THE HUMAN BRAIN

FROM PRIMITIVE TO MODERN

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Although the main emphasis is on evolutionary considerations, some attention is paid to the primitive tribes existing today.

The normal, adult, modern brain has also been taken into account, emphasizing it as a dynamic and mobile organ.

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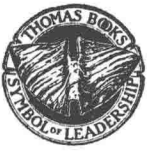

CHARLES C THOMAS · PUBLISHER

Springfield · Illinois · U.S.A.

CHARLES C THOMAS · PUBLISHER
BANNERSTONE HOUSE
301-327 EAST LAWRENCE AVENUE, SPRINGFIELD, ILLINOIS, U.S.A.

Published simultaneously in the British Commonwealth of Nations by
BLACKWELL SCIENTIFIC PUBLICATIONS, LTD., OXFORD, ENGLAND

Published simultaneously in Canada by
THE RYERSON PRESS, TORONTO

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Library of Congress Catalog Card Number: 57-10434

Printed in the United States of America

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CONTENTS

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I

INTRODUCTION

THE GREATEST event in biological history has been unquestionably the evolution of the human brain. Without its unique development, there would be no story of man. Outstanding is the fact that nature has taken her time in building and molding it through periods which have been arbitrarily divided into the following: pre-savage, savage, barbaric and civilized. Her slow and patient method has been to add the new on the old, step-by-step, never giving up the substrata of the latter, yet ever aiming for superiority and dominance by way of the new. We cannot, therefore, ever divorce ourselves, anatomically or functionally, completely from our well-developed and strongly conditioned past. Setting man aside from the remainder of the animal kingdom, as a different specimen, as remote as twenty-five or more centuries ago, has been his upright position, his ability to perform skilled movement, his use of a highly complex language, his mental acuity and relationship to time. The focal and key-point in these increments has been his encephalon. This organ has dominated the scene at every turn, in a sense being inexorable in its metabolic demands and responding as if it had some destiny to perform. In fact, in its requirements, it has been referred to, on occasion, as a blood-thirsty, insatiable vampire.

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From pertinent studies, it has been learned that the human cerebrum, delicate, of paltry appearance and odd chemical composition, is a structure that has become vibrantly alive, sensitive, impressionable, incessantly active during life and even unruly to a certain extent, when thinking in terms of healthful balance, yet having a potent survival value. In a quantitative sense, we have more individual brains today than ever before, due to the increase in population without the end being in sight, so that each passing generation produces more rigid standards in respect to the need of harmony among mankind.

Neurological and other specialized scientists have calculated that a space of 1,500,000 cubic feet, 1,000,000 kilowatts of electrical power, 1,000,000,000,000,000,000,000 wires, the same number of miniature tubes and $200,000,000,000,000,000 in finances would be needed to even crudely simulate the human brain from the physiological viewpoint (Walter, '53). By comparison, nature has been much more economical in providing the encephalon of man with housing space, in the number of wires (neurons), in the amount of electrical power necessary to make it function adequately and in costs considered in terms of dollars and cents.

Probably, the weakest link which exists in the field of human neurology today, broadly considered, is in respect to the effect of man's evolution on his brain and vice versa. Understanding him in his entirety, has far-reaching importance, so much so, that it can be associated with the actual survival of the human race. Modern science has been accused of trying to propose an image of the cosmos to the utter neglect and understanding of man: his psychology, his innate needs and his behavior. The human

functional mechanisms have been studied scientifically, mostly within the last century, but relatively less in proportion to man's long-time inventive obsession with tools made from elements in nature. Some initial progress, however, has been made in the former including important aspects of past developments in the brain.

Globally speaking, human groups and sovereignties, from large to small, have not learned to live with each other in terms of complete accord due to their preoccupation with conflicting ideologies. It is universally agreed that dangers, of great portent, now confront us, more than at any other period in our history, because man can no longer isolate himself with impunity; this is because of the speedy and long-range travel systems and the availability of powerful, destructive forces created by specialized, scientific effort. They are the end-products of certain civilized minds. There are deep-seated reasons for this state of unsettled affairs based, to a considerable extent, on the past, tribal and other racial conditioning of that important organ, man's brain. By knowing man as a whole, there may be better opportunity to reach peaceful and lasting agreements at high political levels influenced by the pressure of an informed people who everywhere innately crave them. Man survives on earth currently varying from the most primitive to the highest intellectual and humanitarian levels, depending on geographical, evolutionary and educational factors. What may be of significance, is a dissemination of pertinent regional, psychological backgrounds.

The view is gaining momentum in certain quarters that we are approaching the era of a new "Psychological Age," where more emphasis will be given to the study and interpretation of the mental mechanisms of man. No better

start could be made in this direction than a fundamental consideration of him as he has been; it is accepted that he receives a biological legacy from his more remote ancestors from which he cannot completely extricate himself. He now represents a product of possibly forty-thousand generations, each family of which, was subject to hereditary influences and transmutations. It always has to be remembered that nine-tenths, or more, of man's existence was spent in a state of savagery.

There is some reason to believe that man's brain has not yet reached phylogenetic perfection, that it is tardy in this respect and still in a state of functional if not anatomical transition, that it does not need to hurry, having time on its side. The progress which has been made in cerebral evolution has been such that man now has an increased range of mobility and adjustability, revolving around his three, inherited, biological impulses: hunger, self-protection and love. It follows that much of this organ, that is, the newest structural mass which has been added, is the least stabilized by experience (Hecker, '41) and the most vulnerable. When man early lost his morphological defenses against his natural enemies, he needed to become gregarious to survive. This, in turn, required him to become obligated morally to his society in order to promote harmony. The latter has never become dominant which has resulted in a continuous struggle between his deeply rooted and individualistic animal urges and his ethical behavior. In order for man to attain full stature, the newer engrams (the lasting traces left in an organism by psychic experiences), particularly those of a humanitarian nature, or an understanding of man as man, must more completely dominate the older, neural mechanisms which have been built-

up during his past brutish existence. In addition, the encephalon must develop to maturity in each normal person's life history, beginning from nothing. It has a remarkable ontogenesis having as its goal, "the functional integrity and dominance of the cerebral cortex."

In its evolutionary formation, the human brain must be regarded as a plastic substance capable of being fashioned and molded to meet the needs of the individual and the race. The evidence indicates that it has undergone a remarkable transformation over a period of many centuries in response to man's reaction to his environment. It can be assumed, therefore, that different and new demands have been imposed upon it from period to period.

One of the amazing features of man's development is that the first thoughts and ideas which he formulated with an uncertain, primitive and relatively undeveloped brain far back in the Old Stone Age have had such an indelible and immortal quality. They can be easily discerned now among all peoples, to the highest degree in the ignorant, to a more moderate extent among the mediocre and less so among the intelligentsia. Myerson ('50) summarizes the importance of our past as follows: Man is . . . "united by the invisible strands of heredity to every form of past life . . . he has fundamental drives and compulsive activities going back to the lowliest animals that ever appeared on earth." It would seem, therefore, that man can only be fully and sympathetically understood, by knowing as much as possible the effect of the response of his ancestors to nature. In his reactions to his environment, each man has had to be content with that which he inherited and make the best of it throughout his ontogenesis.

Comparatively little has been written on the evolution

of man's brain from a broad viewpoint. The available literature is largely heterogeneous, scattered, specialized and understandable to only a select few. The task of assembling and organizing the data pertaining to this subject is challenging because the human cerebrum is notably a complex structure, because man's beginning goes back into obscurity for many centuries, because scientific facts regarding man's nervous system began to accumulate, and slowly so, only about a century ago and because there is still much foundational spadework which needs to be done before our brain functions can be fully understood.

The outline procedure which has been followed in writing the textual material is as follows:

1. Ideas on man's origin.
2. Past conceptions on the functions of the human brain.
3. Highlights of normal brain.
4. Man's simian background.
5. Methods used to study brain evolution.
6. Problems of earliest man.
7. Structural growth of brain.
8. Balancing the sensations.
9. The development of skilled movement.
10. Evolution of the mind.

It is probable that man has always entertained ideas as to how his race originated, even at the primeval level. This has been one of the most perplexing and plaguing questions he has had to contend with, the others being why he exists and what happens to him after death. From the scientific viewpoint, it is easier to try to answer the first of these three. Throughout the presavage, savage, barbaric and civilized periods, man has also held some odd opinions as

to how his brain fits into the general scheme of his bodily functions, yet each was based on the best reasoning and judgment which he possessed.

Because it was felt that a better appreciation of the steps of evolution could be obtained by first outlining some of the highlights of a modern, normal, adult brain, this was done. Under this topic, the attempt is made to underscore it as a highly variable, plastic, yet dynamic organ with great potentialities.

The human phase of brain evolution has been stressed, to the more-or-less exclusion of that which antedates it. Briefly considered, is the possible simian background of our remote primate forebears. This has been done intentionally with the understanding that the brain, at this starting-point, had already evolved to a fairly high degree of development.

Manifold, investigative methods have been employed to study the evolution of the human brain. Lower primates have been investigated as well as dissolution of functions in human cerebral disease, maturation during childhood, behavior of existing, primitive tribes, the acquired characteristics of the adult human mind and the product of man's cerebration during the past in science, literature and the arts. The main problems here are first in trying to fathom, from the data available, the primitive organ in its diverse, physiological capacities and secondly in organizing the facts so as to present a coherent picture.

Shifting from the trees to the ground created problems on every hand because of primitive man's physical and mental equipment. There was no wealth of experience to rely on in combating the vagaries, forces and uncertainties of his new environment. Initially, most of his behavior was

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