

A Chemical Hunger

Note: Overweight is a BMI of 25 and Obese is a BMI of 30. [Calculator](#).

Most experts consider measures like body fat percentage to be better measures of adiposity than BMI, and we agree. Unfortunately, nearly every source reports BMI, and most don't report body fat percentage.

Part I: Mysteries

It's not just that we're a little fatter than our great-grandparents — the entire picture is different.

A century ago, the average man in the US weighed around 155 lbs. Today, he weighs about 195 lbs. About 1% of the population was obese back then. Now it's about 36%.

Past - in the 1890s average BMI of about 23. Only about 3% of them were obese.

most people got slightly leaner as they got older.

their diets were worse, not better. They ate more bread and almost four times more butter than we do today. They also consumed more cream, milk, and lard. Our great-grandparents were able to maintain these weights effortlessly.

Present - middle-aged white men in the year 2000 had an average BMI of around 28. About 24% were obese in early middle age, increasing to 41% by the time the men were in their 60s.

Rates of obesity are also increasing worldwide. Today the **rate of obesity in Italy, France, and Sweden is around 20%. In 1975, there was no country in the world that had an obesity rate higher than 15%.**

Every country in the world is growing more obese. And the trend has never once been reversed.

obesity increased more than twice as much between 2010 and 2018 than it did between 2000 and 2008.

People who live at higher altitudes have lower rates of obesity. This effect also seems to apply to lab rats who are moved to labs at higher altitudes. people living at a higher elevation having lower rates of diabetes than those living near sea level,

Diet doesn't matter

the Mbuti of the Congo, eat almost nothing but honey during the rainy season, when honey can provide up to 80% of the calories in their diet. Their diet is 65% carbohydrate and 17% sugar, which is more sugar than the average American currently consumes. Despite this the Kuna are lean, with average BMIs around 22-23. (repeat for many tribes)

lab animals and even wild animals are becoming more obese as well. Primates and rodents living in research colonies, feral rodents living in our cities, and domestic pets like dogs and cats are all steadily getting fatter and fatter. This can't be attributed to changes in what they eat, because lab animals live in contained environments with highly controlled diets.

It used to be that if researchers needed obese rats for a study, they would just add fat to normal rodent chow. But it turns out that it takes a long time for rats to become obese on this diet. "cafeteria diets".

Sure enough, on this diet the rats gained weight at unprecedented speed. All this despite the fact that **the high-fat and cafeteria diets have similar nutritional profiles, including very similar fat/kcal percentages**, around 45%. **In both diets, rats were allowed to eat as much as they wanted.** When you give a rat a high-fat diet, it eats the right amount and then stops eating, and maintains a healthy weight. But when you give a rat the cafeteria diet, it just keeps eating, and quickly becomes overweight. Something is making them eat more. Raccoons and monkeys quickly grow fat on human food as well.

Part II: Current Theories of Obesity are Inadequate

Calories In, Calories Out (CICO)

This perspective assumes that the body stores every extra calorie you eat as body fat, and that it doesn't have any tools for using more or less energy as the need arises. It ignores how the body accounts for the calories coming in and going out. If you don't eat enough, your body finds ways to burn fewer calories. If you eat too much, your body doesn't store all of the excess as fat, and compensates by making you less hungry later on. Calories are involved in the math but it's not as simple as "weight gain = calories in – calories out".

Everyone "knows" that diet and exercise are the solution to obesity. Despite this, rates of obesity continue to increase, even with all the medical advice pointing to diet and lifestyle interventions, and a \$200 billion global industry devoted to helping people

implement these interventions. It's not that no one is listening. **People are exercising more today than they were 10 or even 20 years ago. Contrary to stereotypes, more than 50% of Americans meet the HHS guidelines for aerobic exercise.** But obesity is still on the rise.

there are many medical conditions that cause obesity

Studies of controlled overfeeding — you take a group of people and get them to eat way more than they normally would — reliably find two things. First, a person at a healthy weight has to eat huge amounts of calories to gain even a couple pounds. Second, after the overfeeding stops, people go right back to the weight they were before the experiment.

1971. Researchers recruited inmates from the Vermont State Prison, some of the prisoners were eating 10,000 calories per day. the prisoners did gain considerable weight, on average 35.7 lbs (16.2 kg). But following the overfeeding section of the study, the prisoners all rapidly lost weight without any additional effort, and after 10 weeks, all of them returned to within a couple pounds of their original weight.

even when eating truly stupendous amounts of food, it actually takes more time to gain weight than it does to lose it.

The story with exercise is the same - even in the group exercising the most — equivalent to 20 miles (32.0 km) of jogging every week for eight months — people only lost about 7 lbs.

Kitavans (Hunt-Gath) examined in 1990 by Staffan Lindeberg were only slightly more active than westerners, had more food than they knew what to do with, and yet were never obese. “Many Westerners have a level of physical activity that is well within the range of the Kitava population,” he wrote. “Hence, physical activity does not seem to explain most of the differences in disease pattern between Kitava and the Western world.”

When hunter-gatherers adopt an industrialized lifestyle, however, they become obese just like anyone else

People in 1950 were a lot leaner than they are now, but it's not because they ate less and exercised more.

Good Calories and Bad Calories

fat consumption has actually fallen over the past few decades, while obesity has skyrocketed.

as obesity has gone up, consumption of carbohydrates has gone down (starting ~year 2000) ... People in the US ate almost twice as much wheat (primarily in the form of bread) in the 1880's than they do today.

About 62% of the Japanese diet is carbohydrates, and most of this is white rice. Despite this, Japanese rates of obesity have been, and continue to be, the lowest of any industrialized nation. people who move from Japan to the US and begin eating less white rice become much heavier. This suggests that the difference isn't simply genetic.

Sugar consumption has been declining for 20 years in the US, while obesity and diabetes rates have increased. (sugar data in the figure below includes all added sugars such as honey, table sugar, and high-fructose corn syrup, but doesn't include sugars naturally occurring in fruits and vegetables.)

obesity in Australia nearly tripled between 1980-2003, while sugar consumption dropped 23%.

all diets work about equally well. It doesn't matter which diet you choose — you lose about the same number of pounds regardless. The problem is that none of them work very well... people lose about 13.2 lbs (6 kg) over six months, and that in all cases people began to gain weight back after 12 months. **It's not just weight loss, either. Satiety, hunger, satisfaction with the diet, and adherence to the protocol is similar for all diets.**

Over the past 50 years, medical science has looked at diet from practically every angle. But none of these diet-based explanations have gone anywhere.

Lipostat

A house has a thermostat. The human body has a lipostat. If your body is too thin, the lipostat will drive you to eat more, exercise less, sleep more, and store more of what you eat as fat. If your body is too fat, the lipostat will drive you to eat less, move and fidget more, and store less of the food you eat as fat.

[research] overwhelmingly support this homeostatic explanation. In animals and humans, brain damage to the implicated areas leads to overeating and eventual obesity. These systems are well-understood enough that by targeting certain neurons you can cure or cause obesity in mice. the few weight-loss drugs approved by the FDA largely act on the brain

In a house where the thermostat has been set to 120°F, there are a lot of things we can do to lower the temperature. We can open all the doors and windows. We can open the icebox. We can order mountains of dry ice off of the internet. All of these things will

lower the temperature of the house a little, but even with these measures, the house will still be hotter than the healthy temperature of 72°F. The furnace will work double-time to push the temperature back up to 120°F, if it's not redlining already. And as soon as you relax any of your heat-dissipation measures, the temperature will go right back up to where it was before.

There are many signals that the brain uses to measure how much fat the body is carrying. One of the most important is **the hormone leptin, which is naturally produced by fat cells. Part of the action of the lipostat is making sure that leptin levels are kept within a desired range**, which helps keep us at a desired weight.

a genetic mutation that makes it so their fat cells no longer produce leptin. from the first weeks of their lives, they are insatiably hungry. By age two, they weigh more than 50 pounds, and may be as high as 60% fat by weight. they become distressed if they're out of sight of food, even briefly.

it's not clear what could cause the lipostat to be set to the wrong point.

in all these theories, the factors that damage the lipostat are related to diet. But as we've just argued above, the persistent failure to find a solution in our diets strongly suggests that we should start looking elsewhere for the explanation.

Part III: Environmental Contaminants

contaminants are the only cause of the obesity epidemic, and the worldwide increase in obesity rates since 1980 is entirely attributable to their effects. For any two people in a group, the difference between their weights is largely genetic, because everyone is exposed to similar levels of contamination. But the difference between the average weight in 1980 and the average weight today is the result of environmental contaminants.

there are many compounds that reliably cause people to gain weight, sometimes a lot of weight. .. all of these are psychiatric medications
we're looking for a factor that:

1. Changed over the last hundred years
2. With a major shift around 1980
3. And whatever it is, there is more of it every year
4. It doesn't affect people living nonindustrialized lives, regardless of diet
5. But it does affect lab animals, wild animals, and animals living in zoos

6. It has something to do with palatable human snackfoods, unrelated to nutritional value
7. It differs in its intensity by altitude for some reason
8. And it appears to have nothing to do with our diets

People's diets were "worse" in the past — full of lard and bread — because diet doesn't cause obesity. The ~1% of people who were obese in the past were people with one of the various medical conditions known to cause obesity

People rapidly started getting more and more obese starting around 1980 because the contaminants are the product or byproduct of some industrial process. We're looking for compounds that were invented around 1960 or 1970, because it would probably take a few years for enough to get into the environment to start affecting us.

Alternatively, these might be compounds that had been invented much earlier, but only began to see widespread deployment around 1980.

The obesity epidemic keeps getting worse because these contaminants continue to be produced and continue to build up in the environment.

Lab animals and wild animals are becoming more obese because they are exposed to the same environmental contaminants that we are.

In 2010, Chris Voigt vowed to eat nothing but 20 plain potatoes (and a small amount of cooking oil) for 60 days straight to demonstrate that potatoes are perfectly healthy, and in fact nutritious enough to sustain a person for quite a while.

2,200 calories. Despite this, Voigt lost 21 pounds over his sixty-day diet. He even had trouble eating enough — he just wasn't very hungry. Why would this happen? Well, unprocessed potatoes are about as raw a food as you can find, and won't pick up contaminants from industrial cooking and packaging.

Obesity is less common at high altitudes because of the watershed. Environmental contaminants build up as water flows downhill and are in much higher concentrations as you approach sea level.

The Mississippi watershed is America's largest drainage basin, covering 41% of the country. If you compare this map of state-level obesity to a map of the Mississippi watershed (below), you'll see that every single state with obesity rates of >35% borders on a river from this watershed system. Also informative is that the three states at the

mouth of the river, Mississippi, Arkansas, and Louisiana, are #1, #3, and #4 in the nation in terms of obesity rate

altitude itself doesn't affect obesity directly. Instead, altitude is a proxy for how high an area is in the watershed ... This is why Mississippi is more obese than low-lying areas of California. In California the water supply hasn't traveled nearly as far in its path to the ocean, and has traveled past fewer farms, highways, cities, and factories.

the fact that diets don't work very well for most people suggests that we pick up these contaminants from other sources than just our food. Probably they are also, to varying degrees, in our water, our workplaces, and our homes.

When they arrive in a new country, immigrants usually have lower obesity rates than their native counterparts do, but over time they become about as obese as the natives are.

Some people are also less affected by these contaminants than other people, even at the same dose, and this difference is largely genetic. But even these people probably still, on average, have much more body fat than their ancestors did.

Part IV: Criteria

The big inflection point for the obesity epidemic was around 1980, so we should be looking for compounds that entered the environment slightly before then.

If people who are exposed to a high dose of the contaminant are fatter than those who are exposed to a low dose, that would be a strong indication that the contaminant is responsible. Right?

There might also be diminishing returns. Let's imagine that today, people on average get a dose of 100 units. Back in 1970, everyone got a dose of 0 units. Now, the first 20 units might be very fattening indeed. But in general, the human body can only get so fat.

being exposed to contaminants doesn't make you gain weight that very same day.

paradoxical reactions, would cause some portion of people to actually lose weight, and would further reduce the apparent correlation between the contaminant and obesity.

someone probably would have noticed. This means that either 1) the contaminants are compounds that we don't usually measure, so no dataset

exists where we can compare them to measures of obesity, or 2) the relevant contaminants are commonly measured, but for statistical reasons like the ones above, there isn't an obvious correlation with obesity.

chemistry and biology allow for bewildering interactions

when chemical contaminants end up in the environment, they can be transformed into different compounds. Since contaminants can sit in soil and groundwater for decades, there's a lot of time for these transformations to happen.

no 2,4-D had been manufactured at the arsenal at any stage of its operations. After long and careful study, the chemists at the plant concluded that the 2,4-D had been formed spontaneously in the open basins. It had been formed there from other substances discharged from the arsenal; in the presence of air, water, and sunlight, the holding ponds had become chemical laboratories for the production of a new chemical

To make matters worse, something quite similar can happen inside our bodies.

Malathion is extremely deadly to insects but is "safe" for mammals, including humans. But malathion is only "safe" because the mammalian liver detoxifies it with an enzyme, rendering it harmless. "If, however, something destroys this enzyme or interferes with its action," ... when malathion was administered at the same time as some of the other organic phosphates, "a massive poisoning results

Part V: Livestock Antibiotics

A large percentage of antibiotics are excreted in animal waste and end up in the water supply

In meat animals, antibiotics often lead to weight gain. Gut microbiota influence energy intake and body weight in mammals, and even short courses of antibiotics can reduce gut microbiota and increase BMI in humans (though the BMI effect was only seen in some antibiotics).

people who eat fewer animal products have lower BMIs, and the effect seems to be dose-dependent

However, there is also evidence against this picture. For one thing, Germany, Spain, Italy, and Japan all use a lot of antibiotics in their meat, and none of these countries is particularly obese. Australia and South Africa are both pretty obese, but both of these countries use less antibiotics than usual. India and Japan are the least obese of the developed countries. Both have obesity rates below 5%. India is the most vegetarian country on the planet and Japan, while not especially vegetarian, mostly consumes seafood in place of meat products.

hunter-gatherers and our ancestors in 1890 ate lots of meat and didn't experience modern levels of obesity.

Environmental contaminants tend to build up in animals through the plants they eat, so **any contaminants in the environment will bioaccumulate**, and concentrations will be higher in animals than in groundwater or in plants.

Part VI: PFAS

Per- and polyfluoroalkyl substances (PFAS) are a group of synthetic chemicals that are used to make a wide variety of everyday products, including **food packaging**, carpets, rugs, upholstered furniture, **nonstick cookware**, water-repellant outdoor gear like tents and jackets, firefighting foams, ski wax, clothing, and cleaning products. Many are also used in industrial, aerospace, construction, automotive, and electronic applications.

PFAS are practically indestructible. They repel oil and water and are heat-resistant, which is part of why they have so many applications

Looking at the uses of PFAS, we see that they're common in:

- Firefighting foams
- Cookware and food packaging
- Paints and varnishes
- Cleaning products
- Automotive applications, including components in the engine, fuel systems, and brake systems, as well as automotive interiors like stain-resistant carpets and seats
- Healthcare applications, both in medical devices like pacemakers and in medical garments, drapes, and curtains

This suggests that if PFAS are linked to obesity, we should expect to see disproportionate levels of obesity in:

- Firefighters
- Food workers (especially cooks)
- Construction workers
- Professional cleaners
- Auto mechanics and others who work closely with vehicles
- Medical professionals who work closely with medical devices and garments / drapes / curtains, though probably not medical desk jobs.

37,000 workers. They found that on average **24.6% of their sample was obese**, which we can use as our baseline.

The rate of obesity in “protective services”, which includes police, firefighters and emergency responders, was 33.3%.

cleaning and building services workers, 29.5%

Truck drivers were the most obese group of all, at 38.6%

mechanics were #5 at 28.9% obese

Health service workers (excluding doctors and nurses) were 28.8% obese

On the other hand, only 20.1% of food preparation workers were obese

only 19.9% of construction workers

PFAS serum levels aren't all that correlated with BMI in the general population.

Part VII: Lithium

Almost everyone who takes lithium at therapeutic levels gains some weight.

with normal therapeutic doses, 15 bipolar inpatients gained an average of 13 lbs (5.9 kg) over six weeks.

while lithium is easy to detect, **assessing lithium levels is not a part of the standard analysis of drinking water**, so we don't have reliable historical data to work with.

There aren't even EPA standards for lithium levels in drinking water.

Measuring serum lithium is relatively easy, and people who are starting lithium treatment get checked frequently to make sure that their blood levels aren't too high. Despite this, **there doesn't seem to be any data on serum lithium levels in the general population.**

Almost no lithium was produced before 1950 .. lithium production truly spikes around 1980.

lithium levels in drinking water vary systematically with altitude, with higher concentrations of lithium found in districts at lower altitudes:

The therapeutic dose of lithium in blood serum is usually considered 2800 ng/mL minimum, 5600 ng/mL recommended low dose

lithium levels in groundwater rarely exceed 200 ng/mL

surprisingly, even very low levels can have an influence on our health and mental states. One study examining data from 27 Texas counties between 1978-1987 found that rates of suicide and homicide (as well as other forms of violent and impulsive behavior) were negatively correlated with lithium in drinking water, over water lithium levels ranging from 70 to 170 ng/mL.

reviews of this literature find that trace levels of lithium have a meaningful impact on behavior.

A serum level in the range of 10 ng/mL is enough to influence mood, and a dose of about 400 µg per day is enough to get you there.

if trace amounts are enough to cause obesity, then we should see relationships between trace lithium levels and obesity rates.

In the Caspian Sea, lithium concentrations are 280 ng/mL. some of the most obese provinces in Iran border the Caspian.

For the most part, Austria has normal amounts of lithium in its drinking water, around 13 ng/mL. But in the east, the concentrations are much higher. In the Mistelbach district, the average level of lithium in the drinking water was 82 ng/mL, and the highest single measurement was near Graz, at 1300 ng/mL. Both of these are in eastern Austria, where obesity levels are highest. Mistelbach in particular is one of the most obese districts in the country.

Chile and Argentina are the most obese countries in South America (28% each) and are two of the biggest exporters of lithium in the world. Unsurprisingly, this is reflected in their groundwater.

In seawater, lithium concentrations are reliably quite high, ranging from 100 ng/mL to over 1000 ng/mL.

the Middle East is extremely obese, one of the most obese regions on earth (all barely trail the United States, Kuwait exceeds) All of them get a lot of drinking water from desalinated seawater. Saudi Arabia gets about half of its drinking water from desalination and is one of the most obese nations on earth. Kuwait built its first desalination plant in 1951, and has actually been one of the most obese countries in the world for a long time. Back in 1975, when the rate of obesity in the United States was around 10%, the rate of obesity in Kuwait was about 18%.

Desalination removes all trace elements from seawater, but because distilled water corrodes metal pipes and trace elements are important to health, the desalinated water is remineralized by blending it with 5-10% brackish water. This means that desalinated water could easily have lithium concentrations of up to 100 ng/mL.

lithium has a wide variety of applications.

If you go and see your local auto mechanic, the black smears covering his hands and forearms might be engine oil. But they might also be lithium grease. This grease is ubiquitous in auto engineering, routinely applied to hinges, joints, and pivot points. It's used in aviation and on many kinds of heavy machinery, including logging and construction equipment, trains, and tractors. It also has a number of household applications. You might put it on your garage door, or the hinges on the gate of your fence. About 7% of the global supply of lithium goes into lubricating greases of one kind or another.

It was introduced in the 1940s, but only started seeing serious use in the 1980s.

“lithium has an increased affinity to thyroid tissue,” and, “high concentrations of lithium in brain tissue – especially in white substance – agrees with investigations that reveal the lithium elimination from brain tissue to be slow.”

lithium therapy is associated with thyroid disease.

lithium concentrations were especially high in the thalamus and Brodmann Area 25. This is interesting for our purposes because Brodmann Area 25 “influences changes in appetite and sleep” and the thalamus governs “sensory relay in visual, auditory,

somatosensory, and gustatory systems.” Both of these brain regions are related to eating behavior.

People who are “immune” or resistant to lithium’s effects on weight gain won’t gain much weight on psychiatric doses for the same reason they don’t gain weight on trace doses — they’re immune or resistant. And in fact we see evidence that matches this; one study says, “the patients who increased in weight during the treatment were overweight already before the start.” From this perspective, it’s not surprising that some people don’t gain weight on psychiatric doses of lithium. If someone from Mississippi has a BMI of 23, they are lean despite (presumably) high levels of exposure and will probably remain lean no matter how much you throw at them (until dead).

Part VIII: Paradoxical Reactions

If obesity is the condition, the paradoxical condition would be anorexia.

On clozapine, people usually gain 10-15 lbs. But some people lose huge amounts of weight instead, up to 50% (!!!) of their body weight.

Lithium increases leptin levels in most patients, and this is presumably part of the mechanism that causes people to gain weight on lithium. But in some patients, lithium reduces leptin levels instead.

People with anorexia have extremely low leptin levels

Brain lesions alone can cause anorexia nervosa

“The lipostat does much more than simply regulate appetite,” says Stephan Guyenet, “It’s so deeply rooted in the brain that it has the ability to hijack a broad swath of brain functions, including emotions and cognition.”

Remember those children we mentioned in Part II, who were born without the ability to produce leptin? Unlike normal teenagers, they aren’t interested in dating, films, or music. All they want to talk about is food.

The Minnesota Starvation Experiment men developed a remarkable obsession with food. The researchers came to call this “semistarvation neurosis”. Volunteers’ thoughts, conversations, dreams, and fantasies all centered on food. They became fascinated by the paraphernalia of eating.

When a person has consumed more calories than they need, their lipostat can boost calorie expenditure by making them fidget, make small movements, and change posture frequently. It's largely involuntary, and most people aren't aware that they're burning off extra calories in this way. Even so, NEAT can burn off nearly 700 calories per day.

When most people eat less than they need, they become sluggish and fatigued

But people with anorexia fidget like crazy. A classic symptom of anorexia is excessive physical activity. In studies where people were overfed until they were 10% heavier than their baseline, NEAT increased dramatically. All of this is strong evidence that people with anorexia have lipostats that mistakenly think they desperately need to lose weight.

In 1985 the New York Times reported, "before the 1970's, most people had never heard of anorexia nervosa." Writing in the 1980s, presumably they would know.

compare the most obese countries to the countries with the highest rates of eating disorders: these match up really well.

the rate of change in obesity between 1990 and 2016 is correlated with the rate of change in eating disorders between 1990 and 2016

It's notable that anorexia most often occurs in teenagers and young adults, especially young women. Are young women being exposed to large doses all of a sudden, just as they start going through puberty? Where would these huge doses come from? It may not be that much of a stretch — PFAS are included in many cosmetics.

Part IX: Anorexia in Animals

Interlude: Income

We don't see much of a connection between income and obesity.

Interlude: Pima & Middle East

the Pima people of the Gila River Valley had very high levels of obesity way before the obesity epidemic started for the rest of the world, as high as 40% obese in 1970. the Pima were exposed to very high levels of lithium in their food and water quite early on, because “in the Gila River Valley, deep petroleum exploration boreholes were drilled during the early 1900’s through the thick layers of gypsum and salty clay found throughout the valley. Although oil was not found, salt brines are now discharging to the land surface

oil-field brines, which tend to contain huge amounts of lithium. Absolutely insane amounts.

In theory, these wells should all be sealed and/or the brines should be injected deep underground. Fortunately, the oil and natural gas industry doesn’t make mistakes.

the United States is one of the top three oil producing countries in the world

“the average well in North Dakota produces 18 barrels of brine per barrel of oil and three barrels of brine per barrel of gas,”

there appear to be more leaks pretty much every year, and we can see that in this sample 46.7% of the brine leakage by volume came from pipeline leaks

In 2014, for example, 42 such brine spills per week, on average, were recorded in North Dakota.

brine has even been used in commercial products sold at hardware stores and is spread on local roads as a de-icer

The industry pawns off brine — offering it for free — on rural townships that use the salty solution as a winter de-icer and, in the summertime, as a dust tamper on unpaved roads. ... In 2016 alone, 11 million gallons of oil-field brine were spread on roads in Pennsylvania

The amount spilled [in 11 states] doubled from 21.1 million gallons in 2009 to 43 million in 2013.

Vegetation is low in most trace elements but some food plants concentrate particular ones. Mesquite beans accumulate strontium; cabbage accumulates sulfate; beans concentrate molybdenum and wolfberry contains an extraordinary 1120 ppm lithium in the dry weight. Pima maybe were getting around 100 times more lithium from wolfberry jelly than directly from their drinking water.

So in the future, we need to keep an eye out for plants that might be concentrating lithium. This complicates things somewhat, but the good news is that if this is the case, we wouldn't have to worry too much about lithium in our actual drinking water. Instead, we would want to make sure that the water we use to irrigate crops is as low in lithium as possible, which seems much more manageable.

Interlude: Wells

back in the day, nobody got their water from deep, drilled wells. Nowadays, millions of people drink well water every single day

Generally speaking, the deeper the well, the older the water you're drawing.

Most deep wells (90%+) were drilled 1970+. "Lithium concentrations ... are positively correlated with well depth",

On February 11, 2021, the USGS released a report titled Lithium in U.S. Groundwater. The first conclusion they share is that "45% of public-supply wells and about 37% of U.S. domestic supply wells have concentrations of lithium that could present a potential human-health risk."

the average level of lithium in Colorado well water is higher than the national average. But this doesn't matter, because almost none of the drinking water in Colorado comes from wells. most of that water comes directly from pure snowmelt.

Part X: What to Do About It

Almost nothing.

we gotta stop spending money on circular nutrition research

Unlike other major causes of preventable death and disability, such as tobacco use, injuries, and infectious diseases, there are no exemplar populations in which the obesity epidemic has been reversed by public health measures.

In every country in this dataset, the obesity rate either stayed the same or increased every single year from 1975 to 2016. There is not one example of obesity rates declining for even a single country in a single year.

In USA between 2001 and 2011, obesity rates decreased in zero counties, stayed the same in zero counties, and increased in 3,143 out of 3,143 counties

The smallest increase between 2001 and 2011 was in Eagle County, Colorado, where obesity rates went from 20.0% in 2001 to 21.5% in 2011, an increase of 1.5%

you can put on more muscle mass. lipostat pays attention to how much fat you have, but it also seems to pay some attention to how much you literally weigh. So if you gain muscle mass, you may lose fat mass

eating more whole foods and/or avoiding highly processed foods ... food products tend to pick up more contaminants with every step of transportation, packaging, and processing

eat fewer animal products ... many contaminants will bioaccumulate

if you have a job in a high-obesity profession like truck driver or mechanic, consider switching to a job in a low-obesity profession, esp if it uses lithium grease

changing where you live. In USA = CO. HI and MA also good. World = Japan, South Korea, and Thailand

Water Filters?

Targeted Experiments

figure out which water filters (if any!) remove lithium from drinking water

figure out if there are high levels of lithium in any of the stuff we're all eating

one desalination plant uses lithium-free brine while another continues with the normal procedure

Lithium, currently our prime suspect, is an alkali metal ion that appears to affect the brain. Other alkali metal ions like sodium and potassium also play an important role in the brain, and there's evidence that these ions may compete with each other, or at least interact, in interesting ways (see also [here](#), [here](#), and [here](#)). If lithium causes obesity, it may do so by messing with sodium or potassium signaling (or maybe calcium) in the brain, so changing the amount of these ions you consume, or their ratios, might help stop it.