Healthy Plate, Healthy Planet

Frank Hu confronts the triple threats of obesity, undernutrition, and climate change.

by Jacob Sweet

Hu believes a plant-based diet can help feed a growing population in a healthy, sustainable way.
Frank Hu and Kentucky Fried Chicken arrived in Beijing around the same time. Hu, a recent graduate of Tongji Medical University, in Wuhan, had never seen a restaurant like it. Three-floored, gleaming, and distinctly Western in atmosphere, KFC proved irresistible to a country unfamiliar with the greasy efficiency of American fast food. On a frigid day in November 1987, thousands waited two hours in line to be among the first Chinese citizens to try the Colonel’s crispy drumsticks and gravy-doused mashed potatoes.

A few decades later, China’s first KFC remains open, a few blocks from Tiananmen Square. At first it stood alone. By 2007, KFCs were popping up around the country at a rate of one per day. Now there are nearly 6,000 KFCs, 3,000 McDonalds, and thousands more Pizza Huts, Burger Kings, and Dunkin’ Donuts.

In 1980, seven years before that first KFC, the prevalence of Type 2 (adult onset) diabetes in China was less than 1 percent of the population. In 2001, that had risen to 5.5 percent. Now, with an estimated 116 million diabetics in the country, the number is 12 percent—and still rising.

Hu, now Stare Professor of nutrition and epidemiology at the Harvard T.H. Chan School of Public Health, moves along the salad bar in HSPH’s Kresge Cafeteria, serving himself a bountiful vegetable medley: arugula, cherry tomatoes, carrots, chickpeas, radishes, Brussels sprouts, a splash of balsamic vinaigrette. Some days, he includes a piece of salmon or chicken. Today, he adds half a hard-boiled egg and some crunchy noodles, for texture. He almost never brings lunch from home; with a cafeteria like this, he doesn’t need to.

Eating unhealthily in the Kresge Cafeteria is almost difficult. Hu works with staff to keep it that way. Above the lengthy salad bar spreads a huge depiction of the “Healthy Eating Plate,” which HSPH and Harvard Medical School (HMS) developed in response to MyPlate, an illustration of Dietary Guidelines for Americans issued by the U.S. departments of agriculture (USDA) and health and human services (HHS) and updated every five years. HSPH thought it could do a better job at following the science. “The Healthy Eating Plate is based exclusively on the best available evidence and was not subjected to political or commercial pressures from food-industry lobbyists,” the school’s Nutrition Source website notes—a jab at the government recommendations. If guests miss the several-foot-long bar in HSPH’s Kresge Cafeteria, serving himself a bountiful vegetable medley: arugula, cherry tomatoes, carrots, chickpeas, radishes, Brussels sprouts, a splash of balsamic vinaigrette. Some days, he includes a piece of salmon or chicken. Today, he adds half a hard-boiled egg and some crunchy noodles, for texture. He almost never brings lunch from home; with a cafeteria like this, he doesn’t need to.

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At the beginning of the line, beside the utensils, cardstock handouts offer more in-depth advice about vegetables and fruits, cholesterol and fats, calcium and milk, and fiber. “Limit milk and dairy foods to no more than one to two servings per day,” says one card. “More won’t necessarily do your bones any good—and less is fine, as long as you get enough calcium from other sources.” On MyPlate, a glass of milk sits next to the meal. The Healthy Eating Plate recommends water, coffee, or tea, suggestions that would likely displease the dairy-industry groups—including the National Dairy Council, International Dairy Foods Association, and National Milk Producers Federation—that gave presentations before the USDA’s 2015 Dietary Guidelines Advisory Committee (DGAC), on which Hu served.

Hu shows off the cafeteria like a proud father displaying his child’s trophies. “The salad bar is the most popular among the students and faculty,” he notes, with understated satisfaction. “We have people coming from the hospitals to our cafeteria just to get a healthier lunch.” If he’s busy, and the salad line is particularly long, he’ll skip to the “Heart of the Plate” section, which offers five healthy, pre-made dishes. Today he scoops the lentil, sorghum, and chick-pea pilaf into his container, already filled with salad. The pizza section is not quite as healthy. “Sometimes we have whole-grain pizza and mostly vegetable pizza,” he says, smiling. “But we also have some unhealthy pizza.”

Hu is the third chair in the HSPH nutrition department’s 78-year history. As a nutritional epidemiologist, he studies the relationship between diet and health. Though he’s arguably the world’s leading expert on diet’s connection to chronic diseases, including diabetes and cardiovascular disease, his research interests range widely. In almost two decades at Harvard, he’s written or co-written more than 1,000 peer-reviewed papers, almost all of them group efforts.

Some of his research is large-scale: identifying the healthiest eating patterns using dietary surveys and disease outcomes provided by hundreds of thousands of people; studying the preventability of heart disease and Type 2 diabetes through diet and lifestyle; working out how genetic and environmental factors relate to obesity. He has published papers on the population-wide health impacts of sugar-sweetened beverages, of coffee and red meats, and of polyunsaturated and saturated fatty acids. He and his colleague Walter Willett, professor of epidemiology and nutrition, have helped push their field toward understanding the health impacts of such eating patterns, a step beyond examining the impact of one particular nutrient or food.

He also works on a smaller scale, pinpointing the precise mechanisms and biological pathways that explain why certain food groups affect people as they do. It’s one thing to know that among large populations, heavy consumers of red meat are at a greater risk of Type 2 diabetes, cardiovascular disease, certain cancers, and premature death. It’s another to know how red meat, compared to plant proteins like nuts and legumes, increases blood levels of low-density lipoprotein cholesterol, which clogs arteries and can lead to atherosclerotic cardiovascular disease. Hu was one of the first in his field to stress the potential importance of metabolomics—the study of the chemical by-products specific cellular processes leave behind—which may allow for better diet measurements and earlier disease-risk identification.

When media sources need an expert on any nutrition topic, Hu often receives a call. The New York Times has asked him to comment on the health impacts of eggs, fish, red meat, walnuts, the Mediterranean diet, calorie restriction, carbohydrate as a replacement for fat, fats as a replacement for carbohydrates, and instant noodles.

Right now, no one study or topic is as pressing to Hu as the intersection of three threats: obesity, undernutrition, and climate change. Of the seven and a half billion people in the world, about two billion are overweight, and two billion more are undernourished. “Both overnutrition and undernutrition are affected by climate change,” he explains. “When the temperature rises—when carbon dioxide increases—that can actually reduce the amount of zinc, iron, protein, and other nutrients in crops like rice or wheat... and that can further exacerbate the problem of undernutrition in the poor regions of the world [see “Climate Change and Crops,” November—December 2017, page 14]. In the meantime, our food system undermines human health because the Westernization of diet has led to high consumption of red meat, processed meats, sugars,
and saturated fats. That has led to a global epidemic of obesity, diabetes, and other chronic diseases.” Animal agriculture, the second-largest contributor of human-made greenhouse gas (GHG) emissions worsens the problem.

An increase in food production during the past 50 years has helped decrease world hunger and increase life expectancy. But a shift to “Western-style dietary patterns”—high in calories, high-
ly processed foods, and meat—is unsustainable, Hu and his colleagues believe, because it damages not only individual and population health, but also the environment.

Since 1963, global meat consumption has risen by 62 percent. In developing nations, the increase has been about five times that, with China increasing its meat consumption nine-fold. The more meat, the greater the cost to the environment. Food production is the world’s largest cause of biodiversity loss, responsible for 80 percent of deforestation, more than 70 percent of fresh-water use, and 30 percent of human-generated GHG emissions, wrote Hu and HSPH project coordinator Elena C. Hemler in the November issue of Advances in Nutrition. Animal products play an outsized role: meat and dairy production accounts for more than 80 percent of the food sector’s GHG emissions, and requires 11 times more fossil fuels to supply a single unit of protein than grain-based sources (see “Eating for the Environment,” March–April 2017, page 11). Red meat is especially inefficient. Producing 50 grams of beef protein yields 17.7 kilograms of carbon dioxide on average. For tofu, beans, and nuts, it’s 1.0, 4, and 1 kilograms, respectively.

If eating red meat were clearly healthy, nutrition scientists might face a predicament. But in Hu’s view, red meat—and processed red meat in particular—isn’t. Much of the data he relies on comes from huge longitudinal cohort studies, in which researchers collect information on participants’ diets and health status over decades. A 2012 study of men in the Health Professionals Follow-Up Study (who had been followed for 22 years) and women in the Nurses’ Health Study (followed for 28)—both collaborations among HSPH, HMS, and Brigham and Women’s Hospital—found that a single-serving-per-day increase in processed and unprocessed meat increased mortality risk by 13 percent and 20 percent, respectively. Hu estimates that if all study participants had consumed less than a half-serving of meat per day, 9.3 percent of premature deaths in men and 7.6 percent in women recorded in the studies could have been prevented.

“Without considering the health of the population, or the health of the community, it’s not really meaningful to talk about personal health,” he says. “In the same vein, without considering the health of our planet, I think it’s really futile to talk about the health of the human population. They are all interrelated and intertwined, and they have to be considered and looked at simultaneously rather than separately.” He believes a healthy, plant-based diet could be the answer.

As a member of the 2015 DGAC, Hu had a chance to compile evidence for dietary guidelines that reflected the importance of diet not just to human health, but to that of the environment. Each member is assigned to a number of overlapping working groups and sub-committees, which focus on a specific topic. The two-year process of reviewing the evidence and writing the final scientific report requires all 14 nutrition scientists to reach a consensus. Almost every week, Hu spent hours on the phone with his fellow committee members, analyzing the available science, and developing their recommendations. Every few months, he traveled to Washington, D.C., for lengthy committee meetings that were open to the public.

Hu was proud of the nearly 450-page final report. For the first time, the committee set a recommended daily limit for added sugar, emphasized type of fat over total fat consumption, recommended lowering the intake of red and processed meat—like bacon, sausages, hot dogs, and most cold cuts—and created an entire chapter on “Food Sustainability and Safety.” The introduction to the new chapter made the case for why food sustainability matters, and why the subject was worth including within the dietary guidelines, pointing to precedents in the nutrition policies of Germany, Sweden, the Netherlands, Australia, and Brazil, among other countries.

In the end, though, the environmental recommendations couldn’t withstand powerful industry lobbyists and congressional opposition. The USDA decided that environmental sustainability was outside the scope of the dietary guidelines, and the final report ignored any suggested limits to red-meat consumption. “Sometimes it’s one step forward, two steps back,” Hu says. Willett was a bit more demonstrative at the time. “This is virtual proof that the USDA is not allowed to say anything negative about red meat,” he told The Boston Globe. “The basic censorship of the report from the Advisory Committee is deeply troublesome.”

Hu still calls his time on the committee valuable. “I think during the process I learned that, of course, developing the strongest scientific evidence base is still the most important, most fundamental in terms of developing dietary guidelines,” he says. “But political leadership is also very important. And advocacy is important, and communications….Nowadays, we have so much misinformation or fake information through social media, I think it’s become even more urgent to disseminate evidence-based nutrition messages to the general public and to policy makers.”

In recent years, he has spoken and published frequently about plant-based diets. Contrary to popular belief, he often explains, plant-based diets do not have to be vegan or vegetarian. For most people, complete elimination of meat or animal products is unrealistic and not necessary for improving health. He often cites a January 2019 report from the EAT-Lancet Commission on Food, Planet and Health—a joint effort between the non-profit EAT, which hopes to improve the global food system, and The Lancet, a peer-reviewed medical journal. Written by a team of 37 scientists and co-chaired by Willett, the summary report concluded that “a global adoption of healthy diets from sustainable food systems would safeguard our planet and improve the health of billions” and recommended how to feed 10 billion people while limiting environmental degradation. Hu also pushes for public-health strategies to make healthier diets cheaper and more accessible—from soda taxes and agricultural subsidies to fast-food marketing and zoning restrictions that could make junk food less appealing and ubiquitous, to public-education campaigns and reforms to the Supplemental Nutrition Assistance Program (formerly known as food stamps).

And the 2015 DGAC report, though not wholly incorporated by the USDA, remains online in its full form. The 2020 DGAC will have less to say. Instead of allowing the committee to decide for itself what to cover, the USDA has limited the scope of the report to answering 80 questions provided by itself and HHS. Not one specifically addresses red and processed meats, ultra-processed foods, sodium—or climate change.

Growing up in a small rural village, Hu was not familiar with overnutrition. With the Cultural Revolution in full swing, he and
his parents, living in landlocked Hubei Province, relied on rations from the government: exchanging their state-supplied tickets at the local corner store for rice and small amounts of meat, salt, and cooking oils. His parents, both peasants, supplemented those supplies with vegetables from a backyard garden.

Hu’s father had finished only elementary school; his mother had no schooling at all. Although Hu attended the local grade school, higher education seemed remote. During the Cultural Revolution, the country’s universities were closed. But in 1976, with Mao Zedong’s death, China began a period of economic reform. The Hu family’s small, self-sufficient farm and fish pond now belonged to them—not the state. His parents had always emphasized education, and universities were beginning to re-open.

Hu had become interested in medicine after being rushed to the hospital with a stomach problem during high school. “A doctor made a really good impression on me,” he reflects. “I wanted to be someone like this person.” His chances of admission to any medical school were slim. But as high school came to a close, he was accepted at Tongji Medical University—one of just a handful among the few hundred students in his graduating class to pursue a higher degree.

Medical school required a clinical internship, which Hu remembers as a few months of patient care in a county hospital. “In the beginning, it was very exciting to see patients, to prescribe drugs,” he says. “But after a while, it became routine, and you’d see the same types of patients over and over again.” He could do very little to help those with chronic diseases. “I realized that the medical approach—treating one patient at a time—is not sufficient to deal with major public-health problems.”

That experience directed him toward preventive medicine and public health: he wanted to help people make behavioral changes before they got chronic diseases. He focused especially on nutrition-related problems like diabetes and cardiovascular disease, becoming interested in epidemiological research that relied on large populations to identify risk factors.

Rather than practicing as a doctor after graduation, Hu knocked on doors and performed health surveys in Beijing for the Ministry of Public Health. He measured people’s height and weight, asked about their typical diets, and sometimes drew blood. He also looked for cardiovascular conditions: hypertension, obesity, and high cholesterol. And at each house, he provided official dietary advice. Epidemiological studies often rely on data collected from thousands of people, and nowadays, Hu says, “almost anyone can just get their data from the computer without knowing where the data come from.” But this study required him to meet each person face-to-face, and the experience gave him the sense that fieldwork is hard. “The participant has to trust you,” he explains. “You have to be very patient explaining the questions.”

Although Hu noticed, based on his fieldwork, that rates of chronic diseases were higher than they had been decades earlier, he didn’t make any connection at the time between his findings and changes in diet like the arrival of KFC. He does recall the restaurant’s unfamiliarity and extreme popularity: he even went himself. “It was a special treat,” he says. “It was expensive, [with] a kind of upscale atmosphere….You could almost see the Westernization of diet happening before your eyes.” Not until he arrived at the University of Illinois at Chicago in 1992—where he started reading hundreds of papers on the connection between diet and health—did he notice.

At UIC, Hu learned the strengths and weaknesses of different study designs. For example, epidemiologists often start their investigation of a given hypothesis with a simple correlational, or cross-sectional, study. Researchers might look at roughly 100 people to
see how what they eat relates to their hypertension status, for instance. Such surveys are one-offs, with no updates over time. They may provide some insight, but leave much to be desired.

Retrospective case-control studies are a bit more sophisticated. Researchers might select 100 recent heart-attack patients and 100 controls—matched by age, sex, and other variables—and compare their diets. The method is better, but far from perfect. Human recall, already an imperfect measuring system, may be altered by life events: the study subjects may think coffee causes heart attacks, for example, and overestimate their level of consumption.

But Hu recognized in particular the importance of large longitudinal cohort studies, including the all-female Nurses’ Health Study II and the all-male Health Professionals Follow-Up Study, both led by Walter Willett. Those studies followed, and decades later continue to follow, hundreds of thousands of health professionals. Every two years, researchers ask participants for information about their smoking and physical-activity habits and their overall health. Every four years, an extensive nutritional survey goes out, assessing what types of food and how often and much they eat, per day, on average. Researchers have also collected biospecimens like blood, urine, and toenail clippings—providing data on some dietary factors that are difficult to assess through self-reporting. This type of cohort study enrolls people who have not yet been diagnosed with any chronic disease, and will continue to follow them until they die. (“It’s a morbid business,” Eric Rimm, professor of nutrition, once told The Boston Globe.) Across the decades, researchers have gathered a trove of data about each participant, allowing them to conduct detailed statistical analyses that link diet, lifestyle factors, nutrition, once told myself.” To perform serious research, write beyond. “I think the whole team deserves more credit than one—refuted then-accepted recommendations to limit dietary fat. It was the type of fat that mattered most with respect to risk of heart disease, he concluded, not the amount. Trans fat was the most dangerous; women who consumed the most were 33 percent more likely to have a heart attack than those who consumed the least. His findings received front-page coverage in The New York Times.

His publishing accelerated over the years, reaching out into all aspects of nutrition, from broad relationships between diet and health, to precise metabolic pathways that explain why certain dietary choices, like increased red-meat consumption, can lead to inflammation and chronic diseases. He emphasizes that his research is far from an individual endeavor. Hu works not only with Harvard faculty colleagues and students, but also with researchers in Spain, China, and beyond. “I think the whole team deserves more credit than myself,” he emphasizes. To perform serious research, write strong papers, and advocate for policies that make plant-based diets more accessible and affordable, Hu needs a robust team, across disciplines, and across the world. And as he has learned, sometimes progress isn’t just about producing the best available evidence. Sometimes, it’s about fighting to defend it.

Late this past September, Hu received emails from several reporters requesting comment on a group of five systematic reviews about red-meat consumption and health outcomes to be published in Annals of Internal Medicine. The reviews preceded dietary recommendations from an ad hoc committee, including many of the papers’ authors, who concluded that people should continue eating as much of it as they saw fit. For Hu and his HSPH colleagues, who had reached consistently different conclusions for decades, the findings were baffling. And even though contradictions appear among published papers, especially those dealing with popular topics, the recommendations took an especially inflammatory approach, directly naming and
disputing recommendations from the 2015 Dietary Guidelines for Americans; the United Kingdom dietary guidelines; the World Cancer Research Fund and American Institute for Cancer Research; and the World Health Organization International Agency for Research on Cancer. Hu was not thrilled by the sensational title for the press release: “New guidelines: No need to reduce red or processed meat consumption for good health.”

He took particular issue with the bold headline claim, fearing that media sources would distribute the new study without context, giving people the impression that the controversial findings were the most conclusive to date. Nutritional epidemiologists often find themselves in this predicament: a contrarian study is more interesting than one that supports a widely accepted view. Shortly after receiving the news release, several nutrition department faculty members who received interview requests began working together to figure out how best to respond.

Hu and Willett found that the ad hoc committee, made up mostly of “methodologists” without backgrounds in nutrition, had applied the GRADE standard—designed for controlled drug trials—to nutrition studies. As a result, most of the studies were judged to be of “low” or “very low” quality for “certainty of evidence,” because the GRADE approach categorizes observational studies as low-quality evidence, and randomized clinical trials—often impossible to perform in nutritional studies for practical and ethical reasons—as high-quality evidence. Even under this system, which Hu called “inappropriate” for evaluating nutrition studies, he argued that the committee’s own data showed that red meat did have a negative impact overall, but that the evidence was dismissed due to its “low certainty.”

To add context to the report and explain the problems with the new guidelines, the department developed an online Q&A page, spelling out why it believed the reviews were neither as rigorous nor as conclusive as the Annals authors claimed. In the days preceding the study’s official release, Hu, Willett, and other faculty members handled dozens of calls from reporters, answering a variety of questions about its findings.

Their efforts stirred controversy. In late January, John Sharp, chancellor of the Texas A&M University System, accused Hu and Willett of working with the True Health Initiative (THI), an independent organization that promotes healthy lifestyles, to “discredit scientific evidence that runs contrary to their ideology.” (The pair are listed among several hundred council members on the THI website.) In a letter to President Lawrence S. Bacow, Sharp cited a Journal of the American Medical Association article in which Annals editor-in-chief Christine Laine stated that her inbox was inundated with about 2,000 caustic bot-generated emails in a half-hour before the Annals issue was released. She accused Hu and Willett, among others, of breaking embargo policy, and criticized their decision to send a letter that urged her to “withhold publication of potentially damaging misinformation pending all due and appropriate review of the matter by [her] office.”

Willett, in a phone interview, referred to THI as a “very informal organization” and denied any wrongdoing, including using a bot to send emails. “I think none of us would know what to do with a bot if we saw one, or had one,” he said. “It would’ve been much worse had nobody said anything about the fact that this was very incon-

sistent with the overall literature, [or] pointed out the weaknesses of this analysis, which are many.” Hu, speaking at a conference a few days later, said: “The debate over the role of red meat in our diets has become more heated and threatens to veer off the science track...Certainly there is room for debate about different research methods and data interpretation, but we should also strive for the goal of improving both human and planetary health.”

Ultimately, the HSPH effort was effective. The findings were covered in most major publications around the country, but many headlines carried nuance that likely would have been absent without the HSPH campaign. “A study says full speed on processed and red meat consumption. Nutrition scientists say not so fast,” wrote The Washington Post. A few weeks later, it published another article, “Research group that discounted risks of red meat has ties to program partly backed by beef industry.” On New Year’s Eve, the Annals issued a correction stating that Bradley Johnston, the lead researcher of the group, had failed to disclose a key conflict of interest with AgriLife Research, a Texas A&M University research agency that is partially funded by the beef industry.

Hu knows that there is plenty of room for improvement in nutritional studies. It’s easy to see relationships between population-wide chronic diseases and red-meat consumption, but harder to find proof that this relationship is causal. Double-blind randomized clinical trials are the gold standard for drug tests. In nutrition studies, such tests can be run for dietary supplements that can fit into a pill, like fish oil, but that won’t work for most foods: it would be hard for subjects not to notice that they are eating large quantities of red meat over a long period of time. It’s also unethical, according to the principle of “First, do no harm,” to encourage this type of consumption. Even without large clinical trials, he believes scientists can make causal inference based on consistent evidence from large cohort studies and small intervention trials.

He and his colleagues are working on these problems, aiming to improve nutritional epidemiologic studies and develop more accurate and reliable dietary assessment tools. Hu thinks that new technology like metabolomics—which can measure thousands of small molecules derived from the metabolism of specific foods and nutrients in blood and urine samples—holds promise in identifying at-risk individuals and tailoring dietary interventions to improve their health.

But even now, Hu thinks there’s enough evidence to act. “In many situations, we cannot afford to wait until so-called conclusive evidence or absolute evidence is obtained,” he says. Just as observational studies made it clear that smoking increased disease risk, he believes that obesity, chronic disease, and climate change present challenges too severe to be pushed to the future. “Globally, if we always just wait for the absolute proof or conclusive evidence, then it’s going to be disastrous. It’s going to be too late for both human health and the environment.”

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