun should have survived such experiences: it is less astonishing that his face should have carried the marks of such sorrows. Even from 1660 onwards, when he had ascended the English Throne, his life was one long succession of quarrels and religious difficulties. His efforts to secure toleration for Roman Catholics; his attitude to the Covenanters: even his own family affairs, left him little peace.

In spite of all these factors—and few monarchs can have taken up the reins of government amongst greater difficulties—he ended his life with the affection and support of his people. The character of the man who could achieve such a result in face of all that Charles had to encounter, must surely be remarkable. When one realises that both his father, Charles I., and his successor,

[1] Arthur Bryant, "King Charles II.," p. 350.

BUST OF CHARLES II. BY HONORÉ PELLE

(From the Victoria and Albert Museum, reproduced from "King Charles II." by Arthur Bryant. (London: Longmans, Green.)

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James II, were unable to retain the Throne (and their difficulties were certainly no greater than Charles II.'s), it speaks volumes for the tact and skill of this king.

What was the basis of such a character ? How was it that he escaped the strain of neurosis which ran through the Stuart blood ? From some of his French ancestors, perhaps the equally humour-loving Henry of Navarre, he had acquired that light-hearted power of rationalisation which enabled him to laugh in the face of catastrophes. It is recorded that, when escaping from his enemies, and clothed in "an old sweaty leather doublet, a green, threadbare coat and a greasy steeple hat," it was considered necessary for him to complete his disguise. He blacked his face by placing his hands up the chimney, and he "could not refrain from laughing!"[1] This sense of humour was to help him through many of the tribulations which the future held.

It is equally probable that his early trials stiffened his character, adding to his will-power and strengthening what might have remained as weak and ineffectual a character as those possessed by his two immediate predecessors.

We can assume, with some degree of probability, that Charles II. was an adrenal-dominant type. His swarthy colour, the low hair-line, the power shown in the lower part of the face, are each and all adrenal traits. Yet he was not without other, perhaps equally potent, hormones.

Closely allied to the adrenal gland is the internal secretion of the gonad. But it would be a mistake to think of this hormone solely in terms of sex. It is true that without it, both sexual desire and power would be lacking. It is, however, something more than a mere activator of the reproductive processes. The sexual secretion adds an ingredient to the male character which completes all that is implied by the word "virility." The presence of the sexual and adrenal-cortical hormones in adequate or predominating quantities, furnishes a

[1] *Ibid.*

character, which, if unmodified by, for instance, the post-pituitary, is first and foremost masculine.

Charles II. was such a character. He was governed less by latent femininity than either his father or grandfather: he was more virile, a fine horseman, a man of infinite resource; less dreamy, and able to see reality where his father refused to. Where Charles I. developed phantasy to cope with difficulties, his successor faced facts.

It is a pity that so many people, themselves suffering from sexual repressions, are irresistibly drawn to consider the great figures of the past solely from the angle of sex. To such as they, the study of Charles II. resolves itself into a study of his *affaires*. They know all about Louise and Nell Gwyn, but precious little about Charles's management of the Dutch wars, or his heroic efforts to pay his father's debts when the opportunity presented itself.

With a virile personality, such as Charles II. possessed, the sex urge was undoubtedly strong. The laxity of morals which was then prevalent must not be forgotten. For, although the Puritan element was gaining ground, and was inexpressibly shocked by the "goings-on" at Whitehall, yet, in general, the superb edifice of repression had, at that time, reached only the first storey. When we remember the glamour that surrounded this king, and the competition which existed to capture his fancy, it is little wonder that a man constituted as Charles was, should have allowed his eye to rove.

The upper part of the face of Charles II. bears out the character which is shown by the jaw. The bony ridges over the orbits are prominent and serve to emphasise the coal-black eyebrows; the smouldering eyes are inky in their darkness, showing the fires which burn within. Contemporary records prove clearly that he was a man of no mean intellect, and that he could dominate when his judgment told him that it was domination, and not graceful retreat, which was indicated.

The character of King Charles II. postulates an adequate

WOODEN HEAD OF CHARLES II. BY GRINLING GIBBONS

(From the Armouries of the Tower of London, reproduced from "King Charles II." by Arthur Bryant. (London: Longmans, Green.)

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anterior-pituitary secretion: and this—harnessed to the adrenal-sexual-hormone—would provide for its possessor the physical basis requisite for the development of such a character.

I can almost hear the reader asking, "What glandular secretion is responsible for Charles's sense of humour?" It is, indeed, a question which I should very much like to ask myself—and answer. But, alas! While I can sympathise with the question, I am unable to furnish the answer. So far as I know, no internal secretion has yet been accused of responsibility for humour. The pituitary—that much overworked *organ énigmatique*—is believed to produce eleven or more hormones, and to be in control of masculinity, femininity, and metabolism; to guide the movements of the digestive tube and the uterus; and to sit on high, supervising sleep, and all bodily rhythmic processes. In addition to those functions, it enables the individual to develop a love of art. It would be too much to make it responsible for laughter!

I wonder whether the thymus, which is so much a gland of laughter-loving children, makes its possessor appreciate the quips and jokes which grease the wheels of life?

JAMES II.

I must plead guilty to a lack of interest in this king, the last of the male Stuarts to ascend the throne of England. He failed so signally and so ignominiously, and this, even with his father's example before him. His reign is an instance of the blinding effect which fanaticism can produce: a warning to us to try to see both sides of a question.

There is really little excuse for James II. Even if you agree that he was justified in attempting to restore Roman Catholicism to England, you must admit that he went the wrong way about it. Even Rome found it necessary to suggest that he should modify his methods and walk a little more warily. Nevertheless, this mis-

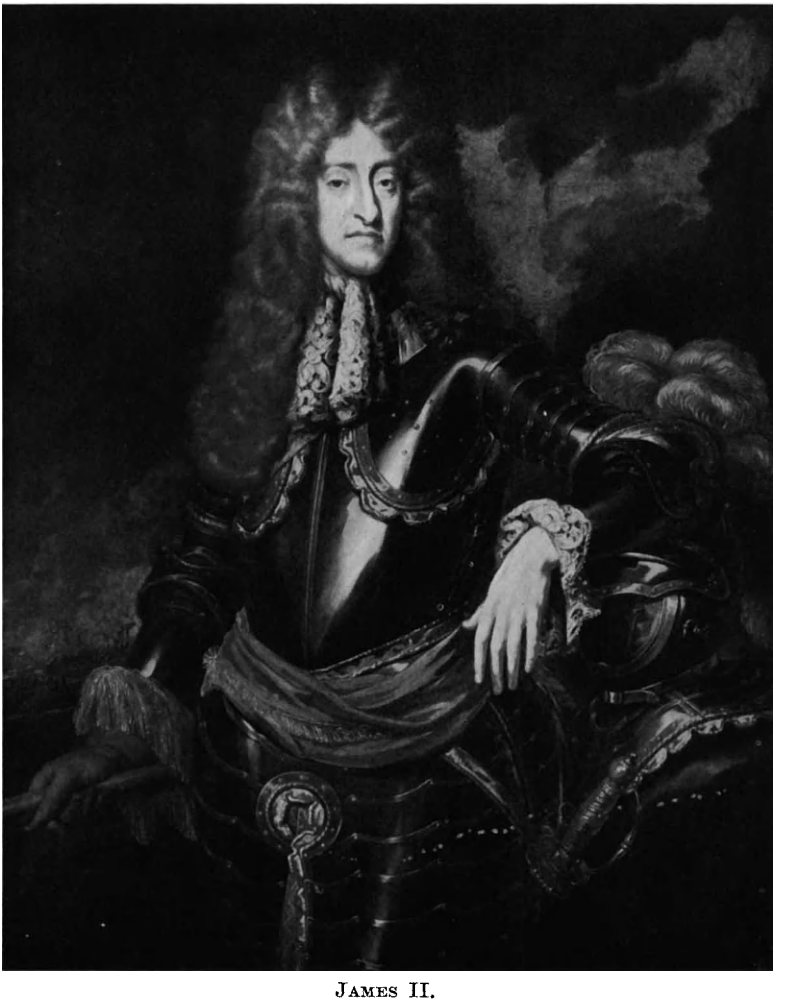
guided man wrecked his plans by a complete absence of judgment.

On his accession in 1685, his first words included a pledge to protect the Church. This promise was greeted with enthusiasm, which should have indicated to the new Sovereign what really were the wishes of his people. His character was stated to be "narrow, impetuous, stubborn and despotic"; and, without doubt, the years he had spent under Charles II., fretting at his powerlessness to help the Church of Rome, were to some extent responsible for the amazingly uncouth manner in which he set about the task of kingship.

Everything was in his favour at the time. His first parliament was friendly; and the loyalty which greeted his ascent was stimulated by the rebellions in the North and West.

James's handling of these two insurrections gave the country a taste of his metal. The executions of Argyll and Monmouth were followed by the revolting antics of Judge Jeffreys of bloody memory. The cruelties and persecutions which succeeded the victory of Sedgemoor were the beginning of James's downfall. For the English people were horrified by the appalling cruelties dealt out by Chief-Justice Jeffreys, and by the licence and bloodshed which were tolerated. On top of all this, which James lifted no finger to quell, came the news that Catholics were being thrust into the places hitherto filled by Protestants in the Army, Universities and Legislature.

Reading the history of this time, which concluded with the trial of the seven Bishops, one is forced to the conclusion that James's fanaticism completely blinded him to the inevitable consequences of his own acts. In many ways, his tactics were similar to those adopted by Germany before and during the Great War, One is reminded of the witty neutral who, at the height of hostilities, was asked who he thought would win the war. He replied that on the whole he considered that the Allies



JAMES II.

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would be the victors: giving as his reason that, as the Germans had done their best to win and the Allies their best to lose, and as neither had attained their object, on the whole he thought that the Allies would win!

So blindly did James institute and continue the persecutions, so openly did he flaunt the constitution, so brazenly did he shut his eyes to the wishes of the people, that there could be only one end. And that end came with undignified flight and loss of his Crown.

What kind of a man was this, who sacrificed everything for one objective? Two questions require answers. Was James II. blind to the consequences of his policy? Was he an idealist, who recked nothing of the consequences, but considered any risk justified in pursuit of his object?

The answer to the first question must be in the affirmative. James was first and foremost a Catholic. He had fretted and fumed throughout the years when he had, forsooth, been powerless to put a spoke in the wheel of Protestantism. He had, therefore, no sooner mounted into the saddle than he went straight for his object, blind to anything but the achieving of this object.

I think that the second question likewise must receive an answer in the affirmative. James was an idealist and no practical man of affairs: no diplomat; not a monarch who could adjust differences or plan a campaign capable of modification. He was blinded to the consequences of his policy by an idealism which would brook no modification.

In James II. ran the streak of neurosis which had made James I. a useless invalid: which had lost Charles I. his head, but which had been smothered in Charles II. by some strange streak of Latin ancestry. In this last Stuart King there was no judgment; no living in reality.

His actions were adjusted to what he wished to see take place, and not to actuality. The adrenal dominance was out of control—there was no balance. He behaved much as a bull (and these animals have exceptionally

large adrenal cortices) who, without stopping to consider what will repay his efforts, charges blindly at the crowd. The post-pituitary in James furnished him with the dream, with the ideal, with the emotional object. The adrenal made it possible for him to try and obtain this object. But, without the balance which the anterior pituitary gives, judgment (which is nothing more than a measured balancing of probabilities) was perforce lacking.

James blundered, and blundered again: and continued to blunder until circumstances made it obvious, even to him, that his blunders had landed him in a dilemma from which the only escape lay in flight.

CATHERINE THE GREAT

Catherine II., Empress of Russia, is an excellent example of a woman who, although occupying an exalted position, and one demanding male attributes, yet remained essentially feminine. Her reaction to her position was very different to that of Elizabeth Tudor. A brief glance at her history will enable the reader to understand and explain her career.

Sophia Augusta Frederika of Anhalt-Zerbst, the daughter of a petty German Prince, was brought up in the simple manner of any ordinary provincial girl. She was re-christened Catherine on her marriage to the nephew and heir of the Empress Elizabeth. As a young woman, Catherine must have been amply supplied with "sex appeal." She had large, eloquent eyes, a dazzlingly fair skin, black hair, a straight nose, and a trim waist. There is no need to emphasise the large and varied list of her lovers: but, as this side of her character was never subordinated, some reference to this subject is inevitable.

We must picture Catherine as a woman first and a ruler afterwards. A cynical Frenchman has said that "woman is a pair of ovaries to which is attached a human being." As Catherine's character was entirely

Catherine II.

Impératrice de Russie.

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governed by her ovarian activities, this coarse aphorism is not altogether inappropriate to her.

In the language of modern times, she was over-sexed: and, as restraint in these matters was not popular in her lifetime, she indulged her inclinations to the full. Neither was there any damping-down of the roaring furnace when middle-life was reached. Catherine continued on the even tenor of her way, one lover succeeding another with almost monotonous regularity.

It is safe to assume that this Empress was well served by those glands which are essential to an active sex-life. In addition to the ovarian secretion, we know that the thyroid—although common to both sexes—is largely a feminine activator. The small but vitally important pituitary—which sits aloft in the recesses of the brain—contributes its meed to the sex-mixture. Indeed, without its help, even the ovarian hormone is unable to exert its influence in this respect. The fact that Catherine—almost to the day of her death—remained an active, though inconstant, lover, is ample evidence that there was no early failure of the glands regulating her sex-life.

Her essentially feminine nature is further shown by her gentleness and consideration to those serving her. Her kindness to servants was a by-word in a country where cruelty was still rife, and where the treatment usually meted out by masters to their retainers was barbarous and brutal.

But what about her maternal instincts? Was she merely a lecherous female, or was her burning desire accompanied by the tender emotions which should hallow and elevate such passion? She was, it is true, indifferent or even actively hostile to her son Paul: but there are three reasons for this. First, she was in ignorance as to whether her husband (whom she detested) was the father; secondly, the child was by no means certainly her own—he was taken away from her for six weeks immediately after his birth; thirdly, the baby grew into a most unprepossessing and unloveable child, and eventually

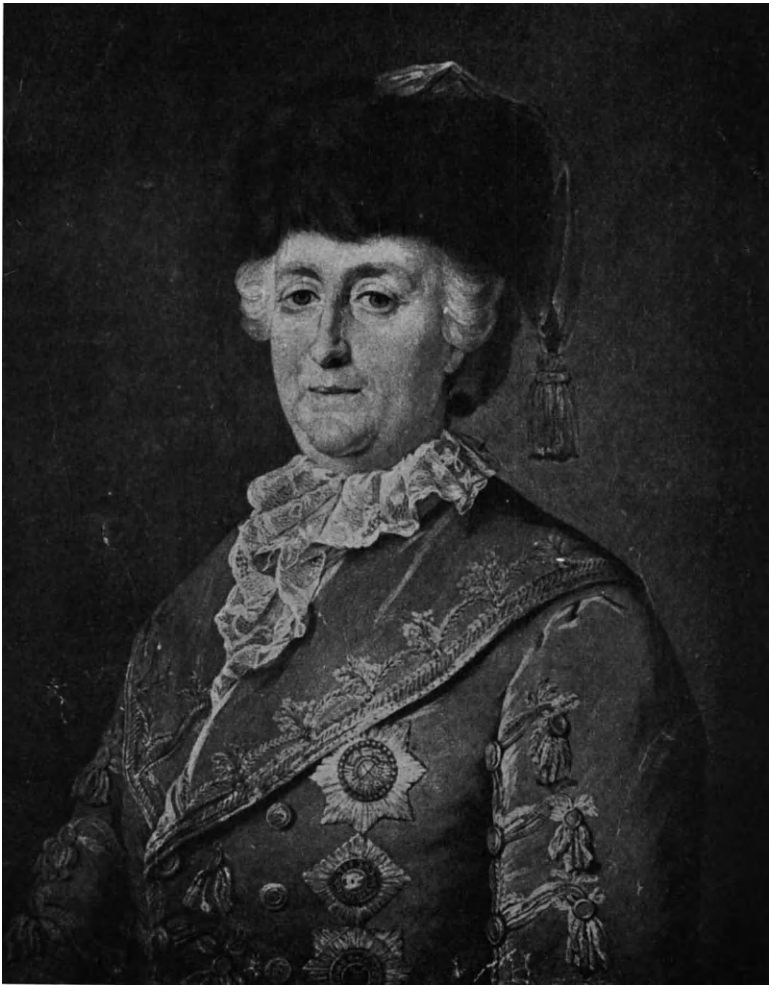
into a man who was constantly antagonistic to Catherine.

On the other hand, she was an adoring grandmother making up for her lost opportunities as a mother. Her attitude to her lovers in later life was, to some extent, maternal. Her earlier *affaires du cœur* were with men of the stamp of Gregory Orlov and Potemkin. Her later lovers—Zavadorski, Zovitch, Korsakof, Lanskoi, Yermolof and Mamonof—were mostly youths with nothing in common with Catherine. She tried to educate them, but never succeeded. One and all retired with vast fortunes and copious honours. Lanskoi alone died, so to speak, in harness: and for him his Empress and mistress wept bitterly.

So much did she grieve for his loss, that it was probably at least three months before she replaced him.

So far we have tried to explain only that side of her character which was responsible for her private life. Catherine, the Empress, showed other facets to the student of personality. There is a portrait of her on horseback. She is wearing a military uniform, and riding astride. Even these masculine attributes are unable to hide her womanly features; while the tight-fitting coat merely emphasises the essentially feminine figure.

Nevertheless, as Catherine aged, she developed a streak of hardness in her character. This ran side-by-side with her femininity. It did not usurp the place occupied by her womanliness, neither was it always in evidence. Probably it was seen most, as is perhaps natural, in her relations with neighbouring rulers. She proved herself a match for Frederick the Great, who was usually plotting to acquire territory, and who kept a wary eye on Catherine. She saw to it that, when the partition of Poland was arranged, Russia got her fair share of booty. She was never cruel, which possibly explains her dislike of war, and the fact that her campaigns were few and her reign not unduly sullied by the spilling of blood. Catherine was an autocrat not so much by inclination as by force of circumstance.



CATHERINE THE GREAT IN UNIFORM

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But she enjoyed power, and the desire to control the destiny of millions is seen again and again throughout her life. From the moment she seized the throne to the day of her death, she was scarcely ever thwarted. The one occasion, curiously enough, was when she proposed to marry Orlov. Her councillors gave her plainly to understand that they would not countenance this; that she might have lovers, but could not become "Mrs. Orlov." Catherine bowed to their will and, for the rest of her reign, put into practice the doctrine which they enunciated on this occasion.

How can we reconcile the character of Catherine the Empress with that of Catherine the Woman?

As she became older, it seems probable that the environment in which she lived demanded an increase of self-assertion and dominance; and that this was furnished by an increased output of the anterior-pituitary.

But this development produced little, if any, change in her features. The profile is an essentially womanly face. Even in uniform—which in itself imparts a masculine air—she remains feminine. Looking at the first of these portraits, one might well believe it to be that of an English lady of the eighteenth century, given to good works—a model wife and mother. There is, moreover, nothing devastatingly sensual in the features, nothing which would lead the observer to place her in the category of the sex-mad. It will be wise to remember, however, that she also lived in an age when licence was the rule, and that she had every opportunity to indulge herself.

At that time, Russia was an uncivilised and barbarous state, far removed—geographically and culturally—from the most polished court of the day, that of Louis XVI. The Russian nation consisted of peasants; a few officials; and a handful of Boyards, or nobles, most of whom were to be found about the Court of the Empress. Now, Catherine came into contact with the nobles only, if we except a few officials whom she met in the course of her duties as ruler. The life led by the average noble of that time in

Russia was one of lazy self-indulgence. The morals of that era were deplorable; and a sense of duty from the noble to his servant had yet to be born.

Into this atmosphere, then, Catherine had been pitchforked. She had found the Empress Elizabeth no better than the rest of her court: supporting countless lovers and usually more or less under the influence of alcohol.

Assuming, as we are justified in doing, that Catherine's endocrine make-up was on the lines of an over-acting post-pituitary and ovary, the environment in which she found herself at an impressionable age, was exactly the most suitable for the development of this side of her nature. Verily, a case of both nature and nurture!

NAPOLEON BONAPARTE

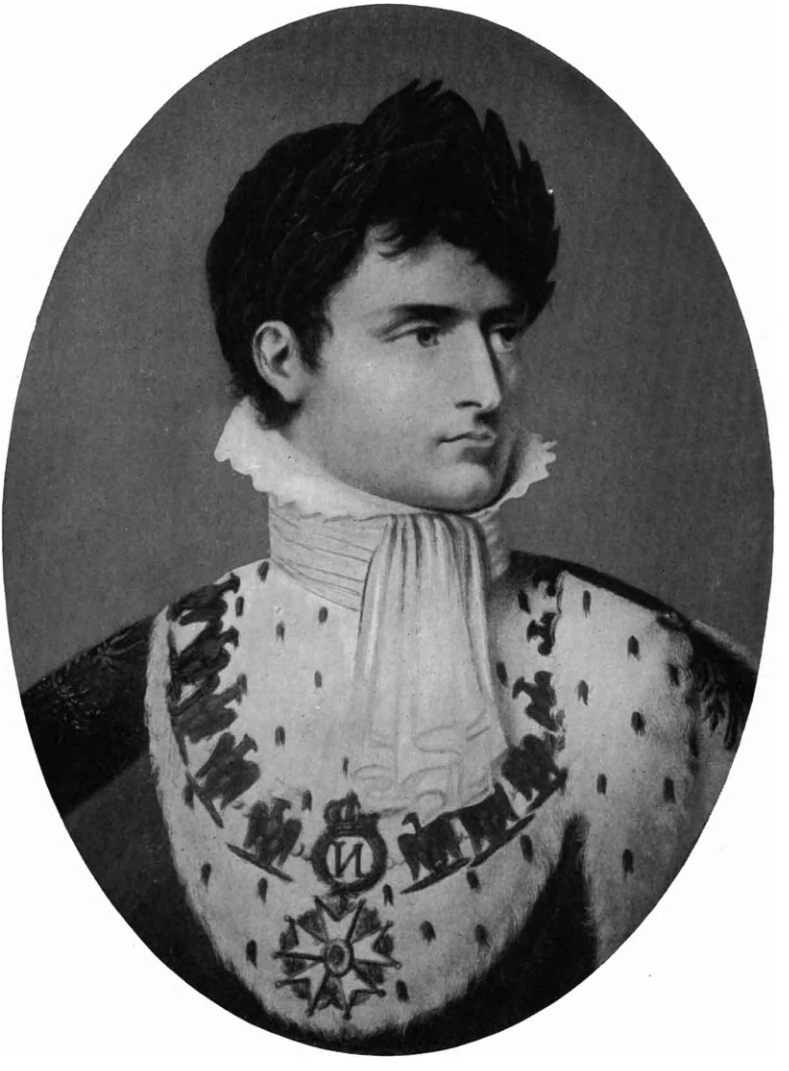
A study of Napoleon I. from the standpoint of endocrinology already exists in Berman's book.[1] It is, however, scarcely possible to omit him from any selection of the world's great men. A few points of interest are, therefore, referred to here.

Napoleon's parents give us little reason to anticipate that they would produce such a son. His father was a notary, living in Ajaccio. He was a man of literary tastes and some considerable intellect. From his mother, Napoleon inherited will-power, the ability to form quick decisions and the tenacity to adhere to these at any cost. It was due to her, with her wild Corsican blood, that he possessed that ruthlessness, amounting to cruelty, which made him trample his way over every obstacle, seeing only the ultimate triumph.

So much for his immediate ancestry. What about the man himself? Did he found an Empire merely because he was born at the right time and in the right place? Or was he a super-man, who was bound to have achieved distinction at any time and in any walk of life?

The reader must answer these questions when he has considered the following facts.

[1] "The Glands Regulating Personality," 2nd edition, pp. 269 *et seq.*



NAPOLEON I. IN 1805.

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Napoleon Buonaparte (as he himself spelt it) was a worker, an opportunist, and a man of almost irresistible drive. In addition to these assets he was well-read, had early specialised in the theory of military strategy, and had subordinated everything to success. He possessed that indefinable quality which makes for hero-worship, that power which stirs to enthusiasm the affections of those with whom he came into contact.

Look, now, at his portrait by Philippoteaux when he was in the early twenties : and bear this in your mind's eye when we are describing the condition of his body at the time of his death. We can agree that Philippoteaux's painting shows a distinctly attractive young man ; and, even if somewhat untruthfully beautified, there is no gainsaying that the subject is the possessor of expressive eyes, a straight nose, and a firm mouth and chin.

If we turn to the miniature by Chatellain, which shows the Emperor in 1805, we shall note the increase in the firmness shown by the lower part of the face. Here the eyes and nose remain much the same, but there is a determination—almost a grimness—in the lips and chin. If we study the portrait, two things stand out. First, the hair, which is plentiful, but with a suggestion that its texture is silky. Second, the well-marked eyebrows. In the miniature, while the hair on the head is still seen beneath the chaplet to be plentiful, the hair of the eyebrow (only the right is clearly shown) is markedly deficient in the outer-third.

The last of the three portraits of Napoleon shows him during his stay at St. Helena. This, a full-length view, is remarkable ; for not only does it offer an excellent profile, but it indicates clearly the pathological changes which had occurred in his body. The nose has become more aquiline, the mouth droops at the corners : while the fact that the Emperor has run to seed is shown by the double chin and the rotundity of the trunk.

As Napoleon's career is intimately bound up with his physical health, and with the changes which this under-

went during his life, it may be helpful at this point to refer briefly to his medical history. We shall, at the same time, stress those points which explain his character and illuminate his early and tragic end.

* * * * *

Two facts are invariably referred to in connection with Napoleon. The first is his stature—he was barely five feet in height; the second is the slowness of his pulse, which was usually about 48 (normal 60-76). It is said that he suffered from irritability of the bladder and that this (as may be expected) became worse as he grew older. Berman attributes this symptom, as well as the "nerve attacks" from which the Emperor suffered, to a derangement of the pituitary gland. It is known that this gland presides over the urinary function: and that the disease named *diabetes insipidus* (in which enormous quantities of urine are voided) is due to a disturbance of the same gland. Certain forms of headache, associated with frequency of micturition, are established as pituitary in origin.

When we consider that Napoleon's symptoms all fit in with the theory of pituitary disorganisation, it is, to say the least, suggestive when we find him short, running to fat of a "girdle" type, and sexually explosive.

I am therefore ready to agree that Napoleon was a pituitary personality, and that his physical condition, as well as his mental, hinged on the state of this gland.

Napoleon, like Pitt, led his fellow-countrymen, when little more than a boy. Both were at their most forceful, long before some individuals have given up skittles. The Emperor of the French made no mistakes worth mentioning, until he had been at his zenith for some years. The more one reads of his career, the more striking does this fact become. The logical conclusion is, then, that there was some physical cause why his powers should fail relatively early.

There can be little question that, just as Napoleon's

NAPOLEON I. AT ST. HELENA

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powers matured early, so did they reach their summit before middle-age. His physical symptoms became worse; he developed obesity; he lost that power of ready decision which had stood him in such good stead throughout his campaigns. At St. Helena, his mental outlook had changed so completely that he scarce behaved like the same man. He was sulky, indolent and indifferent; his chastity while at St. Helena is likewise explicable if we assume a failing pituitary.

The *post-mortem* report emphasises the amount of fat on the body; the thin nature of the cranial hair, and the almost complete absence of bodily hair; while it refers to the feminine nature of the trunk and to the delicate and white skin, changes which are to be expected when the pituitary secretion fails.

The earlier portrait of Napoleon suggests that he possessed thin but abundant hair. The condition of the hair at the autopsy is that of a pituitary type. The early failure of his thyroid is suggested in the miniature by Chatellain.

His subsequent career supports the belief that he suffered from premature thyroid and pituitary failure, accompanied by an early declension of the magnificent intellect which had raised him from a humble island to the highest throne the world has ever seen.

VOLTAIRE

The young noble inquired superciliously, "What is your name, Sir? Monsieur de Voltaire, or Monsieur Arouet?"

"My name begins with me, yours ends with you," was Voltaire's retort. We can picture the scene, which took place in the presence of Adrienne Lecouvreur. The aristocratic puppy, annoyed at encountering the bourgeois poet, and attempting to lower him in the eyes of the actress: Voltaire's quick wit arousing the Chevalier's fury. A few days later, Voltaire was attacked by roughs and soundly beaten in the presence of his rival.

François Marie Arouet was born in 1694, his father a notary, his grandfather a prosperous tradesman. He drifted into the profession of literature, having read law for a brief period at his father's wish. Look at his features, and, if you have ever seen a better combination of mischief and intellect, I should like to know where it is to be found. The profile shows to perfection the broad forehead, the well-developed nose, and the thin lips. It is a strong face, a courageous face, the face of a man of action and a thinker. And Arouet, who subsequently became Arouet de Voltaire—and for posterity, merely Voltaire—was both. The expression of the face, where the smile is deeper on the lips than in the eyes, indicates the character of the man who tumbled in and out of trouble, appearing unable to let well alone.

A poet and a playwright, he combined these often penurious pursuits with successful financial deals. His frequent libels, in which the Regent, d'Orleans, figured, led to his confinement in the Bastille and to his banishment from Paris. It was while he was in prison that he re-wrote his tragedy of *Œdipe*, which, on being subsequently acted at the Théâtre Français, made sufficient money for him to start a series of speculations.

In and out of France, banished and taking refuge in England; finally spending years in Switzerland, with one estate just in that country and another over the border in France (according to which way the cat jumped), the life of Voltaire certainly lacked no excitement.

Voltaire was a man whose intellect developed young, and whose emotions were violent. In his character was a cynicism which made him criticise much which his contemporaries took for granted. He wrote verses at the age of ten, which Ninon de Lenclos read. She left him two thousand francs in her will, with which to buy books.

His emotional life expressed itself in his fond attachment to the Marquise du Châtelet. His relations with

VOLTAIRE

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this lady are sufficiently remarkable to be worthy of comment. For some years she was his mistress, until, apparently, Voltaire's advancing years led to the fair Emilie taking another lover. With the frankness which characterised such relationships in the eighteenth century, she excused herself to Voltaire (who had caught her *in flagrante delictu*) by informing him that she loved him as much as ever, but that she must look elsewhere as well, for he could no longer satisfactorily fulfil the *rôle* of a lover. His remark, when the paternity of her child is under discussion, is typical of his cynical wit. "We will include the child among Madame's miscellaneous works."

At this time Voltaire was a little more than fifty years of age; and, we must assume that his sexual powers were already failing. But his physical activity, while it was undoubtedly on the wane, was by no means over. He speaks of himself as "an old man," although he is to live almost thirty more years—to return to Paris when over eighty and be received with enthusiastic acclamations.

His relations with Frederick of Germany (first when he was Crown Prince and subsequently when he had ascended the throne) were equally stormy. Voltaire was not destined to meet his royal admirer for some years after Frederick had commenced corresponding. Then they met. Eventually Voltaire went to Berlin and stayed for some years, which epoch was marked by continual quarrels, and not a few violent disturbances, caused almost entirely by the poet's quarrelsome disposition and jealousy of his rivals. With one exception these formed the basis of the upheavals which marked Voltaire's residence at Frederick's Court. This exception was a deal in securities, which, to put it mildly, was questionable.

What a curious character! A poet who had also the faculties which go to the making of a company-promoter; a literary genius who was so pugnacious that he was almost built like the Irishman who, on seeing two men

fighting, inquired, "Is this a private fight, or may anyone join in?"

For many years he strove for popularity, but failed to achieve it. Probably he received his greatest ovation, when, just before his death, he journeyed to Paris. His coach was stopped at the gates, and he was asked whether he was carrying any contraband. The erstwhile outlaw poked his head out of the carriage window, "I don't think, gentlemen," he remarked, "that there's any contraband here except myself!" When, subsequently, he appeared at the theatre, he was greeted with enthusiasm such as he had never before met with.

These incidents in a lively career are related to throw a limelight on the man. Poet, playwright, courtier, philosopher, champion of unpopular causes, speculator—what a number of different facets there are to his character! Yet, in one biography he is stated to have been the best example of a man who could stoop to conquer that the world has ever seen.

His exquisite literary style is admitted by all, the facility with which he acquired enemies is denied by none. *La Pucelle*, a satire, in verse; *Philippiques*, lampoons; *Œdipe*, *Artémise*, *Marianne*, *Brutus and Zaïre*, to mention only a few of his plays, give some indication of the work he had accomplished in his early manhood. Later works included *Le Mondain*, *Mériope*, *Mahomet*, *Le Siècle de Louis XIV.*, *Zadig*, *Dictionnaire Philosophique*, and *Irène*.

Voltaire, like Leonardo, was an indefatigable worker, and played more than one part on the stage of life. He was a serious playwright, and a less serious philosopher. But literature was his first love and his last. His output was colossal—his industry amazing. Sceptic and agnostic, he criticised the Church rather than doubted Christianity. Once, towards the end of life, he had approached a priest, but even then with irony. At the end he was refused Christian burial.

What kind of man was this? What physical basis was there for such a personality?

We can best attempt an answer by considering first his main characteristics. He was an artist. Here we have the influence of the posterior-pituitary. He was pugnacious, dogmatic, and quarrelsome—here is an anterior-pituitary influence, reinforced by a powerfully acting adrenal cortex. He was a diplomat—a man able and willing to adjust his point of view where it paid him so to do. A contradiction? And how does this last trait fit in with the pugnacity?

The warp and woof of his character contained a strong strand of acquisitiveness. He liked making money, and valued his offices at the French and German Courts more for their emoluments than for any insignia they might carry. When he could keep his pugnacity in control, when, in other words, his adrenal-anterior-pituitary combination was adequately checked by his posterior pituitary-thyroid secretion, then Voltaire the fighter was metamorphosed into Voltaire the courtier.

Au contraire, when the blood stream contained the hormones which filled Voltaire with choler: when they, in turn, had been stimulated by some criticism, by an encounter with some piece of intellectual buffoonery, then the glands which guided him to quiet consideration were swamped by opposing chemicals. Such occasions occurred when he compared Louis XV. with Trajan, in circumstances where his king could hear and appreciate the sarcasm; and when he faced Frederick of Prussia, defiantly announcing his proposed departure from Berlin.

His milder moods were those in which he helped and financed the poor on his Swiss Estate; when he appreciated the excuses of the Marquise du Châtelet; and when he broke down and wept at her death.

Truly a remarkable man, good sirs! A curious blend of the creative-feminine with the arrogant masculine. It was the masculine, however, which was uppermost.

THE EMPEROR OF ABYSSINIA AND SIGNOR MUSSOLINI

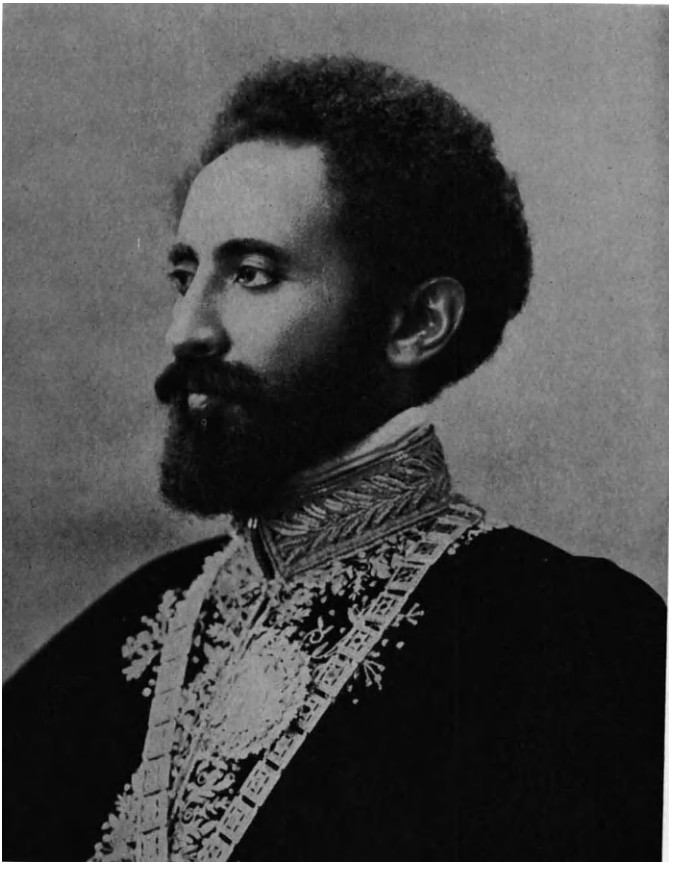
I

Two men, on whom the world's eyes are fixed. One, whose dynasty claims descent from King Solomon and the Queen of Sheba. The other, whose personality has raised him from the lowest rungs of the ladder to the Olympus on which a Dictator sits.

As we gaze on their features, perhaps we can catch a glimpse of their characters. Two very different individuals are portrayed. Even the angle from which they were photographed seems symbolic. The Emperor is looking—somewhat sadly—away into the far distance: attempting to visualise, it may be, the fate which awaits him and his country. The Italian Dictator stares straight into our eyes, giving us the impression that he is ready to contradict any statement we may make. There is something challenging, almost overbearing in the violence of the stare: which is not softened by the knit brows, the long upper-lip or the masterful nose.

Haile Selassié I., Emperor of Abyssinia, was born in 1891 and crowned in 1930. The blood which flows in his veins is partly Egyptian, with Semitic and Negro admixtures. His policy and achievements since his accession stamp him as a progressive, a humanitarian, and an idealist. Succeeding the dissolute Lij Yasu, he set about reforming the country, introducing social improvements on a European pattern, and abolishing slavery. The task can be no easy one, hampered as he is with barbarity and superstition.

The Emperor is of an ancient but mixed blood. One has only to look at his portrait to realise that his endocrine pattern is that so commonly found where negro blood is present. We know that a "pure" race is—with the possible exception of the Andaman Islanders, the Bushman and the Vedda—unknown. The northern parts of Abyssinia are mainly occupied by the Beja



THE EMPEROR OF ABYSSINIA

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tribes; further south we meet the Bisharin, Nerri, Amer and Hadendon. The blood of the Abyssinian is very mixed; and Haile Selassié I., so far as his portrait goes, shows evidences of the influence which a long line of ancestors inter-marrying with tribes of varying types would produce. There is, for instance, a strong negroid strain; and this alone would produce something of interest from the endocrine standpoint. In this way.

The original colour of man's skin was almost certainly black, from which state the white races were evolved. Because the skin becomes stained with pigment when the adrenals are diseased, it has been inferred that the white races are white on account of a sufficiently active adrenal system to keep the skin free from pigment.

If this be so, the negro is adrenal-deficient in comparison to the Nordic: and certainly his characteristics suggest that he may be poorer than his bleached brother in the other dynamic endocrines. The features of the Mongol, and, to a less extent, of the Negro, bear a striking resemblance to certain recognised endocrine types. Look at the picture facing p. 18 depicting a cretin, and, in your mind's eye, add pigment to the face. The broad nose, the prominent cheek-bones, the narrow eyes, the short, crisp, and brittle hair, are seen both in cases of thyroid deficiency and in certain coloured races. Now listen to a description of the South African Bushman.

"Hair commonly very short, becomes rolled up into small knots leaving apparently bare spaces between them, little hair on body. Skin yellow to olive . . . head very small, markedly low in the crown, mesocephalic: face flattish . . . prominent cheek-bones, bulging forehead, upper lip convex: nose extremely platyrrhine: eyes often narrow and slightly oblique: frequently no lobes to ear."[1]

The inference here is that this type, showing as it does features so akin to those seen in thyroid deficiency, must

[1] "The Races of Man," A. C. Haddon, p. 18.

be less blessed with this secretion than the white, tall, relatively large-featured European.

Another type of endocrine deficiency produces a face which, on account of the oriental cast of countenance, has been named "Mongolian." Now this particular lack always results in the same facial appearance, so presumably the underlying deficiency is invariably the same.

If we think, for a moment, of the characterisation of the white man, we shall see that he is almost certainly richer in thyroid, pituitary and adrenal secretions. With this handsome endowment, therefore, he is enabled to carry through tasks requiring mental and physical energy, which are quite beyond the capacity of his darker brother.

To return to the Abyssinian Emperor. The hair is plentiful, wavy, and commences high on the forehead. This type of hair, which ethnologists know as Cymotrichy, is characteristic of (amongst other regions) north-eastern Africa. The eyes are, as is commonly found in this part of the world, almond-shaped. The eyebrows are low, and the body ridges above are not well marked. The nose is semi-aquiline, with only a slightly marked root.

The lower part of the face is hidden by hair: but the chin is pointed, and the jaw orthognathous.

These facial characteristics are consistent with what is known of his policy and achievements. Compared to the more virile type found in Europe, the Emperor is, in all probability, more dominated by his posterior-pituitary than by his adrenal gland; while his anterior-pituitary is relatively deficient. Such an individual is swayed by emotions, feels pity for the oppressed, and sympathy with the suffering. Of more than average intellect, drive, energy and physical stamina are less pronounced.

II

The physiognomist could scarcely choose two types varying more widely than the leaders who form the

SIGNOR MUSSOLINI
(IL DUCE)

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subject of this sketch. Almost every feature in the two differs. Their characters and their records are also widely different.

Il Duce has achievements to his credit which are little less than miraculous: and there will be no disputing that his accomplishments are those of a superman. Like Napoleon I., he arose in the aftermath of an upheaval, to find his nation shattered and unstable. Like Napoleon, he reorganised and improved, built roads and made laws, governed and controlled—single-handed. Like his great prototype, he has been ruthless and cruel, dogmatic and stubborn. In company with Napoleon, he possesses the attribute of inspiring the most profound, national, worship. "We will follow you, Duce, wherever you lead" is to be seen written on walls throughout Italy.

As I write, with Mussolini's portrait facing me, I think I can understand the humble devotion which his leadership inspires. For, however much we, in the twentieth century, may prate of internationalism, may tell each other that nationality sets up barriers which are the ruin of modern civilisation, in our heart-of-hearts we are whipped to enthusiasm by anything which exalts the possessive, whether it concerns our homes or our country. William James said that a man's "ego" includes himself, and everything implied by that term, his wife, his lands and his bank balance. In this we may include his country.

Now, Mussolini has aroused the wildest patriotism by his avowed intention of restoring Italy once more to her former glory. In a street in Rome are four maps which he has installed, showing the size of the Italian possessions from the original city to the present day.

Il Duce understands mass-psychology. He is astute enough to realise that any figure which a populace is asked to worship and to follow blindly, can never be too impressive. I have heard it said that his recent "ten commandments," in which he states that "the Duce can do no wrong," are a sign of a commencing psychosis. I doubt it. Men of his calibre do not suffer

from megalomania unless they are in failing health, and Mussolini shows no signs of this. Rather are his recent actions those of a leader who has made his plans: and, realising that he, and he alone, is responsible, is using every means in his power to increase his prestige.

What of this superman, the first and most amazing of the post-war dictators? What has raised him from the ranks to autocracy? Let us see if we can answer—at all events in part—these questions.

The Italian is, ethnically, largely of Mediterranean stock, with many admixtures from Africa in Mesolithic and Neolithic times; but most of the intruding types have themselves been of Mediterranean origin. Il Duce is dark, his hair originally black, the deep colour of his eyes emphasised by the overhanging and curling eyebrows. His stature is short, his figure broad. Of recent years, his girth has increased so that he now has a distinct *embonpoint*. This is so often (as in the case of Napoleon I.) an early sign of endocrine failure. And when this happens, the mental acuity diminishes to the point where judgment becomes mediocre. Time alone will show whether Mussolini's actions in the critical year of 1935 were due to a long-sighted appreciation of the results of such actions, or were an early indication of glandular failure.

The portrait here reproduced is a recent one, and certainly gives no suggestion of a wavering purpose. Rather is he regarding one, as one imagines a bull would, if one strolled through his field arrayed in an old school-tie composed entirely of scarlet. It is, I believe, in keeping with his character that he should intentionally exaggerate those features which modern slang includes in the term, "he-man." He realises the value of appearing always as the ruthless ruler, determined to lead his people to a glorious future—whether they like it or not.

From the endocrine angle, Mussolini is an anterior-pituitary dominant, supported by a powerfully-acting adrenal gland, and a thoroughly efficient thyroid. Is he, however, going bald? Is there a failure of growth

of eyebrow ? I doubt it. Possibly, he has shaved his head, to emphasis the power expressed in his forehead : from the picture it appears that the eyebrows are still hairy, although there is a slight suggestion of hair-failure in the left eyebrow. Power is expressed in the markedly prominent bony ridges over the eyes : in the long, large nose, in the prognathous jaw. The lips are full, but firm : the cheek bones not unduly prominent.

This is the face of a man whose dynamic endocrines are still in full swing, who shows none of the wavering which characterises glandular eclipse. He may be right in any particular decision, or he may be wrong. But, such a man believes in himself and carries out his decisions to the bitter end.

When a powerful anterior-pituitary (giving its possessor, as it does, a supreme self-confidence) is not controlled by the more feminine posterior-pituitary : when it is supported by the masculinity provided by the adrenal system, and reinforced by the stimulating secretion of the thyroid, we have the ingredients which are necessary for a Dictator. Such a man can make use of an opportunity, can kick the football when it rolls towards him.

For success, it is needful for a man to believe in himself, but it is also necessary for him to possess the power of imparting his belief to others. When he can do this, he is capable of initiative, of inspiring others with a belief in his powers, and of carrying out his ideas, converting the theoretical into the practical.

Such a man, or I am very much mistaken, is Signor Mussolini—Il Duce.

CHAPTER VIII

CONCLUSIONS

A FEW points remain for consideration. Among these is the question of heredity, and how far it can be said to affect the glandular pattern of an individual.

I have no wish to embark upon a discussion of the relative importance of nurture and nature; as I feel sure that there are already ample grounds in this book for criticism. It is, however, necessary to stress one fact, which is that characteristics depending upon the internal secretions are often traceable through several generations. Thus—a cretinous child may have a mother who has a history of thyroid instability. A boy with pituitary overgrowth may belong to a family numbering many tall people among its members. A tendency to pancreatic instability, showing itself in a proneness to diabetes, is known to run in families.

Only in some instances, however, is this true. Many individuals exhibiting endocrine abnormalities, emerge —so far as can be ascertained—from normal and ordinary stock.

A second consideration, which follows on the first, is concerned with the question: How much is the endocrine pattern affected by climatic conditions? While it is conceded that "growing organisms tend to display a symmetrical repetition of equivalent parts," it may be interesting to refer briefly to some facts which bear on the question of environmental influences.

It is known that the broad nostrils of certain races are associated with hot, moist climates. The narrowing of the nasal apertures, found in the inhabitants of colder regions, facilitates the warming of inhaled air. The

medium noses (mesorrhine) are found in temperate climates.

We have already referred to the skin-pigment as showing a relative failure of the adrenal system. If we look at it from another angle, we may inquire why skin-colour is distributed exactly as it is. So far as the Old World is concerned, the skin is darker towards the equator, becoming fairer as the distance from the equator increases.

This is not the rule in the New World. It is possible to explain the many exceptions to be here found by assuming that the inhabitants of the regions have been insufficiently long in their habitat for the climatic conditions to have taken effect. "It rather seems that the various physical features (however and wherever they have been attained) may have taken a definite direction for so long a time that modification in an opposite direction has become impossible. We may conclude that variations in pigmentation arose spontaneously independently of the action of the environment, at a period perhaps when variability and mutations were more prone to occur, and that the deeply pigmented individuals, being more fitted to sustain tropical conditions at length, outlive the rest . . ." (Haddon).

À propos of environment, another quotation from the same source: "A people may be temporarily dwarfed by unfavourable conditions of life, but they increase in stature when the conditions are improved as is shown in the case of the Limousin district in France."

Now, the cast of the features as well as the stature and the skin-colour is determined by the endocrines, making due allowances for the environmental factors which act upon them. Sunlight tans some individuals a rich and envious mahogany brown. Others react by an unsightly freckling; while yet others blister, suffering tortures in a good cause. That wily organ, the pituitary, has a good deal to say on this subject; and it is due to one of the hormones elaborated by this gland that one Adonis tans while his rival burns. But not alone to this organ.

While it is believed that a pituitary secretion stimulates pigment formation, it only does so in conjunction with other hormones. Presumably it is the particular reaction of his thyroid and adrenal glands to the activities of the pituitary, which the blistered neophyte may justly blame. Individuals whose thyroid secretion is temporarily deficient—and such a condition is not unknown during pregnancy—are apt to develop patches of pigment, which clear up when the strain from which their endocrines are suffering is relieved.

Nature and nurture . . . Heredity and environment. What is handed down by the race, is modified by circumstances. But, let us remember, when we are thinking about these problems, that " it is now practically certain that characters acquired by the mortal body are not inherited." (Conklin.)

T. H. Huxley once asked, " If a little knowledge is dangerous, where is a man who has so much as to be out of danger ? " If we are ever to understand the complete workings of the human body, theory must be allowed its lawful place, and legitimate speculation must precede certainty.

The many systems of the human body, although interrelated, yet have a certain autonomy of their own. They are combined in the most wonderful of machines, the workings of which fascinate at the same time that they puzzle. Endocrinology has opened up a fresh field, and is already throwing light upon many a hitherto dark spot.

EPILOGUE

MAN begins life as a small helpless mass, dependent upon the efforts of others. He grows up, through boyhood to adult life, gradually altering as his environment shapes him. When fully grown he faces life, equipped with a mind and body which represents the action of nurture upon nature.

This book has attempted to outline the physical side of character; and to stress the many chemical factors which determine the individual. A knowledge of the forces which shape our destiny brings home to us that we are verily the playthings of circumstance. It should—and I think it does—generate in us all a tolerance to the shortcomings of our associates, a realisation that we are as we are largely on account of the physical basis upon which our personalities rest. It should stimulate endeavour so that, sooner or later, we can improve the genus *homo*, avoiding those disorders which cripple mankind; until, in the words of Francis Bacon, "so every defect of the mind may have a special receipt."

GLOSSARY

Anabolism. Constructive metabolism.
Autocoid. A term suggested to include all the internal secretions, both those which stimulate and those which inhibit.
Autonomic. The term is applied to that part of the nervous system which is divided into sympathetic and para-sympathetic.

Bufo agua. A toad found in the Upper Amazon, the skin glands of which secrete epinephrine.

Cardiac insufficiency. A partial failure of the heart's action.
Castration. Removal of the male or female generative glands.
Catalyst. A chemical body which, by its presence, is capable of inducing chemical changes in other bodies while remaining unchanged itself.
Caucasian. A racial type found in Europe.
Cerebrospinal fluid. A fluid which is found in the ventricles of the brain and spinal cord.
Chalone. A secretion which inhibits.
Chromaffin system. Tissue found in various parts of the body (principally in the adrenal medulla) which stains with chromaffin salts.
Colloid. Glutinous; uncrystalline.
Corpus luteum. A part of the ovary.
Cortex. A bark or rind. In anatomy, it signifies the outer layer of an organ.
Cretin. A child suffering from thyroid deficiency.

Dementia præcox. A form of adolescent insanity.
Dysthyroidism. A condition in which the thyroid acts in an unstable manner.
Dystrophia-adiposogenitalis. A disease in which obesity is associated with under-development.

Endemic. A local disease, as distinguished from an epidemic or sporadic disease.
Endocrine. Pertaining to the organs of internal secretion.
Endocrinology. The study of the organs of internal secretion.
Epidermis. The cuticle or outer skin.
Epinephrine. Another name for adrenalin.
Erosion. An eating or gnawing away; a form of ulceration.
Ethiopian. Descriptive of one of the divisions of the human race, including the Negro, Bantu, and Negrito peoples of Africa.

Ethnology. A science of the natural races and families of men.
Eunuchoidism. A state resembling that found in eunuchs; used also to describe a congenital state resembling the acquired condition found in eunuchs.
Eunuchs. Emasculated men.

Freemartin. A name given to the female of the bisexual twins of cows.

Ganglion. In neurology, a subsidiary centre in the nervous system. A nodular enlargement consisting of an aggregation of nerve cells, that receives and sends forth nervous impulses and serves to stimulate organic and psychical action.
Gigantism. Abnormal overgrowth, the result of disease of the pituitary body.
Goitre. Enlargement of the thyroid body.
Gonads. From the Greek word "seed." The generative tissue of the sexual organs.
Graafian follicles. Small spherical ovarian bodies containing ovum.
Graft. The implantation of tissue or glands.

Hibernation. The winter sleep which takes place in certain animals.
Hindu. A member of the native Aryan race.
Hormone. A secretion which excites.
Hyperadrenia. Over-action of the adrenals.
Hyperpituitarism. Over-action of the pituitary body.
Hyperthyroidism. Over-action of the thyroid.
Hypoadrenia. Deficient action of the adrenal gland.
Hypopituitarism. Deficient action of the pituitary body.
Hypothyroidism. Deficient action of the thyroid gland.

Katabolism. Destructive metabolism; the processes by which waste products are produced.

Lactation. The secretion of milk.
Larynx. The organ of voice.
Lateral. Pertaining to a side.

Mandible. The lower jaw bone.
Mediterranean type. One of the sub-divisions of the Caucasian race.
Medulla. The inner portion of an organ.
Melonochroi. The dark-skinned sub-division of the white or Caucasian race.
Mendelian. Relating to or in accordance with the Mendelian principle of heredity in hybrids.
Metabolism. The change produced in a substance by the action of living cells upon it.

Mongol. The yellow straight-haired people of Asia. Used also to describe a certain type of idiot, where the features resemble those found in the Mongolian races.
Morphology. Morphology is the branch of biology that treats of the form and structure of plants and animals.
Myxœdema. A cretinoid disease, characterised by atrophy of the thyroid gland.

Negrilloes. The African Pygmies.
Negritoes. The Asiatic Pygmies.
Negroid type. Resembling or related to Negroes.
Neurasthenia. Functional derangement of the nervous system, with depression of the vital forces.
Nordic. A term used to describe a race of tall, blond people, inhabiting Scandinavia, Scotland and Northern England.
Nurture versus Nature. A phrase used to indicate the difference between the influence of environment and that of heredity.

Pancreas. A gland connected with the alimentary canal.
Parasympathetic. A division of the autonomic nervous system.
Pelvis. A bony girdle or basin by which the lower limbs are joined to the body.
Physiology. The science of organic functions.
Pituitary. A small rounded gland situated within the cranium.
Pituitary personality. An individual supposed to be dominated by the influence of his pituitary gland.
Pre-pubertal. The epoch before puberty.
Psychology. The science of the human mind or soul, its activities and capacities.
Psychosis. Insanity.
Pygmy. A member of the race of dwarfs found mainly in the region of the Equator; a term used to denote any very small individual.

Scurvy. A disorder of nutrition, produced by lack or deficiency of vitamins.
Secretion. The process by which materials are separated from the blood and elaborated into new substances.
Sella turcica. The pituitary fossa.
Skoptsi. A sect in Russia whose devotion to chastity induces them to practise emasculation.
Sphenodon. A lizard-like reptile.
Sporadic. Occurring here and there, not widely diffused.
Stasis. To stagnate. Stoppage of a flow of blood or waste matter.
Status lymphaticus. A morbid state associated with excessive production or growth of lymphoid tissue, and enlargement of the thymus.
Subjective. Not perceptible to the senses of another person.
Subpituitary. The same as hypopituitary.
Subthyroid. The same as hypothyroid.

Suprarenal glands. Glands situated above the kidneys: an alternative term for adrenals.
Syndrome. A complex of symptoms.

Tetany. A disease characterised by painful tonic and symmetrical spasms of the muscles.
Thymus. A gland situated in the upper part of the chest.
Thyroid. Literally "a shield." The name of the cartilage which surrounds the larynx. The gland attached to this cartilage is one of the most important ductless glands in the body.
Thyroid personality. A type of personality dominated by the influence of this gland.
Thyroxin. A substance isolated from the thyroid.
Toxæmia. Poisoning by toxins produced in the body cells, or by the influence of micro-organisms.
Toxins. Any poisonous albumen produced by bacterial action.

Ventricle. Any small cavity. There are ventricles in the brain. The word is also used to describe two of the heart's cavities.
Virility. The normal reproductive power in one of the male sex.
Vitamins. Chemical substances necessary to normal growth and health. Of recent discovery. Several vitamins have already been recognised.

Xanthochroi. The blonde, blue-eyed peoples of Caucasian blood. Huxley's second division of the Caucasian race.

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