The skin is the largest organ of your dog’s body. It provides a protective barrier against the environment, regulates temperature, and gives your dog its sense of touch. Depending on the species and age, the skin may be 12 to 24% of a dog’s body weight.

The skin has 3 major layers: the epidermis or outermost layer, the dermis or middle layer, and subcutis or innermost layer. Other important parts of the skin include skin appendages (such as hair and claws) and subcutaneous muscles and fat.

The epidermis is the outer layer of skin. It provides protection from foreign substances. The epidermis is composed of multiple types of cells, including keratinocytes, melanocytes, Langerhans cells, and Merkel cells. Each of these cells has special functions.

Keratinocytes provide a protective layer that is constantly being renewed in a process called keratinization. In this process, new skin cells are created near the base of the epidermis and migrate upwards. This produces a compact layer of dead cells on the skin surface. This layer keeps in fluids, salts, and nutrients, while keeping out infectious or noxious agents. The top layer of dead skin cells are continuously shed and replaced by cells from lower layers. The rate of cell replacement is affected by nutrition, hormones, tissue factors, immune cells in the skin, and genetics. Disease, some drugs, and inflammation also alter normal cell growth and keratinization.



The subcutis is the innermost layer of the skin. It contains the subcutaneous fat and muscles. (The word subcutaneous means “beneath the skin.”) The twitch muscle is the major muscle immediately beneath the skin. The subcutaneous fat provides many functions, including insulation; a reservoir for fluids, electrolytes, and energy; and a shock absorber.

* Hair appears from follicles, just below the outermost layer of skin. Dog hair is made out of keratin, which is insoluble protein. It contains high amounts of sulphur (as the amino acid cysteine) and lesser quantities of tyrosine and leucine.
* In human beings, each hair grows from a single follicle. Dogs have single and compound hair follicles; a central follicle which produces the primary hair (or guard hair) which may have two more lateral follicles that produce about 6 to 20 secondary hairs each.
* Dog’s hair varies in its coarseness or thickness – actually a function of the hair’s diameter. Fine dog hairs measure about 75 microns; coarse hair may exceed 200 microns, this is known from being involved with Alpaca fleece classing.

Diet:plays a major role in healthy hair production. Proteins rich in sulphur-rich acids such as cysteine, as well as tyrosine and methionine) essential fatty acids, copper, and B vitamins. Up to 30% of the daily protein requirement of an adult dog can be used to renew skin and hair.

Hormones: Hormonal factors can interfere with proper hair growth.
Thyroid and growth hormone stimulate the activity of the hair follicles, whereas corticoids and sexual hormones slow it down. It is well documented that prolactin (a hormone produced by lactating females) levels stay high in the blood, the coat looks like the summer on, rather thin and sparse.

Texture of Hair: Changes in the texture or appearance of a dogs coat are an indicator of something amiss within, but haircoat changes are not specific for any one disease or condition. Dull or brittle hair can be caused by a dietary imbalance, or it might be due to diseases of digestive, liver, renal, thyroid, immune or parasitic origin. Alterations of hair typically appear rather late in the course of the disease, as hair growth is rather slow; it usually takes about four weeks of disease progress before changes are noticeable in the hair. So, it takes four or more weeks before a dietary supplement will have any positive effects on the quality of hair.

Shine: Shine is attributed to a complex group of fats secreted through glands in the skin (sebaceous glands), which function as a natural dispenser of hair conditioners.

Shedding: Contrary to popular belief, there is no such thing as a dog that does not shed; there are only dogs that shed a lot less. Each hair shaft produced by a hair follicle will eventually die and become dislodged from the kin (shed) and be replaced by a new hair shaft produced by that same follicle. However there are some breeds that hair grows for a much longer period before it dies and is shed.

This is because there are several phases in the activity of a hair follicle. In the first, called the “anagen” or growing phase, the hair is produced by the follicle.

The “catagen” phase is a shot interlude between the growth and the resting (“telogen”) phase.

In the telogen phase, the hair follicle is basically dormant. The growth of the new hair pushes the old hair out of the skin.

Even though spring and winter bring on prolific hair growth, the dog’s hair follicles are not all in the same phase at the same time, so in fact, he never becomes totally bald!

In humans, the hair follicles on our heads spend most of their time growing (anagen phase). This phase can last for years, depending on the ultimate length of your hair (as determined by your genes). While the resting phase for each follicle is generally only weeks. *Poodles have a predominantly anagen cycle like ours; their hair grows for so long, that it needs cutting (perhaps several times) before it falls out*.

Most dogs, though, have a telogen – (resting) predominant cycle. In these dogs the anagen phase is short, only long enough to achieve the genetically desired length of coat – anywhere from one month to a year or more.

The hair then cycles into the telegen phase and remains there for a prolonged period of time. This hair is tightly bound within the follicle and will not readily fall out or be pulled out. In the Nordic breeds, it is thought that the telogen phase may last for years.

**Any stress** – such as **anaesthesia, disease, pregnancy, or administration of certain drugs** – is likely to put most of the follicles into a resting phase. About two to three months after the stressful event, when the follicle starts to be active again, abnormal shedding will often be observed.

Natural Colour:

A dog’s coat colour is determined by his genes. That being known, many environmental factors can, to a certain extent, alter the colour of his hair.

Nutrients, specifically cysteine, methionine, arginine, tyrosine and phenylalanine deficiencies are reported to induct hair discolouration.

As does malnutrition induces disturbance in hair growth and its quality. Trace –elements or imbalances also affect hair quality. Suboptimal zinc levels, it is said, induce greying of hair and copper deficiency causes fading of brown- or black- pigmented hair. Other trace elements – iron and iodine can also affect hair colour, as well as vitamins A, B-2, and B-6, pantothenic, folic, and nicotinic acids, and biotin.

In aged dogs hair colour tends to fade. As a dog ages, his hair turns grey, especially on the head, beginning with the muzzle.

Too much exposure to sunlight can make the hair brittle and cause a black coat to redden or turn brown. After a dog has been clipped, the colour of its hair is noticeable lighter, and scares often leave a mark of hair that remains white throughout the rest of the dog’s life.

Hair loss in dogs

Hairlessness (alopecia) can also develop later in life. These defects can be associated with abnormal teeth, claws, and eyes, or with skeletal and other developmental defects. Hairless breeds of dogs (Mexican Hairless, Chinese Crested, American Hairless Terrier) have been bred for these defects. Many sporadic cases occur in other breeds of dogs, most often in males. Many affected dogs, including most of the hairless breeds, have patchy or pattern hairlessness as well as associated dental anomalies. All animals with abnormal follicular development are prone to clogged hair follicles, hair follicle infections, and hair foreign-body inflammations.

In dogs, there are several types of abnormalities in hair follicles. A syndrome known as colour dilution alopecia is associated with the gene that turns normally black or liver-colored hair blue, beige, or fawn. This syndrome is best known in Doberman Pinschers but is also commonly seen in colour dilute Dachshunds, Italian Greyhounds, Greyhounds, Whippets, Yorkshire Terriers, German Shepherds, silver Labrador Retrievers, and tricolour hounds. Affected dogs are born with normal hair coats but before 1 year of age begin to develop hair follicle inflammation and progressive hair loss in the blue or fawn-coloured areas. Black hair follicle dysplasia develops earlier with more complete hair loss in black and white dogs. It develops shortly after birth and affects only the black-coloured areas. This syndrome is most common in Papillons and Bearded Collies, and is inherited in Large Munsterlanders. Seasonal flank alopecia can appear in Boxers and Airedale Terriers.

Various woolly syndromes and post-clipping alopecia can occur in Spitz-type breeds. Reduced hair growth in Irish Water Spaniels develops at 2 to 4 years of age.

Another condition called alopecia X occurs in Pomeranians and other breeds.

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**Alopecia** is the absence of hair; hypotrichosis, which is much more common, is the presence of less hair than normal. Although these defects can be generalized, they commonly develop in patterns that spare the extremities or correlate with hair color. These ectodermal defects can be congenital or tardive and can be associated with abnormal or absent adnexa, with defects in other ectodermal structures (such as teeth, claws, and eyes), or with skeletal and other developmental defects.

**Ectodermal defect, dog**



COURTESY OF DR. GAIL KUNKLE.

**Ectodermal teeth abnormality, young dog**



COURTESY OF DR. KAREN A. MORIELLO.

**Dog in prior image as an adult with alopecia**



COURTESY OF DR. GAIL KUNKLE.

There are various modes of inheritance in those instances in which familial occurrence has been studied. X-linked ectodermal dysplasia has been reported in German Shepherds. Hairless breeds of dogs (eg, Mexican Hairless, Chinese Crested, American Hairless Terrier) and cats (Sphinx) have been bred for these ectodermal defects. In dogs the defect is due to FOXI3 gene variation. Many sporadic cases of ectodermal defects are described in dogs, most often in males. Affected dogs, including most of the hairless breeds, often have patchy or pattern hypotrichosis as well as associated dental anomalies. All animals with abnormal follicular development are prone to comedone formation, hair follicle infections, and hair foreign-body granulomas.

**Congenital ectodermal defect, dog**



COURTESY OF DR. GAIL KUNKLE.

At least 13 types of **hypotrichosis** have been described in cattle, affecting Angus, Ayrshire, Brangus, Holstein-Friesian, Hereford, polled Hereford, Guernsey, Gelbvieh, Jersey, as well as Normandy-Maine, Anjou-Charolais, and Simmental crosses. Most have autosomal recessive or sex-linked modes of inheritance. Associated defects include failure of horn development, hypophyseal hypoplasia, macroglossia, dental anomalies, abnormal coat coloration, and death (lethal hypotrichosis). Viable hypotrichosis, hypotrichosis with anodontia, semihairlessness, streaked hairlessness, black hair follicle dysplasia (Holstein), and cross-related hypotrichosis (rat tail) are specific types described in cattle.

In sheep, hypotrichosis is rarely reported, with the best known syndrome affecting the Polled Dorset. This involves the hair of the face most severely, but the wool is also of poor quality. In goats, hypotrichosis is associated with congenital goiter. In swine, two forms of hypotrichosis are known (Mexican Hairless, German), one of which is associated with goiter and death in the homozygote.

**Colour dilution alopecia, Doberman**



COURTESY OF DR. STEPHEN WHITE.

In dogs, there are several tardive **follicle dysplasias**, including colour dilution alopecia. This is found in some dogs bearing the coat colour genotype dd, which renders black genotypes blue and liver genotypes beige or fawn. This syndrome is best known in Doberman Pinschers but is also commonly seen in colour dilute dog breeds that include Dachshunds, Italian Greyhounds, Greyhounds, Whippets, Yorkshire Terriers, tri-colour hounds It has also been reported in a German Shepherd. Recently, “silver Labrador Retrievers” with colour dilution alopecia have been reported. Affected dogs are born with normal hair coats but before 1 year of age begin to develop folliculitis and hypotrichosis that is progressive and confined to the blue- or fawn-coloured areas. Recently, defects in the gene MLPH have been identified in affected dogs.

Black hair follicle dysplasia, a similar but earlier developing and more complete hypotrichosis, is seen in black and white piebald dogs. The hypotrichosis develops shortly after birth and affects only the black-coloured areas. This syndrome is best known in the Papillon and Bearded Collie breeds. Genetic analysis in Large Munsterlander’s has indicated an autosomal recessive inheritance in this breed. A similar follicular dysplasia is reported in non-piebald breeds.

Other types of follicular dysplasias of uncertain cause include seasonal flank alopecia of Boxers and Airedale Terriers and various woolly syndromes and post-clipping alopecia in Spitz-type breeds. Familial hypotrichosis of Irish Water Spaniels develops at 2–4 years of age, and a dominant mode of inheritance has been suggested. The condition formerly known as growth hormone-responsive alopecia in Pomeranians and other breeds is now called alopecia X, reflecting the complexity of factors, hereditary and otherwise, influencing these syndromes.

DOG SHAMPOO….Avoid The Top 14

## Certified Organic Is Safest

You put a high level of trust in the manufacturer of your dog’s grooming products, yet there are no regulations that hold manufacturers to standards for ingredient purity, verification of “natural” claims or disclosure of manufacturing processes.

**Certified organic dog grooming products go through a much higher level of scrutiny.**All ingredients are reviewed throughout their lifecycle – from where and how they are grown, harvested, processed, transported, packaged and shipped.

Certified organic dog grooming products also verify that there are no GMO ingredients, no pesticides, herbicides, artificial colors, or artificial fragrance.

**Bottom line**

When searching for your next dog shampoo …

**Search for “certified organic dog shampoo” not “natural dog shampoo**.”

If you do search for “natural dog shampoo” don’t purchase the product if it contains any of the 20 ingredients listed here!

These “top 14” ingredients can be a litmus test for determining whether a product is natural, safe and non-toxic. If the shampoo contains ANY of these ingredients you should NOT use the product on your dog.

1. Proprietary blend of coat and skin conditioners and moisturizers. I know what you’re thinking: “That isn’t an ingredient!” You’re right. But it IS frequently listed on dog shampoo labels. If you see this statement do NOT purchase this product. This is what manufacturers say when they don’t want you to know what’s in the bottle.

2. Artificial fragrance can come from hundreds to thousands of separate ingredients – none of which have to be listed on the label. Some synthetic fragrances have been linked to cancer as well as reproductive and developmental toxicity.

3. Pthalates are likely not listed on the label. If you see “fragrance,” it’s very likely that pthalates are present. They’re used to bond the fragrance to the other ingredients. Pthalates are hormone disruptors … think endocrine system issues.

4. Artificial colors are synthesized from petroleum and are linked to organ damage, cancer, birth defects, and allergic reactions. Artificial colors aren’t “pure” chemicals. Many of them are contaminated with byproducts and are purchased by the manufacturer to visually enhance the product. (What? You thought your shampoo was naturally hot pink?)

5. Formaldehyde preservatives. You won’t see “formaldehyde” on the list of ingredients; but it’s still around. When formaldehyde got a bunch of bad press, it was reformulated into a “slow-releasing” compound. While it may release less formaldehyde than its precursor, it’s still formaldehyde, which has been known to trigger an immune response that can include burning, itching, blistering, or scaling of skin. The jury is still out on whether these chemicals are linked to cancer, as they haven’t been thoroughly tested.

If you see any of these names on the bottle, avoid the product:  Bromopol, Doazolidinyl urea, DMDM Hydantoin (often mis-typed on dog shampoo bottles as DHDH hydantoin), Imidazolidinyl urea, Quaternium-7, -15, -31, -61, and Sodium hydroxymethylglycinate.

6. Isothiazolinone preservatives. Methylisothiazolinone and Methylchloroisothiazolinone are both known skin irritants that have been associated with significant allergic reactions. There’s strong evidence that methylisothiazolinone is also a neurotoxin.

7. Paraben preservatives are thought to be “stored” in the body and have a cumulative effect posing health risks such as estrogen disruption, cancer, and reproductive issues. They may be listed on the bottle as butylparaben, methylparaben, or propylparaben.

8. Cocamide-MEA is a surfactant that is restricted for use in cosmetics because it has high contamination concerns from nitrosamines. Nitrosamines are contaminants that can form under certain conditions – such as high temperature or acidic pH (3-5 or lower). They’re a class of chemicals that are thought to be carcinogenic, have reproductive toxicity, developmental toxicity and organ system toxicity.
Nitrosamines can also contaminate waste water. If you begin to think that the nitrosamine warning is alarmist, think again.

One of the top-selling “natural” dog shampoos on the market has Cocamide-MEA listed as an ingredient. The tested pH of this product was 3.5 … that’s well within the range for nitrosamines to develop.

9. Triethanolamine is very closely related to Cocamide-MEA and may be listed as Cocamide-TEA. It’s used as a surfactant and pH adjuster. Like Cocamide-MEA, it’s at high risk of being contaminated with nitrosamines.

10. Mineral oil in dog shampoo helps the skin retain its own moisture by providing a protective barrier over it. Sounds great, right? It also keeps the skin from releasing its own natural oils and eliminating toxins … and that’s not so great. It’s a liquid mixture of hydrocarbons from crude oil. It’s a possible toxin and allergy inducer. There are a lot of articles online suggesting that pet parents put a drop of mineral oil in their dogs’ eyes before a bath, saying the mineral oil will protect the eyes from stinging if you get detergent or soap in them. Don’t do this!

Only pharmaceutical-grade mineral oil has been cleaned of contaminants like complex hydrocarbons and benzene. Other grades of mineral oil are not completely free of contaminants.

11. SD Alcohol 40 (often called isopropyl or SD-40) is drying to both the skin and hair oils. SD-40 also enhances skin absorption – meaning it is easier for the other toxic ingredients to enter through the skin when SD-40 is present. Many ear cleaning products are primarily SD-40.

12. Polyethylene glycol (PEG) is a humectant – used to help the skin retain moisture. While it is a known skin irritant, the scarier side of PEG is that it is a “penetration enhancer” – meaning it’s a carrier for other chemicals, helping them cross through the skin and into the bloodstream. It gets worse … it may also be contaminated with dioxane and ethylene oxide!

13. PEG-40 Lanolin is a polyethylene glycol derivative of lanolin. There is limited evidence of it causing organ toxicity. The bigger concern is that it may be contaminated with dioxane and ethylene oxide.

14. Propylene glycol is a skin conditioner, solvent and humectant. Like polyethylene glycol, it’s a penetration enhancer. It’s also a suspected immune system toxin, neurotoxin, reproductive toxin and skin toxin.

Next, we look at six more ingredients that may cause allergic reactions or irritate sensitive skin. These ingredients have a high probability of being contaminated with toxic byproducts.

Why “high probability”? There are no governing agencies that set standards or regulations for manufacturers in the pet industry, and no one’s testing these formulations to check for byproducts.

Studies that tested very popular human products found contaminants in some very popular “green marketed” brands!

To be on the safe side, you don’t want any of these ingredients in your dog’s shampoo:

1. Sodium benzoate preservative. When sodium benzoate and citric acid or ascorbic acid (vitamin C) are mixed together they may become benzene – a cancer-causing chemical associated with leukemia and other blood disorders. If not mixed with citric or ascorbic acid, sodium benzoate is considered safe.

2. Sodium Lauryl Sulfate (SLS) is a surfactant, detergent, and emulsifier used in a LOT of products. In its powder form, SLS is a known skin irritant and may be inhaled causing organ system toxicity.

SLS may be contaminated with toxic solvents from the manufacturing process. It’s readily absorbed into the eyes where it’s been shown to cause eye irritation and damage eye proteins. Even at very low concentrations, SLS has been shown to remain in a person’s system (brain, heart, and liver) for 4 to 5 days.

Combine that with the fact that SLS is a known penetration enhancer and there’s a possibility of exposing the eyes to some damaging chemicals. If that didn’t steer you away from SLS, the final blow is the manufacturing process, called ethoxylation, is a highly polluting environmental toxin.

3. Sodium Laureth Sulfate is used as a cleaning agent (surfactant) with a high risk for contamination with 1,4-dioxane (dioxane), a known carcinogen, and ethylene oxide – also a known carcinogen, developmental toxin, immunotoxin, and allergen.

The sulfates are derived from coconut oil and as a result manufacturers market them as “all natural plant based & vegan” ingredients.

4. Ammonium Laureth Sulfate is a surfactant known to cause skin irritation and may be contaminated with dioxane and ethylene oxide. Is the foamy texture it produces worth the risk?

5. Polysorbates are a fragrance component, a surfactant, an emulsifying and stabilizing agent. This ingredient starts out as sorbitol – a harmless sugar alcohol usually derived from corn syrup. It’s then treated with ethylene oxide.

Depending on how much ethylene oxide was used, the polysorbate has a number behind its name. For example, Polysorbate 20 is treated with 20 parts ethylene oxide. If the ethylene oxide isn’t completely cleaned out of the final ingredient, it’s contaminated with a known carcinogen.

6. Cocamidopropyl betaine is a synthetic surfactant associated with skin irritation and allergic reactions. It’s used to make the product thick and foamy. Like the sulfates, cocamidopropyl betaine is derived from coconut oil.

During processing, it’s mixed with the chemicals amidoamine and 3-dimethylaminopropylamine, which can remain in the final product. These contaminants can form nitrosamines under certain conditions (high temperature or acidic pH).