THE FAMILY PHARMACIST

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THE SCIENCE OF DEGERMING YOUR HANDS AND CLOTHING

By now, you probably think you've heard as much about washing your hands as you want to hear. But the simple truth is, the best way to prevent infection from the coronavirus (COVID-19), or many other diseases, is to wash our hands frequently. Up till now the information has focused on the length of time and the mechanics of handwashing, that is, wash for at least 20 seconds, scrub under your nails, etc. However, understanding a little more about the science of cleaning agents is a good way to motivate oneself to develop effective and life-long handwashing hygiene. So my hope is that the following information adds a little more to what you already know.

Basic hand washing includes nothing more than soap and water. "Soap" has become the term we use to describe most cleaners of any kind, used, in particular, to wash our hands. And we often use the words "soap" and "detergent" interchangeably. But are detergents the same as soaps? And how do each of them work?

Germs (viruses, bacteria and other microorganisms) remain on skin surfaces largely due to oils on our bodies. While the palms of our hands don't secrete oil (from sebaceous glands) our fingers do, and they pick up more oil from touching our face, forehead and chin in particular. Microbes adhere to this oil and other grime on our hands. So how do we eliminate the germs?

SOAP A genuine soap is not the same as a detergent. They are similar in ways, but there are significant differences. A little chemistry is necessary to explain. Soap is what happens when you mix an alkali like lye (sodium hydroxide) or soda ash (sodium carbonate) with a fat from an animal or plant (coconut, palm, olive, etc.). So true soaps are made from completely naturally occurring materials (fat and alkali). Early soaps were relatively coarse formulations and had the simple, basic property of lifting dirt and grime from a surface. While modern soaps have improved dramatically in purity and quality, it is important to note that soap is not bactericidal (bacteria-killing). It simply *removes* rather than kills skin bacteria. That being said about bacteria, some researchers believe that soaps and detergents are able to inactivate viruses on the skin, like coronaviruses, because viruses are more susceptible to the way soaps and detergents can disrupt the fatty molecule envelope that holds viruses together. Soaps are said to *inactivate*, rather than "kill" viruses, because viruses are not thought to be living entities. In either case, a vigorous soapy cleansing has to be combined with lots of running water to briskly remove and wash away skin debris and microscopic particles. This is the most effective way to degerm our hands

Because soaps do not kill bacteria some manufacturers have added an antibacterial ingredient to their product. This is ***not*** a good idea. Studies have shown that there is no benefit in doing this and it may even cause harm to the environment and humans, due to the possibility that some of these ingredients may contribute to making bacteria resistant to antibiotics. In 2016 the FDA issued a ruling banning 19 antibacterial ingredients in soaps. The final FDA rule stated that "OTC (over-the-counter) consumer antiseptic wash products (including liquid, foam, gel hand soaps, bar soaps, and body washes) containing the majority of the antibacterial active ingredients will no longer be able to be marketed." But three antibacterials were granted a deferred ruling and may still be found in some soaps. Even so, if a soap is labeled "antibacterial," you're still better off not buying it. It should be noted that this FDA rule does not apply to antibacterial soaps that are used in health care settings, such as hospitals and nursing homes.

Even though true soaps use natural ingredients and are very effective for hand and body washing, there are disadvantages that limit the use of soap for other applications. When soap is used for general cleaning, it needs to be rinsed well with clear, clean water after an application or it will leave a film. Soap doesn't like hard water (water that has a high mineral content). In hard water soap forms scum. Soap scum can ruin fabrics, clothing and other surfaces. For these reasons synthetic detergents have become more popular with consumers today.

DETERGENTS Whereas genuine soaps are made from natural ingredients, modern detergents are synthetic (man-made). A detergent removes dirt and grime from a surface by dissolving, suspending, or emulsifying it. Detergents are more soluble in hard water than true soaps. And manufacturers add other ingredients to detergents to enhance their ability to clean things, like dishes and laundry. Detergents usually contain added surface active agents (surfactants), which lift dirt, grime and oil from the surface of an object. While a detergent loosens soil in a clothes washing machine, setting a water temperature of 140°F (60°C) will kill bacteria and inactivate viruses. This is especially important for bedding and towels.

IMPORTANCE OF WATER Both soaps and detergents will not work without water. Water has properties that make the hand washing exercise amazingly effective. For example, water can dissolve soaps and detergents in a very special way. Both soaps and detergents employ long chains of connected carbon and hydrogen atoms with one end that likes water (hydrophilic end) and the other end of the molecule that wants to avoid water (hydrophobic end). The hydrophobic end is attracted to oily grime and dirt, while the hydrophilic end will stay in solution in water. During washing, the soap or detergent molecules arrange themselves in tiny clusters (around the dirt and microorganisms) that chemists refer to as *micelles*. These spherical-shaped clusters keep the dirt and germs in the center of the micelle. Water, due to its unique properties, keeps the micelles suspended so that they can be carried off by the

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mechanical force of agitation (hand washing or washing machine) and a continuous flow of more water.

In the past some professionals have recommended the use of very hot water to clean hands with soap, claiming that it is more effective in degerming. However, recent studies have shown that water temperature has no effect on the reduction of micro-organisms during handwashing. Water of any temperature will do. But it makes sense that the temperature of water used for hand washing should be guided by comfort, which is in the lukewarm range. This will make it easier to achieve the minimum twenty second recommended wash time.

One last step in the process of handwashing. What's the best way to dry your hands? Results of studies are conflicting, but whether you use paper, clean towel, or blow dry, make sure you dry them. Germs can be transferred more easily to and from wet hands.

References on file

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