THE POTENTIAL AND POTENTIAL PITFALLS OF EVOLUTIONARY MEDICINE

Alan H. GOODMAN, Ph.D., Debra L. MARTIN, Ph.D.
Natural Science, Hampshire College - Amherst, MA, USA

INTRODUCTION: FORAGER PEOPLES IN THEORY AND REALITY

"In the first ages of the world, men lived to a great age. Most of the early patriarchs lived to the age of nine hundred years or more..." (Noah Webster, 1833, *The History of the United States*).

Some of the more enduring questions in anthropology center on the dietary, nutritional, and health status of foraging peoples. These queries are basic to understanding the evolution of sociopolitical and economic systems, the importance of meat and other foods in earlier hominid diets, and the after effects of agricultural revolutions on human biology. This last question, on changes in health and nutritional status with agriculture, constitutes more than an isolated academic debate. It strikes at the core of main themes in anthropology and archaeology, engenders great popular appeal, and may even have significance for understanding quality of life issues for humans in industrial societies. At its core, this question is about progress. Have we, with evolutionary changes from foraging to farming and post-industrial economies, done better with a more adequate diet, less infirmity, and a longer expectation of life, or worse with increasing behavioral and degenerative diseases along with persistent malnutrition and infection?

The generally accepted answer to this question began to shift about thirty years ago. Following the *Man the Hunter* conference and volume (Lee and DeVore 1968) the now dominant perspective emerged that foragers, both prehistoric and contemporary, generally obtain a diverse and "adequate" diet, leading to an adequate, if not superior, nutritional and health status. The world view, that gatherers-hunters were not frequently operating "at the brink of survival" and that they exhibited a long

1999 AH Goodman and DL Martin. The potential and potential pitfalls of evolutionary medicine. In A Guerci (ed.), *Anthropology and the History of Health and Disease*. Genova, Italy, pp 101-115.

standing and successful adjustment, seems to have co-emerged with the notion of an original affluent society. And, it is surely not a coincidence that it became dominant during the late 1960s, a period of great pessimism over the direction of western civilization.

What is interesting in retrospect about this raising of the health and nutritional status of past foragers is that "anthropological wisdom" changed much more dramatically than the data upon which it ought to be based. At a minimum, theory and perspective dominated how the data were read.

The purpose of this paper is to try to reinsert some perspective and data into the question of the health and nutritional status of past gatherers-hunters. We first comment on recent work suggesting strong implications for understanding contemporary maladies from understanding past diets. We then suggest some sources of data upon which one might more objectively evaluate the evolution of health and nutrition.

The purpose of this paper is not to assess how well the data and opinion of the last quarter of a century have sustained this "healthy hunters" paradigm, although this is an issue we will touch upon. Rather, our purpose is to inquire into some of the theoretical progeny of this paradigm. What are the contemporary paradigms and perspectives that have followed from *Man the Hunter* (Lee and DeVore 1968) and the healthy hunters hypothesis? What should they be? Are there questions we should be examining and perspectives that might be useful that are not being asked or adopted?

For the sake of brevity we focus on two illustrative descendants. The first, called "the worst mistake" paradigm, suggests that agriculture brought with it a great decline in quality of life and that the decline was due to the change in subsistence. We focus on the validity of the subsistence change proper as the sole cause of the biological decline. The second offspring, "the Paleolithic prescription", is a popularized attempt to derive lessons that "we modern humans" can learn from forager diets and lifestyles. This perspective is now full blown in what is termed evolutionary medicine or Darwinian medicine (Lappe 1994; Nesse and Williams 1995).

How could evolutionary medicine be more than "just so" stories? At least one way is to base it upon hard evidence. We end with some suggestions for reinserting paleonutritional and paleopathological data into evolutionary medicine.

THE POTENTIAL PITFALLS OF EVOLUTIONARY MEDICINE

Agriculture: The Worst Mistake In Human History?

The name for this first offspring of the "healthy hunters hypothesis" is derived from an article by Jared Diamond (1987) entitled "The worst mistake in the history of the human race". Diamond champions a view that agriculture ushered in a series

of utter catastrophes - not only an increase in malnutrition, disease and death; but warfare, social inequality, prejudice, and despotism. He makes some mention that these "catastrophes" might be linked to agriculture via such factors as urbanization, increased population density, and class formation - not insignificant historical events themselves! However, Diamond never questions the invariance of the linkages from agriculture to declining quality and length of life. Thus, he sees the villain as agriculture alone. Rousseau would be proud.

While Diamond has taken the "healthy hunters" idea to its extreme, Mark Cohen focuses more on understanding the **cause** of the biological decline. *In The Food Crisis in Prehistory* (1977) Cohen, influenced by Boserup, presented a population pressure model for the development of agriculture. He then realized that data on changes in biological well being of groups before and after agricultural intensification could give some sense of the necessity for agriculture, and could lend support to his model. With George Armelagos, in the early 1980s he brought together for the first time individuals with such data, paleopathologists, to directly compare their evidence for health and nutritional changes with agricultural development and intensification. A result of this conference was the 1984 volume *Paleopathology at the Origins of Agriculture* which contained over twenty case studies from different areas (Cohen and Armelagos 1984). Parenthetically, this wealth of comparative information provides a rich data base for testing a variety of hypotheses on the effect of cultural change and related factors on human biology.

These studies and their implications are most recently summarized in *Health and the Rise of Civilization* (Cohen 1989). Here Cohen concludes that population density and settlement pattern, climate and geography, sources and availability of fauna and flora, types of domesticates and sociopolitical developments are local noise, at most confounding and modifying variables. The important historical generalization and nomothetic principle is that agriculture leads, at least temporarily, to poor nutrition and health.

Three decades after *Man the Hunter* the available paleopathological data suggest a general trend toward a decline in health and nutritional status with the origins and intensification of agriculture. For example, we reviewed the prevalence of enamel hypoplastic defects, a measure of generalized nutrition and disease stress during infancy and childhood, from the case studies in *Paleopathology at the Origins of Agriculture* (further research on this defect is cited below). We found a rise in frequency of enamel hypoplastic defects in ten of ten cases where these data were well reported. The degree of concordance is impressive. Furthermore, other indicators of declining human biologies, such as increased growth failure and increased infant mortality, seem to peak with the onset of agriculture. On the other hand, one should not overemphasize the level of health of gatherers-hunters. In many respects life was

nasty and short, with first year death rates invariably over twenty percent life expectancies at birth typically around twenty years, and abundant evidence for episodes of morbidity.

If we agree that health and nutritional status often decline coincidentally with the origins of agriculture, then what can we infer about cause? Cohen (1989) sees no problem in directly moving from correlation - as agriculture increases so do signs of stress - to causation. But, is such a leap justified? What are the processes and mechanisms by which a change in subsistence is related to changes in biological adaptation? How invariant are these processes?

Changes in demographic and settlement patterns and changes in sociopolitical organization are two broad sets of factors that seem as likely to explain the pattern of health decline as the subsistence change. Regarding demographic variables, it is often difficult to disentangle their effects on human biology from those due to subsistence changes as these changes frequently co-occur. However, in one case study from Central California, David Dickel and co-workers (1984) find an increase in sedentism and population density - the demographic changes - along with cultural elaboration and social stratification, but without agricultural intensification. The biological correlates are roughly similar to those typically thought to be due to agricultural development. Stature decreased slightly through time and enamel hypoplastic defects and mortality before two years of age increases slightly.

The Central California example illustrates a richness of factors **potentially** related to changes in human biology. Changes in production are present, although these are variations in foraging patterns and intensities, rather than changes to agriculture, along with changes in demography, settlement and sociopolitical structure. All of these variables are more than confounding factors. They are factors of great epidemiological and anthropological significance.

Turning to sociopolitical factors, Cohen has given some notice to their possible confounding effects. But ultimately they too are dismissed as not the main concern of an anthropologist interested in developing general laws. To the contrary, we suggest that if one were to develop a general model of factors governing human health and nutritional status then one could hardly do better than start with sociopolitical factors. Today, location within sociopolitical systems - whether one is in the first, second or third world and one's location within these systems, the degree that one is in the core of the core or the periphery of the periphery - has as much effect on health as any other set of factors. The same is arguably said for past groups (Goodman et al. 1988).

With colleagues we have previously delineated an argument that the pattern of health seen with agricultural intensification at sites such as Dickson Mounds in Illinois are more consistent with a sociopolitical explanation than an agricultural intensification explanation (Goodman et al. 1984; Goodman and Armelagos 1985). Dickson Mounds

is a combined habitation and burial complex that spans a 300 year period from Late Woodland to Middle Mississippian. The Late Woodland period involved a population that was quite nomadic and subsisted entirely by hunting and gathering. Soon after Late Woodland, during the Mississippian Acculturated Late Woodland, local populations began to settle into villages and trade and contact with Mississippian peoples increased. Carbon isotope and caries data suggest a rapid increase in maize in the diet of this middle group. Finally, the Middle Mississippian represents a culmination of trends towards increased population density and sedentism and increased involvement in the Mississippian sphere of influence.

The health and nutritional changes at Dickson are consistent and profound. At the same time that enamel hypoplasias increase in frequency, long bone growth decreases. One finds dramatic increases in nutritional, infectious, traumatic and degenerative diseases. Many of these changes could be seen as a result of agricultural intensification. However, the main biological changes develop toward the end of this 300 year period, while agricultural intensification seems to have reached a peak early on. What occurs later and is temporally more in line with the biological changes are: (1) change in settlement patterns and (2) increased involvement in trade and a Mississippian sociopolitical system. A close examination of the Dickson data suggest that agricultural intensification may have played an important role in the profound increase in stress, but it would not be logical to consider it as the sole causal agent. Dickson's location as a sort of frontier settlement at the border of the Mississippian sociopolitical system could have made life extremely stressful.

The above is not meant to suggest that changes in diet brought about by the adoption of agriculture, such as an obvious decrease in dietary diversity and ecological stability, did not have an effect on health and nutritional statuses. Rather, it is to suggest that we need to take a closer look at process and mechanism. Also, there are a number of other interesting and valuable questions to be asked. What, for example, are the biological consequences of the interaction between class formation, location in sociopolitical systems, and agricultural intensification? Finally, the view that the decline in health with agriculture has as much to do with location within regional sociopolitical systems is supported by catastrophic changes in health seen today in many former foragers that are being displaced by nation states.

The Paleolithic Prescription: A Guide to Modern Living?

The second offspring of healthy hunters focuses on lessons to be learned from hunting and gathering peoples. This child has been championed by the radiologist Boyd Eaton and colleagues in their book, *The Paleolithic Prescription* (1988), subtitled "A program of diet and exercise and a design for modern living" (also published in the United Kingdom and Australia as *The Stone Age Health Program - Diet and Exercise as Nature Intended).* In this book, which was extensively reviewed in the North American and European popular press, and other recent articles in widely read and prestigious publications such as *New England Journal of Medicine, Journal of the American Medical Associations (JAMA), The New York Times Sunday Supplement* and *Natural History*, Eaton and colleagues argue that there are significant lessons to be learned from prehistory. We agree. The view that we do not support is that the lessons are only about **discontinuities**. They assert that factors governing health today are disconnected from those that governed health before agriculture.

The full argument developed by Eaton and co-workers (1988) and other proponents of evolutionary medicine such as Lappe (1994) and Nesse and Williams (1995) is as follows.

- Hunters-gatherers were extremely healthy. Paleolithic humans infrequently suffered from the so called "diseases of civilization". Rather, their diet was bountiful and varied, with abundant sources of protein and micronutrients. They lived hearty and active lives, banqueting on a rich and varied diet.
- Evolutionary adaptation. Hunter-gatherers did well because their physiologies evolved over millions of years to fit their environmental niche. They became genetically programmed to their foraging way of life.
- Recent Environmental (Cultural) Change Causes Disequilibrium. Revolutionary changes in environment and lifestyle, especially in the last 200 years, are not matched by genetic changes, causing a discontinuity and maladaptation between biology and environment.
- The Lesson. The solution to the problems of modern humans is to re-integrate aspects of hunter-gatherer diet and lifestyle. The lesson is that if we modern humans wish to be healthy then we need to more closely follow a Paleolithic lifestyle. It is interesting to note that in recent years psychology, like medicine, has discovered the evolutionary perspective and now the lesson has been extended to happiness (Allman 1994; Glantz and Pearce 1989; Wright 1994).

A brief examination of this argument reveals some significant flaws. Firstly, we need to be much clearer about the evidence for adaptation of hunter-gatherers and in particular the evidence for their excellent health and extreme robustness. For example, Eaton and co-workers ignore the paleodemographic data suggesting very short life expectancies. The foreshortened lives remains as a powerful alternative hypothesis for the lack of diagnosed chronic disease in hunters-gatherers. We are reminded of a cartoon of a gatherer-hunter family in which the caption is "If we are so healthy then why is our life expectancy only 30 years".

Conversely, at three junctures in *The Paleolithic Prescription* they mention an adolescent Homo erectus skeleton who may have reached an adult height of six feet. This single skeleton is used to support the notion that nutritional status was excellent

during the middle Paleolithic. What they fail to consider is why the boy died prematurely, and why so many other foragers, contemporary and prehistoric, have growth rates that indicate endemic malnutrition (see Cohen 1989 for a review of this literature).

The argument that we are evolutionarily adapted to a hunting and gathering lifestyle is one of great popular appeal. It appeals to a sense of simple explanations and explanations that place blame neither on individuals nor on political-economic forces. But does this explanation help us to deal with the stresses of contemporary lives? How does it work for an executive? Does it do Mayan peasants any good as they come to terms with the introduction of diabetes and obesity into their community?

Does it have the ring of truth? Eaton and co-worker's estimate of mean protein intake, in the range 250 to 400 grams per day, is very high and does not fit well into current recommendations. In other regards, if we eat more like they assume the average forager ate then we would be following a diet that most nutritionists would support. Then again, the same could be said for following a diet similar to nearly any primate cousin.

Lastly, regarding issues of lifestyle discontinuity, one could take this writing as a Western and middle class view of evolutionary change. Firstly, there is no sense that the changes noted are specific only to the rich and to individuals living in the first world. Many individuals, perhaps the majority, have not so dramatically changed their diets and lifestyles. Their lives are still physically active and their diets are not replete with high fat meats and sugary snacks (although these changes are now affecting many more). Second, there is no effort to explain health based on **shared** patterns between the present and past. For example, the effects of poverty and want, usually deriving from some form of sociopolitical hegemony, extend back from present to past.

In summary, the Paleolithic prescription argument is on the right track in trying to show that there are broadly applicable lessons to be learned from a lifestyle that is so basic to humankind. As anthropologists we share a sense that typical explanations for modern ills are short sighted. Where the prescription fails is in the accuracy with which it presents hunter-gatherer existence and the lessons it derives. We can do much better. It would be sad if all paleoepidemiology could suggest is more exercise and a balanced diet, needs most clinicians are already recommending based on biomedical and epidemiological studies of contemporary humans.

THE POTENTIAL OF EVOLUTIONARY MEDICINE: INTEGRATING PAST AND PRESENT HEALTH AND NUTRITION

In this section we examine some potentials of evolutionary medicine. We first provide an example of how studies of nutrition and disease in a contemporary context

can provide insights into health and nutrition in the past. We end with an example of how comparing data on the same health and nutrition indicators from the past and present provides a direct assessment of evolutionary change and progress.

Ethnobioarchaeology: Using the Present to Better Understand Past Health and Nutrition

The goal of paleonutrition research is to better understanding the diet and nutrition of past individuals and groups. These data can then be used in evolutionary analyses and they can also help to understand the specifics of sociopolitical and ecological contexts. Information on foods available for consumption comes from analyses of the environment and archaeological remains, and provides a sense of what was on the menu. In order to provide a sense of what was actually consumed, who consumed it, in what quantity, and to what effect, one needs to directly examine human remains. The obvious problem of studying the past is that it literally fades. Taphonomy is the process by which information is lost through fossilization. At death we lose the ability to take vital measures, and of course too the ability to do dietary intake interviews, and collect thoughts about food. With time after death the loss of information is more variable. We tend to loose soft tissue and information it might yield, and we slowly loose valuable contextual information, and on to the loss of some bones and a sense of population. The challenge of paleonutrition and paleopathology, like any science of the past, is to creatively use the available traces and records.

One such trace of the past is logically found in the elemental substitution in hydroxyapatite, the main chemical constituent of bones and teeth. By studying the chemical concentration of isotopes and elements in skeletal remains, the possibility exists to make direct inference to what was actually eaten. As a result of this potential, the field of paleonutrition emerged in the late 1970s and 1980s. One challenge, however, is that interpretation of the past relies on knowledge of function and context in the present.

The interpretation of zinc concentrations in bones and teeth provides an illustrative example of this need. Early in the history of paleonutrition Gilbert (1975) found that zinc levels were reduced in the bones of groups with increased maize consumption and greater infectious disease. While a promising start, we are seemingly no further along in understanding more precisely what bone zinc levels signify. In a recent review Ezzo (1994) identified three different diet-level hypotheses for zinc levels in prehistoric bones. Zinc could be a function of:

- Animal product zinc consumption
- Plant zinc consumption or
- Total zinc intake

Furthermore, underlying these dietary hypotheses are deeper questions about such key physiochemical processes as zinc binding and transport, how zinc gets into bone and tooth apatite, where it is in the apatite, whether it is all in the apatite, and how other double positive cations might act as antagonists. The key issue is that uncertainty about what processes governing zinc incorporation into hard tissues effects all inferences. High bone zinc concentrations might just as easily indicate a low calcium diet as one high in total zinc. Unless one can develop a mechanism to select among different processes leading to the same level of zinc then one can not make further inferences and the bone zinc data will not be very useful.

In order to better understand bone and tooth physiology and chemistry we have been collaborating on longitudinal studies of mild-to-moderate malnutrition in contemporary contexts. This project is in spin-off of the Collaborative Research Support Project (or CRSP) on nutrition and function, and is work done in collaboration with a large, international group of anthropologists, nutritionists and other scientists, including Gail Harrison, Osman Galal and others in Egypt and Lindsay Allen, Gretel Pelto, and Adolfo Chavez in Mexico (Allen 1993; Allen et al. 1993; Kirksey 1992). We have been playing "tooth fairy" and collecting exfoliated deciduous teeth of children whose dietary intake, residence and health and nutritional status were previously studied during the time of tooth calcification.

We recently completed a pilot study of zinc levels in ten deciduous incisors from the urban village of Kalama, Egypt, in the Nile Delta north of Cairo (see Hecht 1996). Taking advantage of the fact that teeth calcify in layers, much like tree rings, we sequential acid dissolved a layer of domed enamel about 50 - 100 μm below the outer surface, which, importantly, calcify around the end of the second and beginning of the third trimester in utero.

One interesting result is that maternal animal product protein intake during the second trimester is strongly associated with enamel zinc concentration ($r = .84$; $p = .004$). The take home point is not the specific results, but the potential of collaboration between past and present, which we might call ethnobioarchaeology.

To further generalize from the above, a useful and perhaps essential element of ethnobioarchaeology is having parallel measures in the past and present. There are a number of indicators of health and nutritional status in the past that have parallels in the present. These include:

- Infant and Childhood Mortality Rates and other demographic parameters
- Iron Deficiency Anemia (measured by porotic hyperostosis on bones and blood iron status)
- Long Bone Growth and Height
- Linear Enamel Hypoplasia

Linear enamel hypoplasias are defined as lines of decreased enamel thickness They develop during enamel matrix formation, and thus are indelible signs of earlie physiological disruption (Goodman and Rose 1990). Similar to how we timed the bands of calcification in the zinc study, the location of enamel hypoplasias on tooth crowns signifies a specific time of physiological disruption. It is less clear what duration and severity of disruption is required to form a defect, and whether, for example, some nutrients might be more critical than others. While the precise etiology is not well known, they appear to be due to general metabolic disruption.

We have been studying these enamel defects in children living today in order to better understand the etiology of these defects and to improve paleonutritional inferences based upon these defects. We have been especially interested in research situations like the one mentioned above from the CRSP study, in which we could compare the record of enamel hypoplasias with prior information on nutrition and health during enamel formation.

In a recently completed study we compared the frequency and pattern of these enamel hypoplastic defects in children from Tezonteopan, Mexico (Goodman et al. 1991). Tezonteopan is the location of a famous supplementation study of Adolfo Chavez and Celia Martinez (1982). Chavez and Martinez provided nutritional supplementation to a group of pregnant women and then to their infants and compared these supplemented children to non-supplemented children from the same community. On average, supplemented children received about 300 Kcals and 20 grams of protein per day.

The average height difference between the supplemented and non-supplemented children is about five inches (twelve centimeters). Furthermore, supplementation also reduced the percent of days sick: by the second year the mean number of days sick was reduced by about half. As well, supplementation dramatically increased activity. For example, Chavez and Martinez (1982) show that the number of foot contacts with the floor, a novel measure of activity, dramatically increases as the supplemented children get older, but the rate of increase is greatly reduced in the non-supplemented children.

In a blind study we compared the frequency of enamel hypoplasias in the supplemented and control/non-supplemented children. Figure 1 illustrates the frequency of enamel hypoplasias on upper central incisors by half year of development in the non-supplemented and supplemented children. Both groups have a peak rate around the third year, but the overall rate in the supplemented group is about half the non-supplemented. The paleonutritional inference is that enamel defects frequencies are sensitive to changes in levels of nutrition seen in Tezonteopan.

Furthermore, we might begin to further explore the same functional consequences. For example, nearly half of all non-supplemented children are sick at any given time.

Might this also be true at similar rates of enamel hypoplasias in a past population? If so, this would have tremendous implications for interpretation of the stresses of parenting in the past.

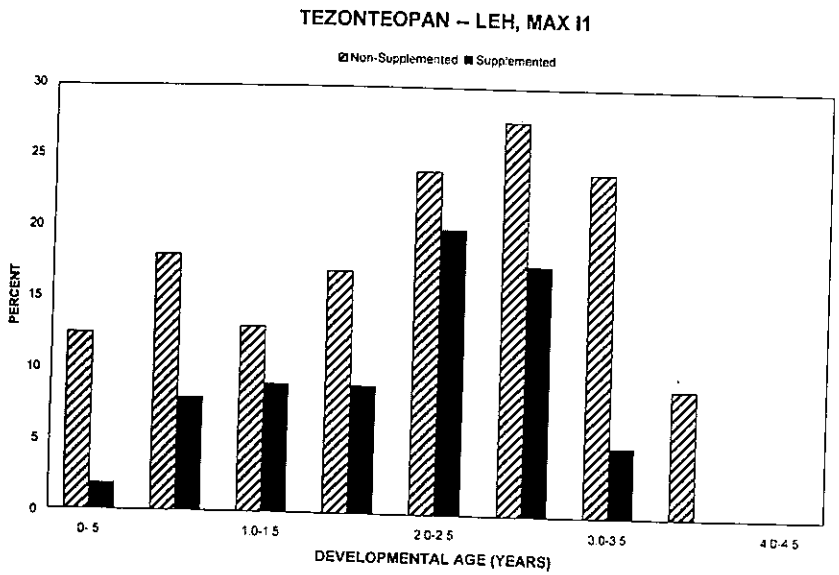

Fig. 1. The frequency of enamel hypoplastic defects by half year developmental period on upper central incisor teeth for supplemented and non-supplemented (control) children from Tezonteopan, Mexico (from Goodman et al. 1991). Supplemented children have approximately half the number of enamel hypoplasias as non-supplemented children.

Past to Present

The second advantage of examining the same indicators of health and nutrition in the past and present is the possibility of direct comparison of past and present populations. Figure 2 plots the distribution of enamel hypoplasias on central incisors by half year ages at development for the non-supplemented children from Tezonteopan and individuals from the Middle Mississippian (agricultural period) from Dickson Mounds, Lewiston, Illinois, USA. (AD 1150- 1300).

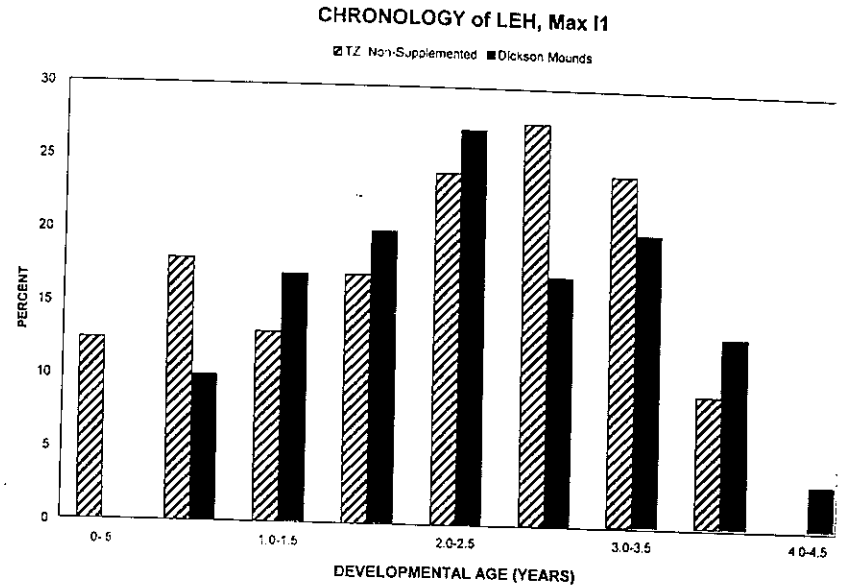

Fig. 2. The frequency of enamel hypoplastic defects by half year developmental period on up central incisor teeth for non-supplemented (control) children from Tezonteopan, Mexico (from Goodr et al. 1991) and Middle Mississippian adolescents and adults from Dickson Mounds, Lewiston, Illir (AD ~1150 - 1300; from Goodman et al. 1984). Although separated in time by nearly 800 years, two groups are very similar in the distribution and prevalence of enamel developmental defects.

What we find most fascinating is how similar the patterns are in both magnitu and shape. Both groups show a peak in hypoplasias-stress around two years of a and the peaks are about equal in height. How does one interpret this similarity?

Moving from the present to the past, the data suggest similar degrees of functior impairment in the past to that which is clear among the present group. As they suf from mild-to-moderate malnutrition, it may also be true that mild-to-modera malnutrition was endemic in the past. This supposition is supported by compari length-for-age of long bones (Goodman et al. 1988; Goodman and Martin in pres In most ancient populations such as Dickson and at Black Mesa, Arizona, classification of lengths of long bones suggest that most individuals would fall in current categories of either first (mild) or second degree (moderate) malnutrition.

Moving from past to present gives one pause. Although nutritional status obviously improved for some, undernutrition is surprisingly constant over the millenn

for the majority. The Middle Mississippian at Dickson is considered to be a population that is not well adapted (Goodman and Armelagos 1985; Diamond 1987). It suffers from very high rates of infectious and nutritional morbidity and high mortality. That a contemporary peasant group appears to suffer about the same degree of biological deprivation cautions against over-generalizing the idea of progress.

SUMMARY AND CONCLUSIONS

How does the happy hunter hypothesis hold up? What can we generalize from a critical evaluation of some of its progeny, and what might we look for in the advancing years?

The "healthy hunters" hypothesis is alive and well. Our only caveat is that we need not overstate the case. We need not oversimplify and focus on single, abstracted explanations. While agriculture is frequently associated with increased biological stress, this association could be due to the confounding effects of increased population density and sedentism. And, there is strong support for the view that the decline in health with agriculture is more likely to result when a group is located in the hinterlands of a political system. One general conclusion should be apparent. It is time to think about processes and mechanisms, interactions between factors, and alternative explanations. It is time to work on a new set of lessons.

Our reading of factors affecting health in prehistory is not so very different from those affecting health today. An alternative lesson is that most of the world has not seen great progress because of the unevenness of development and the development of underdevelopment.Changes in health, then and now, might be viewed not as disconnected from sociopolitical events, but as intimately related to them.

The last decade has witnessed an explosion of interest in evolutionary medicine and evolutionary explanations for a wide variety of contemporary maladies. We are pleased that other fields have discovered Darwin, but we also caution again invoking Darwinism with neither rigor nor data. It is all to easy to make up stories of the past that simply reflect ideas about how one thinks the world ought to work. This is not sufficient. What are needed are data on what life was really like in the past. To this end, we hope this paper has provided some new examples of how to integrate studies of the past and the present.

ACKNOWLEDGEMENT

Parts of this paper originally presented at the Sixth International Conference on Hunting ang Gathering Societies (CHAGS 6), Fairbanks, Alaska (May, 1990) and at the American Anthropological Association Annual Meeting (November, 1997). We wish to acknowledge the support of grants from the National Institutes of Health (R03 DE08607; R15DEO9863) and Howard Hughes Medical Institute.

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ANTROPOLOGÍA DEL GÉNERO CAPSICUM

Fernando CABIESES
Universidad Científica del Sur, Lima, Perù

El género Capsicum es originario de la región Andino-amazónico, en lo que hoy es parte de la selva de Bolivia. Tiene alrededor de treinta especies, cinco de las cuales han sido domesticadas. Algunas de ellas, fueron llevadas al Caribe y a México en las épocas pre-Hispánicas. Probablemente fueron transportadas por las aves migratorias.

Cristóbal Colón encontró lo que ahora llamamos *Capsicum anuum* en el Caribe y lo llevó a España al fin de su primer viaje a América. Resultaba un atractivo substituto de la pimienta (*Piper nigrum*) tan necesaria en la mesa de la nobleza europea y tan escasa por la permanente hostilidad que había invadido el Mediterraneo a fines del siglo XV.

De España, el Capsicum invadió todo el Continente Europeo y pronto, a través de Hungría, llegó a Rusía. Los navegantes portugueses llevaron el Capsicum a las costas asiáticas y el uso de este condimento se generalizó a todo el Mundo.

Aunque seguimos llamándole "condimento" porque sirve para "sazonar" los alimentos, el Capsicum no es buscado por su sabor ni por su aroma. No es dulce ni salado ni amargo ni ácido, que son las sensaciones captadas por los epitelios de la lengua. Su aroma, agradable, no es tampoco la característica que lo hace más atrayente. El fruto del Capsicum es buscado por todos los pueblos del Mundo debido a que produce una sensación quemante, urente, cáustica, picante, infinitamente más intensa y duradera que la producida por la pimienta, la mostaza o algunas raíces como el rábano. El Capsicum es consumido porque produce dolor: un dolor socialmente aceptado como placentero y atrayente, lo que en sí constituye un fenómeno sociológico digno de estudio. Esto lleva al título de este trabajo: "La antropología del Capsicum".

El dolor producido por este fruto andino es el resultado de una compleja substancia llamada "Capsaicina". En determinadas areas del organismo de los mamíferos, existen "receptores" de la capsaicina, capaces de detectar su presencia mediante una sensación ardiente y dolorosa. Un dolor quemante. Pero del esófago hacia abajo, altas