Science AMA Series: I'm Deborah Blum, a Pulitzer Prize-winning science journalist and author of five books, most recently "The Poisoner's Handbook." I'm also publisher of the magazine Undark, where I've just started a monthly column. AMA!

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Abstract

My most recent column (https://undark.org/article/soy-formula-babies-endocrine-disruptor/) looked at soy formula (and other soy products) which contain a remarkably high level of hormonally active compounds called phytoestrogens. I was interested in the idea that by feeding soy to babies - a constant diet at an age critical in human development - we might be running an inadvertent experiment on those children, perhaps alerting their reproduction systems. The scientists I talked to agreed that that's a real possibility. There are studies showing that soy diets can affect gene expression in the vaginal cells of female girls, for instance, that there are other longer term studies showing changes in menstruation and other effects. It's an issue I'd like to follow further. Part of the reason I was interested in that aspect of soy exposure is that I'm a toxicology writer. I've been researching and writing about toxic substances for a decade, as the author of The Poisoner's Handbook, but also as a blogger for Wired and for The New York Times, where I wrote an online column called Poison Pen. I started out being very focused on acute toxicity but I've more recently become interested in low-dose toxicology - the question of what chronic exposure to a very low dose of a compound (say arsenic in rice or drinking water) means in terms of public health. The question of every day exposures and how we navigate them really fascinates me and is part of my current book project, which follows the story of America's first great food safety chemist at the turn of the 20th century. I'm here today from 1 pm-3:00 pm EST to answer questions about chemical exposures in our everyday life, questions of natural versus synthetic compounds, and when it's worth paying attention. Looking forward to hearing from you!

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Considering all the scientific evidence that soy has protective benefits and that cultures that eat several servings of soy a day have better health, I am curious why you have singled out soy. It seems there is a western diet fad right now to demonize all soy when there is no evidence that whole food soy (not isolate) is detremental, and it is even protective. There are also other phytoestrogens (aka isoflavones) in plants, and we know that they bind to estrogen receptors in different ways than animal estrogen. Why are you not looking at the high estrogen/hormone content in cows milk and how that is damaging growth? And, who are you funded by?

Edits: resources https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5188409/

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3249910/

wildyogini

So, to address your last question first, I get a salary from MIT and I don't take outside funding. I write

recently "The Poisoner's Handbook." I'm also publisher of the magazine Undark, where I've just started a monthly column. AMA!, *The Winnower* 4:e150305.57074 , 2017 , DOI: 10.15200/winn.150305.57074

about public health issues when they interest me or - and this was true in the case of soy formula - when I do a literature search and realize that there's an under-told story. As I mention in the piece, estrogen levels are far higher in soy milk/formula than breast milk or cow's milk. That lead me to try to explore So what that means in terms of human development. You are completely right that there are a lot of studies suggesting health benefits of a diet high in soy, for say, cardiovascular disease. But that pattern doesn't play out in the literature (cited in piece) regarding formula and infant exposures and I thought it was important to raise that issue. I think it's important that parents at least see this information so they can make an informed choice and that certainly is the emphasis in this piece.

I had no idea soy accounts for an eighth of the US formula market - is it similar in other countries? How many parents use formula?

Sadnot

As a science writer, I'm not an expert in market share analysis but I did do some research when I was trying to figure out how important this soy formula issue might be. There are a host of reasons why parents use formulas - with soy, it can be medical, for instance, if the baby is allergic to proteins in milk, for example. But the formula market is apparently increasing globally (citation below) driven by rising purchases in Asia. And there I think you are also seeing life style changes and related decisions not to breast-feed. I'm not sure we'll go back to the all breast-fed world of our ancestors so it's important, as my soy story suggest, to be thoughtful about the formulas we choose. Citation: http://www.futuremarketinsights.com/articles/infant-formula-market

How do you think we can help the lay public understand the difference between meaningful toxicities that have significant associations with adverse health outcomes (e.g. radiation exposure, urban pollution, cigarette smoke) and the snake oil salesman's "toxicities" (e.g. dietary cleanses, "detox your face!", "purifying yoga", etc).

p1percub

That's such a good question and I wish I had a brilliant answer to it. Your examples of real health threats versus quack toxicities and "cures" are spot on. Part of it, of course, is that we have a human need for simple problems and correspondingly simple, silver-bullet answers. My simple response is journalist one - keep reporting on the true bad actors, keep calling out the sham ones, keep exposing the realities. Jen Gunter, the doctor and health blogger, has done a great job of this with some of the ridiculous claims of the actress Gweneth Paltrow. (I'll put a link below). The less simple response is that we seriously need to up our game with K-12 science education. There needs to be much better balance between educating future scientists and educating the vast majority of us to be science literate. If we could achieve that, we would all be better off. Citation: https://www.nytimes.com/2017/07/29/style/goop-gwyneth-paltrow-dr-jen-gunter.html

Hi Deborah, thanks for the AMA.

You mention that some preliminary studies that have found soy diets affecting things like cellular gene expression and menstruation. Can you go into a little more detail on what these changes are, whether they have obvious negative/positive upshots, and what your hypotheses are for broad future implications.

Also, do you have any professional hypotheses on low-dose toxicology regarding public health. Are there any issues with certain foods/practices you see as likely having obvious repercussions in the long-term?

Thanks again!

HerbziKal

Your question raises some important issues, thanks. I decided to do write column after reading the recent EHP study by Taylor et. al that looked at DNA methylation effects. This is preliminary work but Taylor believes that he's seeing signs of gene expression changes in reproductive system cells. His idea is that this is a possible mechanism for the later changes when children enter adolescence. It needs confirming, of course. But it's interesting because it's part of pattern and because toxicology reporters like me tend to value mechanism evidence when trying to assess a risk. https://ehp.niehs.nih.gov/ehp428/

There's a lot of controversy about fluoride in drinking water. Is that something that you would or have researched, and is there any truth to it?

BloodedBaenre

When I was a blogger at Wired, I wrote a piece (I'll give you the link at the bottom) on fluoride as a naturally occurring compound. Since then, I've developed a slightly more complex perspective on the chemistry. As I wrote in the Wired piece, we do know that very doses of fluoride have negative effects and we know that from regions with naturally occurring deposits of the element fluorine. The dose we get in public supplies is minute compared to that and is widely consider safe. The more complicated question there, I think, regards the chemical compounds used as part of the fluoride delivery system and some of those can be questionable.

But that's a different issue than the use of fluoride as a public health tool. Most of the people I know who take an anti-fluoride position have dental insurance, have good strong health teeth and regular dental care. There's no question that fluoride is protective and even restorative of tooth enamel and for people without good dental care, it can be incredibly important. I once covered a free dental clinic in Sacramento, CA, where the water was not fluoridated, and I've never forgotten the children there and how much they had suffered. So until we get decent dental insurance for all, I support fluoridation. And I support it now as someone who does have dental insurance. Citation: https://www.wired.com/2013/05/a-natural-history-of-fluoride/

We've all heard of lead in drinking water as a chronic exposure problem but what will the next big chronic exposure crisis?

Doomhammer458

I wish I knew that and could protect people in advance. I do think that we've long underestimated particulate pollution and its health effects and partly because we've known about so long we tend to treat as old news. I know the current EPA administration is looking at rolling back both clean air and clean water rules and I worry that our greatest risk may be from rising levels of the old time risks. It would be such a mistake to go backwards there. We just published a fairly good analysis on the water rule problem at Undark, the magazine published through my MIT program. Citation: https://undark.org/article/clean-water-rule-epa-pruitt/

Hate to be "that guy" but are there any actual studies that show that GMOs are harmful to the human body?

Westastical

I haven't seen any such studies. That doesn't mean I think American corporations have been a shining beacon in the way they handle commercial GMO operations. But I haven't seen studies that suggest that gene editing itself is a public health problem.

Hi Deborah!

This topic sounds extremely interesting. However, I was wondering how can it be researched in an effective way. Low-level constant exposures are incredibly hard to study. I'm involved in radiation protection and the amount of data we have is incredibly limited, despite this being an apparently much simpler topic than chemical exposures.

lucaxx85

I completely agree with you. Low-dose toxicology is fascinating, important and really difficult. As an example, arsenic behaves very differently in acute exposes and low-dose ones. And because the exposures are tiny and chronic, it's difficult to isolate them out from other chronic, tiny exposures - of which there are countless. Which is my way of saying that I don't have a brilliant answer except to advocate for more money for research into these questions. There's much we don't know that we should be trying to understand.

Have you found any substances to be toxic in some way that you never expected would be?

mmm_toasty

That's a great question. Yes, I've found naturally occurring cyanides to occasionally be a real surprise - just a reminder that we often underestimate the toxicity of the natural world. When I was blogging at Wired, one of my favorite pieces was about cyanide producing grass. Citation: https://www.wired.com/2012/06/cyanide-and-poisoned-cows/ And when I first discovered that rice was the grain most likely to store metallic elements (notably arsenic and cadmium), I was really surprised. And I was surprised to learn how many scientists who study the arsenic/rice connection had stopped eating it. Here's a couple links there, one about rice, one about rice cereal and a (now delayed) FDA rule on that: Citation: https://well.blogs.nytimes.com/2014/04/18/the-trouble-with-rice/ Citation: https://undark.org/2016/04/01/fda-issues-warning-on-infant-rice-cereal/

Hi Deborah, thanks for the AMA! I'm a huge fan of The Poisoner's Handbook; I'm a layman when it comes to toxicology, and I found it incredibly informative and accessible.

To get speculative, what's a potential worst-case scenario? The scientists you spoke to didn't go so far as to recommend against using soy formulas, but they did emphasize there were a lot of unknowns in using such a hormonally active ingredient in infant formulas.

ShapeWords

Thanks so much. I love the chemistry/toxciology underpinning of that book. And to answer your question about soy formula worst case - I tend toward conservative but I think it this was a major health threat then these scientist would have called that out more emphatically. My suspicion is that what we're seeing - or what scientists have found so far is a suggestion of some alteration of the normal course of estrogen-driven reproductive system development - the early indicators are things like early menstruation, heavier bleeding, surprisingly aggressive growth of fibroids. None of these - if they hold up across larger samples - are necessarily life threatening but they may make some things harder for the affected individuals. If everyone was feeding their children nothing but soy formula? That could

raise some very interesting question in population genetics. But that would require big time speculation:)

Thanks for your great work. My question is about Bisphenol-A (aka BPA) in plastics. I've seen studies going both ways about its harmfulness to humans. What are your thoughts on it, bad or not, or too soon to tell?

DogsPlan

It's interesting because when I was writing for The New York Times, my editors were so skeptical of BPA health effects that they discouraged me from writing about. It is probably oversold as a poster child for toxicity - as I mentioned in the soy column, the phytoestrogens in formula bind more effectively to human hormone receptors than BPA does. However, there is some interesting research related to BPA's effects on female reproduction and I did eventually persuade my editors at the Times to let me write a piece about that. Of course, it will tell you that we're still figuring all this out. Citation: https://well.blogs.nytimes.com/2014/08/28/in-plastics-and-cans-a-threat-to-women/?_r=0

Science writing is harder than most people (including too many science writers!) know. Reporting on things that are rigorous itself requires a comparable degree of rigor. Do you think science journalism would be much better off if (hypotheticallly!) they were required to obtain a degree in a field of science?

If so, are there some degrees/fields that would be best for that?

iHaveAgency

We actually have that debate in the science writing community also. Here's my take. I've known outstanding science writers who didn't have a science degree and excellent ones who do. And vice versa! If a science writer gets a degree in, say, astrophysics and then only writes about astrophysics then that expertise would be directly useful. The challenge comes when a science writer is, as so often happens, asked to cover another field of science. There's no way to study all fields of science in advance and unlike scientists, journalists tend to be asked to move across the whole landscape. I have a friend at the Wall Street Journal who likes to say that science journalists are the last generalists in science. I'm the daughter of a scientist (entomologist, chemical ecologist) and I was briefly a chemistry myself. So my take on it is maybe a little nuanced. I think it's hugely helpful for science journalists to study science - it helps them understand the process of it, to learn to ask the right questions, and it stops them from being intimidated by the subject - which allows them ask the right questions. But that has to be combined with the ability to tell the story in a clear and compelling way - and that can require very different skills than those learned by studying science. When I got my science writing grad degree at the University of Wisconsin, I spent a lot of time studying things like environmental toxicology. And after I graduated, I found it very difficult to write a clear story. I wanted to qualify everything! It took me a year to find the right rhythm again. So it's finding the right balance that makes a good science reporter.

Hi Deb, former SJMC student here, hope all is well!

I just read an article about a new tobacco delivery system, called the IQOS, seeking approval from the FDA as a "safer" alternative to traditional cigerettes. The creators, Phillip Morris, claim by only heating the tobacco instead of burning it, fewer carcinogens are released. Source article: http://wapo.st/2fz24jZ

My question is two pronged:

Can you explain why releasing chemicals without combustion should be less harmful?

If the claim of a safer cigerette is true, what are your thoughts on the introduction of the IQOS in the United States?

Edit: Thank you for your detailed response! Your article in Wired was very enlightening. It makes me wonder what other crops use the same type of fertilizer without being acid washed post-harvest.

clayt6

There's a lot of evidence that burning things creates all kinds of toxic compounds. It doesn't have to be tobacco. We see that same question raised regarding meat, for instance, (https://www.roswellpark.org/cancertalk/201707/does-burnt-meat-cause-cancer) and even starchy foods like bread and potatoes. (http://www.cnn.com/2017/01/23/health/burnt-toast-cancer-risk-roast-potatoes-acrylamide-bn/index.html). So it's not unreasonable to think that lower the temperature would lower the risk regarding tobacco. Having said that, the tobacco plant is a member of the deadly nightshade family and even without burning the leaves, it contains some notably poisonous compounds. (https://www.fda.gov/TobaccoProducts/Labeling/ProductsIngredientsComponents/ucm535266.htm). The plants tend to also pick up some radioactive material, something I wrote about at Wired a while back. (https://www.wired.com/2012/12/so-about-that-glowing-cigarette/). So to answer your second question, I'm not convinced that IQOS is much more than a clever marketing ploy. I'd like to see some serious studies of health effects before I change my mind on that. Always great, by the way, to hear from a former SJMC student!

Would you consider fructose to be a toxin?

easyasitwas

That's an interesting question and it fits into the current debate on whether "sugar" is toxic. In fact, I've heard people recently argue on whether we should have been focusing on sugar intake rather than fat intake from the beginning. Fructose, found naturally in many fruits and vegetables, the basis of "cane" sugar, is getting a lot of attention because we don't metabolize it effectively and its heavy consumption has been linked to chronic health problems such as obesity and diabetes. Does that make it toxic?

There you raise the rather fascinating question of how we define toxicity. Back in the 1920s, for instance, when it was first determined that radium-based luminous paint was poisoning workers, manufacturers tried to argue that it couldn't be considered a workplace poison because the workers didn't become sick immediately. They were relying on acute toxicity ideas, such as a sudden death from strychnine. Now we accept the idea of long-term chronic poisoning - lead in drinking water being a classic example. So you could make that case but I'd add one caveat. All poisonous substances, even those suspect in such chronic exposure cases, do direct physical harm at the cellular level. If I use the example of blindness caused by drinking wood alcohol/methanol, we know that's caused by a byproduct of that alcohol, formic acid, which is directly corrosive to the optic nerve. We know that radiation poisoning (as with the luminous paint) is acutely damaging to bone marrow among other things. So before I would fully call fructose a toxin, I'd like to see a more fully elucidated picture of the harm it might do on a cellular level. Hope that makes sense!

Hello Deborah. I read the article and I noticed that it sort of brushes aside the effects that the hormones might have on male babies(the link provided leads to a study on monkeys that, however similar, are no humans). Have they not been detected or did the studies focus more on the females ?

I also have another question: I see that there is almost no talk about abolishing, or at least lessening

the use of formula for feeding babies. I believe that is a much safer way to go than trying to change what's in formulas, as they are fundamentally artificial and in order to be mass produced require some sort of compromise on quality. Do you think the government should push for this sort of information to be spread ?

Thank you in advance for your time.

Discostu97

Yes, good point. That article leans that way because the literature on effects on infant males is limited so I focused on what seemed to be a more consistent and solid pattern. However, in my conversations with the scientists all of them indicated that there are studies taking shape at NIEHS that will focus more on effects on males - everyone recognizes that human males also have estrogen receptors so the potential for some developmental changes is also very real. I'm hoping to track those studies as they take shape.

As to your second question, I think the government, which funds the majority of public health research, should be a much more effective communicator of that research. Not just with formula, obviously, although I'd like to see that was well. But with so many public health questions. You'll see I was talking earlier about arsenic in rice cereal. When I was researching that story, even the American Academy of Pediatrics expressed dismay that federal regulators were so slow to cite the dangers and so reluctant to raise them publicly. I don't think that we can engage in good public health policy without good public health communication and I hope to continue to advocate for that.

Good afternoon! I am curious if your studies have led you to any information about our endocannabinoid system? Do you see the CBD movement as a potential wave of healing for systems that have been damaged (many since birth with soy formulas and beyond with all the heavy metals in our environment)? I've been doing my own research but would love your input! Signed, not a scientist

zizap

That's not something I've studied closely but you definitely caught my attention. I've tended to focus on the toxicity end of the scale rather than the antidote end. But you've reminded me that this could be a very interesting aspect of that other side of the story. And for those who you who haven't followed the endocannabinoid discussion, here is a very basic overview:
http://emedicine.medscape.com/article/1361971-overview