Feature Article

Human Biology Eats: Contemporary Research and Future Directions

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Human biology eats? Of course humans eat! But what, how much, where, and why—and the consequences for human biology both in the short and long term—are questions that can be answered from a variety of perspectives. Often, these perspectives look past one another, generating answers within narrow scientific or ideological boundaries. But food is sufficiently important enough that we should, as human biologists, think more deeply and broadly about it.

One way to do so is to recognize that food, eating, and related phenomena exist at multiple experiential levels. For example, hunger is a feeling we get when our bodies need food; this is an evolved hormonal, physiological, and neurological set of signals that we share with other animals that motivate us to seek food. Raise the intensity a bit, and add a more expansive cognitive context, and hunger goes from being a feeling to an emotion. Finally, hunger is a sociopolitical product (derived from social structures and power differentials) and concept, used to distinguish the “food secure” from the “food insecure.” All of these are, in turn, tied to human biological function.

Historically the study of food has been, oddly enough (and despite Levi-Strauss’s The Raw and the Cooked), marginal to anthropology. This is especially puzzling, given its potential as an outstanding domain to realize the ideal of anthropological holism (Wiley, 2006). It is notable though that one of the only early anthropological works on food dealt with hunger, Audrey Richards’ Hunger and Work in a Savage Tribe: A Functional Study of Nutrition Among the Southern Bantu (1932), described the ways in which this emotional and physiological state shaped so many aspects of social life, yet said almost nothing of hunger’s impact on nutritional status and biological function. Decades later, Sidney Mintz’s political and economic analysis of sugar (Sweetness and Power: The Place of Sugar in Modern History, 1985) highlighted both the innate desirability of sugar, and how our taste for it emerged at the intersection of historical forces that linked slavery, colonialism, industrialization, advertising, and culinary habits. Such contributions from cultural anthropology demonstrate the power of food to shape our social lives, and yet only hint at the ways in which it shapes our physical ones. This is where human biologists can contribute the most, by adding this piece to the complex biocultural puzzle of human dietary behavior.

Obtaining food is a fundamental problem for all living organisms, and adaptations related to diet clearly shape both biology and behavior. Humans are no exception. In the contexts of human evolutionary studies, food sharing, hunting, cooking, dietary shifts toward higher quality diets, and gastronomical flexibility have been invoked as contributors to our large brain, small gut, life history, our propensity for social cooperation, and the demographic success of our species (cf., Milton, 1981; Aiello and Wheeler, 1995; Kaplan et al., 2000; Cunnane et al., 2007; Kingston, 2007; Wrangham, 2009). Exposure to different foods such as milk has also shaped the contemporary genetic diversity in our species. Food processing techniques, or culinary traditions made possible by our large brain enhanced our ability to extract nutrients from foods, and became ever more important with the transition to food production and its reliance on a narrower array of foodstuffs than was typical in the preagricultural period (Katz, 1987).

With a focus on food, human biologists are in an excellent position to merge these two broad areas of investigation, by considering how our food environment—including access to too little or too much, different types of foodstuffs, or the cognitive concept of food—continues to shape our biological lives. Through our concern with both the proximate and ultimate causes and consequences of particular diets and patterns of eating, we can use food to demonstrate the value of a biocultural approach within human biology. But furthermore, dietary behavior is cultural behavior, and our choices about food (or lack thereof) ramify across social life, and undoubtedly contribute to social and cultural change. Work in this area also clearly has tremendous policy relevance. If society is to ever successfully translate scientific knowledge into public health policy aimed at improving diet and health, eating itself must be understood in the overall context of our human biology.

The papers in this collection were presented in the plenary session at the 2011 Human Biology Association meetings. They each address food and eating, human biology and human health, from diverse perspectives. The first three consider how the human evolutionary experience with food informs our present eating patterns, with a variety of biological and health consequences. Lindeberg outlines the basic premises of “evolutionary nutrition” and some clinical research that provides support for adopting diets that are more closely aligned with those of our ancestors (or our best approximation of what those might have been). Perhaps no other paradigm has really shaped our understanding of the “ultimate” causes of contemporary chronic diseases (formerly called “western” diseases, but now sadly rife among the world’s populations) than that of evolutionary nutrition, which emphasizes the ways in...
which our bodies are adapted to a dietary regime quite different from that which typifies increasing numbers of diets (i.e., there is a “mismatch” between contemporary diets and our evolved biology). Indeed the Paleolithic diet paradigm has spawned numerous popular diet books and inspired popular “Caveman” lifestyle movements (cf., The New Age Cavemen and the City, New York Times, January 8, 2010). While arguments persist about the nature of the Paleolithic diet, or more accurately, Paleolithic diets, most were higher in fiber, protein, and most micronutrients and lower in fat, salt, and refined sugars than many contemporary diets.

Michael Power extends the evolutionary nutrition paradigm in his consideration of the proximate and ultimate causes of obesity. He draws an analogy between the contemporary food environment and the purposefully benign captive environments of companion, zoo, or laboratory animals, whereby both appear to underpin high rates of obesity. He describes several different hormonal pathways through which the environmental-obesity link might play out, including those that have intergenerational effects. Power also proposes that the transition from “feeding” to episodic “meals” marked an important shift in human evolutionary history that contributed to changes in sociality.

In his paper, John Allen looks at how cognitive behavior related to food and eating in modern humans represents a shift from and elaboration of patterns seen in other primates, and deepens the hypotheses further regarding how this could happen. He proposes a human “theory of food.” Analogous to other complex cognitive adaptations, such as theory of mind and spoken language, this is an internal, cognitive representation of a normative diet that is a product of the developmental and cultural environments in which a child is raised and matures. One of the implications is that normative diets are not just physiologically but cognitively shaped in childhood, suggesting neurologically deep-seated patterns that would be expected to be resistant to later social or environmental adjustments. On a more positive note, theory of food implies that an active and continued engagement in food procurement and preparation in old age may, like continued intellectual and social activity, promote healthier aging.

The papers by Andrea Wiley and Lawrence Schell and Mia Gallo highlight how social structures influence the consumption of particular foods in ways that have consequences that go well beyond under- or overnutrition. Wiley outlines the ways in which continual consumption of cow milk has the potential to alter human life history parameters. This particular food is produced by female mammals for consumption by nursing infants, for whom milk provides required nutrients and bioactive molecules that regulate their physiological functions as well as growth and development. Thus milk is quite different from other foods. Humans are unique in that many consume milk well beyond the traditional age of weaning and they consume the milk of another—quite different—mammal, usually cows. She reviews current research on cow milk and child growth and maturation, noting that milk consumption during periods of rapid growth may enhance that growth. There is also some evidence that childhood milk intake could contribute to early menarche, and both of these outcomes could have longer term negative health consequences. Wiley also highlights how cultural mandates for milk consumption by children, accompanied by widespread perception of the “goodness” of this food and assumptions that it “makes children grow” can have significant impacts on our biology.

Schell and Gallo remind us that food is simultaneously a source of sustenance and potential toxins, making dietary decisions enormously important but also quite tricky. Toxins can be naturally occurring (as cyanogenic glycosides in cassava, for example), but in an industrial food system they more frequently exist in the form of adulterants, intended to mimic a food’s intrinsic properties and do so cheaply (e.g., adding melamine to milk). Consuming locally produced foods is a reasonable response to the fear of contaminants in industrial foods, but as Schell and Gallo’s work among the Akwesasne Mohawk Nation demonstrates, this safety cannot be assumed. In this case, traditional sources of food such as fresh water fish or game became contaminated with PCBs as a result of industrial production upstream from their lands, and then further transmitted through breastmilk. Thus the Akwesasne are caught in a double bind: to follow contemporary dietary recommendations (i.e., to breastfeed and consume local foods, including wild fish) is to put them at risk of the endocrine-disrupting effects of PCBs, while to avoid these would be to put themselves at risk of obesity and chronic diseases tied to consumption of processed energy-dense, nutrient-poor foods. Moreover, avoidance of traditional foods also means erosion of culturally meaningful activities and intergenerational ties. Just as dietary behavior stems from cultural mandates and social structures affecting access to food, it also feeds back into them.

This complex biocultural relationship between human biology, society, and culture is manifest especially starkly in contexts of food insecurity. While human biologists have well-documented the negative consequences of undernutrition on child growth, Hadley and coauthors take a broader view, showing how the lived experience of food insecurity has consequences for mental health in addition to child growth among household in rural southwest Ethiopia. Food insecurity and maternal distress were both associated with poor nutritional status for children, and each had largely independent effects, indicating that food insecurity’s association with child growth does not act through maternal distress, as suggested in other studies.

While Hadley reminds us of the negative psychological consequences of harboring concerns about where the next meal might come from, Anderson and Weindruch provide a very different view of the role of trade-offs around food shortage. They focus on caloric restriction, which ironically perhaps, has been shown in a wide range of experimental organisms (including monkeys) to be one of the only means by which the process of aging might be retarded. It may also work in humans, although a fundamental problem arises in trying to implement such a diet as a means towards better health and longer life: our biocultural histories make it very unappealing to the vast majority of people, and our current environments make it almost impossible to enact, especially if one must also maintain an adequate intake of micronutrients. Anderson and Weindruch suggest this line of applied research could ultimately lead to the development of drugs and “nutraceuticals” that may mimic the effects of caloric restriction.

This hint of future possibilities leads us to an important set of final points. If the papers in this special issue represent the contemporary research that human biologists are doing, then the suggested future directions must include...
consideration of how this fundamental and highly relevant knowledge about food and human biology can be brought to the attention of, and translated into, public health policy and other forms of public good. In a world where rising meat prices in China cascade to Tiananmen Square, creating food security is not only about the health and well-being of individuals, but fundamental to a stable world. Following from Hadley et al., how can we best address that, especially given how small our voices are in the global politics of food? As billions are spent on obesity prevention for those struggling with too much—often poor quality—food, how can we ensure that food meets both cultural and biochemical needs—that it is safe and appropriate (following from Schell and Wiley)? How (following from Allen and Power) can we create the most healthful developmental niches in an ever more complex and technologically oriented and “captive” world?

For human biologists, there are few easy answers to this question of translation, and it is unclear if direct engagement in macrolevel policy is even the best or most expedient path forward. And it isn’t easy to do: The major challenges in working in the human biology-food policy nexus are at least threefold: (1) acquiring a transdisciplinary perspective on how the policy process works (and backing off from the science-centric presumption that more and better knowledge is at the center of that policy process); (2) developing and sustaining prolonged engagements with policy communities and consumers; and (3) struggling to defend both transdisciplinary research and communication within an academic environment that typically favors discipline-based expertise and detached scholarship (David Pelletier, personal communication). In sum, the importance of food for human biology and human biology for the world of food has seemingly limitless possibilities, and also challenges, both of which will—in true modern fashion—certainly gain additional weight as the years proceed.

LITERATURE CITED