

ties at home, Goldin says, “lots of money is going to be left on the table,” which is why she believes so many couples don’t.

Non-linearity helps explain why most of the gender pay gap occurs within professions, Goldin adds. The distribution of men and women in different occupations accounts for only 15 percent of the gap, and the remaining 85 percent arises within occupations. (For college graduates, those numbers are 35 percent and 65 percent, respectively.) In science and health professions, though, workers are more likely to be compensated at a constant rate for additional time worked, and the ratio of women’s earnings to men’s is higher—about .892. For occupations in business and finance, the ratio is .787, and for lawyers, .815, closer to the national gender wage gap.

Improvements in technology have made it easier for some health and science professions to substitute workers for one another in a single job, which reduces the cost to companies of offering a flexible-hours option to employees. Goldin calls pharmacy “the most egalitarian profession” because it shows nearly perfectly linear compensation and one of the smallest gender pay gaps of any field. “Pharmacy has no part-time penalty,” she says. Structural changes, such as centralized computer records and standardization of drugs, allow one pharmacist to take over easily for another without compromising the quality of work. And because it’s easy for pharmacists to work part-time, women are less likely to have to leave their jobs to care for their families, a decision that can make it difficult to reenter the workforce later.

Goldin believes other fields could narrow their gender wage gaps, too, if they did not have an incentive to pay workers disproportionately more for working more. How to induce change in the labor market isn’t obvious. Why can’t you convince clients, she asks, that your employees are like puzzle pieces, each knowing everything the others know, so they’re good substitutes for each other? “As their labor costs mount,” she suggests, firms “will figure out how to make workers better substitutes for each other.” Technological change might also play a role, doing for law, perhaps, what it’s done for health professions, and making it easier for lawyers to hand off clients to one another. But in some cases, Goldin concedes, it may not be possible to embrace this modular model: “We don’t

want the president of the United States to be a part-time president.”

As for policy interventions to close the gender earnings gap—a California law makes it illegal to retaliate against employees for sharing information about their pay, for example—“That’s probably a good thing,” Goldin says. “If the fruit is low-hanging, by all means pick it.” But she balks at the suggestion that regulation can

fix what she sees as a labor-demand problem. Creating an egalitarian workplace, she believes, will depend primarily on reducing the cost of offering time flexibility to workers—securing equal pay for equal work, in the strictest sense.

~MARINA BOLOTNIKOVA

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DIET DEBATE

Are All Calories Equal?

LOW FAT. Low carb. Vegan. Atkins. Paleo. South Beach. Zone. As television shows, magazine covers, podcasts, and books release an endless flood of diet advice, the average person finds it difficult at best to know how to find a sustainable method of weight loss. The latest *scientific* debate in the world of nutrition is no less heated: are all calories created equal?

David Ludwig, professor of pediatrics at Harvard Medical School and of nutrition at the School of Public Health, who specializes in endocrinology and obesity, rejects the popular belief that overeating causes weight gain. Instead, he asserts, the process of getting fatter causes people to overeat. Even though many biological factors—genetics, levels of physical activity, sleep, and stress—affect the storage of calories in fat cells, he points out that only one has a dominant role: the hormone insulin. “We know that excess insulin treatment for diabetes causes weight gain, and insulin deficiency causes weight loss,” he says. “And of everything we eat, highly refined and rapidly digestible carbohydrates produce the most insulin.”

Ludwig argues that eating a diet high in refined sugars and processed carbohydrates leads to a yo-yo metabolism. When people eat high-glycemic processed fare such as baked goods and white bread, he says, insulin levels spike, causing hormone-sensitive



lipase—an enzyme needed for the transfer of triglycerides from blood lipoproteins into tissues—to be turned off. This causes more calories to be stored in fat cells as opposed to the blood, leading the brain to think that the body is hungry.

“Insulin is the ultimate fat-cell fertilizer,” Ludwig says. “When fat cells get triggered to take in and store too many calories, there are too few for the rest of the body—that’s

what the brain perceives. We think of obesity as a state of excess, but biologically it's a state of deprivation, or the state of starvation. The brain sees too few calories in the bloodstream to run metabolism, so it makes us hungry. It activates hunger and craving sensors in the brain, and slows down metabolism."

This combination of rising hunger and slowing metabolism is a recipe for weight gain, he adds, and explains why only a very small proportion of people on low-calorie diets can keep weight off in the long term. A 2012 study by Ludwig and his colleagues, published in the *Journal of the American Medical Association* (*JAMA*), offered some evidence. It examined 21 overweight and obese young adults after they had lost 10 to 15 percent of their body weight on diets ranging from low-fat to low-carbohydrate. Despite consuming the same number of calories, subjects on the low-carbohydrate diet burned about 325 more calories per day than those on the low-fat diet.

A related debate on whether low-fat or low-carb diets provide optimal health benefits is still fiercely contested. Ludwig argues that the type of calories you eat can affect the number of calories you burn, and that none of this is addressed in the conventional calorie-in, calorie-out model. His team observed in its studies that low-fat, high-carbohydrate diets—despite providing a surge in energy or calorie availability in the bloodstream for the first hour or so after a meal—cause problems a few hours later, "when all those calories have been taken up into storage, and can't get out as quickly as needed."

Although study after study shows that added dietary sugar leads to weight gain, Type II diabetes, and heart disease, Dean Ornish—a leading advocate of low-fat diets and lifestyle changes as ways to prevent and reverse cardiovascular disease—argues that an optimal diet is based primarily on plants: fruits, vegetables, whole grains, legumes, and soy products, with some healthy fats (omega 3 fatty acids), and predominantly plant-based proteins. Ornish advises avoiding red meat because of its saturated fat content and studies linking it to chronic inflammation and increased cancer risk. (Ludwig does not exclude red meat as a healthy option, but he also encourages alternatives such as chicken, fish, and soy products.)

Ludwig acknowledges that all low-fat diets aren't necessarily bad for body

weight. But as fat intake decreases, he argues, it becomes increasingly difficult to avoid overeating grains. He notes that even whole grains can cause a spike in the level of blood sugar if heavily processed, because certain processing techniques disrupt the fiber's natural ability to lower blood-sugar concentration. (They can degrade healthy natural antioxidants as well.) He therefore recommends replacing refined carbohydrates with healthy fats (such as nuts, avocado, and olive oil) as a more practical and effective solution for most people.

In a 2015 *JAMA* article, he and Dariush Mozaffarian, now dean of the Tufts Friedman School of Nutrition Science and Policy, called for the United States to rethink its policies on dietary fat. The pair argued in a July 2015 op-ed article in *The New York Times* that limiting the total amount of dietary fat "is an outdated concept, an obstacle to sensible change that promotes harmful low-fat foods, undermines efforts to limit refined grains and added sugars, and discourages the food industry from developing products higher in healthy fats." (Ludwig's own recommendations can be found in his new book, *Always Hungry*.)

To advance the low-carb versus low-fat debate, Ludwig, founding director of the Optimal Weight for Life (OWL) program at Boston Children's Hospital and director of the New Balance Foundation Obesity Prevention Center, is working on a larger-

scale study in collaboration with Framingham State University: three groups of 50 people each are being fed three different diets during the course of an academic year. The amount of protein for each group is fixed at 20 percent, but the fat and carbohydrate percentages range from a very low-fat, high-carbohydrate combination to exactly the opposite. The study design, Ludwig says, replicates the 2012 *JAMA* study but extends the diet phase to 5 months in order to study longer-term adaptation.

Ludwig is adamant that animal research, epidemiology, and clinical trials show that insulin secretion plays a major role in weight, but admits there is room for converging lines of investigation. "How do these different diets controlled for calories affect our metabolism, the number of calories being burned? How do they affect body composition? That's a key question," he says. "If you eat the same protein and the same calories, but just begin with different proportions of fat and carbohydrates, do you influence...how much fat you're storing versus how much lean tissue you have? That's never been well addressed, but it's a critical scientific question."

—LAURA LEVIS

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MELANOMA MUGSHOT

A Cancer Begins

LEONARD ZON HAS CAPTURED the moment when a single cell first becomes cancerous—and he thinks that means an answer to cancer's origins may be within reach. "We're close," he says. If scientists can pin down a cancer's precise causes, they may be able to develop treatments to stop the disease even before it begins.

Zon, a professor of stem cell and regenerative biology in the Faculty of Arts and Sciences and Grousbeck professor of pediatrics at Harvard Medical School, runs perhaps the world's most populous aquarium.



Transparent zebrafish that develop human melanomas (bottom) facilitate the study of cancer susceptibility and carcinogenesis.

His laboratory is filled with tanks of transparent zebrafish (300,000 of them), which he uses to study skin cancer. Tagged with fluorescent proteins, some fish glow red, others green, enabling him to see what is happening inside when a melanoma starts to form. These specially bred experimental