Science AMA Series: We are Dr. Curtis Schwartz and Dr. Janet Windisch here to talk about personal care products and specifically the science of soap. Ask us anything!

Dow$_{C}hemical^{1}andr/ScienceAMAs^{1}$

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Abstract

What you put on your skin or in your hair is personal. Whether it's because of vanity or hygiene, it's good to have an understanding of what's in your personal care products and what makes them effective. Together, we've spent the last five decades improving the science in this area and we're "lathered up" about soap as a method to prevent disease. For a technology that is as fundamental as soap, there is a surprisingly large amount of technical development activity in the area. The early days of using fatty acid and pot ash to create soap are behind us and new trends are driving innovation, including formulating for improved sustainability, new sensorial benefits and multifunctional traits. The need for washing with soap is clear. From bar to liquid and even powder, soap is used globally in different ways. We're here to talk about what's required to make a good soap, the challenges that are driving new research and how we can deliver solutions that will have a positive societal impact. CURTIS SCHWARTZ: I am an R&D director at Dow and have spent the last 30 years in industrial science working on formulations to improve the performance of personal care products, including everyday items such as laundry detergents, soap bars, hair sprays, shampoos, body washes and sunscreens. I received my Ph.D. in Inorganic Chemistry from the University of Illinois and hold over 10 patents. I was part of the POLYOX – Lifebuoy collaboration that was recently awarded a GOLD Edison award for our work with Unilever. JANET WINDISCH – I have a Ph.D. in Chemistry from the University of Pennsylvania and have spent the last 25 years working in the polymers and specialty materials space for personal care, adhesives, coatings and medical applications. I have authored 8 papers, hold 1 patent and enjoy talking all things science. Ask Us Anything! Note: We will start responding to questions at 1:00 PM Eastern Time (10 am PT, 5 pm UTC.) Edit: Minor technical issues, we're here and trying to post!

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REDDIT

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DOW_CHEMICAL R/SCIENCE

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Hi there, thanks for doing this interesting AMA!

My questions (1): in the past 5 to 10 years, the word 'sulfates' has been thrown around and in hair products it seems to be synonymous with 'greasy/oily/bad'. Can you explain the science behind sulfates in hair products and why they seem to be so bad?

(2)Some face wash products leave my face feeling clean and fresh, but 5 minutes later my skin is dry and peeling. This has happened for scrubbing products, foaming products, and others. Is there some specific ingredient that is stripping a needed oil from my skin that should be avoided?

Thanks again!

antilockbrakesystem

Hi, great question. Yes, sulfates. The best cleaning agents contain sulfate groups. They are inexpensive for the formulator, they lather well, they are soluble in water. The problem with them is they clean so well, almost too well, they to be somewhat irritating because they strip the oils from your skin. Go with a milder shampoo or face wash. Those that are formulated with alkyl glucosides, or have mildness claims on them would be a good start. These usually have less or no sulfated cleaning agents, or more betaine surfactants, or additives that reduce mildness.

How is shampoo and conditioner in the same bottle possible? Won't the shampoo soaps bind with the fats in the conditioner?

eigenfood
Great question - there is really cool science behind this. the conditioner used in shampoo is not the fatty alcohol used in rinse off conditioners. polymers modified with a cationic (negative charge) are used in shampoos for conditioning. These positively charged polymers interact with the negatively charged surfactants in shampoo to form a precipitate (very small solid particles) when your put the shampoo on your hair. Since your hair is negatively charged, and the particles are positively charged, The solid particles/polymer sticks to your hair while the surfactant is rinsed down the drain. The polymer can make hair softer, lubricated and easy to comb, less static-y etc. This technology can be extended further to deposit silicone, fragrance, oils on hair and also on skin.

So like most people these days I use gel soap instead of bar soap. I do not use a scrubby or pad to put it on, I just put it in my hand and rub it all over my body. My question is; am I actually cleaning myself, or am I just making myself smell better?

mrcollin101
This is Janet. thanks for the good question. Bar soaps, liquid soaps, shampoos all work by the same basic mechanism. they all contain surfactants which are molecules which have both hydrophilic and hydrophobic portions. Surfactants surround dirt (which is usually oily or hydrophobic) and solublize it and let it be rinsed down the drain. leaving the substrate- your skin or hair - clean. So I think the answer is yes, you are cleaning your skin. The scrubby or wash cloth may help get more stubborn dirt off.

Is it REALLY beneficial to skip using shampoo and conditioner on your hair? I have crazy thick, difficult to manage hair, and am always curious about how to make it nicer. Specifically I'm referring to most of the claims that product, Wen, makes.... shampoo damages your hair, etc.

Bostonchefchix911
Hi, this is Janet. This is why personal care is personal! It depends on personal preference. I have been hearing alot about this idea of not washing hair. Unlike handwashing, which is key to prevent spreading of disease, washing of hair is more related to how we want to look and feel. In the US, consumers like to shower and wash our hair more frequently than other locales Washing of hair removes dirt, styling products and sebum from hair. It's the surfactant which surrounds dirt and oils and washes them down the drain when you shower. However, this does strip hair of natural oils. And lke we all know, then we need to use conditioner to add back the appearance of moisturized healthy hair. I think you will also see more of these products which are conditioners which also cleanse hair.

What's the deal with parabens—propylparaben, butylparaben, etc? They are found in many cleansers, most notably the highly recommended Cetaphil liquid cleanser. (Which I use daily, on my face prior to or after shaving.)

Yet there's no shortage of sources claiming parabens are potentially risky due to hormone mimicking or upregulation issues.

What's the real story? Should I stop using soaps and cleansers with parabens?

Plopdopdoop
Hi, this is Janet. I am not a microbiologist, I'm a chemist, so I'm glad someone already chimed in with comments specifically on parabens. But this brings up a serious challenge - preservatives for personal care products which are safe and efficacious. This is a big technical chlallenge for the industry. as more preservatives are crossed off the list because of potential health or environmental impact, formulators are going to run out of options to preserve their formulas. And none of us want mold growing in our shampoos and facial washes. So, my point -- this is an area where lots of good

scientists are working to find other options. Also, we need to make data based decisions based on good science. One trend is to use organic acids like benzoic acid. or salicyic acid.

What is YOUR personal routine with cleaning yourself?

rufioherpderp
this is Janet --- personal care is really a matter of personal preference. As a consumer, I look for cleansers that moisturize and that don't have much fragrance (which makes me sneeze). And I usually buy mid priced products from the major brand owners - not rock bottom because I don't trust the junky stuff, and not really expensive since I don't think it's worth it.
and lastly, i'm like any other consumer, if I like the way it feels, I stick with it. I have a favorite body wash and bar soap that I've used for years.

I've always been wary of advertising language like ," Now with X technology, creates softer skin in just 5 uses!" Or "With Mediterranean Sea Salt, proven to reduce wrinkles in women over 50!"

- **Are these considered harmless, but exaggerated ways to differentiate product lines, or is there legitimate testing happening in R&D to back all of this up?**
- **What trends in personal hygiene are coming our way in the next 5 years?**
- **What do you look for in a soap?**
- **How many people in R&D touch a product before it is released?**
- **What is the time between conception and release of a product?**
- **How closely does marketing work with R&D to develop ideas for products?**

Luthalis
this is Janet, I'll try to hit on most of these questions. -the FDA requires that claims are backed up with science. It can be analytical data or based on consumer studies.
-trends in personal care: multifunctional benefits, new and different textures and sensory characteristics, more sustainable, fragrance delivery. -The amount of research that goes into a new product and how long it takes really depends on the brand owner (the company who sells it) and how different it is from what's already being sol. for a major brand owner introducing a new type of product, it could take years, with months of consumer testing, at least 6 months of stability testing after the product has been put together. On the other hand, with low tech body wash with nothing new in it, it could be commercialized in 6 months with only 1 scientist touching it.
-lastly, at major specialty materials suppliers and brand owners, marketing and R&D work very closely. Like every day.

Do you have anny tips or tricks that people dont often know about? What can you tell me today that would upgrade my soap-game?

Vertomme
janet here....good question....Umm, I don't have any big insights. Compared to the average consumer, I understand what most of the raw materials do, so I tend to read the list of ingredients, at least the first few. for example, you will find that the vast majority of body washes use the same surfactants, and the difference is the fragrance. I do this to avoid paying more for a product that basically the same as a cheaper one. I also pay attention to the label claims and instructions and tend to beleive them....(with a bit of skepticism.)

Is there any consensus regarding how often should one shower/wash hands? I swear I have never seen anything about this. The reccomended frequency appeared extremely dependent on culture to me.

lucaxx85

The CDC has a great website which adresses this.
Take a look at : http://www.cdc.gov/handwashing/when-how-handwashing.html

In short, they say: •Before, during, and after preparing food •Before eating food •Before and after caring for someone who is sick •Before and after treating a cut or wound •After using the toilet •After changing diapers or cleaning up a child who has used the toilet •After blowing your nose, coughing, or sneezing •After touching an animal, animal feed, or animal waste •After handling pet food or pet treats •After touching garbage

I've heard a few times that it's really not a good idea to add water to a bottle of hand soap that is getting down toward the end in order to extend the life of the bottle. How bad is it really?

LokiDucks
By doing this, you end up diluting the cleaning agents. It's not a bad thing as long as you realize that the concentration of cleaning agents is less per use. This is ok, if the cleaning job you are doing does not require as much soap. As long as it lathers, then you are probably ok. This generally means you are overcoming the effects of hard water. If you have a water softener in your home, then you need even less soap.

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LokiDucks
This is Janet. My husband does this and it drives me crazy. Because it drops the viscosity and makes it squirt out too much and splatter on the counter! But from a sceintific point of view, I see no problem in it.

Since there isn't much else to read in the shower, I always read through the ingredients list of shampoos, and the chemical "methylchloroisothiazolinone" seems to always be there.

What is it, why is it always used, and can you say it five times fast?

kennon42
Methylchloroisothiazolinone is a preservative. It is highly effective against bacteria and fungi at ppm levels in the product. Think about this: shampoos consist of highly biodegradable surfactants in water, at about a neutral pH, in a humid environment in the shower -- perfect environment for promoting microbial growth. So the preservation demand for a shampoo, body wash is high. That's why the methylchloroisothiazolinone is present. It keeps microbes from growing in the shampoo.

How do shaving soaps (i.e. soaps you whip up a shaving lather from) differ from soaps used mainly for the purpose of cleaning your skin? Nowadays most people use pressurised shaving cream but traditional wet shaving with double-edged razors and straight razors has regained popularity in recent years, and with them the use of shaving soap.

P.S. Shoutout to the folks over a /r/wickededge.

MoonlightSandwich
Shaving soaps have a higher concentration of stearic acid. This gives a denser, creamier foam, which is desired for shaving. Whereas soaps made from coconut soaps have a lighter, airy foam -- which is less desired for shaving.

Is there any science regarding all the huge amount of cosmetics soaps on the market nowadays?

I generally go to the supermarket and get the cheapest shower product that's a non-soapy detergent.

However, when I go to the farmacy or when I hear estheticians or dermathologists it seems like there are hundreds of kinds of detergents made out of anything, from mud to "vegetable stem cells" to honey to basically any chemical element in the universe. Is there any basis for some if not all the differences or is this just marketing?

lucaxx85
Yes, great question. Most of the soaps in the market use the same basic surfactant cleaning agents: SLS, SLES, Betaine. After that, all of the companies are trying their best to diffrentiate themselves in an extremely competitive category. In the shampoo and body wash category, they try to differentiate by fragrance, exotic ingredients (like you noted), honey, botanicals. Some of it does nothing but beautify the label. It's hard to answer your questions without going to a case by case basis. But in my view, if you like the cheapest shower product, then stick with it.

Forgive me if this isn't the sort of question you're after, but I've long been curious:

Do formulations for older products ever change? For example, I love Irish Spring (the green swirly bar soap). That stuff has been around for a long while now, I want to say the 1970s.

Much the same with "Dove", which is even older, if memory serves.

Do these products ever undergo small evolutions as advances are made in materials and methods, or do old products remain essentially 'static' soaps not to anger long-time users? If changes are made, is it like the food industry where new formulas are poured over to be indistinguishable from the old ones to the end user?

Tin_Whiskers
These brands have been around a long time and there is lots of goodwill tied up in them and millions of loyal users. I don't know about these examples, but in general the brands do change but not very much, recently. Dove will always be about mild cleaning. And Irish Spring will always have a strong fragrance delivery.

Since I'll probably never get to ask this question again and I'm legitimately curious:

When I was 2 I had this habit of always trying to drink the hand soap. My parents obviously stopped me, because that doesn't seem like something someone drink. Really how dangerous is it though? Like how much hand soap would I have to drink to make me throw up? To knock me out? To kill me? And how does it affect my body in a negative way.

herowcatsmanzzz
Hi, I'm not really sure! But I think you are probably right in that you would probably throw up before it kills you. Some formulators but a bittering agent in the product, so that after ingesting just a tiny amount, you can't help but throw up.

Why is potassium hydroxide used for liquid soap and sodium hydroxide for solid soap? The hydroxide part is responsible for saponification, does the counter ion really matter?

MycoChemist
It affects the phase diagram, i.e., when the soap turns into a solid or remains a liquid at a certain concentration in water. The ratio of sodium to potassium soap affects this.

What is your professional opinion of the "no poo" (no shampoo) movement that has gained traction in recent years?

rmg22893
https://www.reddit.com/r/science/comments/3ofxf8/science_ama_series_we_are_dr_curtis_schwartz_and/cvx3rbm

I have heard that people should change brands or types of soaps, shampoos, and other

cleaning products every so often because your body (and the bacteria they are supposed to clean) can build up an immunity to a product if you use it exclusively. Is there any truth to this?

capass
Yes, it is true, although I have no scientific proof of this except in the context of shampoos to prevent build-up, improve volume, it is useful to change shampoo regimes.

A lot of antibacterial soap claim they kill 99.9% of bacteria. What amount of bacteria will 'normal' soap kill? And what makes antibacterial soap any different?

whatamoppet
Hi, this is Curtis. Yes, there's a lot of questions about to what extent soaps with anti-bacterial claims work versus regular soap in a home-use situation, as can be easily seen on the FDA website. My opinion is by far, the best thing you can do is to use soap and water, and wash for at least 15 seconds, rinse, and dry with a clean towel.

There are so many types of shampoos in the market. For anti dandruff, anti hairfall, damage control, for dry hair, oily hair etc etc and when I read the ingredients, about 80-90% of them have the same ingredients based on sodium lauryl sulphate (if I'm right). What actually makes them different? Is there any actual difference if I buy general use shampoo instead of the shampoo that promises 3 times silkier and glossier hair?

auroralover1
Good point! Yes, you are right. First, they are always about cleaning. But second to that, it is about fragrance, conditioning versus clarifying shampoo, volume up, volume down, shine, colored hair. It is hard to differentiate for sure. I would go with what you like.

Every time I wash something I can't help but think about a part in the book "The Lost World" where Sarah Harding washes her hair with dish soap proclaiming "it doesn't matter, all soap is essentially the same." Is there any truth to this?

AnticPosition
Dish soap is designed specifically for that application, so I would not recommend washing your hair with it.

I am a bedridden patient who uses a bedside commode and lives with two indwelling feeding tubes and a central IV line (so the tip of the catheter lets out right at my heart, creating very high infection risk if proper sterile protocols are not followed). We use alcohol based hand sanitizer *heavily* in my care, pretty much before and after touching my tubes or IV every time, and always after I use the restroom. Washing with soap and water is less frequent for me unless I have an active infection such as CDiff which isn't eliminated by alcohol sanitizers and requires washing with soap/water or bleaching.

Long term, is it likely that this extensive use of alcohol hand sanitizers is going to increase chances of infection or antibiotic-resistant infections, or in some way severely damage my skin microbiome? I know that this is how they have me clean my hands whilst inpatient in the hospital, even long term over weeks, but no one really discusses the true *long* term consequences.

ETA: I also handle alcohol prep wipes frequently throughout the day to clean my IV connections, enteral connections, injection sites on my skin, etc. and the area where my central line is accessed is sterilized with providone iodine or chloraprep and alcohol.

heiferly
Hi -- this is Curtis. I have been reading the responses, and I have nothing to add to this regarding the use of alcohol based sanitizers and antibiotic resistance.

There are some soap ingredients that people like to stay away from (e.g. sodium lauryl sulphate, parabens). What do these do? Are these (or other ingredients) things that people should avoid in their soap?

felixfelix
Most shampoos and body washes contain both sodium lauryl sulfate (SLS) and sodium lauryl ether sulfate (SLES). SLS is a stronger cleaning agent, has more foam boosting power (important for a shampoo!), while SLES is milder (but foams less). It's a trade-off. Usually this is combined with a betaine surfactant (foam booster, but poorer cleaning). If you are looking for a milder shampoo, try finding a shampoo that has SLES has the first ingredient, or SLES/betaine as the first and 2nd ingredient on the label. I would avoid a shampoo that has only betaine. These don't clean very well.

My Husband and Daughter have Psoriasis/eczema. What soap should I buy for them? Thank you.

dogpoopfight
My recommendation would be to consult your dermatologist to determine what is best for your husband and daughter.

Hello, Can you tell us some ingredients that we should be aware of, that may be harmful or unnecessary in products such soap, shampoo, conditioner and body wash. An example being fragrances as it most likely causes irritation, and does not contribute to the effectiveness of the product.

numzz
Probably the worst thing that can happen is that the products you use clean too well. For the skin, that means skin or scalp irritation, skin redness, dry skin. If that happens, I would a shampoo or body wash with mildness claims on them. There are many. After a while, for shampoos, you'll probably notice that there will be some build-up on the hair. Then use a cleansing shampoo, or a milder body or facial wash.

My husband and I have a roommate and I think he uses my husband's soap. How gross is this? To offer clarity, I'm talking about shower/bathing soap, not hand-washing soap. And I'm really serious, I'm wondering about microbes, fungus, and all other scientifically gross things that can happen from sharing soap. Thanks!

misscpb
I'd say, he should get his own bar of soap. Either that, or get a body wash!

I recently found out that my roommate was using my bar of soap. I was grossed out by this, as I feel like you said it is a personal thing (aka buy your own darn soap).

People seem to be divided on the 'ick' level of this - some say it's soap so it basically cleans and de-cooties itself, while others are on my side and think that it is just gross.

So science (represented by you fine scholars) what say you? Communal soap? Or soap is an individual thing?! Does soap in fact 'clean itself'??

JayBeCee
I'd say, he should get his own bar of soap. Either that, or get a body wash!