Natural selection, on the other hand, could not possibly have taken place apart from the mechanism of physical death inherent in the process of the survival of the fittest. If men evolved as a result of this process, then physical death could not have resulted from man's fall. Rather, man's tendency to die would have been inherited from his immediate forbears. Yet, if physical death is not a result of the fall, then our redemption in Christ is not physical either, or such Biblical passages as I Corinthians 15:21-22 would be completely nonsensical.

In keeping with the parallels provided in the Scriptures between Christ's resurrection and our own, it seems inescapable that, if our redemption is not physical, then neither can Christ's resurrection have been physical. Yet this is in direct contrast to the latter portion of the gospel according to John, in which Didymus the disciple is invited to touch the risen Christ and inspect the marks of the wounds inflicted by his crucifixion.

In view of these considerations, it seems inescapable that it is logically inconsistent to hold both that Christ has been raised in the physical sense, and that man has evolved during a process of natural selection.

LIEBERMAN REVISITED

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"If we accept the theory of evolution, we must face the problem of the evolution of human language."[1] Many philosophers[2] and researchers[3-5] have approached this problem but no one answer has been universally accepted. Philip Lieberman's conclusions were presented in Palermo's[6] book as probably correct—conclusions of which I am skeptical. Using scientific evidence, I have attempted to highlight his major errors, thereby showing that his suggestion of a missing link in the evolution of language is unfounded.

1. Lieberman's Argument

Philip Lieberman[7] believes that evolution proceeds in small steps, and the only reason that human language appears to be so disjoint from animal communication is that the hominids who possessed "intermediate" language are all dead (i.e., Neanderthals). He says that human linguistic ability must be viewed as the result of a long evolutionary process that involved changes in anatomical structures through a process of mutation and natural selection which enhanced speech communication.[8]

Lieberman and his colleagues conducted a comparative study of twelve human newborn skulls and heads; two modern apes *(Pongidae)*, who do not have speech; fifty modern adult skulls, who do have speech; and Neanderthal man, using La Chapelle-aux-Saints as the representative, to assess the language capabilities of the Neanderthal man. Although he and others[9,10] agree that Neanderthal man probably had some form of language, Lieberman suggests that "Neanderthal man did not have the anatomical prerequisites for producing the full range of human speech."[8] His conclusions are primarily based on skull and jaw structure similarities of Neanderthal man and the human newborn, and consequently, the differences of these two as compared with modern man. These include (as summarized in Le May[10]),

1) the body of the Neanderthal mandible is longer than the ascending ramus, whereas they are nearly equal in the adult man.
2) the ascending ramus of man inclines from a vertical plane and the angle formed by the body and the ramus is more open.
3) the mandibular coronoid process is broader; the mandible notch is more shallow in Neanderthal.
4) the styloid process is more inclined from the vertical plane, and the hyoid bone and the larynx are higher in position.
5) the dental arch is "U"-shaped (as opposed to "V"-shaped in modern man).
6) the length of the hard palate is less than the distance between the hard palate and the anterior margin of the foramen magnum.
7) the portion of the occipital bone between the foramen magnum and the sphenoid bone is nearer horizontal, while in modern man it is more vertical.

Furthermore, he concludes that Neanderthal man had no chin, which he designates as a pongid characteristic. The head was smaller than modern man, resulting in small frontal lobes and inadequate cavity space for forming vowels (particularly /a/, /i/, /u/). Also, he suggests that Neanderthal man had a supralaryngeal vocal track in which the larynx exited directly into the oral cavity. In the adult human, the larynx exits into the pharynx.[3] The tract consisted of only one tube, so Neanderthal could not encode, as modern man does with two tubes. (Speech is possible without encoding, but it is about ten times slower than normal speech.)

To reconstruct the supralaryngeal tract, Lieberman first located the position of the hyoid bone and thus of the larynx, which is beneath it; secondly, he reconstructed the tongue and the pharynx, relative to the larynx; next, he built the laryngeal, oral and pharyngeal cavities; and finally, he cast the supralaryngeal air passages, or vocal tract (as summarized in Falk[4]).

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It is essential that this reconstruction be accurate, as the human vocal tract displays characteristic features not found in other primates. Language is based on these specialized features,[11] the most important of which is that the tract is bent.[12]

The vowel triangle (i.e. /a/, /i/, and /u/) was chosen because Troubetskoy had noted that these vowels occurred in "practically all of the languages" that he studied;[7] thus Neanderthal would have been able to produce them if he had an adequately formed vocal tract (according to Lieberman).

In conclusion, Lieberman, et al.[8] claim that "the similarity between human newborn and the adult Neanderthal fossil conforms to the view that modern man and Neanderthal man had a common ancestor." Neanderthal is not "directly related to modern man" because he had specialized features, like a supraorbital torus, that are not present in most modern men, human newborns, or in apes. Since Neanderthal man was more advanced than present-day non-human primates in phonetic ability, but since he did not have "the full range of human speech," and also lacked the neural detectors involved in speech perception, "Neanderthal man thus represents an intermediate stage in the evolution of language, indicating that evolution of language was gradual, and not abrupt."[3]

2. Evidence Against Lieberman's View

Although some researchers support Lieberman's contention that Neanderthal had inadequate speech,[13, 14] a number of others are critical,[15, 16, 10] or cannot replicate his findings.[4, 5] Morris states that Lieberman's argument "of human newborn-adult Neanderthal similarity, and dissimilarity of both to adult man is not necessary . . . (and) it can be refuted."

First, the Neanderthal skull chosen for study, La Chapelle-aux-Saints was not adequately representative of the race.[15] It had only two teeth, which was the result of a periodontal disease, so the observed mandibular angle and the mandibular canal is distorted (points 2 and 3a above). Also, La Chapelle suffered from osteoarthritis of the tempero-mandibular joint, thereby producing superio-inferior shortening and thus, a shallow mandibular notch (point 3b above). Although Lieberman and Crelin[17] argue that arthritis does not affect speech production, they fail to recognize that arthritis *does* affect the bones, which are what they were studying.

Concerning the reconstruction, Carlisle and Siegel,[16] and Morris,[5] find it faulty and the measurements inaccurate. For example, Morris noted discrepancies in Lieberman's illustrations as to the locations of the styloid process angle. This angle is important in that it is the key to the location of the hyoid bone, and thus of the larynx. Lieberman had measurements of 33 and 41 degrees, and 10 and 20 degrees in different figures. Morris' reconstruction places the hyoid bone lower and more posteriorly (indicative of modern man) than Lieberman's and he measured both styloid process angles to be 15 degrees. Morris shows that Neanderthal did not have high larynx position, an elongated vocal tract or an horizontal tongue resting position, but has low larynx position, an angulated vocal tract, and the back of the tongue is vertical (forming the anterior wall of the oral part of the pharynx) as in modern man (point 4 above).

Supporting Morris, Falk[4] reasons that the skeletal similarity between Neanderthal man and modern man suggests that the larynx of Neanderthal should be reconstructed like that of the adult human, with the hyoid bone well below the inferior edge of the mandible, and thus lowering the larynx position. He adds that Lieberman failed to take into account that Neanderthal man was erect and that "all parts of his body are as adapted to the upright posture as are those of modern man."[13] Therefore, Neanderthal "could not have differed fundamentally from modern man in his cervical curvature and the carriage of his head," according to Falk. Consequently, one would expect that the oral passage would form a right angle with the oral pharynx as is the case for modern man, rather than the wider angle which characterizes the slumped posture of the chimpanzee (point 2 above). Also, the chimpanzee is not normally bipedal, as is shown by the carriage of the head and the high position of the epiglottis relative to the soft palate. Man is characterized by a separation of the epiglottis from the soft palate, which is correlated with his erect posture. Falk concludes that, in light of these facts, Lieberman is not justified in his high placement of La Chapelle's hyoid bone.[4]

Le May[10] presents some statistics on some modern men with normal speech who show physical features in common with Neanderthal man (points 6 and 7 above). For example, one man had an U-shaped mandibular arch (point 5 above) and yet could speak (see Le May for illustration). Furthermore, both she and Carlisle and Siegel[15] note that many modern men show prognathism, with the mandible longer than the ramus (point 1 above), and still have normal speech.

Lieberman's claim that Neanderthal man lacked a chin[3] is also challenged.[10, 15] Carlisle and Siegel assert that not only did Neanderthal man have a chin, but that not all modern men have distinct chins. Lenneberg,[9] in reference to the absence of a chin, along with the structure of the mandible and the shape of the denture, states that "all we may deduce from this evidence (if it is indeed accurate) is that the vocalizations of fossil man did not bear any close acoustic resemblance to the speech sounds of any modern tongue" (p. 261).

Lieberman's assertion that Neanderthal had small frontal lobes[3] is questioned by Le May.[10] She claims that a study of La Chapelle's endocranial cast points to a larger brain, and one which "resembles modern man in an area important for speech and thereby suggests that Neanderthal had the neural development necessary for language." She states that the speech areas of the brain lie along the banks of the Sylvian fissures, usually on the left. Her approximations of Neanderthal Sylvian fissures resemble those of modern man (Le May gives an illustration).

Furthermore, Lieberman makes no comparison of other than American skulls (e.g., not with pygmies). Carlisle and Siegel[15] note that La Chapelle can be compared to the Australian aborigines, which further

lessens any dissimilarities to modern man. Moreover, Lenneberg[9] shows that "if one cannot make unfailing deductions from recent (three years ago, in his example) bones, one can hardly presume that inferences are possible about fossil man who lived under almost totally unknown circumstances" (p. 257). He also states that endocasts give no language-relevant information, only the approximate size and shape of the brain; and this furnishes no secure clue about the capacity for language. Le May[10] supports this, citing pygmies and dwarfs, with smaller brains yet with normal speech, as examples. Also, there is "no direct evidence" to link the evolution of speech to the fossil record (Washburn & Lancaster[11]).

E. L. DuBrul[18] points out that if the Neanderthal vocal tract were as reconstructed, "he would not have been able to open his month, let alone speak." In the same way, Falk[4] notes that Lieberman's reconstruction would indicate that the Neanderthal would not have been able to swallow like a human. The muscles would be pulling the hyoid bone forward in the act of swallowing, rather than raising it, as is normal for man; the tendons involved in swallowing are placed above the level of origin in Neanderthal, rather than below as is normal for man. Falk concludes by saying that there was too much missing from the skull and Lieberman made broad anatomical generalizations and miscalculated angles where organs were relative to one another. Lenneberg sums up by saying that "language is not an arbitrarily adopted behavior, facilitated by accidentally fortunate anatomical arrangements in the oral cavity and larynx. . . ." (p. 175).[9]

In using primarily the vowel triangle as a basis for "the full range of human speech," Lieberman fails to take into account the full range of modern speech productions. Computer analysis shows that Neanderthal could produce /I/ and /e/;[4] and Lieberman admits that there may have been intermediate degrees of phonetic ability.[8] Furthermore, Troubetskoy did not show that the vowel triangle was universal, but that "vowels *like these* occurred in *practically all* of the languages *that he studied*" (in Lieberman;[7] italics are this author's). Neanderthal speech may not have included these vowels; in any case, their absence would not have made his speech inferior to that of modern man, as Lieberman would suggest. The following response by John H. Fremlen illustrates this point:[19]

> The Demese ef the Ne'enderthels:
> Wes Lengege e Fecter?
>
> Et seems qwete prebeble thet the Ne'enderthel ked speke less well then ther seccessers, end thet wes the resen fer ther demese. Bet even ef we beleve the kempeter reselts (Research News, 15 Nov. 1974, p. 618), et seems emprebeble thet ther speech wes enedeqwete bekes ef the leck ef the three vewels seggested. The kemplexete ef speech depends en the kensenents, net en the vewels, es ken be seen frem the general kemprehensebelete ef thes letter (1).
>
> Jehn H. Fremlen
> Depertment of Phesecs
> Eneversete ef Bermenghem
> Bermenghem B/F 2TT, Englend

1. The neutral vowel throughout is "e," as in "her."

Furthermore, Gibbons[20] estimates that the area of the formant frequency of the vowel triangle of La Chapelle-aux-Saints lies within 0.81 standard deviations of the mean of a modern population of English-speaking people, that is, within the range of 66% of the modern sample. This is another example of Lieberman's inaccuracy.

Some controversy exists as to the placement of Neanderthal man in evolutionary sequence.[21] Marcellin Boule, who constructed the restored cast of the skull analyzed by Lieberman, et al.,[8] did not believe that Neanderthal was a hominid. As a result, it is possible that his restoration was biased—and that this consequently biased Lieberman's results.

Finally, Lieberman, et al.,[8] state that "although the larynx was judged to be as high in position as that in newborn and apes (Pongidae), it was purposely dropped to a slightly lower level to give Neanderthal every possible advantage in his ability to speak." This action is to me an unclear and questionable one.

3. Summary and Discussion

In summary, Lieberman's major errors include:

1) Faulty (and perhaps biased) reconstruction of the skull, including placement of the hyoid bone and consequent projected placement of the larynx.
2) Using the vowel triangle as the only basis for assessing adequate language and miscalculating Neanderthal's ability to produce those vowels.
2) Using an inadequate representative of the human race and then comparing it only with American skulls.
4) Making broad generalizations based on inadequate data.

It is his adherence to the evolutionary theory of man that hinders Lieberman. In his desire to produce evidence for a (questionable) existence of a missing link, he makes errors that may not have been made had he been more cautious in his approach. His inferences that the speech he does concede to Neanderthal was inferior are unfounded (as cleverly illustrated by Fremlen). He does not know the extent to which the vowel triangle appeared in speech utterances throughout history. He assumes much importance of a relatively minor detail, especially since these vowels have not been found to be universal.

His failure to examine skulls other than the average American is a major oversight, particularly since La Chapelle was not discovered in North America.

In conclusion, Lieberman bases his theory on information which has yet to be verified. The theory of evolution is just that—a theory—and the idea of a missing link is conjecture. I refer the reader to the opening quotation from Haldane. The theory of evolution is one I do not accept; therefore, this kind of study of language evolution is unnecessary. In T. S. Kuhn's terminology, Lieberman is operating in a paradigm which has the evolutionary theory as its base. I am operating in the paradigm which has creation as its base. The two are incommensurate with each

other, which makes communication difficult. However, Lieberman's results have been seriously brought into question — the erors cannot be ignored — and I feel that this is important to recognize when reading his paper.

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GENETIC ENGINEERING: THE EVOLUTIONARY LINK

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Although a great deal has been said about the creation-evolution controversy, much less has been written about the implications of evolutionary thinking. One area of great concern is how evolutionary assumptions cloud our perception of genetic engineering. It is the purpose of this paper to expose that link and provide a Biblical base for evaluating genetic engineering.

Genetic Engineering

For thousands of years, man has had the ability to breed variations within created kinds. But recent advances in genetics now allow him radically to alter genetic structures and transcend the barriers between the created kinds of plants and animals. One of the most sophisticated techniques used to do this is recombinant DNA research (rDNA).

This research technique was first developed in the 1970s by scientists working at Stanford University and the University of California at San Francisco. By using restriction enzymes, they could cut small segments of DNA (called plasmids) and insert foreign DNA into various hosts (principally *Escherchia coli*). These formed genetic hybrids called chimeras (due to their conceptual similarity to the mythological Chimera which was a creature with the head of a lion, the body of a goat, and the tail of a serpent).

The possible benefits of this technique are vast. They provide a means by which genetic repair can be affected on plants, animals, and man. They also allow scientists to alter existing organisms so they can manufacture medical or industrial products for our use.

But there are also dangers. Many scientists have been concerned that rDNA techniques might produce an "Andromeda Strain"[1] for which there is no cure. As a result, the National Institutes of Health have established various guidelines for physical (P1, P2, P3, and P4) containment. Further studies, however, have shown that the potential danger of escape and infection is much less than originally assumed.

But it is with these guidelines that we begin to see evolutionary assumptions working. The assumptions about safety are based upon the theory of evolution. Experiments performed with DNA from animals considered to be evolutionarily close to man are believed to be more dangerous than those performed with DNA from less-advanced animals.

Since we live in a created world, such a rating may not be completely accurate. Certainly, similarity in morphology implies some similarity in genetic structure. We might expect that DNA sequences of other mammals would be more similar to human DNA than to viral RNA, but we would also expect some excep-

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