SPEECH AND VOICE

Their Evolution, Pathology and Therapy

Leopold Stein

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SPEECH AND VOICE

THEIR EVOLUTION, PATHOLOGY AND THERAPY

by

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WITH A FOREWORD BY

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FOREWORD

BY J. R. REES, M.D.

It is indeed a privilege to be associated with this book, which will certainly be recognised as setting new standards in the scientific approach to speech problems.

Like every other psychiatrist who is called on to deal with neurotic and allied difficulties in children and adults, whether in peace or in war, I am frequently puzzled by the speech problems which present themselves. Much of the speech therapy of the past has been unsatisfactory because of its emphasis upon the purely mechanical aspects of the condition, while at the same time the purely psychological approach has not been sufficient to lead to satisfactory and radical treatment.

Throughout this book Dr. Stein gives us evidence of his wisdom in combining the two approaches, and by setting out the basic pathology of the various conditions he throws a flood of new light upon them.

It is fortunate, I think, that this book should appear now, during the war, when so much of our technique and methods is in the melting-pot. This work will lead to advances in this particular field of medical and educational work.

J. R. R.

May 1942.

PREFACE

> "A man should never be ashamed to own he has been in the wrong, which is but saying, in other words, that he is wiser to-day than he was yesterday."
>
> DEAN SWIFT
> *Thoughts on Various Subjects*

This book has a curious history. For more than twenty years I had been treating disorders of speech and voice and had become convinced that the Viennese School of Speech Therapy was right in reading the *Book of Speech*—to use George Meredith's words[1]—"by the watchmaker's eye in luminous rings eruptive of the infinitesimal." When I came to this country I found many excellently trained speech therapists practising our young science with much ardour, sympathy and—not least—intuition. The English and American textbooks supply a considerable volume of facts, "raising in bright relief minutest grains of evidence;" and though among them I found many that I had previously overlooked or neglected, it seemed to me that the collection of facts had gone ahead of the comprehending of them within a suitable coherent unit and of their elucidation.

While still pondering how to remedy this condition, I was greatly encouraged to set to work by Dr. Boome, Miss Baines and Mrs. Harries, who in their book *Abnormal Speech* express the view that "the centre of Speech Therapy is now here." I felt, however, that it would be better not to contribute to the efforts already made by speech therapists in this country by grafting on to existing ideas those that I had brought with me. Convinced that theoretical knowledge in itself is of no account unless methods of practical application can be deduced from it, I had to find a basis on which our diagnostic and therapeutic endeavours could be consolidated.

The right outlook can, to my mind, be attained only by realising that the data provided by the evolution and development of Speech and Voice are those from which we may best hope that our efforts to understand and to help will achieve success.

This book is far from being a translation of my former articles and books. The broad outlook of this country and its liberal but cautious methods have shown me a better approach. My concepts have undergone a further integration which, as will be seen in such chapters as those on the Evolution of Speech, Dyslalia, and Stammering, justifies, I think, this attempt to write anew on these matters. Other chapters, as for instance, those on voice disorders, and on Rhinophonia, are based on my former papers and books as no considerable advances have been made recently.

I have maintained an eclectic point of view in so complex a matter as speech and its changes, but I have not included many valuable findings that do not seem to contribute to a solution of the *problems*

[1] *The Egoist*, Prelude.

with which we are faced. To my mind eclecticism should be applied in such a way as to show that "between the most opposite beliefs there is usually something in common—something taken for granted by each; and that this something, if not to be set down as an unquestionable verity, may yet be considered to have the highest degree of probability." [1]

This book is not and cannot be regarded as an Encyclopedia of Speech Pathology. To give it the character of a handbook would, in view of the multitude of contributions, exceed one man's powers. Nor can it supply the special knowledge that must be presupposed in order to understand one of the most complex responses of mankind. In the *Book of Human Speech* there is "a constant tendency to accumulate excess of substance, and such repleteness, obscuring the glass it holds to mankind, renders us inexact in the recognition of our individual countenances." [2] And—to avail myself once again of Meredith's words—this is what I have learnt from the great thinkers of this country, that the *Book of Speech* needs a "powerful compression" to give us "those interminable mile-post piles of matter . . . in essence, in chosen samples, digestibility." [3]

Every effort has been made to point out the basic mechanisms of those organ systems which carry out speech-patterns. This aim, however, created a difficulty in that the concepts of speech and its deviations must naturally be based on ideas elaborated by branches of knowledge serving us as auxiliary sciences. I have tried to overcome this, and hope I have kept the golden mean in giving the essential data. If desirable details appear missing to some it is for this reason.

Some subjects have been given preference on account of their import in treatment, e.g. Stammering and Dyslalia. If some seemingly equally important items are comparatively short, it is either because we know nothing more about them or because what is known lacks, to my mind, probability, the correlation of the facts not having been cogently established. Other chapters, such as that on the evolution of language, may appear perhaps rather aphoristic or arbitrary, not because there is not enough knowledge but because to explain the data provided by sciences such as Comparative Philology would lead us too far afield. The relevant examples given are designed to induce further study with which the writer himself is profitably occupied. Books which the reader might find useful as an introduction to the specialities concerned are mentioned in the Bibliography.

I have endeavoured to do justice to the demands made of the candidates in this country for qualification in Speech Therapy. This has necessitated the frequent use of simple examples, pictures and similes. I have taken care to keep the happy medium between common parlance and scientific modes of expression. This 'Socratic method' has been adopted because both the layman and the scientist must try to discover "which of our terms are undefined or partially defined

[1] Spencer, H. (1880). *First Principles*, H. M. Caldwell, New York–Boston, p. 7.

[2] Meredith, G., l.c.

[3] Ibid.

or draggled with fringes of connotation" [1] so as to reach a *common* basis of understanding.

This book may also serve as a guide for all who are concerned with child welfare and education. It is a book for the nurse, teacher, psychologist and singing master. Doctors may also find subjects in the book which should be of use in their daily practice.

This is a personal confession. Reference is therefore made only to those workers whose findings seem to support my views. Thus the Bibliography is necessarily somewhat arbitrary, for I have tried to avoid controversies which would not be compatible with our pragmatic line of thought. Therefore, eminent writers are not quoted who "tell quite a different story;" . . . "it is mine, not theirs, I am trying to tell in such wise as to render it, if I can, at least comprehensible." [2]

I am conscious that at the present stage of our knowledge my explanations can be only tentative. But having learnt from experience that my improved method of approach has enabled me to help my suffering fellow-men, I feel no hesitation in setting out my principles and practice for the consideration of all workers in this field. If they gain from my mistakes, my aim is achieved. And finally, "there is no book so bad but something good may be found in it." [3]

I should not have been able to undertake this work without the previous knowledge gained in years of collaboration with my teacher, Prof. Fröschels. If in many respects I follow my own way and directions taken from workers such as W. Meyer-Lübke, Hughlings Jackson, Alfred Adler, M. Seeman, and others, he will now understand that it is the natural and inevitable course of spiritual integration.

Substantial progress in knowledge I owe to the manifold help I have received in this country. I owe an especially great debt of gratitude to the Directors of the Institute of Medical Psychology (Tavistock Clinic), London, for having offered me the opportunity to work and to verify my ideas. Discussions with the members of the staff have contributed much to my work.

I have received much encouragement, too, from my work at the Central School of Speech Training and Dramatic Art, from Miss E. Fogerty's friendly support in my teaching and searching and her never-flagging interest, and from the friendly spirit of the Association of Teachers of Speech and Drama. Not least I feel I must express my profound thankfulness to John S. L. Gilmour. Our many discussions on questions of genetics, classification, phylogeny and epistemology have not only been a source of intellectual stimulation, but have also helped me to master the subtleties of the English language. Others, especially Mrs. T. L. Gilmour, Miss Baines, Dr. D. Murray, Mr. McNae, and Miss Bennett have helped me greatly over questions of English diction. The latter and Dr. H. Fleischhacker bestowed many pains

[1] Bloomfield, L. (1939). *Linguistic Aspects of Science*, The University of Chicago Press, Chicago, p. 46.

[2] Lloyd Morgan, C. (1929). *Mind at the Crossways*, Williams & Norgate, London, p. 94.

[3] *John O'London* (no date). *Treasure Trove*, George Newnes Ltd., London, p. 28.

upon discussing the whole subject with me. I wish to thank Mr. C. Joliffe for the diagram on p. 181.

I should like also to pay tribute to Messrs. Methuen & Co. for publishing the book in these troublous days.

Many friends who have supported and helped me in this work prefer not to be acknowledged publicly. One who has been working for many years in this sense is my faithful wife, who in good and evil days, in joy and sorrow, has sacrificed all her personal interests unmurmuringly on my behalf. To her I owe my greatest debt.

L. STEIN

KEW, *July* 1942

CONTENTS

CHAPTER I

GENERAL PRINCIPLES

For many thousands of years men have been living together in communities. A community, by its very nature, implies the existence within itself of certain links which connect the individual members with one another. One of the most outstanding of these links is communication by means of sounds, known as 'language' or 'speech.'

The terms 'language' and 'speech' are so familiar that the ordinary man may think it unnecessary to give them any deeper consideration. He may assume that they are part of the make-up of every normal person, here for him to use, just as he does any other tool; and he attributes to them certain qualities such as goodness, badness, beauty, and so forth.

However, when he finds his tool proving inefficient, he is faced with the necessity of seeking some means by which he can improve it. During this process he may awaken to the fact that language *is* a tool, a tool which needs handling, and that this necessitates some knowledge of its structure. Take, for example, the man who tries to make himself understood in a foreign land. He may, because of this experience, ask himself, "What is language? What is speech? What is articulation?" These questions do not then seem to him so superfluous as they did before he encountered this difficulty in his own life.

He may then begin to observe aspects of language which until then he had taken for granted. He learns to distinguish sounds, letters, intonation, and so forth. Having separated them and named them he assumes at last that he has grasped the nature of his tool. But to his astonishment he finds still that he cannot handle it as he would or use it to accomplish his ends.

This experience may lead him to the conclusion that knowledge based only upon outward observation does not gain for him an understanding of the real nature of the thing itself. To take an example: he who merely sees the various parts of a locomotive—the wheels, axles, etc.—cannot be said to have a knowledge of the locomotive itself until he recognises some relation between all its different parts. Put into scientific language: "The ordering of the mass of experience into a special kind of structure or system is at once the principal aim of thought and the measure of its advance." [1]

Desiring in this work to avoid any pitfalls in clipping together the given sense data, let us not take anything for granted but begin on the very simplest level of thought and try to learn as many facts as possible, and to arrange them in an orderly manner. How can this be done?

In our endeavour to find a simple basis from which to start, we must look for that which lies *behind* the vague and hazy idea which is

[1] Blanshard, B. (1939). *The Nature of Thought*, Allen & Unwin, London, i, p. 67.

presented to our thought by the word 'speech.' Having done this, what do we find? Beings like ourselves who act and behave in certain ways and in so doing exhibit certain phenomena which can be perceived by the senses of sight and hearing.

What then could be simpler than to examine the conditions under which these phenomena arise? Since we are convinced that the phenomena in question have some sort of significance and we have started to find a method by which they can be handled, we shall be forced to submit the interpretation which we give to them to some test as to its usefulness or practicability. "A true scientific theory merely means a successful working hypothesis. It is highly probable that all scientific theories are wrong. Those that we accept are variable within our present limits of observation. Truth then, in science, is a pragmatic affair. A good scientific theory accounts for known facts and enables us to predict new ones, which are then verified by observation. . . ."[1]

"This atmosphere of provisional hypothesis and practically verifiable statements constitutes what has been called the 'homely air' of science, and is one of its great charms. Science has adopted the pragmatic criterion of truth, namely, success, and as a result science has been successful."[2]

Here we must make clear what it is that characterises a tool as useful or successful.

The history of the development of mankind shows us that at each stage man has been faced with the necessity of mastering the circumstances in which he has found himself, in other words, of adapting himself to his environment. Step by step, sometimes partly by what seemed to be mere chance, he has discovered means for accomplishing this task, and has rendered these means more effective by detecting new and better methods.

The familiar things of everyday life, such as pens, motor-cars, or spoons, are what they are because of a gradual process of development. We are justified then in regarding tools and machines as mere extensions or developments of the handling organs of those who have made them. Can we not also infer that their mode of working is similar? This is the more likely as, when closely examined, new phenomena usually prove not to be complete innovations but a further evolution of something already existing.

When we examine these familiar objects carefully, we discover a complex mass of impressions (phenomena) with which our minds are quite unable to deal. We instinctively wish to examine something simple enough to be comprehensible. For example, some one interested in motor-cars naturally wants to understand its engine. His teacher, therefore, will introduce him first to a less complicated type of engine; thus the process of simplification has been accomplished.

How can we apply this method in attempting to establish a theory of speech and its variations?

The answer is that we must look to nature. We must see how

[1] Sullivan, J. W. N. (1938). *Limitations of Science*, Pelican Books, p. 206.
[2] Ibid., pp. 212–13.

nature has built up the process of speech, and this will necessitate investigation in a new direction. Our investigations are therefore given a new orientation. " The aim of a scientific theory is to present a system of propositions logically connected, which system must be an expression and a classification of natural laws." [1]

We should remember, however, that a ' natural law ' is not something in itself, but only the *symbol* or outward expression of the nature of reality, the actual structure of things.

" We are no longer required to believe that our response to beauty, or the mystic's sense of communion with God, have no objective counterpart. It is perfectly possible that they are, what they have so often been taken to be, clues to the nature of reality. Thus our various experiences are put on a more equal footing, as it were. Our religious aspirations, our perceptions of beauty, may not be the essentially illusory phenomena they were supposed to be. In this new scientific universe even mystics have a right to exist." [2] All sciences dealing with speech are legitimately concerned, therefore, with such things as beauty, ease of expression, and so forth, and even mystical abstractions such as the feeling of ' grace ' may play their part.

[1] Lauwerys, J. A. (1938). " Scientific Instruments," *Proceedings of the Aristotelian Society*, **38**, p. 236.

[2] Sullivan (1939), pp. 186–7.

CHAPTER II

DEVELOPMENT AND EVOLUTION

Fortunately the procedure employed by the scientists who have been elucidating the general principles of development provides us with what we need when confining our investigations to language and speech. This is a great help, since speech and voice pathology is still at a comparatively early stage of development. Material from which the framework of this science may be constructed has still to be collected.

Since language and speech are so essential a part of human behaviour let us try to understand how this has come about. The view is no longer held that the world has become what it is by an instantaneous act of creation, but that it has grown to its present state through aeons of time.

Mankind has always been puzzled by the phenomenon of growth —the gradual changing of a seed into a plant, of a child into a man. The original belief was that the completed flower existed from the beginning within the seed from which it unfolded, impelled by some mysterious power. From this belief were developed by analogy the expressions 'development' and 'evolution.' These terms, now commonly in use, are Latin equivalents of our words unroll, unfurl, unfold.

This primary meaning of the words was held until the eighteenth century. Only then did the epigeneticists replace this by the assumption that primary tissues in the egg gradually adopted the form and structure seen later in the individual. This doctrine was then given the scientific name 'evolution.'

Lamarck asked himself how it was that these tissues changed into the particular forms and structures observable in any given individual. His answer was that it was due to a gradual transformation forced upon the individual, who during the course of his life was compelled to adapt his functions to differing surroundings. The following quotation shows to what extent biologists have been able to observe this process: "Under the microscope the set of genes—the chromosomes of the egg—are seen to go promptly to work. They suck up a quantity of material from the surrounding cytoplasm, becoming balloon-like. They transform this chemically, then give it off again into the cell body, visibly changed into something new. Diverse new substances thus formed move into different regions of the egg. By cell division some of the newly manufactured substances are passed into one cell, others into another. Thus the cells become diverse; the different structures of the body are being made. This is repeated in each cell generation, the chromosomes by interaction with the cytoplasm changing the substance of the cells, until finally nerve, muscle, bone, gland and other tissues result." [1]

[1] Jennings, H. S. (no date). *Prometheus*, Kegan Paul, London, pp. 37–8.

In the course of time the modified habits and the effector organs were handed on to the offspring, that is, they were 'inherited.' This theory has been further developed by Wallace, Darwin, Lyell, Goethe, Haeckel, and others, and has led to the conception that the structures and functions have in some degree been handed down to successions of living beings. We are then able to detect a common fundamental pattern of structure, function, habit, and so on, which has been modified, specialised, and differentiated in various directions.

The fundamental laws governing this process have been put in general terms by Herbert Spencer. According to him the pattern of function in living beings can be accounted for by the principles observed in the inter-relation of the ultimate constituents of the world.

Haeckel has combined observations on the origin of the individual and inferences as to the origin of the race in his famous statement, that "the series of forms through which the individual organism passes during its progress from the egg-cell to its fully developed state is a brief compressed reproduction of the long series of forms through which the animal ancestors of that organism (or the ancestral form of its species) have passed from the earliest periods of so-called organic creation down to the present time." In brief terms, the development of the individual is a recapitulation of that of the race.

This bipartition of the process of descent into (1) the growth of the individual (ontogeny),[1] and (2) the origin of the ancestry (phylogeny),[2] enforced the use of the term 'development' for the former and 'evolution' for the latter.

We cannot, however, fail to realise that the aggregates of particles representing 'things' manifest qualities which are not found in the individual particles. The knowledge has given rise to the theory of '*emergent* evolution,' which states that "at various stages of material complexity, radically new properties emerge. According to this theory both Life and Mind are emergent properties of certain material aggregates. A complete knowledge of the constituents of these aggregates would not enable us to predict that, in combination, they would manifest the properties of life or mind." [3]

Our method of approach to our subject will now be based on the conception that "Body and Mind, man, is the outcome of his ancestry, and it is along that line that investigation appears to hold out the greatest promise of ultimate success," [4] and that "the selves mount upon the grand staircase of history" (Lord Acton).

In making the theory of evolution the basis of our investigations concerning speech and its variations, we are well aware that many links in the chain of development of human speech are missing. There is still much work to be done by biologists, psychologists, speech therapists and philologists, but the writer hopes to show in this work *which* links are missing and to suggest possible ways of supplying them.

The need of deriving the observable variations of speech from its

[1] *On* 'the being.' [2] = *phylon*, 'race, tribe, kind.'

[3] Sullivan, l.c., p. 136.

[4] Douglas, A. C. (1932). *The Physical Mechanism of the Human Mind*, E. & S. Livingstone, Edinburgh, pp. 11–12.

development has apparently been felt by most of the writers on the subject since they preface their observations on disorders of speech and voice by a survey of normal speech development. We do not, however, feel that the connection between this development and the pathological facts has been made sufficiently clear.

In the following chapters we shall therefore attempt to use the evolutionary principles which we have thus briefly outlined, in explaining the structure of language in its variations.

NERVOUS FUNCTIONS

The nerve cell.—Having shown in the previous chapter that it is necessary to begin our investigations by always dealing with the simplest aspect of any phenomena, let us here take the cell as our ultimate structural unit. We shall not go into details concerning its principles, constituents, or properties, all of which are explained at length in the textbooks on anatomy and physiology. (See Bibliography.)

The cell manifests a simple but efficient form of reaction, the process by which an organism adapts itself to the changes in its environment.

When the organism, through propagation of its cells, grows more complex, it proves useful to subordinate the activities of its individual cells to the maintenance of the whole organism. As part of this process some cells are evolved for special purposes and acquire the function of regulating the relationship between individual parts and in bringing about their co-operation in the service of the whole organism.

Muscles were evolved before either nerves or sense organs. When muscles are stimulated to contraction through the influence of the nerves connected with them, they move the bones which with their connecting joints constitute the framework of the body.

The central organisation is provided by the nervous system, which co-ordinates the functions of the various systems of the body. Its work can be compared to that of the central office in a big establishment composed of many different departments all of which, working harmoniously together, are essential to the successful functioning of the whole.

The nervous system, to carry out its task efficiently, developed through differentiation three distinct types of nerves: (1) those possessing the power of receiving incoming messages; (2) those able to transmit what is received; and (3) those capable of carrying out the instructions which have been transmitted. They are called afferent, connector, and efferent neurons respectively.

This differentiation takes place as soon as in the metazoa certain cells have specialised in taking over certain activities of the unicellular organism, such as movement or secretion. All of these specialised cells, such as muscular cells, glandular cells, etc., possess a definite structure which enables them to carry out their particular task efficiently.

The nervous system is the fundamental unit with which we have to deal in our investigations into language and speech, as it is this system which governs the actions of the whole body. In describing

the phenomena which it exhibits, we shall follow the theory of evolution, regarding it not as something already existing, but as something in the process of becoming.

A nerve unit consists of a cell with various branches. The nerve cells are grey and are usually gathered together in masses called ganglia. The grey matter of the nervous system consists of such aggregated cells. Bundles of nerves (axons) form the white matter. The nerve branches take on a different appearance as soon as they leave the body of the cell. One of these branches, the axon, is a fine thread of, at times, considerable length. It can be compared to a wire which, to prevent the electric current from escaping, has been surrounded by a sheath. The axon divides into many branches which terminate in various organs. Other ramifications resembling trees are called dendrites; these do not separate from the grey matter of the central nervous system, but connect the nerve cells with each other. The unit which consists of the body of the cell, the axon, and the dendrites, is named the neuron.

Two neurons can come into contact within the grey matter of the nervous system. The axon belonging to each neuron splits up and its branches touch the dendrites of the other neuron or its cell. This connection through contact is called synapse.

Reflex arc.—Afferent nerves, connector nerves, and efferent nerves are arranged in such a way as to bring about a response to incoming stimuli independently of voluntary control. The organic basis of this *reflex action* is the *reflex arc*. To illustrate what we mean by 'reflex action' let us take the following simple example: a frog whose brain ('seat of consciousness') has been separated from the spinal cord scratches himself if some sulphuric acid is spilt on him; or if you put a fly in his mouth he will eat it, but should you only show him the fly, he will make no attempt to reach it.

These examples, simple as they appear, deserve further consideration. Though carried out by an elementary mechanism, these actions are not of a simple nature, for they show well-designed 'patterns,' viz. those of effectively removing a stimulus which causes pain or of swallowing something desirable.

Following along the path indicated by the theory of evolution, we must assume that the previous experience of the ancestors of the frog has impressed upon this fundamental unit of nerve function the particular action we have seen. This shows us a process which is going on in evolutionary time, as well as developmental time.

"The passage of a reaction along a nerve-path has the effect of sensitising that nerve-path (i.e. of endowing it with increased conductivity) to that particular reaction." This "sensitisation, or 'canalisation,' of a nerve-path by any specific stimulus—representing, as it does, a molecular modification—is in reality an incipient *structural* change." [1] Thus the outstanding feature of the nervous system is its response to changes of environment and its power of adapting the whole organism to them. The reactions of the nervous system show

[1] Douglas, l.c., pp. 27 and 37.

us a definite pattern, growing more and more complex as the individual reaches higher and higher levels of development.

Such structural and functional patterns are to a great extent inherited. The structure of any action, therefore, should always be regarded in the light of the many patterns of adaptation which have been impressed on its nervous mechanism at previous levels of evolution and development. Every action constitutes a hierarchy of patterns.

The spinal cord.—The nerves receiving messages from the outside world (afferent nerves), the nerves transmitting those stimuli (connector nerves), and those stimulating the effector organs (efferent nerves), are in higher animals bundled together in what is called the spinal cord.

The spinal bulb (*Medulla oblongata*).—The Medulla oblongata is, as its name indicates, the upper extension of the spinal cord. Here arise those nerves especially concerned with swallowing, breathing, the secretion of saliva, the movements of the heart, and dilatation and contraction of the blood vessels. In addition the bulb contains the pathways through which external stimuli can reach higher cerebral parts, and through which the impulses from those parts are conveyed to the efferent nerves and the effector organs.

Mind.—Man, when subjected to sensory stimulation, such as in tickling, shuddering, sneezing, coughing, laughing, and sucking in infancy, exhibits reflexes similar to those which occur in the frog. All these movements appear *almost* involuntary and beyond his control. If a fly settles on the nose of a sleeper, he brushes it away with a well-aimed movement of the hand. This is an example of automatic control, the sleeper being, it is assumed, unaware of the occurrence.

During consciousness such movements can be performed deliberately and with some awareness of them, or be left unperformed. A mystical being, the 'mind' or 'soul' has been assumed to be the controlling factor in such phenomena.

For centuries questions as to the genesis and the substantiality of mind have exercised the thoughts of men. But in accordance with our fundamental concept nothing need be said in answer to them. The same process may present itself in two aspects according to our point of vantage. This and the terminology used in an attempt to describe the sets of life-patterns in their gradations make them appear then as psychological or physiological patterns. In order to preserve the unity of the underlying acting whole we may at times find it helpful to use the behaviouristic method of approach.

The doctrine of Behaviourism, as expounded especially by Watson,[1] refuses to have any dealings with "introspectively observable facts." . . . "It refrains from describing or explaining emotions, desires, fantasy, thoughts, memory, etc. The psychologist must rely upon data of one kind only, the data or facts obtained by observing the movements and various bodily changes exhibited by human and other organisms." [2]

[1] Watson, J. B. and McDougall, W. (1928). *The Battle of Behaviourism*, Kegan Paul, London.

[2] McDougall, ibid., p. 52.

" Sane Behaviourists " combine those data with all the conclusions arrived at by means of introspection, thus directing attention from facts of consciousness to facts of *conduct.*

Instinct.—With a view to pursuing the hierarchy of action-patterns we will now modify our last example. Suppose we are talking to a friend who suddenly flicks away a wasp from his nose. We observe he uses the same kind of action as was exhibited by the sleeping man. Now, however, we can ask him why he acted in this way, and he naturally answers: " I felt something stinging me, and I instinctively put my hand up to remove it. I did not think about what I was doing."

We would doubtless agree, and we may therefore conclude that (1) man is able to act in response to external stimuli; (2) no concentration on the particular action is necessary; (3) he is introspectively aware of a certain feeling; (4) this precedes cognition.

How are these data to be accounted for? The action itself possesses a striking similarity to that of the frog and of the sleeper. From this we infer that it is based on that evolutionary pattern. Such reflex actions, as far as they are " inherited habits, characterised by a high degree of sensitisation in their nerve-circuits, as evidenced by the promptitude and invariability of the response," are termed instincts.[1]

Sympathetic nervous system.—Our description of the symptoms was not quite exact. We might have noticed that (5) the man became pale, that his pupils had dilated, and that his pulse had quickened; (6) on being questioned he would declare that he had heart palpitation and other vague bodily feelings of uneasiness, even that he was on the point of fainting.

But his report seems to indicate that there is more in this than meets the eye. ' Life ' itself was in danger. To maintain the life of a more specialised and differentiated organism organs have been developed—such as the intestines, heart, blood vessels, lungs, and glands —designed to effect metabolism. Their functions are controlled from a nerve-system constituting the oldest nerve-paths, viz. the *sympathetic* or *autonomic nervous system.* The autonomic nerves interact with the spinal nerves on the reflex principle already mentioned. In our example we saw how they unite in action to re-establish equilibrium. The processes going on in the sympathetic nervous system are highly canalised, and therefore hardly under our conscious control. This absence of conscious control is characteristic of reflex actions, instincts, and emotions.

Endocrine system.—In recalling instances of blushing, feeble pulse, sweating, etc., which have occurred in other subjects under observation, we may assume that these primitive reflex processes are governed by some as yet undiscovered influences. In fact they encroach upon the primary factors of life, viz. the activities of the *endocrine glands.*

The endocrine system consists of several glands producing substances (hormones) which get into the blood, and affect the metabolism of the body in every respect.

Emotion.—Let us revert to the man who was stung by the wasp.

[1] Douglas, l.c., p. 128.

He said he 'felt' something; that is the vital point. His experience was certainly a vivid one, but on the other hand, he found it difficult to give it a satisfactory description. We can discriminate between two types of feeling—pleasure and displeasure. Both types appear as an 'attack' on those experiencing them, and not as an action which they themselves have taken.

The idea that we are in some way dominated by agencies which at the time we cannot discern, is expressed in common parlance by the verb 'to affect,' derived from the Latin *facere*, 'to do,' and *ad*, 'to.' The fact that some potentialities of movement are aroused is implied in the word 'emotion.' Its meaning originates from the Latin *movere*, 'to move,' and *e*, 'out of.'

Pleasure "may range from lukewarm appreciation to voluptuous delight; desire or will may range from comparative indifference to intense longing, or to blind and impulsive action." Displeasure is felt as anger or frustration which "may pass from mild resentment to uncontrollable rage."

"Those stimuli which evoke the more active reactions upon which these sensations depend show a tendency to set in motion not only the voluntary muscular mechanism, but to overflow, as it were, into the muscular glandular department of organic response presided over by the sympathetic. We have seen stimulation of the lachrymal glands associated with frustration; stimulation of the sweat glands may be associated with fear; and stimulation of the suprarenal glands (resulting in rise of blood-pressure) is characteristic of anger, and so on."[1] Thus certain primitive behavioural patterns, such as reflexes, instincts, and emotions are not of a differing kind, but in reality one and the same action described in terms of physiology, biology, and/or psychology.

Interbrain.—The requirements of life give rise to further growth of the cell mass in the primitive nervous system and to definite structures capable of better adjustment. The next anatomical structures to emerge are the *thalamus* and the *hypothalamus*. The former acts as a higher reflex centre receiving incoming stimuli from all the sense organs.

This stage of development extends back as far as the evolutionary level of the fish. The long period throughout which the reflexes have worked explains why, according to Cannon, "emotional expression is a complex highly organised reflex act which differs from cortical activity in being far more uniform and stereotyped in character."

There is much evidence to show that "the sympathetic nervous system is under the control of the hypothalamus (diencephalon)."[2] This accounts for the visceral (vegetative) components in emotional reactions. Injuries to the interbrain often produce uncontrollable laughing or weeping.[3]

The mid brain (*mesencephalon*).—Pursuing the example of our friend who was stung, we reached the stage where he had removed the wasp. The time has come to investigate this activity in greater detail. We

[1] Douglas, l.c., p. 93.
[2] Wright, S. (1934). *Applied Physiology*, Oxford University Press, p. 86.
[3] Woodworth, R. S. (1935). *Psychology*, Methuen, London, p. 348.