The Meaning of Cleaning

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Guests
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Introduction
Lather, rinse, and repeat – an insight into early chemistry. **In this month's episode of #FinallyFriday we dive into the history of soap, debunking soap origin myths and breaking down the science of making soap.** From sourcing specific wood ash to hunting down ancient recipes, our two experts explore all the factors that are needed to create a good bar of soap. **Sally Pointer** is an archaeologist and freelance heritage educator with a background in museum education and teaching traditional skills. **Dr Sarah Robb** began making honey soaps and beeswax creams after leaving academic research in 2003.

Transcript
It's the first friday of the month, which means that it's time for the next episode of #FinallyFriday, bringing you insights and discussions from around the world focussing on experimental archaeology, ancient technology, archaeological open-air museums and interpretation.

Jess: Hello and welcome to #FinallyFriday. My name is Jess Shaw, and today I am joined by two specialists from our EXARC community, focussing on the history of soap and how it came to be.

Sally Pointer is an archaeologist and freelance heritage educator with a background in museum education and teaching traditional skills. She has recently completed an MSC in experimental archaeology at the University of Exeter, where she is now an honorary associate research fellow. Her research interests are diverse, and she's currently working on projects that explore early textile tools and bast fibres in prehistory. She has an ongoing interest in the development of cosmetics, perfumes and soaps across time, and is also working on a book project to explore the history and archaeology of soap. She regularly teaches workshops on ancient skills and traditional crafts, and can often be found in costumed interpretation and audience engagement at heritage sites. She also uses social media and YouTube to share projects and tutorials on a wide range of topics. The origins of soap have been clouded in myth and misinformation for a long time, and a major project within her MSc and currently being prepared for publication, explores the probable scenarios in which true soap was first observed in the ancient world.

Dr. Sara Robb began making honey soaps and beeswax creams after leaving academic research in 2003. Formulating for nearly 20 years, Sara's recipes are available in books, ‘Dr. Sara's Honey Potions Beauty and the Bees’ ‘Making and Selling Cosmetics: Honeycomb Cleansing Cream’, and numerous journal articles: British Beekeeping Journal, BeeCraft, BBKA News, Bees for Development Journal. Dr. Robb has a keen interest in teaching others to formulate cosmetics, running workshops at the British Beekeepers Association Spring Convention, and the National Honey Show and helping small producers by providing cosmetic product safety reports. Dr. Sara Robb is a VUB Certified Safety Assessor, member of the Society for Cosmetic Scientists and the Cosmetic Toiletry and Perfumery Association.

Thank you for joining me and I'm really looking forward to this episode. So to start off, how do you define soap?

Sara: Oh, soap. What is soap? That's really an interesting question and I think we can divide that maybe into two areas. We can think of soap as a molecule, and we can also think of soap as a cosmetic product or a product that can be used in other areas, to clean. In both cases, the chemistry for making soap is the same. If you imagine that you have your fats or oils there are certain molecules in those that are called triglycerides and soap is made by reacting an alkali with these molecules. To give you a more visual kind of idea of what's happening when you make soap, if you imagine that your oil or fat is an ocean and swimming around in that, there are all these little jellyfish, and so the domed shape, the body of the jellyfish, is actually a molecule of glycerin. The jellyfish also has three tentacles hanging down, and these three tentacles are the fatty acids and those are actually what become soap when we have the chemical reaction saponification. So I often call the hydroxide a pair of scissors that would come and cut the molecule. But in our analogy, let's

imagine that we have some sharks swimming in our ocean and that these are the alkali. They come along, they're not very nice sharks, they're going to be very mean to our little jellyfish. And they're going to come along and cut the little tentacles off the jellyfish. And what we end up with in our - what was once oil - is glycerin floating around the little bodies of the jellyfish and soap molecules floating around. So now we have these three soap molecules. Depending on the concentration, this soap can be used for cleaning or it can be used for other functions. So when we think of a bar of soap, it is primarily made up of the soap molecules and glycerin. However, soap used for other reasons might be less concentrated, and I think we may talk more about that later.

Jess: Fantastic. I really love that description, that's a really nice analogy. So, we take it for granted, but why might experimental archaeology find soap interesting?

Sally: Soap is one of those areas that we take so much for granted today, but we forget that humans have been interested in keeping things clean. They've been interested in cosmetic processes, and they've been interested in what we today would call chemistry and science, for an awful lot of years. So when you start looking at the history of soap, partly it's a story of how modern chemistry comes into being, but it's also a story about the similarities as well as the differences between the people we are today and the people we were a few thousand years ago. Often when you start exploring the archaeological record, you'll find there are far more similarities between our earlier selves and us today than you might expect. And one of those things is that we like clean clothes. We like clean bodies, we like to think that we're looking attractive and some of the cosmetic preparations that we very much use every day today can be traced back a hugely long time. However, even though we know that there are those similarities, finding out exactly what happens when is a bit more of a detective story and experimental archaeology can really help us fill in the gaps between what has been recorded in the documentary record and what we can excavate in the physical archaeological record.

Jess: Fantastic and so true. I really love the commonalities.

Sara: To follow on that, I think you can also, just as Sally said, if you look at experimental archaeology and science and you look at formulation of both cosmetics and pharmaceuticals throughout history, you will find, if you look back to the Ebers papyrus, you will see the formulations in that and the ingredients in that are very similar to the things through history, the same ingredients making the same types of products that are to clean or to adorn. So this whole process really is a scientific journey exploring through time what's been happening and becoming more competent at making these things as we learn more about all of the ingredients and the molecules.

Sally: One of the things that you find when we start looking at soap throughout time is that our modern understanding of what happens in the past is very clouded by myth, misinformation, just stories getting confused as the years go by. One of the things I've had a

lot of fun with recently is trying to explore some of the stories that people have conjured up to explain where soap probably came from. The really fun thing is we can prove that almost all of these are completely wrong.

Sara: One of the things I have always read as a soap maker when I started making soap was this idea of there being some kind of animal or human sacrifice, and then the fats of the human or the animal getting mixed in some water that happened to be by a fire. And now you've got this bubbly stream that we can wash our clothes in, for instance. I'm sure Sally can comment on that. I think that seems to be a really prevalent myth about the origins of soap.

Sally: Definitely, there are a couple that turn up over and over again and they turn up being repeated by actually very, very competent writers on science and soap and the evolution of ideas. But you can test them and work out that they don't work. So you had two different myths in your recollection there. The first is often described as the Mount Sapo idea, and this is a story that says that there's a mountain somewhere near Rome. I'm not sure if it actually exists or not, called Mount Sapo, on top of which there were sacrificial pyres to the gods. So you'd create your offering, kill an animal, burn it on the pyre so that the fumes would rise up to heaven. And while you're doing that, fat will render out of the carcass, drip down into the fireplace underneath, and then being on a mountain, this will trickle down the mountainside with the aid of rain. And at the bottom was an area where wash women apparently did their laundry. Now the theory is that the fats and the alkali caused by mixing the ashes with the rainwater would give you conditions that would create soap. But we can test this experimentally. There was a researcher called Hedge back in the nineties who had a great deal of fun testing some of these myths, experimentally. He didn't actually build a funeral pyre on top of a mountain, but he did use a dustbin lid with essentially a roast dinner that he set fire to in it. And then checked just how much fat, how much ash and what happened when you then let it get rained on and things. You can demonstrate scientifically that although you may have the ingredients that you need, so you need fat and alkali as Sara explained earlier, what you don't have are the right conditions. It's a little bit like saying to somebody who's never done any baking today “oh making a cake is really, really easy. You just take flour and fat and sugar and eggs and you've got a cake”. Well, it might be the right ingredients…,

Sara: … but Sally, I could use the same ingredients and I can make cookies! I don't have to make a cake!

Sally: Yes and this is exactly the point. It's the conditions, isn't it? It's not the ingredients that's the issue. We can find lots of scenarios where we've got the ingredients. Another one that's very popular is the campfire cleanup theory. And this goes along the lines of: there you are, roasting your mammoth by a campfire and all your cooking equipment is getting lovely and greasy. So at the end of the day, being sort of tidy-minded cave people as we are, we want to clean up so we rub all of our greasy equipment with ashes and then rinse it off in

water, and you've got lovely clean cooking gear and a nice mammoth roast. Now again, you've got ingredients that you need. You've got your fats, you've got the means of making alkali. You've probably actually done quite a good job of the washing up. It's not actually gonna give you soap. It's a little like Sara is saying, the same cake ingredients could make cookies, or they could make scones or they could make a Victoria sponge. It's how you put it together that's important. And this is one of the areas we can test using experimental archaeology. And even if we can't pin down an actual reference that says this is the very first time and place that we made soap, we can go looking for the right scenario that would allow people not only to put those ingredients together in the right proportions and in the right conditions, but possibly more importantly to see results in a form that makes people go “oh, something interesting is happening there, wonder what this stuff is…”. And more importantly than that, because accidental discoveries happen all the time throughout history, a one-off chance discovery is one thing. But if somebody goes “oh heck, that's ruined my soap”, and just chucks it away, well, it's not really discovery. You've just got a ruined batch of soap. For somebody to then say “oh, this stuff that we've discovered that does something interesting. I wonder if I can do it again”. And then somewhere down the line to say “we've done this so many times now that we can do this any time we want to”. Then you're starting to get a new discovery. We can tell when this doesn't happen, and we can tell when it does, but it's that gap in-between.

Sara: I think something interesting there too is that we consider making soap a craft and certainly making cake is a skill as well. And so you could give those same ingredients to different people and someone will have the intuitive skill to make it into soap and someone else won't. Probably this was passed on in a way where someone did figure it out and was able to repeat it and then they were competent at making soap. But what's interesting is if you look at old recipes or if you look at old texts, they may list ingredients that could be combined to make soap, but it's the experimental archaeologist's job to figure out how would they actually do that. I think it's important not to be influenced by our preconceptions of today because we need to consider that they may have done things differently and the idea that they could take those ingredients and make soap, someone using a specific method could very well do that. Whereas other people using today's knowledge may not get the result and may end up with something that they would consider as a failure and reproducing that product or making that product.

Sally: Yeah, absolutely right, completely agree. When I was exploring this potential earliest history of soap fairly recently, I drew up a fairly immense table of references to what today we would probably call ‘proto’ soaps. There are a lot of references in the ancient world. I'm talking places like Sumeria, Babylonia, Egypt, roughly 4,000 years ago, where there are a lot of documented references to mixtures of oils and alkali. So sometimes the alkali will be potash, it might be natron, it might be an organic alkali, like wood ashes. Frequently, it's not explained which alkali in question, but these are mixtures of oils and alkali that are listed as cleansing pastes and yeah, they absolutely work. If you just mix a reasonable quality of alkali

with a reasonable quality of fat, you'll get something that feels a little unusual to our modern taste, but will absolutely cleanse. What they're not though - and this is why they're proto soaps - they're not actually soaps because the reaction hasn't happened, and I'm sure Sara can explain more about why a chemical reaction's so critical.

Sara: This is really, really interesting to me. We actually make products very similar to this today. But if we look back, look at the experimental archaeology of these proto soaps, I would say that this reaction between the alkali and these fats and oils, we are making soap molecules, but we are not making soap. One of the methods that we still use today to make cleansing creams is using a very dilute alkali solution and adding that to fats to make enough soap molecules to act as a surfactant, to make an emulsion and to make a thickened product that won't bubble when we use it. So we don't recognize it maybe as soap itself, however, the molecules are still there. It is a cleansing product, and this proto soap, I would argue, could be the very first cleansing cream.

Sally: I completely agree. I'm thinking in particular of a recipe that I'm sure you know very well, Sara. It's one that's in the Ebers papyrus, so 16th century BC and it essentially recommends that you mix oil, honey, a natron into a mash, which you then pound into, well, it translates as a plant puree, into a sort of an aqueous plant extraction. I'm fairly sure that you'd agree with me that this is going to make some sort of aqueous cream that probably doesn't foam. But that alkali element, the natron, helps emulsify it into something that's probably actually quite a pleasant cream to use.

Sara: Yeah, I agree a hundred percent and I would love to recreate that. That's one on my list.

Jess: May I interject and ask what natron is?

Sally: Natron is a naturally occurring alkali salt. It's not a million miles from things like bicarbonate of soda. It's not quite the same, but it's not a million miles from that. And a lot of people today will have come across it as one of the ingredients that we used in embalming mummies, in ancient Egypt, it's used as a desiccant and a preservative…

Jess: Fantastic, multi-purpose!

Sally: … so lots of lovely overlaps with these ingredients.

Sara: It's probably a very weak alkali. I can imagine a situation where you mix that with water and oils or fats and you can make an emulsion. But similarly thinking about this even further, let's say we have some potash. We make a lye with ashes and it's a very weak solution. If we mix that with fats and oils, then I think we also will get an emulsion. It might be a bit gray and may not look fantastic, but I think that that could also be used as either a moisturiser or a cleansing cream or something along those lines. So I think when we look back, maybe

people are trying to take proto soaps and fit them into what we believe soap is today. Maybe it wasn't soap as we call a soap product, but it did contain soap molecules and was used for cleansing.

Sally: One of the things that we can trace is the point at which we do start seeing what we would call true soaps in the documentary record. So we go back 4,000 years ago to the Mesopotamian world, and we have all these different types of proto soaps, some of which are industrial, they're listed as for scrubbing floors or for cleansing wool, some of which are cosmetic, like the one we just talked about from the Ebers papyrus. Come forward a couple of thousand years in time, once we're into the Roman world the documentary evidence suggests that true soap is known about. Several writers talk about it as options for both cosmetic purposes and as medical options. People like Pliny even talk about it in terms of almost a recipe. So there's a very, very famous quote from Pliny where he says that soap is an invention of the Gaelic peoples for making the hair red. It's made from suet and ash, and the best was from beach ash and goat suet, comes in two kinds, thick and liquid, both used among the Germans, more by the men than by the women. Now this is almost a recipe. He's not only telling us what type of fat to use, he's telling us what ashes to use to create the lye source. But even more interestingly, he's saying very specifically, this is a cosmetic preparation. It's used for the hair, very popular with men because as we all know, men are far vainer than women when it really, really boils down to it…, particularly in the ancient world, no generalisations here at all! But it comes in two kinds, thick and liquid. People have worked out the difference between hard and soft soaps, which means that they're capable of manipulating lye sources. So somewhere in that 2000 years, something happens…

Sara: Something that's really interesting to me about what you just mentioned, Sally, is soap as a pharmaceutical, and this is a really important part of soap's history. The same methods were used to make pharmaceutical soap and in fact, for many of the earliest pharmaceuticals, soap was a basis or a component in the pharmaceutical preparations. They also, for pharmaceutical soap, knew that you could use different lye sources to make soft green soap, for instance, or bar soap and they were used pharmaceutically in different ways. There's this vast overlap of cosmetic and pharmaceutical preparations where you could argue that for a very long time they were very much the same. And then cosmetics branched off from pharmaceutical preparations.

Sally: Absolutely. There are so many overlaps between what we today would think of as being very different areas of human experience. Today we very, very rarely think of the cosmetic industries and the medical industries as being closely aligned, unless you're going for something like cosmetic surgery. But they are part of the same set of understanding research, ingredients and experiences. When we try and trace what's happening, it's really important that we keep a very open mind about where to look for evidence. I did a little bit of work recently trying to find a plausible scenario for the first observation of true soap in a setting where not only was it likely to be happening in a repeated fashion, so over and over and over again, but also where it would be observed by people who understand the

ingredients well enough to be able to say “something interesting going on there. There's definitely something interesting going on. Now that's a bit different than what happens in other situations. And we can do this deliberately and we can make use of it”. I think I've got a reasonable scenario where we start moving away from proto soaps and into true soaps. And again, this is within this wider batch of industries. So for soap to form, we not only need fat and an alkali, the alkali must be in a form that's accessible to the fats, and that usually means that it's in solution. It doesn't have to be, but it usually means it's in solution. Just mixing dilute lye and fat together may give you a few molecules of soap at the points of contact, but it's not gonna give you a huge amount. What you need for true soap to form are the right ingredients in the right qualities and quantity, but they have to be combined in a setting that generally involves heat, agitation, time, and enough of everything for them to really come together. So this gives us a very specific setting that things happen in. And we think we can pin it down because in the ancient world, there is an extremely well-developed perfume industry. This is very, very well documented. There's an awful lot that was written down both at the time, but also in modern research about how the perfume industry in the ancient world works. So we know about their ingredients, we know about their recipes, we know about their methods, and one of the key methods is to soak perfume ingredients in fats, and then you strain them. You strain them through cloth. We're talking 4,000 years ago. Cloth is a very, very valuable commodity. You are not going to strain your fats and chuck away the piece of cloth at the end of it. That needs degreasing. Coincidentally, at the same period in time, there is a professional laundry industry, and this is also documented. We can trace that launderers can be professional. They even note down the sorts of pots that they're using and the sorts of settings that they're working with. Now, if you take your greasy cloth that you've strained your very precious perfumed oils through and you want to get it clean, the best way to get it clean is by boiling it in a lye solution. Now that does give you the conditions where you will see soap, and we can test this experimentally. I've done a series of experiments with different strengths of lye, different sources of lye, different types of oily cloth and the amount of lye that will give you the cleanest cloth will also give you the best bubbles on your pan of laundry. But what's really, really important is it doesn't just happen once. It happens every single time you do this and launderers, because they're used to getting things clean, are a body of people who are able to look at that and go “oh, now that's interesting. Even though I've just washed that pan of greasy cloths, the stuff that's left over afterwards is actually better at cleaning than the raw lye was to start with”. So I think we might have it. I think we might know where real soap is first observed.

Sara: You can explain this chemically because each oil or fat has something called a critical micelle concentration. We have talked about how if we have a little bit of lye, we end up with a few soap molecules. Those few soap molecules do not form what's called a micelle. And what a micelle is is the little soap molecules forming a little circle, and that little circle, or micelle is what is necessary for soap to bubble and for soap to clean. So there's a critical concentration for each oil, fat to make micelles. And so what's happening is as you put that cloth in the lye, you are making enough soap molecules to reach that critical micelle

concentration. And then you have the formation of bubbles and the opportunity to use that product as a cleanser to clean other things. If it's too dilute, we won't have that formation of those little spherical compounds of soap, and we will not have any cleaning function. And so Sally, your experiment in the archaeology of soap shows that under these conditions we can reach that CMC value or level, and we really are having soap forming in that pot as a cleaning product.

Sally: It's absolutely fascinating how we can use modern science to explain something that people were observing through trial and error and empirical experience thousands of years ago. We're talking a 4,000 year gap between this potential scenario and the work that Sara does today as a cosmetic chemist. But they are directly linked. There is very similar things happening. We just have very different ways of explaining them today.

Sara: I would say that they are scientists. I think that everything we do is science. When you make soap, when you make a cake, you are a scientist. You are the person who has that special talent for always making that cake come out beautifully. They have very skilled hands and are good at the practical side of science. People ask that question. The launderers asked: what is this? What are these bubbles? Can I use these bubbles to clean other items? This all is very much a progression of science. And as we understood more and more, then we were able to kind of harness that information and perfect making soap.

Sally: Yes, it is very much part of an ongoing story, isn't it? Because if we look back to most of the early history of soap, it's very much reliant on inconsistent lye sources. So you might be using potashes, wood ashes. If you're using ones from softwood plants, you're gonna get a different quality of lye from if you're using hardwood plants. If you use ashes that have come from plants that grow near the seashore, they're rich in salts, you're gonna get a different quality of lye, which can then lead to hard soap rather than soft soap. It takes until the end of the 18th century before we can chemically synthesise lye sources, which then allows us to use what was we think of today as a modern scientific approach to making soap. Up until that point, yes, they're absolutely using science, but I think you could argue it's an art more than a science because it relies on understanding your ingredients, understanding the materials, and adjusting the working practice for every single batch to get what you need. Whereas today scientists like Sara can understand the ingredient so very specifically that you can guarantee a batch will come out the way you intend.

Jess: You mentioned the different ashes from the different woods can affect it. Is there one that you found is particularly good for making soap?

Sally: Hardwood ashes generally are great. So even Pliny, he talks about beach ash. Well, beach is a high quality hardwood and it does give very, very pure ashes, which give a good quality of potash. If we look back at port records from the medieval period through the Tudor period, probably a bit later as well, the demand for high quality soap in Britain is so high that

we are not producing enough ashes of the right sort. We import them, we import barrels of ashes into Britain so that we can make the type of soap that modern commerce is demanding at that point.

Sara: Interestingly too, if we look at the history of lye, even after the scientists were able to synthesise lye, it was still very, very inconsistent. And if you look at the historic formulations, they are not written in a percentage kind of value. They use something called a hydrometer where they actually measure the density of the liquid, and that's how they know whether or not the lye solution will be strong enough to make soap. And I know that Sally can tell a story about soap makers using the same idea of the density of lye prepared with ashes in a different kind of hydrometer. One we all have in our kitchen.

Sally: Absolutely. When we look back at early soap references, one of the ways of telling whether your lye is strong enough is to see if it's strong enough to float an egg. And that egg is acting as a hydrometer that many of us will have done this in our kitchens day to day. If you've got a batch of eggs, you think “oh, I should've used these eggs a while ago. Are they still fresh?” Well, there's an old trick where you put an egg into a large glass of water. If it sinks and sits at the bottom, it's still good to eat. If it floats, there are too many gases changing within the body of the egg. It's probably not worth eating. Lye has a different ability to float an egg. So if you can float an egg so that a patch about the size of what we today think of as being a small coin, a 10p piece perhaps shows on the surface, your lye was strong enough to make soap with. The other way to check is to see if it will dissolve a feather. Now the fact that it dissolves a feather tells you how careful you need to be in your day-to-day working practice, because if it'll dissolve a feather, it's doing some quite unpleasant things to your skin. But having said that, one of the classic ways that the old soap makers check on the progress of a batch of soap is to taste it. Which sounds horrendous, doesn't it? It sounds like the most terrible thing you can do, but you do it incredibly carefully. You take the most minute speck on the tip of a finger, and you just touch it to your tongue. And if you've ever used your tongue to taste food while you're cooking, you can tell the difference between salt and sour and spicy incredibly accurately, and your tongue can judge relative alkalinity, but you gotta be careful because otherwise you end up burning the tip of your tongue, which is no fun.

Jess: I'm guessing you don't do this in your practice, Sara?

Sara: Well, actually I have to admit that I have done this because I have read these stories and it actually works. If you very, very carefully just take the tip of your tongue and touch soap, if the soap is neutral, there won't be kind of this, it's called a zap test, is what I think I remember it being called, you won't feel that zap. But to put it into context, it is somewhat dangerous, but we also would put a lemon to our tongue. So a lemon rather than being an alkali it would be acid. We would do that and we can taste, we can feel that zap as well. I wouldn't recommend it, certainly soap also tastes very bad. That's why old mothers used to

say that they would rinse out their children's mouths with soap. It's an unpleasant experience. But certainly you can feel that zap, but if it is still alkali and if it's neutral or closer to neutral, because it never really is neutral, then you won't feel that zap.

Jess: I love that, thank you. You've both been talking a lot about hard and soft soaps. What's the difference between them?

Sara: Okay, I'll do the chemistry first. The difference between a soft soap and a hard soap is actually the metal that is in the soap. So if we use potassium hydroxide, we get a potassium soap. Potassium soaps tend to be softer. They tend to absorb more water. If we use sodium hydroxide, we will have a sodium soap, and those soaps tend to be more firm and also do not absorb as much water and they tend to actually lose water, which is why when we make sodium soaps, many people cure their soap. They are trying to get rid of this water, whereas that doesn't happen with potassium. But interestingly, you know, when we're talking about using ashes and things, other metals in the ashes will also form soap. So we can look at some historical publications from scientists and they will have done experiments looking at magnesium, calcium, even lead soaps. All of these metals can form soaps. But when we think about hard and soft soaps and soap in general we really tend to think about sodium and potassium soaps. Potassium soaps are soft, sodium soaps are hard.

Sally: In craft practice, historical craft practice, the way that generally translates is that if you take wood ashes from inland trees, so the sorts of things that you might get out of a domestic fireplace at home, you are likely to end up with a potash lye. If you use plants that have been exposed to salts on the seashore so that might be things like glassworts, but it might also be things like seaweed, you're gonna end up with salt in the mixture and that is pushing you towards a sodium lye. People worked out that salt was this magic ingredient very early on. I would argue that it's highly likely that that quote from Pliny about hard and soft soap suggests that that has been worked out by that point, and it can be achieved as simply as making a big batch of a potash lye soap, so from ordinary hardwood ashes, and then putting in brine or salt in the second stage of cooking. That will change the nature of the soap completely. The result will be something that's solid and you can cut.

Sara: And actually, that's exactly the method that the scientists in these historic publications that I'm referring to prepared the other metal soaps. It's very difficult to make, for instance, a calcium soap or a lead soap, but you can swap out the metals by making, for instance, a potassium soap and then putting in a salt that has calcium or has magnesium or has lead. This knowledge can be seen in craft as well as scientific studies.

Sally: It used to be believed that the chemical reaction was going to continue for a very considerable amount of time after getting your soap to nominally done, and I think that is very much a hangover from the days where you could get it very, very nearly there in the pan. But then time would just let it finish up, as well as the evaporation. Using the methods

that Sara's working with today so much of that can be bypassed to the point where, Sara, I think you often teach people how to make soaps that can be used the very same day that you make them.

Sara: Yes, that's right. I wanna pick up on one thing that Sally just said. People did think that that saponification reaction or the chemical reaction between the hydroxide and the fats and oils continued during the curing process. But now we know that for the most part, that is nearly completely finished and that the curing really is just this evaporating of excess water in order to make the soap hard. The method that I teach, I call same-day-soap, and it simply is reducing the amount of water so that we do not have to wait for all that water to evaporate. There are some historical studies that show that to make an ideal soap of any metal salt, there is a specific amount of water that is necessary to form a colloidal gel. This may be going off too far on a tangent, but what that really means is that if you start with that amount of water the chemical reaction happens. You don't need to evaporate the water, and you have this beautiful colloidal gel of soap that already has micelles formed inside of it, and it can be used and it will form lather immediately after it cools. So there is no reason that you need to actually wait for this to cure, for instance.

Jess: Fantastic. Do you guys have anything else you want to add or explore?

Sally: The history and archaeology of soap is definitely an area with a lot still to discover. We are starting to understand how people went from the very earliest observations of the properties of fats and alkalis were mixed together, to being able to observe true soaps, to a later point, being able to produce both hard and soft soaps. There is still a gap in between. There's a 2000 year period where we know something is changing. It's going from something that is being recognized and probably used repeatedly within a laundry setting to something that is being produced in a format that you could put into a jar or a bar and use for cosmetic purposes. There's clearly still work we can do to try and narrow down exactly where that happens. And at the other end of the spectrum is the work that chemists like Sara are doing to help us completely understand what's happening. When as modern crafts people or small scale enterprises, we mix different lyes with different fats to be able to develop exactly the products that we want today. And they are related. I absolutely love the idea that when a modern craft soap maker develops a new recipe, there is a direct link to wash balls being made in the 16th century, to Castile soap being made in the 13th century to laundry soaps being made in the eighth century, to the Romans or the the Gauls rather, washing their hair with goat fat soap to increase the red highlights 2000 years ago. And then a direct link to people who we can almost struggle to imagine 4,000 years ago, doing laundry to rescue very valuable cloth from the perfume industry so that the cloth can be reused again. It's an unbroken story and it's one that's very much still happening.

Sara: Absolutely. I think it's so fascinating to me and as somebody who is now using a modern method, I learned so much by reading the history and looking back at what people did. I'm sure that I will go back and try and reproduce more of these historic formulations.

Maybe do my own experimental archaeology in my kitchen.

Jess: Yes. I remember you mentioned prior to recording that you wanted to be an archaeologist in your childhood, and I hope that you realise that you can participate in archaeology and contribute to experimental archaeology, even now. There's no limit, which is fantastic. It's such an interdisciplinary subject.

Sara: That's right. When I was a child I guess it was watching the Agatha Christie films. I thought it would be so fantastic to be an archaeologist. But I grew up in the Midwest of America, in Iowa, and in the summer we had 80% humidity and the temperature would be maybe 40 degrees. And I really didn't like the heat. And the other thing, my parents used to take us on camping trips where there were no campsites. So it was out in the dirt and I hated to feel really sticky and dirty. And I thought, well, I really can't be an archaeologist. Fast forward to present day, and I discover Sally Pointer, who is a soap archaeologist, and I think I really missed the boat there. But unfortunately that position is already taken. So I have found my own path, but no one told me that I could be a soap archaeologist. Very, very cool type of archaeology, I think.

Sally: There's definitely room for more than one of us. You can definitely be a soap archaeologist too!

Sara: Thank you!

Jess: Fantastic, I love the variety. Thank you so much for the interesting discussion. It's really exciting because this is really new research that hasn't yet been published. As a final question, kind of linking to what you've been talking about: what are your plans for the future and how can the EXARC community help to make a difference in regards to the points you discussed today, is there anything we can do?

Sally: Well, I'm hoping to publish an outline of this project in the EXARC Journal. I think it is an area where the very huge diversity of people within the EXARC community are in a really good position to keep an eye peeled for those missing references. I'm sure in that missing 2,000 year gap, there are some shreds of evidence about what is happening where in this interesting growing understanding of the chemistry of fats and alkalis and I wouldn't be at all surprised if it's somebody within the wider EXARC community who spots it in a totally different piece of research and I just hope they're remember to flag it up so I can spot it too.

Sara: For me one of my interests is the history of bee products in pharmaceuticals and cosmetics, and in addition to that, as you can tell, I'm very, very interested in soap. One of the things that I have been spending time researching is the history of pharmaceuticals going back as far as I've been able. What I find is that there is this incredible similarity and crossover between cosmetics or craft in a community and what was used to prepare medical formulations. I'm interested in how soap was developed in that sense and looking back further and again, trying to find these missing pieces that will bring it together. And I really

think that, on Sally's side with the archaeology of soap and then me looking at the history of soap in pharmaceuticals, that there is kind of this connection. One of my obstacles is really, a lot of the early medical texts are in Latin and I don't speak Latin and so that's quite difficult. But perhaps I should be looking at experimental archaeological texts or going back and looking at other things to look for this information because there wasn't this clear definition, a division between pharmaceuticals and cosmetics or soap used for cleansing purposes, cosmetics or pharmaceuticals.

Jess: Fantastic. Well, thank you very much, Sally and Sara, for joining us today and sharing your experience and expertise. I know I certainly learned a lot and I'm sure our listeners did too. So thank you. And thank you to everyone else for listening to this episode of #FinallyFriday by EXARC. If you would like to become more involved with EXARC, why not become a member? Alternatively, you can make a small PayPal donation through the website to help support EXARC in its endeavors.

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