Mannequin Moulage

by

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7.0 Mannequin Moulage

First, a few general comments about mannequin moulage. This chapter is for mannequin's only. For moulage techniques that can be used on people see my Casualty Simulation Techniques Guide.

Stay away from cheap Halloween prosthetics; these may contain plasticizers and dyes that can migrate into the mannequin's skin causing permanent discolouration. Unknown or off-brand makeup may contain dyes which will stain. Cheap makeup is usually not very cost effective either since the pigment level is very low (professional makeup often has a pigment level approaching 50%)

Always test makeup on a small, hidden area on the mannequin to be sure that it will not stain the skin. Be aware that most mannequins are made from more than one type of plastic; what might not stain one type of plastic may stain another type. Soft plastics seem to be more susceptible to staining than hard plastics.

Before beginning mannequin moulage make sure that any surface dirt, oil, or adhesive has been removed. For Laerdal and Life/form® mannequins, I have found that Goo Gone® gel cleaner does a good job. Before you clean a mannequin always read the directions that came with the mannequin. Check with the manufacturer before using **any** cleaner since some mannequins need a specific cleaner. Gaumard HAL mannequins, for example, should **not** be cleaned with Goo Gone® or similar cleaners. Some cleaners contain solvents which can soften, deform, or even dissolve a mannequin's skin.

Sometimes mannequins, especially older ones, can develop a sticky or oily surface from plasticizers used in the manufacturing of plastics. If you have a silicone or vinyl mannequin which is exuding plasticizer from the skin, wash the skin with soap and warm water, then lightly powder with baby powder.

I try not to use petroleum jelly and similar substances in simulation. Petroleum jelly and other grease do not easily clean up with plain water and can leave a slippery film on the floor and other surfaces which can be a slip hazard. Petroleum products can damage latex which is still used in some mannequins. Instead of a petroleum product, use a water-based lubricant like Muko.

In most cases I dislike using regular food items in simulation. Over the years I have come across several unfortunate instances of items being packed away without being cleaned thoroughly of all food residues with

predictable results. Food can easily work its way into the mannequin's joints, especially if the mannequin is being turned and re-positioned during the scenario.

Experimentation

Simulation is a relatively new profession and you will most likely end up doing some experimentation to find a solution to a problem. I've listed a few tips below to help you develop safe and effective solutions.

- Research your problem before beginning. You might find that someone has already solved the problem. Be sure, though, that they have solved the same problem that you have.
- Understand the mechanism by which your solution is meant to work. Does this make sense? Are there any safety issues?
- If you discover that you need a particular chemical or a piece of equipment, purchase it. While using items you already have might be attractive, it may not be the best or the least expensive way to do things.
- Keep a detailed, written record of what you do. Record measurements, times, temperatures.
- Be consistent with your measuring and mixing (see following). Accurate measurement means consistent results with less waste.
- Test your mixes under working conditions and storage conditions.

Measuring and Mixing

Here are some tips on measuring and mixing for simulation.

Pot life is the amount of time you have after you **begin** mixing to mold, cast, or manipulate the mix. Demold time is the time the mix takes to **fully** set. The pot life and the demold time are often dependent upon the ambient temperature where you are working.

- Use the bathroom, rehydrate, and turn off your cellphone before you start!!!
- Know your pot time before you start. Review the product data sheet.
- Have all of your materials and tools available BEFORE you begin. This includes additives and pigments. Have you released your mold or original?

- Use separate mixing rods for each component to prevent cross-contamination.
- Thoroughly stir the individual components before beginning.
- Do not mix very small amounts; it amplifies any mistakes you make in measuring.
- Measure twice, cut once.
- Use measuring containers which are accurate (many disposable containers are NOT). In most cases use separate containers of the same type to measure your liquids.
- Do not try to measure both liquids in a single container; it is very easy to make a mistake and ruin the entire batch.
- Do not mix by sloshing components together; this does not adequately mix the components.
- Do not whip components together; this incorporates air into the mix which is difficult to remove.
- Scrape the sides and bottom of the container while mixing.
- Use a wooden toothpick to remove bubbles from liquids (gelatin or silicone) while casting. A wooden toothpick has less chance of damaging a mold than a metal object.
- When casting using a **melted** medium like gelatin, warm your mold so that the medium will flow into detailed parts of the mold. Do **NOT** do this for silicone since the heat will accelerate the curing process and may restrict the flow of the silicone into the detailed parts of the mold.
- Mix in an area of the proper temperature, usually 20°C to 24°C. Ditto for storing your mix components.

Dyes and Pigments

If you are doing moulage, you'll most likely be using some type of colourant to make substances for simulation. It is a good idea to have a basic knowledge of the dyes and pigments you will be using.

First, some definitions. A pigment is a finely ground solid, used for colouring, that does not dissolve in solution or, in the case of a dyed material, become part of the material it is colouring. Examples of common pigments are titanium white (titanium dioxide) and ultramarine (lapis lazuli, a mineral). Pigments are usually more fade resistant (lightfast) than dyes of a similar colour.

A dye is a substance which is soluble in a liquid, or more generally, chemically bonds to the material it is colouring. Common examples are the food dyes tartrazine and Allura Red AC. Both of these dyes are from a general group of dyes called azo dyes. Tartrazine and Allura Red AC are approved as food colours, FD & C Yellow 5 and FD & C Red 40 respectively.

Sometimes dyes are made into pigments by combining the dye with a salt or an inert binder to make a lake pigment. Many azo dyes have corresponding lakes. Be aware of this when purchasing colourants. Lake pigments are usually insoluble in water.

You can purchase many of these dyes and pigments online or in bulk from commercial suppliers. Purchasing in bulk is usually much, much cheaper than buying food colour from a retail store. I have found powdered dyes (FD & C #5 and #40) available in retail stores selling South Asian foods. Check the label before buying as some of these dyes are adulterated with salt.

A general note about dyes. I have found that many common dyes (most food colours for example) can be set by using a weak acidic solution; for example, a weak solution of acetic acid (≈ 2% v/v). Dyes that can be set like this can usually be removed by a weak alkaline solution followed by a rinse in distilled water; for example, aqueous ammonia.

Before beginning, check to make sure that the colouring you are using will not stain your mannequin. I've found that some mannequins can be stained with FD & C 40 red food colour, a common colouring in stage blood and blood used in simulation. Caramel colour and yellow food colouring do not seem to stain most mannequins I've worked with but, to be sure, check the mannequin that you are using. Apply a bit of the substance in a hidden area and leave it for a few hours, or even better, a few days. Clean as you normally would and see if it stained. Be aware that some substances can stain when combined with solvents.

Simulated Urine

Simulated urine is used during simulation in catheterization trainers, urine collection bags, and to stain/soil adult briefs. Ideally, simulated urine should look real, be stable during storage at room temperature, be non-staining, and be inexpensive. It should be simple to alter the appearance of the urine to replicate different clinical findings.

I usually use distilled water and tartrazine as my basic mixture. By itself, tartrazine is too yellow for regular urine. Add a very, very small amount of FD & C Red 40 to push the colour towards a darker yellow/orange. Add more red to simulate blood in the urine. This combination of dyes is inexpensive and does not tend to stain.

Problems I've had with simulated urine in collection bags is the drying of urine on the inside of the bag and mold growing inside bags during storage. Adding glycerin to the mix (20% v/v) will help to prevent this. Glycerin is a humectant which prevents drying of the simulated urine and it has antifungal properties as well. Seal the supply tubing with RTV silicone to prevent leaking and evaporation.

For thin, stringy blood clots that form in urine collection bags, mix clear artist's acrylic medium with red flocking. Flocking is made up of fine fibers and will not be affected by water. Drizzle the mix on silicone parchment paper. You can shape the clots by hand while drying. Once dry, add to the urine bag.

Be cautious of artificial urine used for urinalysis in the classroom. These may stain certain types of plastic. To the right is a photo of a urine collection bag which was partially filled with artificial urine. The bag was permanently stained a deep brown-orange. It was difficult to tell, without experimentation, if it was the colourant alone which caused the staining or the colourant in combination with the other components in the artificial urine.

Pros-Aide® Prosthetic Adhesive

Pros-Aide® is a skin-safe adhesive that is widely used in special effects makeup and works equally well on both humans and mannequins. Right out of the bottle, it is a thin, milky liquid.

Unlike most adhesives you may be familiar with, Pros-Aide® is applied to one surface, usually the prosthetic, and allowed to dry. This adhesive dries clear and tacky. The prosthetic is applied to the skin or mannequin **only after the adhesive has dried**. If Pros-Aide® is not allowed to dry it will not work properly. This is the primary reason people have problems in using Pros-Aide®.

You can tell Pros-Aide® is dry since it will go from a milky state to a clear state when fully dry. It is best to apply Pros-Aide® with a piece of a disposable makeup wedge (sponge). If you use a brush, the adhesive will work its way into the bristles near the ferrule and destroy the brush. It is almost impossible to clean this stuff out of a brush.

If you've applied Pros-Aide® to a surface and it has lost its tack you can sometimes reactivate it by applying a small amount of 99% isopropyl alcohol. The reason that Pros-Aide® may lose it tack is that it attracts dust. To avoid attracting dust you can store pieces coated with dry adhesive, tacky side down, on baker's silicone parchment; the tacky surface will not stick to the parchment.

To remove from mannequins and other hard surfaces, use 99% isopropyl alcohol. You can remove **small** amounts from your skin with 99% alcohol but for large amounts use either isopropyl myristate or Pros-Aide® Remover; these removers are kinder to your skin than 99% alcohol. The remover should be available from the same place you purchased the Pros-Aide®.

PAX Paint

PAX paint was invented many years ago by legendary makeup artist Dick Smith (1922-2014). This paint is used to paint prosthetics made from latex or gelatin. PAX paint is made from a 1:1 mixture of artist's acrylic paint and Pros-Aide® (PAX = **P**ros-**A**ide® and liquite**X**). Many makeup artists, myself included, use Liquitex brand acrylic paints. For more transparency, thin the PAX with additional Pros-Aide®. After painting, lightly powder the prosthetic with neutral set powder to reduce tackiness.

When painting wounds and dimensional effects, begin by painting the darkest areas first. Use a blue or purple colour for the dark/shadow areas. Wash your lighter colours in over the top of the darker colours to blend and mute. Some of the Liquitex colours I use frequently are:

- Naphthol Red Light – fresh blood, muscle, road rash when stippled
- Red Oxide – scab, old blood (mix with Naphthol Red Light), road rash when stippled
- Cobalt Blue Hue – shadows, deep areas, bruising,
- Yellow Oxide – subcutaneous fat, bruising
- Parchment – bone, small highlights
- Raw Umber – dirt, feces, weathered skin, aging. Mix with Yellow Oxide or Red Oxide for more variety.

You will notice that I don't have white or black listed. These two colours tend to stand out and look unnatural when used alone. Instead, try to limit yourself to the colours listed above to paint your wounds. Build up the colours in thin layers using acrylic medium to dilute the colours as needed. You will find the wounds will look more realistic.

Acrylic Medium

Acrylic medium is the base of acrylic paint without any pigment added. It is available in matte or glossy. This is useful for creating your own, reusable effects. Mix tan, white, or green with the acrylic medium to colour trac sponges and other dressings. I have used it, with acrylic colours, on adult briefs to indicate soiling; in this case do not dilute with water since the water will be absorbed by the filling in the brief. This allows a brief to be used several times, saving cleanup time and money. Since fresh acrylic paint can sometimes be a bit sticky, allow to dry for at least 24 hours before use or give a light dusting of talc.

Flesh Effects Gel

Flesh Effects Gel is a gelatin-based product made by Ben Nye; similar products are available from other manufacturers. Scar Effects Gel is a similar product only with colouring added to simulate flesh colour. It is available from other suppliers as slabs or blocks in a variety of colours. You can also make your own effects gel using the following formula. I use Knox brand gelatin which has a reported Bloom number of 225 (medium Bloom). Commercial effects gel uses prosthetic gelatin which usually has a Bloom number of 300+ (high Bloom). The following can be adjusted to the materials you're using and to your personal preference.

- 14g Gelatin (food grade, 2 × 7g packets)
- 30mL Glycerin
- 15mL Water

Mix components in a microwavable container. Heat in the microwave on high for 9 seconds and stir. Repeat until the gelatin is dissolved. Pour into individual containers and allow to set. Use the same way as the commercially made product.

You can add a *small* amount of coloured flocking (an inert coloured textile fibre) to this mixture. Colour flocking has an advantage over other types of colour in that it will not stain. A close approximation of a mannequin's skin colour is a mix of flesh (beige), red and white flocking. Adjust quantities to match the colour of your mannequin.

For blood vessels, you can use synthetic yarn in various shades of red. Cut the yarn to a convenient length and separate into smaller diameter strands. You can carefully dip these in liquid gel effects and place on a parchment sheet to set. Doing this will make the yarn easier to handle and position in your effect.

Heat the container in a cup of hot water until it turns to a thick liquid. For convenience you can use a small crock pot (aka slow-cooker) filled with water. Use a metal makeup spatula and wooden sculpting tools to shape the gel before it sets. Heat your metal spatula to keep the gel from setting and sticking to the metal. I usually keep the spatula in the hot water while I work and dry it on a towel before using. You can sculpt effects ahead of time on a piece of silicone parchment (baking parchment) which is available from most supermarkets. To keep the gel workable for a longer time, use a piece of wood or plastic under the parchment for insulation.

Gel effects can be used to create small effects like lacerations, bullet and fragment wounds, blisters, pustules and lesions. For more durability apply Pros-Aide® to the area before applying the effects gel and seal the finished effect with another thin layer of Pros-Aide® before colouring. Powder the Pros-Aide® with neutral setting powder to eliminate stickiness after colouring.

Gel effects can be stored at room temperature out of direct sunlight. It has been my experience that gelatin/glycerin compounds are stable and resistant to mold and decomposition. For large amounts of gel effects use the following formulas:

Soft *(good for general use)*
- 30g Prosthetic gelatin (300 Bloom)
- 100mL Glycerin
- 50mL water

Medium *(easier to sculpt, can be coated on baking parchment with a wide brush for Zombie skin)*
- 40g Prosthetic gelatin
- 100mL Glycerin
- 50mL water

Hard *(hard can be used for corns, calluses, and other skin conditions)* Add additional gelatin to the medium mix until the desired hardness is reached. The same amount of 70% sorbitol solution can be substituted for the water to give additional toughness.

Zombie Skin

The term “Zombie Skin” comes from the 1970s special makeup effects industry. Originally, zombie skin was made by stippling a thin layer of liquid latex on a clean glass surface, breaking up the surface, then applying another layer of latex. The resulting sheet was powdered and stored. It looks like destroyed skin and was used to make burns, wounds and, of course, zombies.

Zombie skin has many uses in medical moulage. It goes on quickly, is easy to make ahead of time, is versatile, and cheap.

I try to avoid the use of latex due to latex sensitivity. Instead of latex, you can use gel effects to make a zombie skin. Take a sheet of baking parchment and place on a hard insulating surface like a piece of wood. The insulating surface keeps the gel effects from setting immediately so you have time to brush it into a thin layer. Heat some of your gel effects until it is a thin liquid.

You can add some flocking for colour. This formula has no odor. Flocking is short synthetic fibres commonly used to colour prosthetic appliances. It has the advantage of not staining surfaces like some types of dye. You can purchase flocking from suppliers of special makeup effects.

Using a soft brush at least 5cm wide, quickly coat a very thin layer of liquid gel effects onto the sheet. Move the sheet to a heat conductive surface such as a metal counter top to set the gel. You can break up the surface by dragging a tongue depressor over it if you wish. Transfer the sheet back to the insulating surface and brush on another thin layer, then back to the conductive surface. When you have the type of effect you want, lightly powder the skin, carefully strip it from the parchment and lightly powder the back. The powder keeps the skin from sticking together. You can store this in a plastic bag until you use it.

To use, adhere with Pros-Aide®. Colour with creme makeup or PAX paint, lightly spray with makeup sealer to help protect the zombie skin from moisture.

If you need to break up the skin more, use a small, angled brush with synthetic bristles dipped in warm water. The warm water will weaken the gelatin skin and you can pull or push it apart. Don't use too much water or else you may weaken too large an area.

Blood Clots

Blood clots are made from a formula similar to the Flesh Effects Gel given previously.

- 28g Gelatin (food grade, 4 × 7g packets)
- 100mL Glycerin
- 50mL Water
- FD & C #40 Red colour, Blue food colour, Titanium white powder (titanium dioxide, available from art stores)

Mix the gelatin, glycerin and water in a microwaveable container. Microwave for about 15 seconds (1000w oven) and stir. Microwave for 10 seconds and stir, repeating this step until the gelatin is dissolved.

Mix the red and blue dyes along with titanium white into a very small amount of water until uniform without lumps. Add to the hot gelatin mixture with constant stirring.

To form realistic clots, place the container in a shallow tub of cold water. The gelatin will congeal at the sides of the container. Stir or scoop out the clots as necessary and transfer to another container.

This clotted blood can be reused many times. You can remelt it in the microwave and shape it as desired. If you need to clean it or wash off liquid blood, you can rinse it ***quickly*** in very cold water. Dry with a towel.

Store in a closed container in a cool, dark location. Does not need refrigeration if no additional water is added.

Surgical Breasts

This gelatin formulation was developed for a surgical simulation of a tumour located in the adipose tissue of the breast. The tumour was cast from Smooth-On silicone in a two-part stone mold.

Skin

- 20g Prosthetic Gelatin, 300 Bloom
- 45mL Glycerin
- 45mL Sorbitol, 70% solution

Heat mixture while stirring until the gelatin is dissolved; do not allow the mixture to boil. Add a water-based makeup foundation to the liquid until the desired flesh colour is reached.

Fat

- 12g Prosthetic Gelatin, 150 Bloom
- 150mL Glycerin

- 50mL Sorbitol, 70% solution
- 50mL Water

Heat mixture while stirring until the gelatin is dissolved; do not allow the mixture to boil. Add yellow flocking or yellow food dye for colour. A small amount of titanium dioxide (titanium white) can be added for opacity. The titanium white powder can be mixed with the water before adding for an even dispersion. Allow the mix to set. Reheat to a hot liquid the pour into the mold. This mix seems to work best if allowed to set and left for 48 hours before reheating and casting.

To make the breast prosthetic

Pour a 1cm layer of “fat” into the bottom of the container. You can add a piece of woven gauze at the bottom to anchor the prosthetic in place later. Allow the “fat” to set. Press the silicone “tumour” into the fat layer. Now, pour a new layer of hot “fat” onto the existing layer. Make sure the liquid is hot enough to melt and bond with the existing layer. Allow this layer to set.

Place a single layer of thin, stretchable synthetic cloth (Powermesh) on top of the “fat” layer. This keeps sutures from cutting through the gelatin “skin”. Pour hot “skin” on top of this and quickly use a wooden tongue depressor to spread and force the mix through the cloth. This will melt and bond with the “fat” layer. Keep this layer as thin as possible. When cooled, dust the skin with talcum powder to reduce tackiness.

This can be used inside or outside of the container. If outside, carefully pull the gelatin away from the wall of the container. Refrigeration of the prosthetic may help in removal by stiffening the gelatin. The “fat” is sticky enough to grab onto most smooth surfaces at room temperature.

Simulated Bone

Simulated bone can be used in open fractures, trauma, and surgical simulations. Make simulated bone from Sculpey® oven bake clay. This brand of clay is available in a number of colours from most art and craft stores. If you are careful you can mix different colours by kneading to get a natural looking bone colour. When you are sculpting the bone make sure that the base has the same curvature as the area of the mannequin where it will be attached. If you do this it will be simpler and the simulated bone will be more firmly attached to the mannequin. To set, bake your sculpture at 130º C (275º F) for 15 minutes per 6mm thickness.

You can cast Sculpey® in silicone plate molds if you are very careful and your mold does not have excessive undercuts. I use Mold Max® 30 by Smooth-On which is a fairly stiff (shore 30 A) tin-cured silicone to make molds for Sculpey®. Soften the Sculpey® by placing it in a plastic bag in

a container of hot, not boiling, water. You can then carefully press the softened clay it into the mold, paying particular attention to detailed areas.

When you have finished, place the mold in a refrigerator (not the freezer) and leave for several hours. The cold stiffens the Sculpey® and makes it easier to remove from the mold without deformation. Allow to return to room temperature and bake as described previously.

Methylcellulose Base

Methylcellulose base is an excellent base for simulated blood products and other bodily fluids. You can colour or tint it with food colouring or with FD & C Red 40 to make simulated blood. If you use food colouring or Red 40, test for staining on any surfaces that will be exposed to the compound. To make 1L of methylcellulose base:

- 200mL glycerin
- 10g Methylcellulose (Monster Makers brand)
- 800mL of water, see following for details

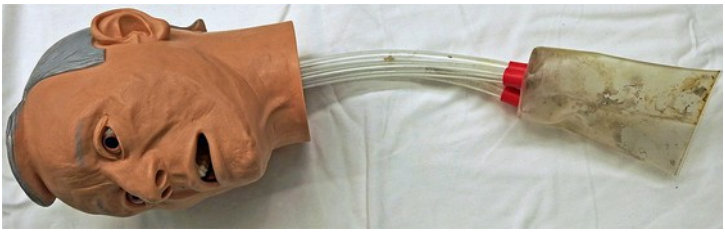
Methylcellulose is a thickener and emulsifier used in a variety of products including food. It is soluble in water, although the solubility decreases as the temperature increases; the opposite of most solutes. To get an even mixture of methylcellulose without lumps a special method of preparation should be used.

Stir the methylcellulose powder into 200mL of hot water (about 90°C). This will disperse the powder in the water but it will not dissolve. Now add, while stirring, 600mL of cold water (0°C to 5°C). Allow to stand for 30 minutes then add the glycerin and stir until uniform. It takes several hours for the methylcellulose to absorb the water. I usually leave it overnight. This will give you a fairly thick base. You can alter the amount of methylcellulose to give you a thicker or thinner base. Use the same technique for mixing as above.

This solution will keep for several days at room temperature but should be used as soon as possible. I've kept it for several weeks at room temperature without any problems. It will grow mold if kept too warm for too long.

Enteral Formula

Enteral feeding is a common subject taught in nursing schools. In many cases, real commercial formulas are used which can cause problems if the feeding supplies are reused, opened and not refrigerated, or the feed lines are not fully and properly cleaned after use. You can make a simple enteral formula which does not require refrigeration and will not dry out or decompose. This formula can be cleaned with water.



Above is a mannequin head with attached stomach bag. This bag was filled with real enteral formula and emptied without being rinsed. As you can see it is now discoloured and moldy. Using a simulated enteral feed avoids this.

Use the methylcellulose base given previously as your starting point. While stirring, add small amounts of calcium carbonate to the mixture to opacify it. You may find it easier to mix the calcium carbonate in a small amount of water first to avoid lumps. Dilute the methylcellulose base with two to four times the amount of distilled water to give you a solution which has the approximate thickness of a commercial enteral formula. Once you have the opacity that you wish, stir until uniform and divide into small containers. Label the containers as **simulated** enteral formula and indicate that the liquid must **not** be consumed. Shake well before use to distribute any calcium carbonate particles which may have settled. Powdered calcium carbonate is used in making artist's gesso and can be purchased cheaply in bulk at many artist's supply stores.

Prosthetic Wax

Prosthetic wax (aka mortician's wax, face and nose wax) is used in makeup for 3D effects over bony areas. You can use it on the hard surfaces of the mannequin to sculpt effects. Wax must be coated with a Pros-Aide® or other coating to be able to take cosmetic colours. It is available in flesh colour which is a close match to many mannequins. Clean and properly stored wax can be used several times before discarding if used on mannequins. The wax can be softened by adding a small amount of petroleum jelly.

Wax has several advantages and disadvantages. It is easy to sculpt and holds detail very well. Wax will stick to your mannequin but is easy to remove. On the downside, wax effects can be deformed by pressure or an applied dressing and may deform from heat as well.

When sculpting, give your tools a light coating of water-based lubricant to prevent the wax from sticking. I've found that stainless steel dental instruments work well for sculpting wax. To remove wax from the mannequin, gently scrape off and remove any residue with a suitable cleaner. A citrus-based gel cleaner or mineral spirits works well on most mannequins but make sure you follow the mannequin's manufacturer's recommendations.

RTV Silicone

RTV (Room Temperature Vulcanization) silicone is commonly found in big-box building supply stores and is used to seal doors, windows, and bathtubs. Please note that you must ***never*** use this product on humans. The particular product I use is made by GE Silicone, all-purpose, clear.

RTV silicone cures by moisture from the air; 50% to 70% relative humidity gives the fastest cure. The curing process generates acetic acid (vinegar) which will dissipate if you keep the finished prosthetic in a well-ventilated space for three or four days after you make it. Since making prosthetic wounds for mannequins may involve using the silicone in thick layers you can use a simple trick to make the silicone cure more quickly. For every 10mL of silicone, add one drop of glycerin. Stir the mixture until evenly mixed. You can add a very small amount of artist's acrylic paint to the silicone to intrinsically colour it.

RTV moisture cured silicone is also useful in blocking tubing in some types of medical devices. I use it to block PEG tubes and JP drains to prevent leakage and stop fluids being pumped into mannequins.

After the silicone has cured you can colour it with a mix of artist's oil paint and RTV silicone, thinned with naptha. Please be aware that some artist's oil paints contain lead and other toxic substances. Check the label before using. Naptha should **NEVER** be used in an enclosed space since the vapour is harmful to breathe and it will form an explosive mixture with air. You can also purchase specialty silicone paints from Smooth-On which are easy-to-use and work very well.

Silicone prosthetics often will not hold water-based stage blood. You can use some types of drying blood, such as the Fleet Street Bloodworks brand, which are designed to work with silicone. If the bottom of the silicone prosthesis becomes dirty and will not grab onto your mannequin's skin, try cleaning with a lint-free cloth and mineral spirits.

Laser Tattoos

For a fast, repeatable moulage for your mannequin try laser tattoos. A laser tattoo is made by using a colour laser printer to print wounds, bruising and skin conditions onto a special paper which releases the colour when wet. You can purchase this paper from special effects makeup suppliers. It is usually called water-slide paper or decal paper or something similar. If you are not sure, ask. With the mannequin's skin we have to be careful since laser toner can ***really*** tattoo the soft plastic skin. If you have ever had a mannequin come into contact with laser printing you will know what I mean.

To get around the marking aspect of laser toner I seal the images after printing with Krylon® Crystal Clear Acrylic varnish. This is important; if you don't seal the tattoo with varnish it **will** mark the mannequin's skin permanently. Give your sheet two light coatings of this about 10 minutes apart and allow to dry for at least two hours in a dust free environment.

To use, cut out the tattoos leaving a 1cm border all the way around. Using a makeup sponge stipple on two coats of Pros-Aide® adhesive and let dry. Turn over and press down the tattoo on the mannequin where you want it; caution, once it is on the mannequin don't attempt to adjust the position. Carefully press down over the entire surface.

To release the backing paper use a damp sponge to moisten the backing paper. As the moisture penetrates the paper it will release the tattoo. It will peel away, leaving the tattoo on the mannequin. Use the ball of your thumb to make sure the tattoo is in contact all around. Once any water has evaporated, spray lightly with Ben Nye Matte Fixative. You can remove the tattoo, Pros-Aide® adhesive and the makeup fixative with 99% isopropyl alcohol.

Feces base

Many of the feces formulas I've come across use products that must be refrigerated after mixing. The following can be mixed and stored at room temperature:

Basic Formula

- 500 g all-purpose white flour
- 50 g sodium bicarbonate (baking soda)
- 250 mL molasses (molasses is sold by weight, 350g = 250mL)
- 250 mL glycerin
- 50 mL water

Mix the flour and sodium bicarbonate together in a mixing bowl. Mix the molasses, glycerin and water together thoroughly then stir in the flour/bicarbonate a little at a time. After thoroughly mixing let the mixture sit for 24 hours. This will give a caramel-coloured mass, slightly soft. It will rise, due to the molasses and the sodium bicarbonate, and should be kneaded down. I've found that this mixture keeps well; the glycerin and the high sugar content of the molasses retard spoilage. You do not need to keep this refrigerated but it should be kept in a cool place out of direct sunlight. I've kept it in a sealed container at room temperature with no evidence of spoilage or mold. This mix sometimes separates in storage; if it does knead it before use. The mix may darken with age.

I've included a table which gives directions on making feces that are like the ones on the Bristol Stool Chart. All variations use the standard formula of baking soda, flour, molasses but vary the amount of glycerin and water used. Included are photos and notes on formula modifications. Note that if you add more than the 50mL of water in the standard formulation the mixture may spoil if stored.

The glycerin is hygroscopic and acts as a humectant in this recipe; molasses is also an humectant. A sealed container is necessary; both glycerin and molasses will absorb moisture from the air and the resulting increase in moisture may lead to spoilage. This recipe won't dry out and is easy to remove from non-absorbent surfaces with soap and water. You can shape feces by hand.

If you require feces that are light in colour, use a corn syrup like Crown® Lily White®, instead of molasses. Use the same amount of corn syrup as molasses. You can mix both molasses and corn syrup in different ratios for any shade of feces you wish; just use the same amount as stated in the standard formulation. Adjust the colour further with food colouring.

Bristol Stool Chart

Type	Description	Notes
 **1**	Separate hard lumps, like nuts (hard to pass)	Use 200mL glycerin, no water. Shape by hand. Additional colour may be added to darken feces. Brush with glycerin to increase realism.

Type	Description	Notes
 **2**	Sausage shaped but lumpy	Use 250mL glycerin, no water. Shape by hand. Additional colour (food colouring) may be added to darken feces. Brush with glycerin to increase realism.
 **3**	Like a sausage but with cracks on the surface.	Use 250mL glycerin and 50mL water. Shape by hand. Brush with glycerin to increase realism and keep fresh.
 **4**	Like a sausage or snake, smooth and soft.	Standard formula; no modification. Shape by hand, coat with glycerin to keep fresh and maintain shine.
 **5**	Soft blobs with clear cut edges (passes easily)	Shape pieces by hand from standard formula and dip in or spray with a mixture of half water and half glycerin to soften mix.
 **6**	Fluffy pieces with ragged edges, a mushy stool	Add water to standard formula. **Do not store** this modified formula; discard after use.

Type	Description	Notes
 **7**	Watery, no solid pieces, entirely liquid	Add water to standard formula. **Do not store** this modified formula; discard after use.

In use, colour according to the condition. For melena, don't use the sodium bicarbonate; add black food colour and additional molasses, as needed.

For diarrhea mix in a bit of water. Don't mix too much and leave the mixture a little bit lumpy. After thinning out the fecal base, **discard after use**; do not reuse or store since the thinning **does** affect the keeping properties.

For more stiffness, add flour to the base. The feces can then be shaped by hand. Brush with glycerin to keep the feces looking fresh and moist.

You can add stage blood to the feces; don't mix too much or it will blend entirely with the fecal base. For mucus add a bit of unscented talc powder to a water-based lubricant such as K-Y® Jelly. Colour, as needed, with food colouring.

If you need the smell of feces there is a commercially available spray available from distributors of simulation supplies. Do **not** add this scent to the simulated feces, spray in the air in the simulation suite instead. If you are using this product wear gloves and spray only a small amount into the air. About three (3) pumps of the sprayer of this product will produce a powerful odour in a room the size of a private hospital suite. The smell takes a few seconds to appear but is very powerful and realistic. Avoid spraying this solution on or over surfaces which may absorb the smell (pillows, blankets).

Drying Blood

I've had success with using a product called drying blood on mannequins. Drying blood is designed to dry after application but to keep looking fresh and wet. There are several different manufacturers of drying blood; the brand I like is Fleet Street Bloodworks by PPI. Other

brands may work. Before you use any drying blood product on your mannequins test in an inconspicuous spot on the mannequin to make sure it will not stain.

Paste drying blood should be applied with a makeup spatula and will give a 3D appearance. Liquid drying blood should be applied with a small brush to control the flow.

After drying, even the best brands may not look entirely fresh and wet. You can use a small brush, dipped in glycerin, to coat the drying blood and keep the wound looking fresh.

You can make a drying blood for a wound dressing by mixing clear acrylic medium with red acrylic paint and/or red food dye. Apply to the dressing and allow to dry. Use gloss acrylic to simulate wetness.

Old, Thick Blood

Old, thick blood is a term I use for blood found in ulcers and other wounds. It has thickened and turned a reddish brown colour. A simple way to replicate this blood is to colour a corn syrup like Crown® Lily White® with FD & C Red 40 and caramel colour.

- 250 mL Corn syrup
- 1 g FD & C Red 40
- 1 mL Caramel colour

This product can be stored at room temperature and cleaned with soap and water. Adjust colouring as needed.

Non-staining Blood

Most stage blood, the kind normally used in simulations, is coloured with FD & C Red 40 food colouring. This azo dye has a tendency to stain some types of surfaces. You can make non-staining blood for simulation by mixing a water-based lubricant like K-Y® Jelly with red flocking. Flocking is made from short, fine, synthetic fibres and can be purchased from special makeup effects suppliers. Glycerin added to the no stain blood will make it flow and keep it from drying out. Add a tiny amount of yellow, brown, black or blue flocking as necessary to adjust the colour of the blood. One of the nice properties of this blood is its ability to stick to silicone and some other types of slick surfaces. This blood was used in the 2011 movie *"Water for Elephants"*.
A few points about no stain blood:

- Getting the colour right takes a bit of experimentation. I suggest filling several small containers with the colours you need (venous blood, arterial blood, old blood). Adjust the consistency just before use by adding glycerin.

- Do not compound any of this blood in a windy area and be very careful not to spill any of the flocking. Dry flocking is very light and will easily be blown around by a light wind.
- This blood does not flow or dry in the same way that stage blood does.
- If you have very good eyesight AND you look at this blood up close or with a magnifier you might be able to see some of the fibres.
- Keep this away from the eyes. The tiny flocking fibres and the glycerin may cause irritation if this blood gets into the eyes.
- Although the colour fibres in this blood will not stain, the water-based lubricant base may stain some types of surfaces. Test a small area first.

Protecting the Mannequin's Skin

To use makeup on your mannequin you need to protect the synthetic skin from stains. You can protect the mannequin's skin with a thin coating of flesh effects gel. Coat the gel with Pros-Aide® to protect it from moisture. Please note: Do **NOT** use Pros-Aide® alone to protect the mannequin's skin, the creme makeup will penetrate Pros-Aide®. Remove the tack by dusting lightly with a finishing powder. Ben Nye Makeup has several powders available: Banana Luxury Powder is an excellent match for Laerdal SimMan® 3G skin. There are other colours including Cocoa and Beige depending upon your mannequin's tone. Apply the creme makeup lightly and set with Ben Nye Neutral set powder.

You can use plastic wrap to protect the area instead of gel. This technique lets you prepare the effects ahead of time. Although the plastic wrap may stay in place by itself you should use the following method:

1. Decide where you want the effect. Tear off a piece of baking parchment large enough to cover the area. Hold the baking parchment on the mannequin.
2. Using an HB pencil outline the area where the effect will be. Make sure the area you outline is at least 5mm larger all around than what is needed for your effect. When you draw the area, try to use smooth curved lines as much as possible. Smooth curved lines blend more easily than do sharp, straight lines.
3. Once you have your outline, place your baking parchment **pencil side down** on a white surface. Place a sheet of plastic wrap (Saran wrap or similar) over the outline. The sheet must be large enough to cover the outline.
4. Pour out a bit of Pros-Aide® in a dish or palette. Using a makeup sponge stipple the Pros-Aide® in a 1cm or 2cm area along the inside of the line you've drawn. When you first start stippling the

Pros-Aide® will bead up slightly but will become more even as you work it. Stipple all the way around the outline. Let the Pros-Aide® dry; it will go from a white colour to a clear translucent colour.

5. Carefully move the plastic wrap to one side, keeping the Pros-Aide® side up. Flip over the baking parchment.
6. Pick up the plastic wrap by the corners, flip it over Pros-Aide® side down, and carefully position so the Pros-Aide® area matches your original pencil outlined area. Drop gently into place and smooth out. It should stick to the parchment.
7. Using a sharp pair of scissors, cut out the wrap/parchment approximately 5mm inside the pencil line you've drawn. This should give you a Pros-Aide® border inside the cut line. Try to make your cut as smooth as possible.
8. If you wish, you can apply your makeup effects to the plastic wrap now (recommended) or you can do this after it is applied to the mannequin.
9. To apply, strip the wrap off the parchment and carefully apply to the mannequin. The best way to do this is to adhere one edge, then pull the wrap tight and work your way around making sure that you don't have any wrinkles. Rub down near the edge.

If you want to blend the wrap into the mannequin even more you can apply Pros-Aide® by stippling with a makeup sponge on the top of the wrap. Apply to the area up to the area where you will be doing your makeup effect and over the edge of the wrap onto the mannequin's skin by about 5mm all around. Let the Pros-Aide® dry then powder with a powder that matches the mannequin's skin colour.

Usually you will want the wrap to be even and tight on the mannequin's skin so it won't be noticeable. If you are trying to create a burn or an area of destroyed skin, you can apply the wrap so it is purposely wrinkled. Experiment before you try this during an actual simulation so you can get a feel for how it looks.

You can also use a self-adhesive dressing like Tegaderm but always test first. These are difficult to remove from some types of mannequins, especially if the dressing has been left in place for a few days.

To remove the wrap, peel off the wrap and remove the Pros-Aide® with 99% isopropyl alcohol or use Pros-Aide® remover. I've found the disposable industrial wipes good for this and for general mannequin cleaning since, unlike paper towels, these do not disintegrate and leave lint sticking to your mannequin.

Using Creme-based Makeup

Creme-based makeup is available in a large variety of colours at a reasonable price. You may already have some for making up your standardized patients. I use Kryolan brand but other brands may work just as well. ***Unless you have tested the creme-based makeup on the mannequin you intend to makeup you should use a barrier, as previously described, to protect your mannequin's skin.***

Creme makeup is made to be softened by the temperature of the skin. When applying creme makeup to a mannequin it may require a bit more work to get it even and to get the right colour depth. If you are wearing clear vinyl examination gloves, you can blend the makeup on the back of your hand to help soften it before you apply it to the mannequin's skin. Creme makeup can be applied with an artist's brush and thinned with 99% isopropyl alcohol, if needed. Clean the brush with soap and water after use.

To create a bruise with creme-based makeup use the following instructions. Once you have mastered bruises you can use the same techniques for other conditions.

I've assumed you've already applied wrap or some other protection to your mannequin. To create a bruise here is what you will need:

- reference photos of bruises
- bruise wheel (creme makeup)
- makeup sponge, triangular white
- makeup spatula, stainless steel
- makeup palette, flat white plastic
- neutral set powder
- muffin palette, white plastic
- powder brush (large, round soft bristles)
- fan brush (large, soft bristles)

Procedure:

1. Pick pieces out of your makeup sponge so the end is uneven without any square corners. Your sponge should be similar to the one in the photo right.

2. Decide how your finished bruise will look. Look at your reference photos. How was the bruise caused? Is it over a bony area? Is the bruise well-defined?
3. Using the makeup spatula, pick up small amounts of colour from the bruise wheel and transfer to your palette. Always work from your palette, never directly from the bruise wheel.
4. Put a small amount of neutral set powder in one of the pans of the muffin palette. Work from the palette, never from the powder container.
5. With your makeup sponge, pick up and apply the lightest colour to the area. Turn your sponge often so you get a realistic blended colour. Once you've finished with the lightest colour pick up a darker one. Keep working until you have a bruise that looks realistic. Stop.
6. Pick up neutral set powder with your powder brush. Lightly apply the powder by tapping the brush on the bruise. Apply a slight excess of powder.
7. Remove the excess powder by lightly whisking it away with a fan brush.

Mucous, Pus and more

The base formula is your choice of water-based lubricant mixed with glycerin to alter the viscosity.

To make pus, add to your base mixture some titanium white (titanium dioxide powder), adding a small amount to begin; enough to cover the tip of a tongue depressor. Titanium white is an artist's pigment and you can purchase it from an artist's supply store. If you wish, you can use Ben Nye Ash Dust instead of titanium white. Alter the colour with a **TINY** amount of food colouring. If you use titanium white or Ben Nye Ash Dust, you won't need to refrigerate the product and can store at room temperature.

If you need mucous for a scenario involving smoke inhalation, get some cheap, black eye-shadow. Break it up into suitable sized soot particles with the end of a makeup palette knife and mix with a water-based lubricant. Eye shadow does not dissolve in the water-based lubricant and retains its shape.

If you need black grease or motor oil for a simulation, mix Ben Nye Charcoal Powder (this is not real charcoal, it is an approved makeup colour) with a water-based lubricant or glycerin. As always, if you want to use this on your mannequin, test in an inconspicuous spot to make sure it doesn't stain.

Non-staining Povidone-iodine substitute for medical simulation

Povidone-iodine is often used to prepare sites for medical procedures (i.e. catheter insertion) or as a surgical scrub. The distinctive brown-orange colour is useful in visually showing the area has been prepared. Regular povidone-iodine solution will permanently stain the skin of many mannequins and task trainers used in medical simulation. The solution presented here looks like povidone-iodine but will not stain most vinyl skin. It is simple and inexpensive to compound.

- 4 mL Caramel colour
- 180 mL distilled water
- 60 mL glycerin
- 5 drops of hand dish washing detergent
- 20 mL isopropyl alcohol (99%)

Mix the caramel colour and water thoroughly before adding the glycerin. Now add the dish washing detergent and then mix in the isopropyl alcohol. The caramel colour, by itself, has a cool brown colour. It is not exactly like povidone-iodine, which is a warm-brown/orange colour, but is close enough for simulation. Store at room temperature. Shake well before use.

If you cannot obtain caramel colour, use Crosse & Blackwell Gravy Browning instead. Use 40 mL of the browning and 140 mL of distilled water; all other quantities stay the same. The brand of gravy browning used, Crosse & Blackwell, does not contain any spices; only caramel colour, water, glucose and salt. If you use a different brand, check to make sure it does not contain any spices. You may have to adjust the amount for other brands of gravy browning for the same effect.

You can add a small amount of tartrazine to this mix to give the simulated povidone-iodine a more realistic yellowish colour. Dissolve the tartrazine in a small amount of water and add a tiny amount at a time. Check for staining on your mannequin or trainer before using.

Please note that this mixture may NOT work with every mannequin and task trainer. Before using test on a small, inconspicuous area to be sure that it does not stain. In the original formulation I used FD & C 40 red azo food colouring to adjust the colour to more closely approximate povidone-iodine. This colouring is often used to colour simulated blood for use on mannequins. I found this food colouring left a faint pink stain on some types of vinyl surfaces. The stain was easily removed by scrubbing with a paste made of sodium bicarbonate and water.

If someone has inadvertently used real povidone-iodine on one of your mannequins, you may be able to remove the stain. The photo shows povidone-iodine stain removal on a catheterization trainer. The stain in the left photo shows the stain after repeated washing with soap and water; the blue topped bottle is sodium thiosulfate solution for aquariums. The right photo shows the stain after a treatment with sodium thiosulfate. Repeated treatments will remove more of the stain. Removal of this type of stain often takes repeated cleanings. After washing the area with soap and water, wipe with 99% isopropyl alcohol to remove as much of the stain as possible. Next use a solution of sodium thiosulfate and a soft cloth to clean the area. Rinse well with clean water. You can purchase sodium thiosulfate in solution from aquarium and fish pond retailers or you can purchase the chemical from a laboratory supply and make your own solution.

Copper Sulfate as an Anti-fungal agent in simulated IV solutions

In the past I've used tap water to refill IV bags used in simulation. In most cases this worked quite well, but over time, I've encountered fungus growing in stored IV bags and in drainage lines. In some of the equipment this has caused blockages, especially in fine tubing and filters.

On the right is a bag of simulated 2/3 & 1/3. It had been stored on a shelf in a dark, warm room for several months. Although the 2/3 & 1/3 solution had been drained, the bag had not been rinsed before refilling with tap water. The black masses inside are fungus.

Several solutions were proposed. Bleach (sodium hypochlorite) could be used but there is a risk if it is splashed on fabric or other items that it could cause damage. Isopropyl alcohol was suggested but it is expensive and could weaken or damage some types of adhesives if left in contact for extended periods of time.

A very low concentration of copper sulfate turned out to be the best candidate for treating our simulated IV solutions to prevent fungus. It has a long history of safe use in agriculture to treat fruits, vegetables, and grain. Copper sulfate is used to prevent algae blooms in lakes and ponds; it has been shown to be safe for aquatic life at low concentrations. Additional uses include wood preservation, as a herbicide, in mildew control, and as an anti-foulant. Copper sulfate is generally safe for humans, especially at the low concentrations used to prevent fungus and algae. (Borkow 2009) (EPA 2008). The no-observed-adverse-effect level (NOAEL) for copper sulfate in drinking water is 4mg/Cu per litre, 200mL consumed once per week for 5 weeks. (Araya 2001).

Based on the above, I've been using distilled water treated with a very low concentration of copper sulfate to refill simulated IV bags. Distilled water is used since:

- It does not contain any organic materials that support life.
- It does not contain any dissolved compounds which could cause precipitates when the copper sulfate is added to the water.
- It is pH neutral (copper sulfate anti-fungal/anti-algae activity depends on the pH of the water) which preserves the anti-fungal/anti-algae action of copper sulfate.

A simple way to prepare copper sulfate is as an approximate 0.1M solution. Dissolve 12.5g of copper sulfate (pentahydrate) in 500 mL of distilled water at 20°C. Assuming 10 drops per mL (10 gtts/mL) each drop will contain approximately 0.64 mg of copper. **Four drops of this solution per 4 litre bottle of distilled water** should be sufficient to prevent fungus.

References

Borkow, G. and J. Gabbay, 2009. Copper, an ancient remedy returning to fight microbial, fungal and viral infections, *Current Chemical Biology*, 3: 272-278.

EPA, 2008 (June), *Coppers Facts, Prevention, Pesticides and Toxic Substances (7508P)*, EPA 738-F-06-014, United States Environmental Protection Agency

Araya, M.; McGoldrick, M. C.; Klevay, L. M.; Strain, J. J.; Robson, P.; Nielsen, F.; Olivares, M.; Pizarro, F.; Johnson, L.; Poirier, K. A. Determination of an Acute No-Observed-Adverse-Effect Level (NOAEL) for Copper in Water. *Regul. Toxicol. Pharm.* 2001, 34 (2), 137-145.

A simple hack: Use photos

One of the techniques I've found very useful is to create wounds using actual photos of wounds that can be found online. This is a quick way of getting a realistic moulage for a complex wound. For example, a surgical wound for a hip joint replacement will, in many mannequins, be over a gap caused by the mannequin's joint. This can present problems with a three-dimensional moulage. A photo can bridge the gap without any problems.

Photos works well when the learner must evaluate the wound. In some cases it is difficult to build a complex wound which contains all of the clues necessary for the evaluation.

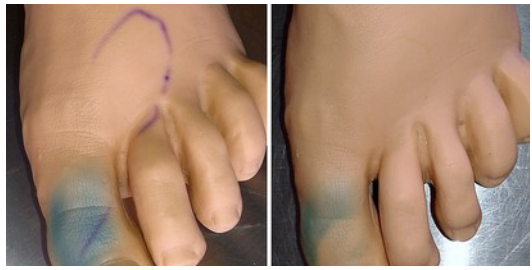
There are, of course, techniques to using this hack effectively. The first is, make sure that you scale the wound properly. If it is out of proportion to your mannequin then much of the effect will be lost. If possible use a photo which has a high enough resolution at the scale you wish to reproduce it for the wound to appear realistic. You can flip a wound left-to-right or right-to-left in case you need it for the opposite side of the body. Usually you cannot flip a photograph top-to-bottom, since this reverses the shadows and can give the image an entirely wrong look.

The photo shown is of an artist's plastic palette tray. The left image is the original, the right image is the original flipped top-to-bottom; nothing else has been done. You will notice that the convex wells in the original now appear concave.

At the edges of the photograph, use an imaging program's filters to blend and soften skin variations to match the solid colour of the mannequin. If you are looking for a low-cost solution to image manipulation, I suggest you download a copy of GIMP (GNU Image Manipulation Program). GIMP is free software and runs on Windows, Mac OS and Linux.

Removing Stains

Try a citrus-based cleaner such as Goo Gone® Spray Gel. Before you use this check the instructions that came with your mannequin; citrus-based cleaners can damage some types of material. After using the Goo Gone®, wash the area with hand dish-washing detergent and warm water. Sometimes mineral spirits work well to remove adhesive residues but always check manufacturer's recommendations. For dye stains (e.g. food colours) try a paste made from sodium bicarbonate and water. Rub into the stain then rinse. You can also try aqueous ammonia but do this in a well-ventilated area and wear gloves. For faint stains from dyes, leaving the mannequin exposed to direct sunlight for several days is surprisingly effective.



The photo (previous page) shows the before and after appearance of a pen ink stain on the foot of a mannequin treated with benzoyl peroxide. In many cases the ink appears to diffuse into the vinyl mannequin's skin and spread, making removal very difficult. To remove persistent stains such as ballpoint pen ink above try benzoyl peroxide. This is available as a 5% ointment used as a topical treatment for acne. You should wash the area with dish soap and warm water, then use a cotton pad or industrial wipe to clean the area again with 99% isopropyl alcohol. Apply a small amount of the ointment to the pen mark. If possible, expose the stain to direct sunlight. It may take one or more days to work on old or deep stains; some stains may take several applications over a week. After the stain is gone, wash the area with soap and warm water to remove all of the benzoyl peroxide ointment. Be very careful not to get the benzoyl peroxide on your clothing or other surfaces as it a powerful bleaching agent. You will notice, in the photo, that the bleaching did remove some of the blue paint on the mannequin's toe in addition to the stain. I have found that this type of treatment does sometimes affect paints applied to mannequins but, in general, will not affect intrinsic colour. It is very easy to reapply paint to a mannequin.

To remove dye stains from clothing try adding borax to your wash; usually about 125mL (half-cup) for the average size load. Follow the directions on the borax package. This works well with clothing that you cannot bleach.

This chapter 30 pages total. Last update: February 15, 2022