

**WHAT HAPPENS TO THE CRANIOFACIAL STRUCTURE
OF HUMANS WHO LIVE PAST 100 YEARS?
NEANDERTHAL SIMILARITIES. ©1997**

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ABSTRACT

If the ages of the Biblical patriarchs and the earliest men of Genesis are to be taken literally, there must be a way to recognize the skulls of these people. Anthropology has a rich history of longitudinal growth studies of adults. Computer assisted extrapolation of modern longitudinal adult male growth studies with lateral cephalometric radiographs has made possible the approximate visualization of such aged craniofacial remains up to 500 years of age. Comparisons have been made with a young male adult Neanderthal and two older adult Neanderthal males, all of whom are classics and lived in southwestern, France. Dental attrition and lower facial height increase have been used to demonstrate the likelihood that longer periods of time were necessary for the transition of a young into an old Neanderthal. It is concluded that the Neanderthals were the old peoples of the Bible.

INTRODUCTION

Modern man 's average life expectancy at birth is seventy-five years [17] , and the maximum longevity is 115 [17] or 120 [28] years. Death, of course can come much sooner with accidents or disease having nothing to do with chronological aging. The complete life tables of the Office of the Actuary of the USA end at the age of 119 [28]. Most people think we have experienced an increase in life expectancy from the mid-nineteenth century to today [28], and it is common knowledge that life expectancy at birth has doubled from 40 to close to 80 years since the early 1800's.

This is true in mathematical calculations because of one major factor. Comfort wrote that, "This has been due almost entirely to a reduction in the mortality of the younger age groups-the human 'specific age' and the maximum life-span have not been appreciably altered " [11]. What he maintained was that the increase in life expectancy from 40 to 80 is due to the fact that the deaths of many young children in the 1800's pulled the average age of death down to the level of about 40 years. With most children today surviving the early years , the average age of death has risen to the length of years revealed by David in Psalm 90:10, which is about 80 years.

As Comfort said, the 80 year span has never really changed, and this is true, but I think that he is missing the point that we all must learn about our mass longevity. The fact remains that people are not just living longer but more people are living longer. This is what the statistics say. We must also ask about the time period to which this term,'longer', applies. The answer seems to be: More people are living longer in our day than in all the ages past except the pre and immediate post-flood times. But how is this possible? There must be a change in the way most of us get to be that old and survive childhood. I think we can safely say that the general increase is due to modern technology and not increased vitality of our cells [24]. Many of us now arrive at those old ages whereas in the past it was the few with healthier systems who lived to old ages. This was survival of the most healthy; however it was devolution not evolution that was governing the system. It is my belief that fewer and fewer lived to long ages until modern science came to the rescue. As man weakened through the ages science was called upon to prop him up. Modern medicine and immunological advances have decreased the death rate of infants as well as adults. Any increase that we may see in the coming years will be due to more modern medicine and technology and not to our strength as individuals. Some even say that modern

science has failed in the field of cancer and other fatal diseases, so they are turning to alternative medicine and herbal remedies.

Comfort continued, "The large changes in the survival curve of man over the last century represent, quite simply, the removal of causes of premature death, but the age at which a man becomes old, judged by criteria of increasing infirmity and liability of death, is exactly what it was in Biblical times" [11, p.5]. By Biblical times he is referring to the times of the majority of Biblical peoples from Moses to King David's time through the times of Jesus Christ. He is not referring to the early peoples of Genesis.

If I could add a comment in the margin of Psalm 90: 10, it would say, "As for the days of our life, they contain seventy years, or if due to strength, eighty years," Comment: (without modern antibiotics or modern medicine) Today, this is not the way most of us age, naturally due to strength. We age artificially, due to the intervention of modern science. This seems primarily because of increased emphasis on preventative medicine, maintaining good health through frequent check-ups, exercise, diet, supplements, a generally healthy life style, and more organ transplants.

There is, of course, the fact that "the centenarian (100+) population grew by 160 percent in the U.S. during the 1980's" [30]. And, "many demographers predict that 20 to 40 million people will be aged 85 or older in the year 2040, and 500,000 to four million will be centenarians in 2050" [30]. All of this seems to say that great numbers of people surviving to a ripe old age will be increasing in the future. Raising the numbers of survivors into their 90's will most likely produce an artificially inflated average age of life expectancy at birth in the future. This will have nothing to do with evolution but everything to do with modern medical technology and perhaps even genetic engineering.

Thomas Perls has described the oldest person alive in the present era, Madame Jean Calment of Arles, France who turned 120 in February, 1995, making her the oldest living person in 1995 whose age had been verified [30]. She died in 1997 at 122. Some speculate that she might have been the oldest person ever. Most of us do not even come close to this age. Perls maintained that people with Methuselean aspirations are up against incredible odds [30].

If we read the Bible as it was written, as Dr. Francis Schaeffer was fond of saying, we would have knowledge that is different than the finite knowledge of the world [34]. We would have knowledge directly from God. We would know that the oldest person on record wasn't Jean Calment. The oldest person in the world could have been Adam if he hadn't sinned. However, he was 930 years old when he died, just 39 years younger than Methuselah, who reached 969. Methuselah, therefore, has the record of having the longest life on earth. Beginning with Adam first, Jared, was the sixth generation, and he reached 962, becoming the second oldest person to be recorded in history. Noah's life extended to 950 years, making him the third oldest person recorded. Immediately after the flood the ages of humans dropped dramatically but still remained at levels not experienced today. We must recall the scene depicted in Genesis 47:7-9. Joseph brought his father Jacob and presented him to Pharaoh; and Jacob blessed Pharaoh. And Pharaoh said to Jacob, "How many years have you lived?" Then Jacob said to Pharaoh, "The years of my sojourning are one hundred and thirty; few and unpleasant have been the years of my life, nor have they attained the years that my fathers lived during the days of their sojourning." Jacob lived 17 more years in Egypt and died at 147. His father Isaac had lived to 180 and Abraham 175. Pharaoh asked Jacob only one question. How old was he? Jacob told him and also affirmed the declining nature of this longevity amongst the Israelites. Should we dismiss these ages as being exaggerated or mistaken? If we take them seriously our next question should be; where are the remains of these old people? Or, were their bones never preserved? If you found someone who lived past two-hundred years would the cranium look like modern man? How would you know what his appearance would be? We know there must have been some preservation in Israel since the patriarchs were buried in caves, (Gen.23:9,25:9,50:13) and the Mt Carmel caves of Skhul, level B and Tabun, level C were repositories of modern human and Neanderthal remains [35].

In order to identify a very aged skull we should first know what would happen to our head and face if we lived past 100 years. Then, we might know how it would appear.

This should be the focus of Biblical anthropology, if we take the Bible seriously.

ADULT CRANIOFACIAL GROWTH

Important longitudinal research at University of Iowa was reported in the American Journal of Orthodontics in 1994 [5]. They were able to show that after the normal growth period for modern man is finished, growth still continues in the face and head. The comparisons were made with cephalometric radiographs of the face and head of each person when he or she was 25 and when he or she was 46. They stated in their discussion, "Overall, the present findings suggest that age related changes in the craniofacial complex do not cease with the onset of adulthood, but continue albeit at a significantly slower rate, throughout adult life" [5, p.185].

Going back into history, we find numerous studies on adult growth. In fact, it is one of the most documented facts in anthropologic literature. In 1936 Ales Hrdlicka of the Smithsonian Institution wrote, "There is a universal notion that when the adult stage of life has been reached, all growth except in bulkiness, has been accomplished and henceforth ceases. The very definition of an adult is that of a person grown to full size and strength. The purpose of this paper is to show that, while such a concept suffices in general, scientifically speaking the view is largely erroneous." [20]. One hundred years earlier, Parchappe in Paris, concluded that the volume of the head increased up to age 50 [29]. In 1899 Pfitzner, in Germany, examined 3400 male and female cadavers and found that their heads and faces grew into middle age 35-45 [31]. Jarcho, of the Moscow University reported on age changes in the adult in 1935 to beyond 40 years [22]. He found that the heads of three groups, the Russians, the Kirghiz, and the Uzbeks increased more in length than in breadth from ages 20-25, 26-39, and 40 years and above. An index called the 'cephalic index'(width of cranium divided by length x100) decreased in all groups with age. In short, the heads became longer (dolichocephalic) over the years and wider too but not to the same extent since the shape of the skull changed as it gained more in length than in width. Parchappe found dramatic increases of length over width [29]. Hrdlicka also emphasized that overall the results are not entirely uniform but the general tendency is clear. He believed that adult growth of the head was a fact, not to be ignored [20]. Another facet of the adult skull growth to be considered is its height. Pfitzner's Alsatian male skull adult height figures start at 120.9 mm for age group 20-25 and finish at 121.6mm for 81 years and over. This represents a mere increase of 0.7mm, less than 1mm of growth in head height. Female Alsatian head height actually slightly decreased from 117.1mm for the 20-25 group to 116.2 for the over 81 group [31]. In old American white males from Hrdlicka's figures we find the male (247 skulls) height decreasing slightly from 80mm to 78.5mm between 29 and 59 years. The females showed a tiny increase between these ages (1.8mm) but nothing compared to the almost 5mm increase in length.

The picture that we get here is of an aging skull which, in general terms, grows much longer, a little wider with practically no increase and sometimes a decrease in height. Therefore it can be concluded that with the exception of the females of one isolated Indian tribe in the US [20], all other groups of peoples studied by the aforementioned anthropologists showed the following: a skull whose proportions changed as it aged with the lengths gaining the most, the widths next, and the heights the least.

Cranial Thickness

T. Wingate Todd in 1924 measured 448 male skulls for thickness of the bone itself in various places [39]. He found a sporadic thickening of the cranium during later life. It has long been a myth in our society that aging was synonymous with bone loss. The skull gets thicker in certain places with age. Campbell, a radiologist, in 1966 observed in his work that the cranium throughout life continues to thicken in certain places [9].

The Face

Tallgren in 1957 used cephalometric radiographs of 165 women in a cross-sectional study. Her results showed that there were increases in facial height from the youngest to the oldest groupings [37]. Milo Hellman, for whom there is a coveted award in the American Association of Orthodontists, said in 1927, the face does keep on growing "until old age." [18]. Pfitzner also determined the enlargement of the length of the face for 3400 cadavers in 1899. From the point where the nose meets the forehead to the bottom of the bony chin increased in height from 20-25 years to 81 years and over 5% in men and 1.5% in women. The width of the face also expanded about 2% [31]. Hrdlicka found similar results with older Americans and concluded, "In old Americans therefore, as in the Alsatians, the face appears to enlarge appreciably, during adult life, in both its height and breadth, and that up to the sixth decade." [20] Using 10,000 Irish men, Hooten and Dupertuis, in 1951, expressed surprise when they found continued facial growth into the sixth decade [19]. They also documented continuous head growth. Lasker, in 1953, confirmed this trend in the human head in studies on Mexicans and said, "The curves for age changes reported for Mexico are essentially similar to the findings in other groups. The chief factors responsible for the age changes apparently cut across geographic and racial boundaries" [25]. Sarnas wrote a Master's thesis on the growth of skulls of ancient man at the Univ. of Rochester in 1955 [33]. He used 120 skulls of ancient Indians from Indian Knoll Kentucky from supposedly 5000 years ago. He noted that the cranial length increased from the younger to the older group among males while the cranial height did not increase. The total facial height also slightly increased. They had dental attrition which slowed this process. Ruff in 1980 confirmed in his study of 136 ancient skulls from Indian Knoll, Kentucky, that the very same increases took place in aging and he believed that it was a phenomenon that transgressed all borders of sex, race, population, genetic, mechanical or environmental factors. In other words, it was universal in character [32].

More Longitudinal Studies

With the exception of the Iowa examination, all of the above have been cross-sectional studies (different people). There are other longitudinal works of merit. Buchi studied 200 Swiss adults and separated them into six age classes. He concluded that aging resulted in gains in diameter of the head and face and also of the long bones [8]. Thompson and Kendrick in 1964 used cephalometric (measurable) radiograph analysis of 71 men aged 22-34 years. They took measurements once a year. They saw that without much attrition of the teeth the vertical dimension of the face increased significantly [38]. Kendrick and Risinger in 1967 measured the same 71 men and reported increases in head length, and facial depth [23]. Harry Israel of the Fels Institute in Ohio conducted and published at least 12 studies on the nature of long term adult growth [21]. Susanne in 1977 published a work done on 44 Belgian men. He measured their heads twice between the ages of 25 and 60 years. He found consistent increases in head length and head width. He also demonstrated gains in the lengths of their faces, their noses and their ears. He found a decrease in the size and thickness of the lips [36].

To test this phenomenon yourself, if you are an older person observe a picture of yourself at a younger age. If you are a younger person, observe pictures of your parents or grandparents when they were younger and older. The changes you notice are not just soft tissue changes, they are genuine bony changes. If you are over fifty try on a hat that fit you at twenty. Barring shrinkage of the hat, it will not fit as it did when you were 20.

LONGEVITY RESEARCH

If there were extremely old people who lived in the past, we can assume they would have undergone the same changes in the face and head that the aforementioned studies have described. Perhaps it was at a different rate with different tooth wear since our modern diet requires little mastication. If this is true, where are the remains of these people? Do the museums have any skulls of these very old people? Would the museums that are dominated by evolutionary ideology even consider such a view of their remains?

In 1995 I and Brian Garner used a longitudinal study from the University of Michigan Center for Growth and Human Development. Garner created a computer program that extrapolated the Michigan data which ended in the 80 year range out to 500 years. In was our opinion that by this method it might be possible to visualize how the Biblical patriarchs appeared when they had reached a great age. We used results obtained by Rolf G. Behrents in a radiographic study of adult aging conducted at the University of Michigan in 1985 [4]. It all began with a group of 113 people at Case Western Reserve in Cleveland, Ohio in 1928 in the Broadbent-Bolton Study. This original study started with 6,000 normal individuals who were generally of European ancestry. In 1985, after narrowing down the field to those who were able to be located and would participate, and those who did not have orthodontic treatment, were in good health physically and orally, and had x-rays taken at or after the 17 year level and final x-rays after the age of twenty-five, they settled on 113 people. The initial average age for the participants was 19.7 years and the final average age was 46.4 years. This was a total of 26.7 years of change for the bulk of the population, which is a short period of time and does not indicate later changes. Significantly, however, there also were 41 people at 57 years or over at their last examination. So it is a graphic display of the growth of the head and face of contemporary adults from middle America. Lateral head (cephalometric - measurable) radiographs had been taken on these individuals, and carefully digitized marking points were located that were reduced to mathematical data. Garner took Behrents' data and extrapolated beyond the eighty year range. He used only the 79 males in the study because it is generally believed that the amount of change that took place in the male was greater than in the female. Therefore it is assumed that while the alterations were almost similar in both sexes, the male changes would be more noticeable because of their usually heavier musculature and basic genetic differences. The male initial age was 19.8 years and the final age was 46.6 years with 26.8 years of change.

Craniofacial changes from 34 to 83

The oldest person in the Michigan study was a female aged 83 and Figure 1 shows her two cephalometric radiograph tracings done at two different ages [3, p.56]. She was 83 (solid line) at the time of the second x-ray and 34 (broken line) at the time of the first. Starting at the forehead (frontal bone), the soft tissue and bony forehead grew more at the lower half than the upper; so the brow ridges started to come forward along with the middle part above the nose (glabella). This growth was accompanied by the frontal sinus growing upward and forward. The soft tissue nose became longer and the bony upper part of the nose (nasal bones) moved forward and upward. The teeth and jaws (maxilla and mandible) came forward and the bony chin started to flatten somewhat. The cheekbones (zygomatic arches) came forward also. The eye socket (orbit) moved forward and the ear hole (acoustic

meatus)rose.The back of the skull started to develop a larger point or protuberance on the occipital bone. The lips dropped and so did the lip line. The gonial angle and lower border of the mandibular body also dropped. Overall, the face looks as if were pulled anteriorly and slightly inferiorly while the back of the skull extended posteriorly.

COMPUTER EXTRAPOLATIONS FROM THE MICHIGAN DATA [4]

The results of our extrapolations past 100 years in males show nearly the same phenomena occurring as seen in Figure 1. Figure 2 superimposes age 100 to 500 in bony changes viewed in the lateral radiograph on the sella-nasion line. This line is drawn from the center of sella turcica (pituitary fossa) to the junction of the frontonasal suture at the most posterior point at the bridge of the nose. The sella-nasion line is not visible in the extrapolations because it would obscure the multiple structures we want to emphasize. Superimposition is accomplished by using the right angle reference markers in the lower left corner of the tracings. The base of the right angle reference marker in each tracing in Figures 2 and 3 is parallel to the invisible sella-nasion line. The angle itself is a set distance from sella.

Figure 3 presents three of those ages (100, 300, 500) with the soft tissue changes viewed in the lateral radiograph. We found the following alterations in the craniofacial skeleton for a modern male human if he lived 500 years :The base of the cranium moved downward and very slightly forward behind the socket of the lower jaw near the opening of the spinal column. However, the angle of the base of the cranium from the front of the brain to the very back appeared very stable with only increases in length at both ends. The point (nasion) where the nasal bones meets the frontal bone moved forward at all ages. The frontal sinus, which is just above the bridge of the nose and between the eyes, continued to develop spectacularly with age. This carried glabella and the center of the brow ridges forward. Behrents gave just the height measurements and no points for determining changes in the center of the internal width of the frontal sinus; however the sinus expanded with the glabella portion of the browridges. The eye-socket slightly enlarged and moved downward and forward increasing the height of the orbit. The base of the zygomatic bone also advanced forward so that the midface sloped forward and gave the impression of a "muzzle". The maxillary sinuses enlarged. The maxilla extended in the forward direction, so that during the adult years there was additional bone added above the upper front teeth at the "A" point (the most posterior point on the curve of the maxilla between the anterior nasal spine and supradentale). The maxilla also descended as it grew forward, and the back of the hard palate lowered more than the front part. The palate tilted toward the rear as it descended, so that it became more parallel to the anterior base of the brain. The tip of the nasal bones advanced forward and elevated slightly. Menton (the most inferior point on the symphysis of the mandible) is an indicator of the front of the mandible. Menton moved downward as the entire mandible descended. The chin and mandible seem to have advanced forward at a faster rate than the maxilla. This would make the mandible more prognathic (protruding) with age in relation to the maxilla unless a habit such as thumbsucking pulled the maxilla forward. The angle that the mandible makes within itself, between the ramus and body became more acute with age.

The curious thing about the mandible is that while the ramus and body elongate, the center of the anterior border of the ramus resorbs during aging. When using Behrents' final angle for the anterior border of the ramus, we discover that the projection from 200 to 500 shows this area to have resorbed. (Fig. 2 dashed line) When using Behrents angle for the 31 to 50 years we note there is bony deposition there. (Fig 2-solid line) In Fig. 1 this border did not decrease. Perhaps there are male female differences. However, Behrents' direct measurement [4] across the ramus at this point to the gonial angle showed a 0.19mm increase in males and a 0.19mm increase in females. Therefore, both projections are correct because they display the inner and outer ramal changes. In modern man's lifetime resorption does proceed at the center of the anterior border and proceeds up the medial side of the ramus onto the coronoid process. The coronoid process elongated at first under 100, but after that became shorter because of this resorption pattern. A large section of the ramus resorbed as shown in Fig 2 (dashed line). If the masseter and internal pterygoid muscles (sling muscles of mastication) did not maintain strength and position into old age perhaps both the inner and outer border would resorb. Behrents thought that the coronoid is responsive to increased or decreased biomechanical demands placed on it with age.

Our program has no way to determine muscle strength or positioning of the sling muscles in old age. Therefore resorption should overwhelm this anterior border and coronoid process if the sling muscles did not retain their insertion base across the lateral and medial sides of the ramus. Perhaps the forward movement of the teeth initiated some forward movement of the muscles to increase their mechanical advantage [12]. Anterior muscle positioning has been found in Nubian jaws and skulls by Carlson and Van Gerven in their oldest skulls with more forward facial positions allegedly 12,000 years BP. They found posterior mastication muscle positions in younger skulls [10]. Therefore it is my opinion that the solid line represents the lateral edge of the anterior ramus border that flows into the oblique line, but

that immediately medial to that edge the ramus is resorbed and appears scooped out. Both representations are correct. The temporo-mandibular joint or glenoid fossa became wider and the condyle on the end of the ramus became thicker. As is visible in the 500 year old male, the teeth moved so far forward that the chin began to look flat. This was the result of the mandibular front teeth and alveolar process tipping back as all the lower teeth slid forward over the chin. A train car analogy can be made here. It is like a moving passenger train car where the car or mandible is moving but the passengers or teeth are also moving to seats closer to the front. To make it more accurate, the people in the front are reclining in their seats while the people in the back have their seats in the upright position. The maxillary teeth moved forward also but less than the lowers. The lower teeth moved through all the ages. The chin appeared to become smaller because of the amount of forward movement of the teeth and alveolar bone, but it is not being resorbed. There is just a filling in of bone above the chin.

Therefore, if the patriarchs of the Bible had extreme longevity, which we have lost, can it be proved that their craniofacial features were like these extrapolations? Neanderthal specimens are presently in museums that match these extrapolations. I took cephalometric radiographs of the Neanderthals presented in this paper in the museums of Paris, France and Berlin, Germany. See Figs. 4 and 5 for cephalometric radiographs of La Ferrassie 1 and La Chapelle-aux-Saints whose remains are held at the Musée de l'Homme in Paris.

EXTREME OLD AGE OR FAST GROWTH RATES

None of the Neanderthal craniofacial features (Fig 6) could be attributed to extreme old age if it could be proved that they had a faster growth rate than modern man in specific craniofacial regions as detailed above. It has already been claimed by Dean, Stringer and Broomage [16] that the Neanderthal children matured quicker and grew faster than modern children. I found flaws with this argument in the four Neanderthal children's reconstructions which I studied in the European museums and found the bones were manipulated to show rapid growth and maturation. Pat Shipman summarized Trinkaus' thoughts concerning the Neanderthal face, "the overall forward thrust of the middle region of the face - an arrangement described by a later scholar, Erik Trinkaus, as looking as if a modern human face, made of rubber, had been grabbed by the nose and pulled forward" [40]. The real question is: "How fast did it get pulled forward?"

PASSIVE TOOTH ERUPTION

All of the teeth keep erupting throughout life (passive eruption) [1] [2]. Bone is added (apposition) on the lower border of the body of the mandible and small amounts to the alveolar areas which surround the teeth. This continuous passive eruption of teeth is what compensates for the continuous wear or attrition on the biting surfaces of the teeth. This process maintains or increases the height of the lower face throughout modern man's life or in some instances, with excessive attrition as in Australian aborigines, it does not quite keep up with that wear on the teeth, and lower facial height is lost [26]. When this continuous eruption process lags behind that of the surface wear on the teeth the distance between the anterior nasal spine (tip of the median, sharp bony process of the maxilla at the lower margin of the anterior nasal opening) and menton decreases. If this passive eruption process is faster than the occlusal or surface wear over a long period of time, this distance will increase. This latter process (Fig. 2) occurs in modern man. There is a rapid increase of lower facial height and not much attrition of the occlusal surfaces of the teeth because of a soft diet. Therefore these computer diagrams are not accurate from the standpoint of tooth attrition when comparisons are made to ancient people of the Bible because grinding stones always left minute traces of grit in the flour of bread. Stone tools left grit also. Ancient man's dental wear had to be slightly greater as it was just a few centuries ago. Different populations wear their teeth down at different rates and it is directly related to diet, enamel amount and quality, and eruption dates of teeth. Even teeth in the same mouth have different rates of enamel wear or occlusal attrition. There is also attrition between the teeth.

What happens when there is extensive wear of all the biting surfaces of the teeth and the facial height still increases well into adulthood? Would it mean faster tooth wear accompanied by a faster rate of passive eruption of those teeth with very rapid bone build-up on the lower border of the mandible? Murphy [26] found out in his studies of Australian aborigines that passive means passive. Among modern *Homo sapiens*, Australian aborigines wear down their teeth on the biting surfaces as much and as fast as any group. Murphy measured Australian aborigines' occlusal tooth wear and the compensating passive tooth eruption and lower jaw bony build-up by determining lower facial height of 337 skulls with different levels of tooth attrition [26]. Murphy concluded, "In the Australian aborigines attrition, by its rate and degree, overshoots the anticipated mark. Compensation is not fully adequate and the net result is a decrease in facial height." Aborigines lost lower facial height because they wore down their teeth so fast. No amount of passive eruption or bone growth could keep up with it. Did

Neanderthals who had equally extreme wear or even more occlusal wear than aborigines, have faster passive eruption, so that their lower facial height from young adulthood to late adulthood increased? Fig. 7 shows the disarticulated tooth-bearing portion of the maxilla in optimal centric occlusion with the mandible of a Neanderthal youth Le Moustier, considered 15 to 18 years by modern standards [27]. Cuozzo has calculated his age at 29 to 34 years by means of mandibular gonial angles, cephalometric facial growth comparisons of Neanderthal children to modern and Eskimo children, sexual and osseous maturational studies, tooth enamel attrition both occlusally and interproximally, diet considerations, and muscular chewing forces [14]. Fig. 4 is a typical Neanderthal adult, La Ferrassie 1. The standard ages of these two classic specimens who lived allegedly 50,000 years ago and both in the same Dordogne province of France is 16 years [6] and 40 years, [35, p.88] or 45 years [40, p.340]. Fig 5 is also a classic Neanderthal adult from nearby Corrèze province, La Chapelle-aux-Saints, again approximately age 40 [35, p.88] or 45 years [40, p.340]. If these ages were correct, the bony changes necessary to produce a La Ferrassie 1 or a La Chapelle from Le Moustier would have to have been extremely rapid. C.Loring Brace and M.F.Ashley Montagu have said, "The fact, however, is that at age sixteen, the Le Moustier youth had relatively little growing left to do, and that in those few remaining years, interrupted by his early death, he could never have acquired the formidable supra-orbital torus or browridge so markedly developed in the remains from Neanderthal, La Chapelle-aux-Saints, and one not both of the Spy skeletons" [6]. They could not suggest long term adult growth past 200 years of age. That would be unscientific in their minds.

Let us use the paleoanthropologists' ages of 16 years and 40 -45 years for the lower facial height increase found between Le Moustier (Fig. 8 radiograph) and La Ferrassie and Le Moustier and La Chapelle-aux-Saints. See Table 1. We can compare these differences of Lower Facial Height (LFH) to those of the Behrents' study of modern males in Table 2.

TABLE 1
LFH Measurements Made From Cephalometric Radiographs

<u>Neanderthals & Years of Age</u>		<u>Low. Facial Ht. (mm)(ANS-Me)</u>	<u>Diff (mm)</u>	<u>Rates mm/yr</u>
La Ferrassie 1	40 -45	75.8 (estimated ANS)	17.5	0.73- 0.60
La Chapelle-aux-Saints	40 -45	78.7 (Actual ANS)	20.4	0.85- 0.70
Le Moustier	<u>16</u>	58.3(estimated ANS)		
	24 -29 years difference			

TABLE 2
Univ. of Michigan Data Calculation 200. LFH Modern Males

<u>Years of Age</u>	<u>Mean Low Facial Height (mm)(ANS-Me)</u>	<u>Diff(mm)</u>	<u>Rate mm/yr</u>
Final	46.6	68.7	
Initial	<u>19.8</u>	67.0	1.7 0.063
	26.8 years difference		

The modern rate of 0.063mm per year for LFH increase with practically no wear on the teeth contrasts sharply with the rate of 0.85 to 0.70 mm/year from the Moustier to La Chapelle or the 0.73 to 0.60 to La Ferrassie with enormous tooth attrition. Now, let us even assume that Le Moustier had five more years of active youthful growth remaining until the age of 21. The average growth for modern males from 16 to 18 is 1.98 mm [7] The Bolton standards do not go any further than that. Let us allow Le Moustier up until 21 years of age to cease his active or youthful growth period. If we do so at a generous youthful rate of 1.0 mm per year for five more years, his lower facial height would be 5.0mm+ 58.3mm= 63.3 mm. For Le Moustier to become La Chapelle he would have to advance his LFH to 78.7 during the onslaught of extreme molar occlusal attrition. This is an increase of 15.4 mm. Starting with this maximum level of attained growth as a young person, he would enter the adult growth stage at that point and have to attain an adult rate of change of 15.4/19 =0.81mm/year or 15.4/24= 0.64mm/year. This would be over twelve and one-half times to ten times faster than the rate of modern man (0.063). To become La Ferrassie it would be 0.66mm/year to 0.52mm/year or from over eight to over ten times faster than modern man. From what is known about attrition and severe attrition, the rate of LFH increase would slow down and not speed up.

Because of the extremely fast growth rates necessary for Neanderthals to acquire adult characteristics, it seems that the physiologic process of a Le Moustier growing into a La Ferrassie or a La Chapelle is better explained by longevity than increased rates of growth. At the modern rate of growth for LFH it would take Le Moustier 324 years to achieve the La Chapelle LFH and 278 years to achieve the La Ferrassie LFH.

CONCLUSIONS

Comparisons are made from the computer extrapolations with original Neanderthal lateral cephalometric radiographs size and shape. The conclusions are as follows: 1. Neanderthal adult craniofacial bone shape and size are very similar to the 200 to 300 year old extrapolations. 2. Since the rate of change (growth velocity) probably was much slower than modern man, the modern measurement extrapolations at each age are probably larger than the actual ancient craniofacial form and the real ages of Neanderthals are greater than postulated here for the sizes shown. 3. Some deceleration in growth velocity is also to be expected which could not be taken into consideration. 4. A comparison of Lower Facial Height increase in modern man and Neanderthals (taking into consideration the effect of extreme dental attrition) makes it highly improbable that the Neanderthal adult growth rate was excessive. In fact, it probably was slower than modern man. 5. Evidence has been presented for the Neanderthal peoples to actually be the old humans described in the Bible.

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REFERENCES

- [1] Ainamo, A., Ainamo, J., **The Dentition is Intended to Last a Lifetime**, International Dental Journal, 34, (1984), pp.87-92.
- [2] Barker, B.C., **Relation of the Alveolus to the Cemento-enamel Junction following Attritional Wear in Aboriginal Skulls, An Enquiry into Normality of Cementum Exposure with Aging**, Journal of Periodontology, 46:6, (1975), pp.357-363.
- [3] Behrents, R., **Growth in the Aging Craniofacial Skeleton**, Monograph 17, 1985, Craniofacial Growth Series, Center for Human Growth and Development, Univ. of Michigan, Ann Arbor, Michigan.
- [4] Behrents, R., **An Atlas of Growth in the Aging Craniofacial Skeleton**, Monograph 18, 1985, Craniofacial Growth Series, Center for Human Growth and Development, Univ. of Michigan, Ann Arbor, p.94.
- [5] Bishara, S.E., Treder, J.E., Jacobsen, J.R., **Facial and Dental Changes in Adulthood**, American Journal of Orthodontics and Dentofacial Orthopedics, 106:2, (1994), Aug., pp.175-186
- [6] Brace, C.L., Montagu, M.F.A., **Man's Evolution. An Introduction To Physical Anthropology**, 1965, McMillan Co., Toronto, Canada, pp.156-158
- [7] Broadbent, B.H., Sr., Broadbent, B.H.Jr., Golden, W.H., **Bolton Standards of Dentofacial Development**, 1975, CV Mosby Co., St Louis, Missouri.
- [8] Buchi, E.C., **Anderung der Korperform bei Erwachsenen Menschen, eine Untersuchung nach der Individual-Methode**, Anthropologische Forschungen, Heft 1, (1950), Anthropologische Gesellsch, in Wein pp.1-44.
- [9] Campbell, J.A., **Roentgen Aspects of Cranial Configurations**, Volume 4, 1966, Radiologic Clinics of North America, W. Saunders Co., Philadelphia, Pa., pp.11-31.
- [10] Carlson, D.S., Van Gerven, D.P., **Masticatory function and post-Pleistocene evolution in Nubia**, American Journal of Physical Anthropology, 46:3, (1977), pp.495-506.
- [11] Comfort, A., **The Biology of Senescence**, 3rd edition, 1979, Elsevier North Holland, Inc. N.Y., N.Y., p.5.
- [12] Cuozzo, J.W., **Mechanical Advantage and Adult Growth in the Etiology of Craniofacial Pain**, Autumn, (1991), Journal of the New Jersey Dental Society, pp.23-31.
- [13] Cuozzo, J.W., **Neanderthal Children's Fossils: Reconstruction and Interpretation Distorted by Assumptions**, 8:2, (1994), Creation Ex Nihilo Technical Journal, pp.166-178.
- [14] Cuozzo, J.W., **Buried Alive**, Master Books, Green Forest, Arkansas, In publication.
- [15] Cuozzo, J.W., **Earlier Orthodontic Intervention: A View from Prehistory**, Journal of the New Jersey Dental Association 58:4, (1987), pp. 33-40.
- [16] Dean, M.C., Stringer, C.B., and Bromage, T.G., **Age at Death of the Neanderthal child from Devils Tower, Gibraltar and the implications for studies of General Growth**

- and Development in Neanderthals, American Journal of Physical Anthropology ,70,(1986), p. 301-309.
- [17] Hayflick, L., How and Why We Age, 1994, Random House, N.Y. N.Y., p.15.
- [18] Hellman, M., **Changes in The Human Face Brought About by Development** International Journal of Orthodontia, Oral Surgery & Radiography,13, (1927), pp. 475-516.
- [19] Hooten, E., Dupertuis, C., **Age Changes and Selective Survival in Irish Males**, Studies on Physical Anthropology, Volume 2, 1951, American Association of Physical Anthropology and Wenner-Gren Foundation, N.Y. N.Y., pp.1-130.
- [20] Hrdlicka, A., **Growth During Adult Life**, Volume 76(1936), Proceedings of the American Philosophical Society, pp. 847-897.
- [21] Israel, H., **The Dichotomous Pattern of Craniofacial Expansion During Aging**, American Journal of Physical Anthropology, 47,(1977), pp.47-52.
- [22] Jarcho, A., **Die Altersveränderungen der Rassenmerkmale bei den Erwachsenen**, Anthropologischer Anzeiger ,12,(1935), pp.173-179.
- [23] Kendrick, G.S. Risinger, H.L., **Changes in the Anteroposterior dimensions of the Human Male Skull During the Third and Fourth Decades of life**, 159 (1967), Anatomical Record, pp.177-81.
- [24] Koop, C.E., personal communication
- [25] Lasker, G., **The Age Factor in Bodily Measurements of Adult Male and Female Mexicans**, Human Biology, 25:1(1953) Feb., pp.50-63.
- [26] Murphy, T., **Compensatory Mechanisms in Facial Height Adjustment to Functional Tooth Attrition**, Australian Dental Journal, Oct, 1959, pp.312-319.
- [27] Oakley, K.P., Campbell, G.C., Molleson, T.I., Catalogue of Fossil Hominids, Part 2, 1971, Trustees of British Museum, London, Part II Europe, p150.
- [28] Olshansky, S., Carnes, B. Cassel, C. **In Search of Methuselah: Estimating the Upper Limits to Human Longevity**, 250,(1990), Science, pp. 634-640.
- [29] Parchappe, R., **Reserches sur l'encéphale**, Volume I, 1836. Du volume de la tête et de l'encéphale chez l'homme. Paris Cited from Hrdlicka, A. [20]
- [30] Perls, Thomas, **The Oldest Old**, Scientific American, Jan.,(1995), pp.70-75.
- [31] Pfitzner, W., **Der Einfluss des Lebensalters auf die Anthropologischen Charaktere**, Zeitschrift fuer Morphologie Und Anthropologie, I (1899), pp.325-377.
- [32] Ruff, C.B., **Age Differences in Craniofacial Dimensions Among Adults from Indian Knoll, Kentucky**, American Journal of Physical Anthropology, 53 ,(1980), pp.101-108.
- [33] Sarnas, K., **Growth Changes in Skulls of Ancient Man in North America**, Acta Odontologica Scandinavica, 15,(1957), pp.213-271.
- [34] Schaeffer, F., Personal Communication.
- [35] Stringer, C., Gamble C., **In Search of the Neanderthals**, 1994, Thames and Hudson, NY, NY, pp.96-104.
- [36] Susanne, C., **Individual Age Changes of the Morphological Characteristics**, Journal of Human Evolution 6,(1977), pp.181-189.
- [37] Tallgren, A., **Changes in the Adult Face Height due to Aging, Wear, and Loss of Teeth and Prosthetic Treatment**, Acta Odontologica Scandinavica 15,(1957), supplement 24.
- [38] Thompson, J. I., Kendrick, G.S., **Changes in the Vertical Dimensions of the Human Male Skull During the Third and Fourth Decades of Life**, Anatomical Record 150,(1964) , pp.209-214.
- [39] Todd, T.W., **Thickness of the Male White Cranium**, The Anatomical Record, 27:5,(1924), pp245-256,
- [40] Trinkaus, E., Shipman, P., The Neanderthals, 1993, Alfred Knopf & Co., New York, p.317.

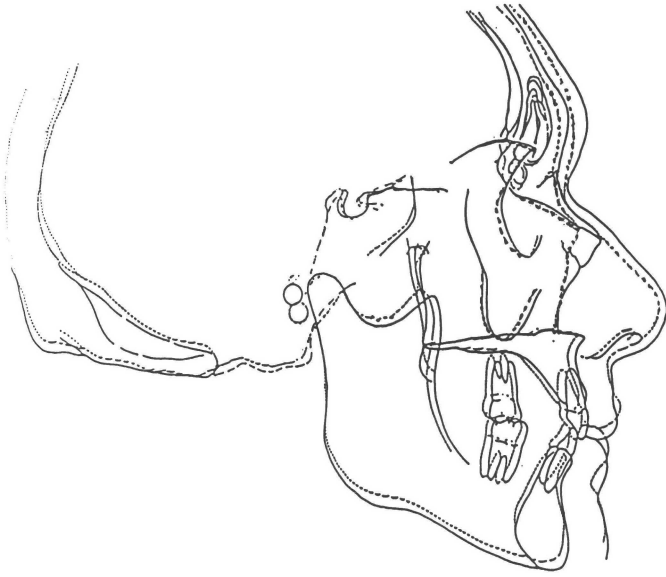


Figure 1. Superimposition, female ages 34-83.

The dashed line is 34 years of age and the solid line is 83 years of age. This figure has been adapted from Behrents, [3, p.56]. This female was the oldest person in Behrents' study and represents 49 years of adult bone growth.

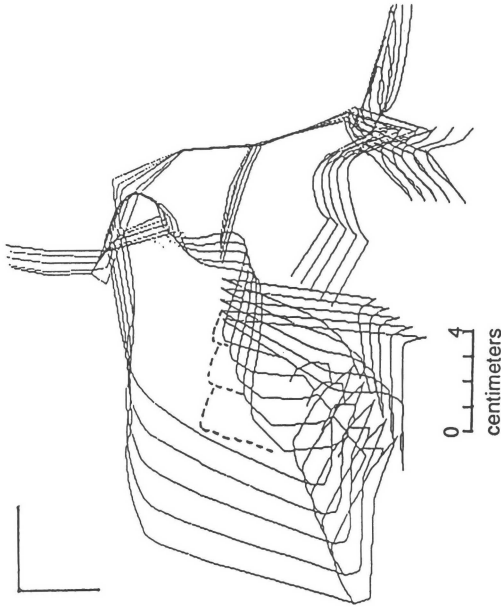


Figure 2. Projected bony alterations of a modern male
craniofacial skeleton from 100 to 500 years of age

Slower rates in the ancients must have produced less extensive modifications age for age. While this diagram emphasizes the main structures involved in modern alterations; deceleration at older ages cannot be measured.

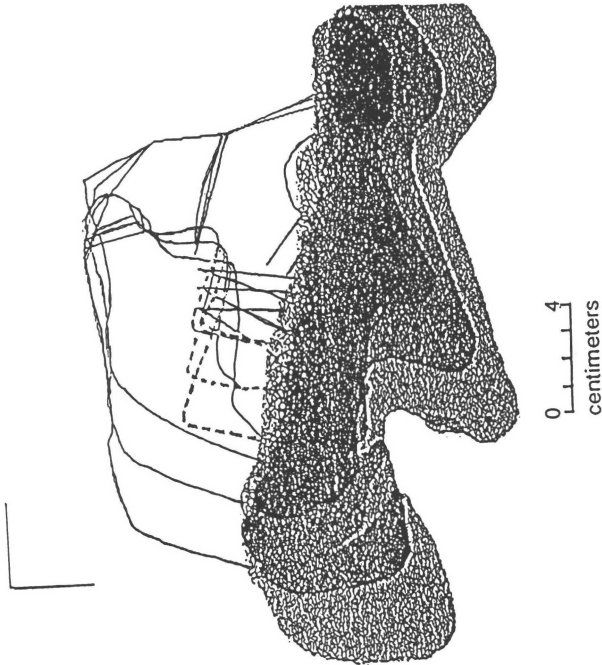


Figure 3. Projected soft tissue alterations of a modern male
craniofacial skeleton at 100, 300, and 500 years of age

As you observe the increasing size of the nose and face in old age, your conception of the appearances of the aged Noah, Shem and their close relations should change and begin to conform to this model. The rule for slower rates applies here as in Figure 2. The dashed lines indicate resorption of the anterior ramal border which probably was externally modified by the masticatory muscles function and position, nevertheless continued slightly between the lateral and medial borders.

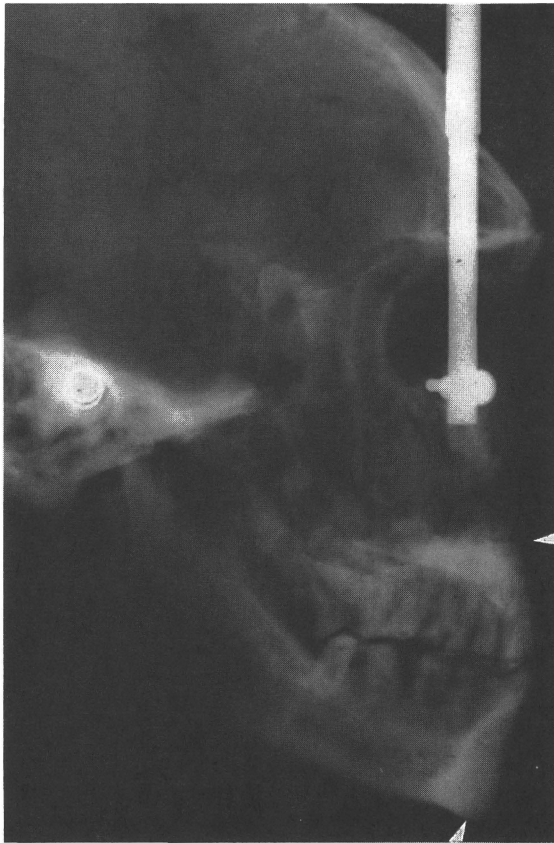


Figure 4. La Ferrassie 1 Lateral Cephalometric Radiograph

This classic male Neanderthal was discovered in 1909 in the Dordogne département, of southwestern France. Arrows point to ANS (anterior nasal spine-estimated) and Me (menton). His lifespan was probably over 250 years.



Figure 5. La Chapelle-aux-Saints Lateral Cephalometric Radiograph

This classic male Neanderthal was discovered in 1908 in the Corrèze département of southwestern France. Arrows point to ANS (anterior nasal spine) and Me (menton). His lifespan was probably over 250 years.

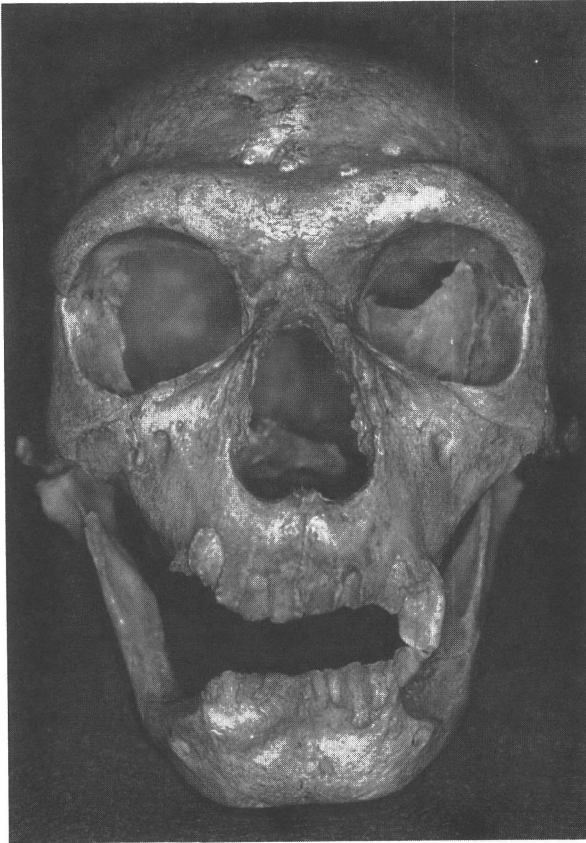


Figure 6. La Chapelle-aux-Saints Frontal View

This classic male Neanderthal has been called a different species in comparison to *Homo sapiens sapiens*. This view portrays why some would think this is true. Many of his physical features are outside the norms of modern man. It makes better sense to understand that age and function can produce this morphology over hundreds of years rather than call him another species or ignore the differences and call him modern man.

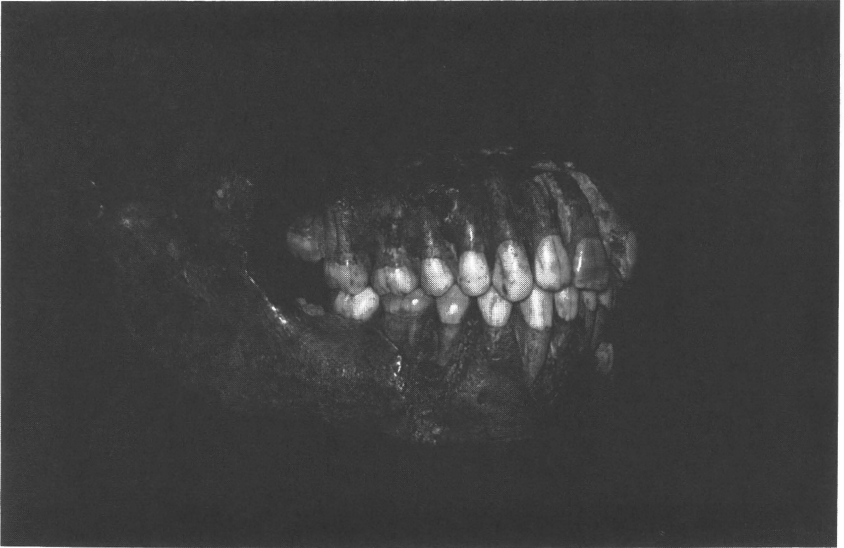


Figure 7. Le Moustier Partial Maxilla and Mandible in Maximal Centric Occlusion

This classic male young adult Neanderthal was discovered in the Dordogne département of southwestern France. He is has been designated 16 -18 years old, but probably was at least 29.



Figure 8. Le Moustier Partial Maxilla and Mandible Radiograph in Centric Occlusion utilizing Cephalometric Technique

The lower facial height measurement (LFH) from this partial maxilla and mandible in maximal centric occlusion establishes the starting points for the calculations concerning the Neanderthals rates of growth. The arrows point to the ANS (anterior nasal spine-estimated) and Me (menton).

