

# Opinionator

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## Stand Up While You Read This!

By OLIVIA JUDSON



*Olivia Judson on the influence of science and biology on modern life. .Olivia Judson, an evolutionary biologist, writes every Wednesday about the influence of science and biology on modern life. She is the author of “Dr. Tatiana’s Sex Advice to All Creation: The Definitive Guide to the Evolutionary Biology of Sex.” Ms. Judson has been a reporter for The Economist and has written for a number of other publications, including Nature, The Financial Times, The Atlantic and Natural History. She is a research fellow in biology at Imperial College London.*

TAGS:

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Zack Canepari for The New York Times, left; Chris Machian for The New York Times

Wrong: Sitting at your cubicle. Better: Walking while clicking and talking.

Your chair is your enemy.

It doesn't matter if you go running every morning, or you're a regular at the gym. If you spend most of the rest of the day sitting — in your car, your office chair, on your sofa at home — you are putting yourself at increased risk of obesity, diabetes, heart disease, a variety of cancers and an early death. In other words, irrespective of whether you exercise vigorously, sitting for long periods is bad for you.

That, at least, is the conclusion of several recent studies. Indeed, if you consider only healthy people who exercise regularly, those who sit the most during the rest of the day have larger waists and worse profiles of blood pressure and blood sugar than those who sit less. Among people who sit in front of the television for more than three hours each day, those who exercise are as fat as those who don't: sitting a lot appears to offset some of the benefits of jogging a lot.

So what's wrong with sitting? The answer seems to have two parts. The first is that sitting is one of the most passive things you can do. You burn more energy by chewing gum or fidgeting than you do sitting still in a chair. Compared to sitting, standing in one place is hard work. To stand, you have to tense your leg muscles, and engage the muscles of your back and shoulders; while standing, you often shift from leg to leg. All of this burns energy.

For many people, weight gain is a matter of slow creep — two pounds this year, three pounds next year. You can gain this much if, each day, you eat just 30 calories more than you burn. Thirty calories is hardly anything — it's a couple of mouthfuls of banana, or a few potato chips. Thus, a little more time on your feet today and tomorrow can easily make the difference between remaining lean and getting fat.

You may think you have no choice about how much you sit. But this isn't true. Suppose you sleep for eight hours each day, and exercise for one. That still leaves 15 hours of activities. Even if you exercise, most of the energy you

burn will be burnt during these 15 hours, so weight gain is often the cumulative effect of a series of small decisions: Do you take the stairs or the elevator? Do you e-mail your colleague down the hall, or get up and go and see her? When you get home, do you potter about in the garden or sit in front of the television? Do you walk to the corner store, or drive?

Just to underscore the point that you do have a choice: a study of junior doctors doing the same job, the same week, on identical wards found that some individuals walked four times farther than others at work each day. (No one in the study was overweight; but the “long-distance” doctors were thinner than the “short-distance” doctors.)

So part of the problem with sitting a lot is that you don't use as much energy as those who spend more time on their feet. This makes it easier to gain weight, and makes you more prone to the health problems that fatness often brings.

But it looks as though there's a more sinister aspect to sitting, too. Several strands of evidence suggest that there's a “physiology of inactivity”: that when you spend long periods sitting, your body actually does things that are bad for you.

As an example, consider lipoprotein lipase. This is a molecule that plays a central role in how the body processes fats; it's produced by many tissues, including muscles. Low levels of lipoprotein lipase are associated with a variety of health problems, including heart disease. Studies in rats show that leg muscles only produce this molecule when they are actively being flexed (for example, when the animal is standing up and ambling about). The implication is that when you sit, a crucial part of your metabolism slows down.

Nor is lipoprotein lipase the only molecule affected by muscular inactivity. Actively contracting muscles produce a whole suite of substances that have a beneficial effect on how the body uses and stores sugars and fats.

Which might explain the following result. Men who normally walk a lot (about 10,000 steps per day, as measured by a pedometer) were asked to cut

back (to about 1,350 steps per day) for two weeks, by using elevators instead of stairs, driving to work instead of walking and so on. By the end of the two weeks, all of them had become worse at metabolizing sugars and fats. Their distribution of body fat had also altered — they had become fatter around the middle. Such changes are among the first steps on the road to diabetes.

Conversely, a study of people who sit for many hours found that those who took frequent small breaks — standing up to stretch or walk down the corridor — had smaller waists and better profiles for sugar and fat metabolism than those who did their sitting in long, uninterrupted chunks.

Some people have advanced radical solutions to the sitting syndrome: replace your sit-down desk with a stand-up desk, and equip this with a slow treadmill so that you walk while you work. (Talk about pacing the office.) Make sure that your television can only operate if you are pedaling furiously on an exercise bike. Or, watch television in a rocking chair: rocking also takes energy and involves a continuous gentle flexing of the calf muscles. Get rid of your office chair and replace it with a therapy ball: this too uses more muscles, and hence more energy, than a normal chair, because you have to support your back and work to keep balanced. You also have the option of bouncing, if you like.

Or you could take all this as a license to fidget.

But whatever you choose, know this. The data are clear: beware your chair.

*Notes:*

*The term “calorie” sometimes causes confusion. Most people, when referring to the energy content of food, use “calorie” instead of “kilocalorie” — which is the actual unit that food energy is measured in. When I refer to 30 calories, I am following this convention and therefore technically mean 30 kilocalories. For metric system users, that’s about 125 kilojoules.*

*For sitting a lot causing heart disease, obesity, diabetes, certain cancers and early death, independently of whether you exercise regularly, see, for*

example, Katzmarzyk, P. T. et al. 2009. "Sitting time and mortality from all causes, cardiovascular disease, and cancer." *Medicine and Science in Sports and Exercise* 41: 998-1005. (This study looked at the fates of 17,013 Canadians over a span of 12 years.) See also Dunstan, D. W. et al. 2010. "Television viewing time and mortality: the Australian diabetes, obesity and lifestyle study (AusDiab)." *Circulation* 121: 384-391. (This study considered 8800 Australians followed for a median time of 6.6 years.)

For the negative effects of sitting a lot on healthy people who exercise regularly, see Healy, G. N. et al. 2008. "Television time and continuous metabolic risk in physically active adults." *Medicine and Science in Sports and Exercise* 40: 639-645. For fatness and three hours of television, see Dunton, G. F. et al. 2009. "Joint associations of physical activity and sedentary behaviors with body mass index: results from a time use survey of US adults." *International Journal of Obesity* 33: 1427-1436.

For energy expended during sitting as opposed to gum chewing, fidgeting, and standing, see Levine, J. A. et al. 2006. "Non-exercise activity thermogenesis: the crouching tiger hidden dragon of societal weight gain." *Arteriosclerosis, Thrombosis, and Vascular Biology* 26: 729-736. For weight gain by slow creep, see Hill, J. O., Peters, J. C. and Wyatt, H. R. 2009. "Using the energy gap to address obesity: a commentary." *Journal of the American Dietetic Association* 109: 1848-1853. Note that the process of gaining weight is different from the process of losing weight.

For fatness versus leanness being a consequence of small differences in daily movements, see Levine, J. A. et al. 2005. "Interindividual variation in posture allocation: possible role in human obesity." *Science* 307: 584-586. For some doctors walking four times further than others while doing the same job, see Conzett-Baumann, K. et al. 2009. "The daily walking distance of young doctors and their body mass index." *European Journal of Internal Medicine* 20: 622-624. I have borrowed their "long-distance" and "short-distance" terminology.

Two outstanding papers provide fascinating overviews of the more sinister aspects of sitting. See Hamilton, M. T., Hamilton, D. G. and Zderic, T. W.

2007. "Role of low energy expenditure and sitting in obesity, metabolic syndrome, type 2 diabetes, and cardiovascular disease." *Diabetes* 56: 2655-2667; and Pedersen, B. K. 2009. "The diseasome of physical inactivity — and the role of myokines in muscle-fat cross talk." *Journal of Physiology* 587: 5559-5568. The Hamilton et al. paper discusses the results for lipoprotein lipase, and describes how sitting differs from standing in terms of muscles flexed. The Pedersen paper discusses a variety of other compounds that are released by active muscles, as well as the impact they have on metabolism. For muscular activity in rats and the production of lipoprotein lipase, see Bey, L. and Hamilton, M. T. 2003. "Suppression of skeletal muscle lipoprotein lipase activity during physical inactivity: a molecular reason to maintain daily low-intensity activity." *Journal of Physiology* 551: 673-682.

For the physiological impact of men reducing how far they walk for two weeks, see Olsen, R. H. et al. 2008. "Metabolic responses to reduced daily steps in healthy nonexercising men." *Journal of the American Medical Association* 299: 1261-1263. For the advantages of taking breaks from sitting, see Healy, G. N. et al. 2008. "Breaks in sedentary time: beneficial associations with metabolic risk." *Diabetes Care* 31: 661-666.

For the advantages of having a stand-up desk attached to a treadmill, see Levine, J. A. and Miller, J. M. 2007. "The energy expenditure of using a 'walk-and-work' desk for office workers with obesity." *British Journal of Sports Medicine* 41: 558-561. For a set of radical suggestions regarding how to reduce sitting, including the idea of attaching the television to some kind of exercise device, see the crouching tiger hidden dragon paper mentioned above.

The advantages of rocking chairs have mostly been explored in the elderly. See, for example, Pierce, C., Pecen, J. and McLeod, K. J. 2009. "Influence of seated rocking on blood pressure in the elderly: a pilot clinical study." *Biological Research for Nursing* 11: 144-151. However, I see no reason why rocking wouldn't be preferable to passive sitting in younger people too. For the advantages of using a therapy ball instead of a desk chair, see Beers, E. A. et al. 2008. "Increasing passive energy expenditure during clerical work." *European Journal of Applied Physiology* 103: 353-360.

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# Experts: Sitting too much could be deadly

By MARIA CHENG, AP Medical Write

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LONDON (AP) — Here's a new warning from health experts: Sitting is deadly.

Scientists are increasingly warning that sitting for prolonged periods — even if you also exercise regularly — could be bad for your health. And it doesn't matter where the sitting takes place — at the office, at school, in the car or before a computer or TV — just the overall number of hours it occurs.

Research is preliminary, but several studies suggest people who spend most of their days sitting are more likely to be fat, have a heart attack or even die.

In an editorial published this week in the *British Journal of Sports Medicine*, Elin Ekblom-Bak of the Swedish School of Sport and Health Sciences suggested that authorities rethink how they define physical activity to highlight

the dangers of sitting.

While health officials have issued guidelines recommending minimum amounts of physical activity, they haven't suggested people try to limit how much time they spend in a seated position.

"After four hours of sitting, the body starts to send harmful signals," Ekblom-Bak said. She explained that genes regulating the amount of glucose and fat in the body start to shut down.

Even for people who exercise, spending long stretches of time sitting at a desk is still harmful. Tim Armstrong, a physical activity expert at the World Health Organization, said people who exercise every day — but still spend a lot of time sitting — might get more benefit if that exercise were spread across the day, rather than in a single bout.

That wasn't welcome news for Aytekin Can, 31, who works at a London financial company, and spends most of his days sitting in front of a computer. Several evenings a week, Can also teaches jiu jitsu, a Japanese martial art involving wrestling, and also does Thai boxing.

"I'm sure there are some detrimental effects of staying still for too long, but I hope that being active when I can helps," he said. "I wouldn't want to think the sitting could be that dangerous."

Still, in a study published last year that tracked more than 17,000 Canadians for about a dozen years, researchers found people who sat more had a higher death risk, independently of whether or not they exercised.

"We don't have enough evidence yet to say how much sitting is bad," said Peter Katzmarzyk of the Pennington Biomedical Research Center in Baton Rouge, who led the Canadian study. "But it seems the more you can get up and interrupt this sedentary behavior, the better."

Figures from a U.S. survey in 2003-2004 found Americans spend more than half their time sitting, from working at their desks to sitting in cars.

Experts said more research is needed to figure out just how much sitting is dangerous, and what might be possible to offset those effects.

"People should keep exercising because that has a lot of benefits," Ekblom-Bak said. "But when they're in the office, they should try to interrupt sitting as often as possible," she said. "Don't just send your colleague an e-mail. Walk over and talk to him. Standing up."