STUDYING THE HUMAN BRAIN

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This study looks into the question, "why" the human brain is so large and complex. In the course of the investigation, the role of language in the fossil record is examined. The conclusion: that man and his brain are unique creations, will, it is hoped, encourage more insight into this most challenging area.

Few would deny that the three-pound human brain is the most complex structure in the universe. In fact, the human cranium really contains two brains in one, the *corpus callosum* that connects the two large hemispheres having over 20×10^6 connections. Epileptics whose *corpus callosum* was severed led nearly normal lives despite this obvious lack of intercommunication.[1]

Consider the marvelous human brain—philosophers attempt to fathom it, science is still in an elementary stage of understanding it, and the computers cannot assimilate its myriad of functions. Neurological and other specialized scientists have calculated that a space of 1.5×10^6 cubic feet, 1×10^6 kilowatts of electrical power, 1×10^{21} wires, 1×10^{21} miniature tubes, and 2×10^{18} dollars in finances would be needed even crudely to simulate the human brain from the physiological view point.[2]

The case for design and a Designer seems paramount in considering the brain. Yet if evolution (the molecule to man theory) is true then this master jewel of its vast tireless struggle must assuredly proclaim also its creator — time, chance, mutation, natural selection, etc. The two views are discordant and if the reader is polarized between them and wonders 'is the debate of this issue truly important?' — consider this observation from Lassek in his book *The Human Brain.* "Circumstantial evidence, inference, and conjecture have been freely used in attempting to place together the story of mankind and his evolution, but scientific detective studies, during the past century, of remote and living savage and barbaric tribes have been helpful in crystallizing the overall picture. In all probability, the problem will continue to fascinate the minds of thinking men the world over whether they be theologists, philosophers, scientists or other specialists. It is doubtful whether it will ever be solved to the satisfaction of all because the human race can be traced back, with some degree of surety, only to about 5,000 B.C. Beyond this date, man's behavior is partially clothed with mystery. Any conclusions made in this field will always be of significance to man because *where he thinks he originated affects his everyday psychology.*"[3]

Studies and Comparisons

The mind of man and the studies of its supreme complexity is more than curiosity but a contemplation into the very core of our human-ness. For what really holds man distinct from the animals is his brain — correct? Presented below are a few studies pertinent to this presentation.

1. Man's brain is not absolutely the largest, the average human brain weighs 1.5 kilograms while that of the larger whales weighs 5 kilograms[4] and in elephants 2.5 kilograms.
2. Brain weight compared to body weight does not have man at the pinnacle. In the whale its ratio is 1:8,500, in man 1:44, in the marmoset and capuchin monkey 1:27 and 1:17.5 respectively.
3. Man does have the substantial advantage in cortical surface area (due largely to the extensive fissurization that buries 72% of the cortex). Compared to the monkey, man has 2,579 cm^2; monkey 109 cm^2.[5]
4. The amazing enlargement of the human brain continues rapidly after birth; the difference in capacity between human and pongo (chimpanzee) foetal skulls is not markedly divergent — being 120ml to 95ml respectively.[6]
5. Man's motor cortex is augmented 16.7 times over that of the monkey (being 80.18 cm^3 to 4.79 cm^3) which allows in part for the fine motor functions that humans display.[7]
6. The "hallmark" of man is his relatively large frontal lobes or association cortices; however when frontal lobe measurements are compared to the rest of the cortices, man is not unique
   —man 1:3.79 (25.4%)
   —chimpanzee 1:3.61 (27.8%)
   —and macaque 1:3.79 (26.4%).[8]
7. Man's brain is a leader but not a numerical champion in comparing the sum of neurons in the hemisphere
   —man 6.9 billion
   —chimpanzee 5.5 billion
   —and macaque 2.5 billion.[9]

Why Is Man's Brain Different?

"Man's cortex is more finely differentiated cytoarchitectonically and therefore capable of unique and complex behaviors."[10] Given then that man's large lobes are finely differentiated, the question pleads 'how this specific specialization arose'? Jerison proposes to offer an answer in his book *Paleoneurology of Language.* "This is actually an essay on why the human brain is so big. Language is clearly part of the answer, and it may be the whole answer."[11]

Dr. Jerison, in studying localized brain lesions and their effects on language, estimates that 50% of the volume of human brains is involved in language — its transmission, reception, assimilation, comprehension and association. Evolutionists believe that the beginning of language had to have selective advantages. That possibly the perception and memory required to create cognitive maps of their hunting ranges supplied the hominids an environmental niche.[12]

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There arises in this author's mind a difficult decision — if language (other scientists believe that toolmaking may either have preceded or paralleled the advent of language)[13] was the new skill that necessitated man's brain to enlarge and if the larger hominid brain is what allowed him the use of language — then which came first? Remember that natural selection is a passive screen, then the creation of the delicate and intricate functions of man's brain (mind) relies upon the undirected chances of nature, i.e., that force that can only and ultimately produce biological change — genetic mutation.[14] With this in mind consider the following illustration.

The computer has already been likened to our brain — then imagine if the critical operations of any large city bank (every bit as subjected to competition and pressures from within or without as the hominid ancestor) would be improved if by happenstance fashion connections were switched, pulled, added, or rearranged in the micro-chip-centered-hardware of its giant computer. Would you deposit your funds in an experimental bank of this order?

It has been estimated that 600 cm^3 more 'brains' would be needed to channel a language-incompetent chimpanzee onto a level of competency.[15] But is the addition of 'more' cerebral tissue really the answer to the advent of higher intelligence? "The fact that this expression (density) is valid from the smallest mammalian species to species with brains much larger than man is another indication that intelligence does not bear a simple relationship to neuron density and degree of axodendrite complexity in the cerebral cortex."[16]

Zamenhof conducted an interesting study in which he injected somatotrophin into pregnant rats increasing the neuronal mitotic activity in the feti. He got increases of

—70.4% in cortex volume,
—30% in cerebral hemisphere weight,
—and 14.8-27.6% in cortical cell density at maturity.[17]

But on psychological performances these 'superbrain' rats acted only equal to controls. In fact, females, who seemed to have more changes in cortical structure, needed more trials than males in learning mazes. Zamenhof concludes, "Perhaps the behavioral evidence is best explained by the possibility that increased density actually lowered dendritic branchings and the level of task requirement."[18]

Some scientists are not satisfied that hominid language evolved as a response to selective pressure for improved communication. They point to the examples of birds who have subprimate encephalization and yet produce marvelously variable sounds, responding with selectivity to many specific songs and show plasticity in their productions inducing "racial variants on their calls."[19] They suggest the rapidity of hominid encephalization during the past few million years (which no other mammalian species evidence) suggest a niche uncharacteristic of primates had been invaded and that was that of the social predator.[20]

It is known that wolves, for instance, are highly successful social predators, displaying great daily range and navigation skills aided by sophisticated olfaction and scent marking systems. Researchers theorize that since primates had a reduced sense of olfaction, the hominids evolved a vocal-acoustic "language" system in substitute.[21] This theory has many problems aside from the point that nature in bypassing a 'simple' dimunition of olfaction in early hominids certainly detoured an equivalent distance of light years in its blind quest to construct a superior and 'complex' achievement in man's brain. Where is the evidence for man's evolutionary record as a predator? Rose remarks candidly, "The fossil and other direct evidence for the evolution of human subsistence patterns is patchy and equivocal."[22] Also, while the motor systems were developing to produce the complex sounds of human speech, the neuronal control had to be as highly integrated as any other cortically directed motor system (to have the plausibility of working effectively) and no motor system requires such sophisticated control as the voice box and associated organs of speech. This prerequisite bespeaks of pre-adaptions.[23] If you include pre-adaptions in your model, then it seems nature is no longer blind and working randomly. Nature then demonstrates the same forethought and provision as a Master Designer and theologically becomes equivalent to God.

Also, research into man's behavior, brain size, and brain complexity still affords more baffling questions. Holloway in his article for *Brain Research* states, "However, assuming for the moment that a relative increase in frontal association cortex did take place in the case of man, it still remains unclear as to how this would account for man's behavior in contrast to the apes."[24]

As noted above in study number seven, man does have more neurons to work with but the question is asked, "What is the difference between $2^{6.9} \times 10^9$ and $2^{5.5} \times 10^9$? Does this infinitesimal difference between two infinities decide the difference in behavior between the two forms (man and chimp)? . . . it is disappointing to find that man has but 1.25 more neurons in his cortex than his lowly cousin."[25]

Holloway goes on to say "It is not clear how either 1.25 more neurons or additional maturation time would explain the differences of behavior between man and ape."[26] And in his conclusion he summarizes,

(a) gross differences of the size in brains alone does not explain differences of behavior within the primate order
(b) cytoarchitectional differentiation is not in line with current evidence of neurohistology
(c) frontal lobe differences appear to be slight, if they exist at all, within much of the primate order and
(d) simple addition of more neurons still leaves the difficulty of explaining the nature of the transformation.[27]

See also Figure 1.

Singularity of Man

There is something fundamentally unique about man's brain because of what he 'can do' with it. He is the sole owner in the universe of this marvelous organ that enables him to be all that is meant by the encompassing word — human. With this brain (and its in-

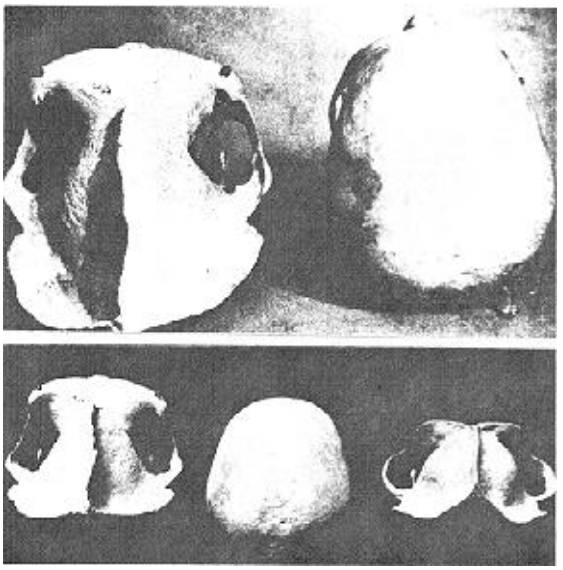

Figure 1. Upper: posterior view of gorilla (left) and human (right) skulls show the vast difference in exterior design.
Lower: posterior views of skulls (left to right) of gorilla, orangutan ("man's closest cousins"?), and man. The vast differences in design are not only obvious in an external view, but also have their counterparts in differences in cranial capacity, size of brain, and intelligence.
These pictures are according to Reference 46, and are used here by permission.

herent mind) he is not just at the pinnacle of nature's creation — he is above nature because it appears that only man can truly manipulate nature itself.

Where did this power come from? Some would suggest that the terminus to this question is found in the beginning. Read Genesis 1:28-30.

To state that man is unique is an understatement. Consider these few examples. Man is the only creature who weeps, who creates new materials (even elements), who provides elaborate shelters and tools, who possess culture, tradition, and the means for transmission of experience (in language written and spoken). Only man buries the dead, reproduces works of art and music, decorates and adorns himself. He only enacts laws and governments to set rules for his behavior and he alone displays a moral conscience, the ethical knowledge of right and wrong. Only man is truly teachable with the ability to learn from experience and the witness of past generations and modify his environment accordingly. Man alone domesticates other animals, cares for his sick and injured with medicine, has science that fathoms the laws of the universe, and has compassion for fellow creatures (with means to save from extinction endangered species). And man is the only being who worships a higher being — who worships God.

And recent research is now disclosing that man's mind has demonstrated a higher level of consciousness than ever before acknowledged by science. French physicists have reported that school children by thought alone can alter the decay rate of radioactive emission.[28]

Endocast

The physical evidence for hominid evolution and the theoretical evolution of man's brain depends heavily on fossil remains. By fossil evidence it is hoped that traces of his ascent can be construed. When fragments of skulls are discovered, the pieces are analyzed and assembled and missing portions are supplied to form what is believed to be an approximate conformity of its living shape. By studying the interior conformation, dimensions, indentions, and modeling of the inner table of fossil bone a cast of the possible configuration of the organism's brain can be assumed.

Studying imprints of endocranial grooves is speculative business; and some researchers like Weidenreich confess: "comparatively speaking the number of grooves means nothing; and the whale steals the show in this respect. This marine mammal has without question the most intricate cerebral arrangement of all the different species."[29] This points out the fact that a study of endocranial groove imprints alone (which is all the evidence a fossil can give) in the case of the whale, would probably not lead to our understanding of the 'intricate cerebral arrangement' that we know exists.

In studying the sizes and shapes of skulls in early man Weidenreich in his paper for *American Anthropologist*[30] compares these variations to corresponding variations among breeds of dogs. He suggests that the vast differences in sizes exactly parallels alterations in sizes and shapes of what would be predicted from different varieties of man.

This entire area of attempting to uncover a lineage of man's supposed evolution through fossil findings coupled with neuropaleontological assumptions is laced with problems. Bennett summarizes one aspect of this search well, "There were also striking exceptions to the general relation — idiots with larger brains and geniuses with smaller brains. The hypothesis of an intrinsic relation between brain size and cerebral exercise or ability was therefore generally abandoned. The difficulty of working with such factors discouraged research, and the problem largely reverted to the speculative realm."[31]

Olson writing in the *Journal of Human Evolution* upon the graduations in hominid ascension notes: "The evolutionary and systematic fallacy inherent in morphological grades becomes increasingly evident as the paleontological record increases in its completeness and the morphological discontinuities caused by inadequate sampling are reduced."[32] Elsewhere in this same journal Zindler states, "All other augments and elaborations assigned to mankind's lineage — such as a hominid augment to bridge the gap between the australopithecine and habiline *(homo habilis)* elaborations — are hypothetically inspired constructs in the absence of a tenable cranial fossil record."[33]

Attempting to trace the theorized enlargement of man's brain through fossil skull and endocast analysis has other inherent hazards. It must be remembered as Jerison points out, "potential sources of error . . . if a pathological or immature fossil happens to be collected. If the only evidence on the fossil is the endocast, then the error is unavoidable and one must include it in estimating the risk of errors in wrong decisions."[34]

Jerison is critical of the role endocasts attempt to assume in landmarking 'developing' language areas.

He states, "To argue that a particular depression in a natural endocast in a fossil hominid represents a posteriorly shifted lunate, and therefore, enlarged language area anterior to the lunate, seems to me futile and probably false."[35] He goes on: "Is there further evidence in the endocasts themselves for localized expansion of the language areas? In my view, aside from the evidence of asymmetry, the answer is no."[36] He finalizes his opinion of localized language areas in hominids by saying, "It is impossible to use evidence of fossil endocasts as part of the argument in its favor."[37]

In fact, an interesting observation is made concerning the cortical relationship involved in brain structure and language. "If one works on the problem as a bit of design engineering it turns out to require moving structures into unusual positions."[38] This 'requirement' from an engineer (designer standpoint) is just the exact design that presently functions in all normal human brains.

Finally this enlightening statement by Holloway should be appreciated by all interested in the theory of human evolution. "The study of primate endocasts, particularly in the great apes and hominids, gives exceedingly little information about evolutionary changes and permits little basis for suggesting hypotheses concerning the events of man's evolution . . . The extreme variability of cranial capacity is well appreciated, and its correlation with any sort of behavioral attributes is notoriously low. Brilliance may be exhibited by men whose cranial capacity differs as much as 1000-1100 ml, a magnitude which is as much or more than the known (supposed) increase in this parameter from say Australopithecis to modern Homo sapiens, i.e., the whole of hominid evolution."[39] Please note the graph illustrating these ranges: Figure 2.

Microcephaly

It is no supreme whim or fluke of nature that man's brain is so vastly complex — no matter what the size, as observations in microcephaly reveal. Microcephaly is a rare condition (1 out of 250,000 births) resulting in small craniums usually from premature closure of the skull sutures in the infant's early development. Reference to the graph shows microcephalics with cranial capacities in the 500 cm^3 and one in the 300 cm^3 ranges. Holloway states, ". . . the fact remains that very small brain size within pongid limits permits behavior patterns that in no sense can be viewed as pongid."[40] "These examples of microcephaly make salient the fact that something in the way of human specificity exists, even when the brain is deficient."[41]

Conclusion

One must assume that for man's brain to evolve as rapidly as it 'has' in the relatively short span of a few million years, then a dynamic and variability of structures must have arisen to pass the accrediting forces of selection. However, if we use the present as our key to the past — a different picture emerges.

Notice these two observations. One — by Bennet and Diamond writing in *Science*, "Whatever the cerebral residuals of experience are, it is unlikely that they will involve large changes of either gross anatomy or chemistry. It is characteristic of the brain that its variability is extremely low. Weight of the brain varies less from individual to individual of a species than the

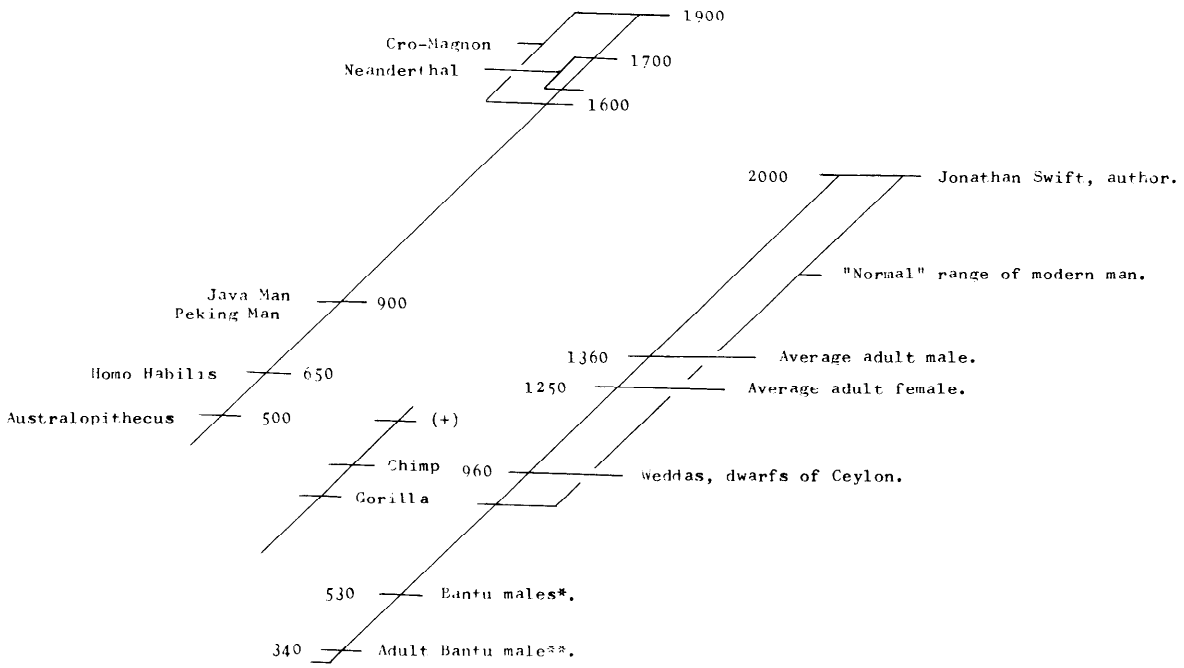

Figure 2. This shows brain capacities for some alleged evolutionary ancestors, the apes, and modern man. Unless specified, points represent a mean value. The scale is in milliliters.
***Average of three brothers with cranial capacities of 561, 511, and 517. They possessed speech capabilities.**
****Institutional worker.**
(+) One large brain case of a gorilla. Reference 8, p. 128.

weight of almost any other organ, and we have found the coefficients of variation for acetylcholinesterase activity to be almost as small as those for weight."[42] And two — by Grassé in his book *Evolution of Living Organisms*, "For several millenia the Chinese have numbered hundreds of millions. The conditions of their physical and social environment have favored intensive selection. To what result? None. They simply remain Chinese. Within each population, men differ by their genotype, and yet the species Homo sapiens has not modified its plan or structure or functions. To the common base are added a variety of diversifying and personifying ornaments, totally lacking evolutionary value."[43]

We have attempted, in short, to examine the issue of our large uniquely human brain, the role of language in its development, and the place of fossil studies (endocast) aiding our understanding. Some evolutionists predict a bleak future for us humans noting that the endocranial capacity of man has decreased since Neanderthal times.[44] Perhaps one intellectual was right — It's later than you think.

Finally, it is hoped that open-minded research will newly be channeled into this most fascinating area of the human brain. It is believed that a greater knowledge of the *design* and function of the brain can only return benefits to mankind at large. It is not just academia at work here but the use of this fund of information to cure mental diseases, mental illness, understand our development, aid learning, predict effects and causes, prevent mental retardation, strokes, cancers, dementias, epilepsy and hundreds more — all basically to better understand ourselves. To conclude, this last comment by Dr. Weider Penfield, a pioneer in the electrical treatment for epilepsy, seems most beneficial. "Do brain mechanisms account for the mind? [In] death the mind seems to vanish, as in sleep. I said "seems" . . . If, however, during life, when brain and mind are awake, direct communication is sometimes established with the minds of other men or with the mind of God, then it is clear that energy from without can reach a man's mind. In that case, it is not unreasonable for him to hope that after death the mind may awaken to another source of energy."[45]

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A NEW JOURNAL OF PHYSICS

It is apparent from correspondence that many readers of the *Quarterly* are interested in the theory of relativity, and related matters. These people might like to know about the *Journal of Classical Physics*, which is apparently in its second year of publication, and of which we have heard recently.

The purpose of the journal seems to be to take up the line of approach to physical problems which was followed so successfully, by Maxwell, Lorentz, Heaviside, and others around the turn of the century and a little earlier, before it was abandoned — prematurely, some think — early in this century. Items which have been published include: Electron Structure; Similarities between Gravitational Force and the Force Between Electrostatic Dipoles; Modifications of Maxwell's Equations; and Astronomical Counterevidence to Relativity.

The address is: The Journal of Classical Physics, Box 492, New York, New York 10185.