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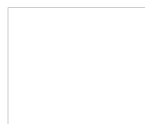
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AngryToxicologist is a scientist in the public health sector, knows plenty about

toxicology, and is occasionally angry about it all. Drop me a line at tox@angrytoxicologist.com.

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Friends of Earth, no Friends of Science

Category: Consumer Tox

Posted on: August 15, 2007 8:03 AM, by [angrytoxicologist](#)

Friends of Earth put out a [report on nanotechnology and sunscreens](#) recently. They bungled it. Big time.

A little background.

Zinc (Zn) and Titanium (Ti) Oxides are the best sun protectants known. They don't break down in the sun and they have broad UVA UVB coverage. However, they are bright opaque white (you remember the thick white stuff lifeguards put on their noses and ears?). If you make it small enough, though, the solution will be clear, not white, and still do a good job. Most nanoparticles in sunscreen may be nano in terms of size, but nanotechnology (from a toxicology perspective) also means that the particle is built from the atom up which gives it a different structure and, therefore, different properties. Most ZnO or TiO₂ sunscreens are just finely 'micronized' (i.e. ground up really good) to get down close to or in the nanoscale particle size range. The use of the word "nano" is nothing more than a marketing ploy in many cases, or misused for something finely micronized. However, true nanoparticles may be used in sunscreens as they are in other areas, so it's worth looking into.

Risk to science that is...

That said, let's dig into this report. I'll start with the "risk to human health" section.

First, nanoparticles have unprecedented access to the human body... Crucially for the use of nanosunscreens, the jury is still out on how readily and how deeply nanoparticles penetrate skin. The ability of nanoparticles to be taken up through the skin and to



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access the blood stream remains poorly understood, although there is growing evidence that some nanoparticles may penetrate intact skin 9.

The jury is still out? The jury saw the evidence and came back in 5 minutes with "not-guilty". Maybe some nanoparticles do get in but TiO₂ and ZnO particles don't. Study after study after study has shown no penetration past the dead layer of skin. I'm talking good studies. There is some question of what would happen under conditions of severely damaged skin. If you have damaged skin, you could stick to the Zn only sunscreens and since we already have Zn in our bodies, it won't hurt at all to let a little more in. Also, the study that FOE references is about quantum dots. Any quantum dots in sunscreen? No. Any reasonable similarity between quantum dots and TiO₂ or ZnO other than size? No. Do I care then? No.

When ingested, some nanomaterials may pass through the gut wall and circulate through our blood 8.

Okay, don't eat your sunscreen. Good advice anytime. Also, the studies they cite aren't about TiO₂ or ZnO. One is about gold nanoparticles. An extra warning to my readers in Bel-Air: Warning, when applying your gold sunscreen, please don't eat it.

Studies have also shown that particles 1,000 nm in size can cross human skin and gain access to the dermis (the lower or inner layer of the two main layers of tissue that make up the skin), up by cell mitochondria¹⁵ (the principal energy source for cells) and cell nuclei¹⁶, where they can induce major structural damage to mitochondria¹⁷, cause DNA mutation¹⁸ and even result in cell death¹⁹.

Let's see about the references. One is about water-soluble biocompatible nanocontainers that were designed to penetrate the skin. Another is about air particulate matter (most likely from combustion engines). A third is about ultrafine TiO₂ powder that is inhaled. The other reference numbers are actually repeats of the first two papers. So, the only extra thing we've learned about sunscreens is that you shouldn't dry out TiO₂ sunscreen, crush it, and snort it. Also good advice for any sunscreen.

That's it. That's the whole health risk section. So, ZnO and TiO₂ don't breakdown like other sunscreens, they do provide complete UVA UVB protection unlike other sunscreens, and don't absorb into the skin like other sunscreens. So, actually, ZnO and TiO₂ sunscreens are safer than the conventional ones. Way to get it completely backwards FOE! I'm sure they mean well, but if you don't have the expertise or the insight to even be able to interpret the papers you cite correctly, you shouldn't even be thinking about doing a report. In fact, what *were* you thinking? Nanotech is hot and sounds scary so we should do a report and cobble together any research on things that are small? Using research on any type of nanoparticle to talk about ZnO and TiO₂ is like saying that "all chemicals are bad, look at these studies on pesticides!"



The Listener

As Oliver Sacks observes the mind through music, his

belief in a science of empathy takes on new dimension.

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May 2007

April 2007

[Here's what I use](#) (note to the manufacturer: Your name and packaging looks vaguely like Vagisil. I suggest a change). [Here's what I use on the kids](#) (it's a little thick to put on, but it doesn't come off and that makes it worth it).

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Caveat: Nanotechnology does present a lot of new risks that are poorly understood for most particles at this point. Many are really toxic, many are not. We clearly aren't doing enough to study the real nanoparticles that are being currently used in commerce. Learn more about the risks of nanotechnology including sunscreens by reading [this journal article](#).

Update (Aug 16th):

Texas Reader asked "Angry Toxicologist - would you please look into the criticism of a lot of the most popular sunscreens [sic] by something called "The Environmental Working Group"?" I thought this was a question worthy of an update so here we go:

Useless and Random

Any money I would have gotten from writing this blog is donated to the [National Capital Poison Control Center](#). They rely on grants, save lives, and decrease health care costs. So read this blog every day!

What I'm reading, watching, and rating:

Saw [Stranger Than Fiction](#)**** out of 5

Reading [We're in trouble](#)*** out of 5

Saw [The Lives of Others](#)***** out of 5. Best movie I've seen in a long time.

Short answer: I agree with most of their conclusions, but I don't like how the message is put out there, and I think the 'search for your cosmetics tool' is near worthless with the exception of the very valuable UVA/UVB part.

Reasons:

1) They are right on about the regulatory system for cosmetics;

2) I specifically looked for their stance on the nano and they have a pretty reasoned take on it, however,...

3) At the top of the search page you can click on "no nano-particles" for your cosmetics search. This seems really disingenuous. In the fine print they say that nano is fine but where most visitors look, they can click "no nano". So really the implicit message that they are sending is that nano is a big problem (there aren't boxes for any other special 'no' categories). It seems like Environmental Working Group is hedging their bets here, pandering to scientists/journalists and the general public in separate ways. If you don't choose "no-nano", the TiO₂ and ZnO ones come out among the best.

4) Their "scoring system" for the cosmetic site as a whole is really arbitrary. I think the info they provide on full UVA/UVB protection is really useful, but I wouldn't pay attention to a lot of the rest of the stuff. For instance, does everyone view cancer risk as worse than reproductive risk? Wouldn't it depend on how potent that toxic chemical is? (EWG does some ranking on strength of evidence but that's much different than potency) Wouldn't every finding in there be contingent on the amount of each chemical in the product which isn't known? (I doubt that manufacturers told them the amounts) There is no sound reason behind how they added untested chemicals to the rating (how do you compare the risks of what you don't know with what you do?). I haven't looked through the whole thing, but I would guess that based on


the scoring system well-tested chemicals fare much worse than those that we simply don't know anything about. EWG has solid reports in many areas, but it seems like it should stay away from the cosmetics scoring business. I doubt they will quit, though, [it gets a lot of press](#).

So this is somewhat insightful. As far as nanotech goes, where FOE just totally bungles it, EWG gets the science generally right but tries to be really slick about it. I don't like it either way and I'm not sure which I like least, FOE's boneheadedness or EWG's sneakiness. Possibly, the slickness/hiding could be due to backlash among the other greenies. I got some evidence for that theory yesterday. From four e-mails, I got the distinct impression that I had stepped into a pissing match between FOE and EWG with my sunscreen/nanotech post. I didn't actually know this until right now (it was on the EWG press page that I found for the link above), but there was a [pretty good NYTimes blog post](#) that describes this whole mess.

Texas, thanks for the follow up question.

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Comments

Whew! Now I can go back to worrying about other nanotechnology like the ipod nano.

Posted by: Nostradumbass | [August 15, 2007 9:36 AM](#)

Yeah, those must absorb into the skin, too. :)

Posted by: angrytoxicologist  | [August 15, 2007 10:40 AM](#)

It is hard to fault FOE for being wary when many new chemicals and compounds are being release that are not adequately tested for human toxicity and environmental impact. And if no one expresses a worry about this, then there is little chance of new regulations being put into place that mandate it.

However, it would obviously help if they had better advice on the scientific merits of their arguments. I don't understand why they don't place an ad in the local paper and hire one of

the many underemployed and highly experienced toxicologists that are just looking for an opportunity to feed their families.

Posted by: Mike | [August 15, 2007 11:03 AM](#)

No, iPod nanos absorb through the ears, silly!

Thanks for this post. I have been trying to make sense of the sunscreen issues lately and you have provided some clarity on at least one issue. I had a basal cell carcinoma removed from my nose about 8 years ago (I regret those teenage years of futile attempts to tan my pale Irish-German skin). After my MOHS surgery I increased my sunscreen usage quite a bit as well as avoided the sun as much as possible, but perhaps too much. I am noticing benefits to a few minutes of unprotected sunshine each day (not enough to burn or turn pink).

Posted by: [Anna](#) | [August 15, 2007 11:27 AM](#)

I dunno Mike, I think there is plenty of blame to be put on FOE for the following reasons:

1) They have responsibility for a report that used science badly and came to a decision that is actually bad for people, and bad for sunscreen companies that are trying to do the right thing. If a company published something that had these effects, would you be equally forgiving?

This [FOE's report] kind of crap is exactly what makes industry types throw up their hands and say, "Well, you're damned if you do and damned if you don't, so why do we bother trying". I know, in a perfect world they would do the right thing out of the goodness of their hearts or because we lived in a world where personal care products were regulated seriously. But we don't live in that world.

2) There are plenty of other serious issues that need tackling that they can express worry about.

3) They did have some well trained help on the project (look at the contributors). I'm not sure what to make of this (did they not look over it, not care, not know, figured nano needed a good wack and no one would notice?)

4) Sure, not every non-profit can have a toxicologist on staff. But if you don't have the expertise, get involved, but don't wade in past your depth.

Posted by: angrytoxicologist  | [August 15, 2007 12:35 PM](#)

Let me add to the list of FOE neglect the fact that a large number of people outside the science fields have difficulty making sense of all the "it's bad for you"/"never mind"/"no wait it may be bad after all" reports they see in science challenged media. If Friends of the Earth (what kind of name is that anyway? It seems geared to imply that opposition to their charter requires enemy of the Earth status)wants to help its base it would do much better than scare

tactics.

I don't consider main stream media to be on a disinformation campaign, but that is what it amounts to in a lot of areas. This does not serve the general public in any way, and there is a danger of information exhaustion syndrome that will inevitably do more harm than good. These types of articles should be criticized loudly, regardless of any perceived intention. Doing harm is doing harm, and false information is harmful.

Posted by: B8ovin | [August 15, 2007 3:31 PM](#)

The nanotech scare thing is ridiculous...as you pointed out in the post, this one word 'nanotechnology' is being thrown around as a monolithic entity. It's just small...it's like saying "watch out for technology, it might be bad for you".

Really? Thanks.

Hopefully, we can soon discuss the specifics types of nanotechnology instead of grouping it as one...THEN we'll be getting somewhere with identifying potentially harmful tech.

great post!

Posted by: Brian | [August 15, 2007 3:41 PM](#)

Well written. Thank you.

Not that I've ever heard of FOE before, but are they a formerly respectable organisation that are going a bit Greenpeace or do they generally issue this sort of disguised junk science?

Posted by: Nat | [August 15, 2007 7:08 PM](#)

Angry Toxicologist - would you please look into the criticism of a lot of the most popular sunscreens by something called "The Environmental Working Group"? My dermatologist encourages me to use Neutrogena's sunscreens that cover both UVA and UVB rays but EWG lists Neutrogena sunscreens as having dangerous ingredients. I'd really like to know if they are out to lunch on their "science."

Thanks,

new reader

Posted by: Texas Reader | [August 15, 2007 11:18 PM](#)

So, you have a blog that is now sponsored by Dow Chemical, a major chemical company that also has a long history of polluting earth with its toxic chemicals for profit.

And you use that blog to - complain about Friends of the Earth?? I don't get it. They are a small NGO, while Dow is a huge company that fights against any legislation that would protect our environment.

Why pick on the little guy?

OK, you claim that their data is not great, but what about the chemical industry, and the companies that are now trying to move into nanotechnology (where patents and profits are clearly on the agenda). Their data is not exactly reassuring either.

If you know so much about nanotechnology, why don't you contact FOE and offer to help them get their facts right.

I liked your blog better when the Dow.com ad was not telling me how to "see the world".

Posted by: [Martin F](#) | [August 16, 2007 7:11 AM](#)

Martin,
Chemical industry shadyness or FOE's size doesn't excuse them from creating a bad report (not just bad but harmful!). See the comment I made to Mike above. Sides aren't important. Getting things right is important.

I bet if Dow looked through all my posts, they would be more uncomfortable with me than you are with their ad (look at the STATS post just a few days ago). Either way the ads don't really don't really affect me. Mainly because if I ever got pressured in anyway about my content, I'd just fold up shop and go back to the old site; I'm only on SciBlogs to reach more people. I can't imagine that happening; look at other SciBlogs and it's quite clear people say what's on their minds around here with no interference.

Posted by: angrytoxicologist  | [August 16, 2007 7:50 AM](#)

I'm agreeing with Martin F here. I've been familiar with FoE for 15 years and always known them as trying to and usually managing to get their science right. And they're most certainly not the first ones in history getting it wrong. If you had contacted them intending to correct factual and methodical mistakes they would most probably be thrilled. If your intention is to improve public health, I think that would be a far more productive route than polarizing yet another environmental (non-)issue.

Posted by: Mats | [August 16, 2007 9:21 AM](#)

This is precisely the sort of thing that has made me swear off supporting environmental organisations. I once belonged to Greenpeace, but lost my sympathy for it years ago. It's a pity: organisations like Greenpeace and Friends of the Earth have a valuable role to play if they would just play it objectively and honestly, and without the kind of technophobic streak that they often show.

Posted by: [Russell Blackford](#) | [August 16, 2007 9:23 AM](#)

Mats,

I can't say this definitively but I'm pretty sure FOE would have said 'butt-out'. Maybe I'll try next time. However, that sort of defeats the purpose of blogging or even news! If I found out that Exxon put out a press release full of fiction and instead of informing people about it, I went to Exxon and said, "you know you should fix this here or I'll have to write about it" you would cry "foul!". And rightly so. Just because they are good guys/gals with a noble goal doesn't mean they get a pass from doing the right thing (see Russ B's comment). In essence, what you are defending is the right to mess up the facts because you agree with their ideology. Sound like anyone you know with really low approval ratings?

I should add that the driving principle for me in hewing to the facts not ideology (although facts drive ideology, too), is the knowledge that I could be wrong. Initially I thought that nanotech in sunscreens sounds like a bad idea. When you think that you could be wrong it drives you to figure out what is really going on. A good dose of self-doubt while still pressing your case would do wonders all around.

Posted by: angrytoxicologist  | [August 16, 2007 9:52 AM](#)

Texas Reader, I would have responded to this earlier but your comment was stuck in the junk box (for what reason, I don't know). Your question deserves an update to the post, which I will put up in a bit.

Posted by: angrytoxicologist  | [August 16, 2007 11:00 AM](#)

This is precisely the sort of thing that has made me swear off supporting environmental organisations.

Are you sure that's a broad enough brush?

Posted by: Alexandra | [August 16, 2007 2:41 PM](#)

Thanks much for the post AND the specific recommendations, which are a great help.

I hope you'll consider nudging the environmental groups to consider what you wrote as a chance to better their explanations and get it closer to right next time.

One of the great teaching moments in science, I think, is when kids see that "hard argument" is real, productive, useful, and mutually appreciated by scientists. Not that scientists aren't human and have problems dealing with criticism, but that scientists are trying to do something very different than debaters or any other kind of people the kids may see pounding on one another's ideas.

I think your piece is good, hard, argument -- blogging isn't publication nor seminar interaction, but it can rise to the level of really improving everyone's thinking.

And it can -- should --- be a chance for these teaching moments mutually agreed to by people arguing about science to show kids that yes, these people really are doing something

different and important.

Once a kid gets the point of how scientists deal with their own feelings about the real world as it's revealed over time, the people clinging to their rhetorical and political arguments look pathetic by contrast.

Candle in the dark, you know.

Posted by: Hank Roberts | [August 16, 2007 3:44 PM](#)

Thanks for the thoughtful answer (and the EWG update). I do agree with what you say and in terms of integrity you appear to be a lone voice speaking out for the ordinary citizen - glad to hear that Dow will not be telling you what to say, and I'm getting the impression that they might actually be listening. I will keep returning to your blog for more. Cheers.

Still, nanotech needs to be investigated by independent researchers before "sold" to the public. Haven't corporations learnt anything from the GMO debate when Monsanto thought they could sell their patented seeds to the entire World, for profit.

Posted by: Martin F | [August 17, 2007 7:26 AM](#)

Dear AT,

We encourage open debate of our Skin Deep tool, but you may have looked at an outdated version - we relaunched it four months ago. We think [our current site](#) actually addresses some of your concerns. Skin Deep is a guide to help consumers make decisions about personal care products based on what's known about hazards of ingredients and gaps in safety data for products. Our Skin Deep research also helps us advocate for stronger health policies when it comes to exposures to chemicals in personal care products.

You mention a concern about cancer being rated in Skin Deep as a more serious health concern than other potential health risks linked to cosmetic chemicals. This isn't the case. Cancer is important, but other health concerns such as reproductive, developmental, and neurotoxicity are considered equally important in Skin Deep 3.0. We've expanded on a rating system developed by the [Scandinavian governments](#) to help bridge the gap between the strength of the evidence and the potency of the chemical (in fact about 20% of the raw data in the site is data on the potency of ingredient hazards). We also make adjustments based on considerations of skin absorption and the presence of penetration enhancers in products that can increase exposures. Our hope is to someday transform Skin Deep into a full-blown risk-based system, which would put all ingredients and products on a level playing field in our rating system, but that would require data on hazards, potencies, and exposures for all 7,000 chemicals we've found in products - basic data that federal law doesn't require cosmetic companies to collect. (We're trying to change that, too.)

And about your concern over "how we added untested chemicals to the rating (how do you compare the risks of what you don't know with what you do?)." We have the same concern. This is why ratings for chemical hazards in our site are now shown separately from ratings on

uncertainties and data gaps. We haven't always shown the data this way, but with our system we think site users can better understand, for instance, if a product might have a low hazard or safety rating merely because it hasn't been tested.

As for the 'no-nano' search tool, I'd encourage you to look at the [advanced search tool](#). There are number of ways to search for products free of particular ingredients. Our audiences include policy makers, the media, the public, and industry, and while we can't always predict the ways that people will want to use our data, we try to provide flexibility in our search functions. And we put in the 'no-nano' box after a variety of testers asked for it.

Skin Deep is tool to weigh disparate factors that play into the safety of personal care products. Ultimately, we think all products should be proven safe before they're sold. In the meantime, Skin Deep is our best stab at showing people information about what's in personal care products. We're trying to make it better every year. We've heard the cosmetics industry plans their own release on the safety of their products; we can't wait to see what they disclose.

And by the way, we have a position open for a [Senior Scientist](#) if you'd like to come by and help us improve our system - we are continually working on it to make it better.

Posted by: [Kristan @ EWG](#) | [August 17, 2007 12:49 PM](#)

Skin is great for keeping your insides in and the outside world out. Indeed, Alan Sherman wrote a song about its properties a few years back.

Could a virus or a bacterium be classed as a nano particle? Skin is what keeps these buggers out of your body. Some sort of trauma to the skin is required for viruses or bacteria to gain entry. If skin can do that, why wouldn't it keep out nano particles of titanium dioxide or zinc oxide? Are nano particles larger or smaller than 'germs'? This enquiring mind would like to know.

Posted by: grasshopper | [August 19, 2007 9:09 AM](#)

The link from Kristan@EWG a couple of posts above this one is worth calling attention to (Kristan, EWG ought to consider buying an ad on the Sciencebloggers page, or somewhere).

I hope some of the real scientists reading will click the link --- it leads to:

....

SENIOR SCIENTIST

EWG seeks a doctoral level scientist or M.D. with a commitment to the environment and a desire to advocate for public health protection through original research.

....

The ideal candidate will have:

- * PhD in environmental chemistry, public health, epidemiology, toxicology, or related field.
- * Excellent writing, editing and personal communications skills.

- * Strong computer and data analysis skills.
- * Possess a strong commitment to protecting the environment and human health....

Posted by: Hank Roberts | [August 21, 2007 8:55 PM](#)

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