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- Read the enclosed course.
- Complete the questions at the end of the course.
- Return your completed Answer Sheet/Evaluation to Paragon CET by mail or fax, or complete online at www.ParagonCET.com. Your postmark or facsimile date will be used as your completion date.
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Faculty

Paragon CET Staff

Division Planner

Leah Pineschi Alberto, licensed cosmetologist and instructor of cosmetology, has been educating students in Northern California since 1975. In addition, she has been responsible for training educators in cosmetology, esthetics, and manicuring for more than 30 years.

Mrs. Alberto began her career with Don's Beauty School in San Mateo, California. She held a 30-year position at Sacramento City College and is currently a State Board expert with Cinta Aveda Institute. She is a salon owner, a former Department of Consumer Affairs examiner, and a speaker at the Esthetics Enforcement Conference.

The health and safety of the community of stylists, salon owners, and school owners has been the focus of Mrs. Alberto's career. She served on the State Board Task Force on Pedicure Disinfection commissioned by Governor Schwarzenegger to investigate the cleanliness of the pedicure industry. The Task Force was responsible for developing foot spa safety regulations in response to illnesses and deaths resulting from unsafe pedicure practices.

Mrs. Alberto is currently a member of the California Cosmetology Instructors Association and has her own consulting business.

Audience

This course is designed for all salon and spa professionals.

Accreditation

Paragon CET is approved as a provider of continuing education by the Illinois Division of Professional Regulation for Cosmetologists, Estheticians, and Nail Technicians. License number 190.000510.

Paragon CET courses meet the requirement for continuing education as set forth by the Iowa Board of Cosmetology Arts and Sciences.

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Designation of Credit

Paragon CET designates this continuing education activity for 2 CE hours.

About the Sponsor

The purpose of Paragon CET is to provide challenging curricula to assist professionals to raise their levels of expertise while fulfilling their continuing education requirements, thereby improving the quality of service to their clients.

Course Objective

The purpose of this course is to provide salon professionals with a review of the chemical makeup of the hair, skin, and nails.

Learning Objectives

Upon completion of this course, you should be able to:

- 1. Define pH and how it affects hair, skin, and nails.
- 2. Outline the chemical and anatomic makeup of hair, skin, and nails.
- 3. Describe chemicals commonly encountered in the salon setting.
- 4. Discuss conditions and disorders that can affect the quality of hair, skin, and nails, including considerations for children and the elderly.

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A complete Works Cited list appears on page 14.

1

INTRODUCTION

In order to offer safe and effective services to the public, cosmetology professionals must be aware of the chemical makeup, growth, and structure of hair, skin, and nails. Salon professionals' basic knowledge and their commitment to increased understanding will translate into client satisfaction.

ACIDS AND BASES

Understanding the potential hydrogen (pH) scale is essential to the discussion of the chemical makeup of the hair, skin, and nails. The pH scale measures the acidity, or excess of hydrogen ions (H+), and the base or alkalinity, defined as an excess of hydroxide ions (OH-). On the pH scale, values between 1 and 7 are considered acidic, and values between 7 and 14 are base or alkaline. For example, vinegar has a low pH (2.4) and is acidic, tasting sour, bitter, or sharp. Chlorine and ammonia both have high pH (11.7 and 12, respectively) and are extremely alkaline. Distilled water is usually between a 6 and 7 on the pH scale, which is considered essentially neutral (neither acidic nor alkaline). If substances are combined, the pH of the resulting compound will be different than the original portions.

Each change of one number up or down on the pH scale is exponential. A pH of 9 is ten times more alkaline than a pH of 8. A pH increase of two whole numbers is equal to 100-fold change in alkalinity. Therefore, a small change on the pH scale indicates a large actual change in pH [2].

THE PH OF HAIR

The pH of hair ranges between 4.5 and 5.5. When selecting products for use on the hair, it is important to consider the condition of the hair and the pH of the product. The higher the pH, the more alkaline or harsh the product may be. In the case of shampoo, a higher pH may be selected to remove buildup, but this in turn can strip hair of necessary oils, resulting in over-stimulation of the sebaceous oil glands in the scalp and worsening of oily hair. Highly porous hair, often a result of overprocessing, is dry and brittle (lacking necessary oils) and will require a shampoo with a lower pH and therefore less alkalinity [2].

THE PH OF THE SKIN

Normal skin surface pH is between 4 and 6.5 in healthy people, though it varies among the different areas of the skin. Newborn infants are born with a higher skin surface pH compared to adults, but this normalizes within three days of birth. Similar to the action of alkaline products on the hair, the pH of products used on the skin must be chosen thoughtfully [3]. The skin is protected from bacterial and fungal infections and surface contaminants by the acid mantle. The acid mantle is a thin, film-like barrier on the outermost layer of the skin. The acid mantle contains lactic acid, amino acids from sweat, free fatty acids from sebum (an oily substance secreted by sebaceous glands via the hair follicles), and amino acids and pyrrolidine carboxylic acid from the cornification process of skin [3]. Cleansing the skin with alkaline soaps or detergents can disturb the acid mantle.

THE PH OF NAILS

Nails are essentially hardened skin cells. They are susceptible to both bacterial and fungal infection when the pH changes as a result of exposure, age, and certain medications.



CHEMICAL AND ANATOMIC MAKEUP

SKIN

Skin is the largest organ of the body and acts as a barrier against the environment, pathogens, and dehydration. The skin has seven functions [13]:

- Sensation
- Hydration
- Absorption
- Regulation
- Protection
- Excretion
- Respiration

Sensations or feelings allow you to react to temperature, pain, and pressure and to recognize touch. Some areas of the skin are more sensitive (e.g., fingertips) than others. Skin also allows the body to retain and absorb water and excretes perspiration and oils. These functions can cool the body, allow a person to remain hydrated, and maintain suppleness. The skin serves as an important form of protection as it guards against the elements and from bacteria and fungi [2]. Finally, skin provides for expression and body image [13]. Skin plays a vital role in self-esteem and social communication. Skin characteristics have an impact on how an individual communicates both verbally and nonverbally and how the other person reacts to that individual. It also provides significant social cues regarding health and vitality.

Human skin is composed of two main layers: the epidermis (outer layer) and the dermis (inner layer) (*Image 1*). The epidermis is divided into five layers of cells. They are, in order from the outermost inward:

- Stratum corneum: This layer is composed of dead keratinized cells and is constantly being sloughed off and renewed from below. It also contains the acid mantle, an oily layer with reduced pH.
- Stratum lucidum: Also known as the clear layer, this layer is found in areas where the epidermis is thicker, like the palms of the hands and the soles of the feet. It lies directly below the stratum corneum.
- Stratum granulosum: This layer is actually composed of 1 to 5 sub-layers and is believed to help with keratin formation.
- Stratum spinosum: Often referred to as the "prickly layer," cells in this layer begin to flatten as they are migrating toward the skin surface. The stratum spinosum acts as a stabilizing support to the skin.

• Stratum germinativum or basale: The deepest layer of the epidermis is the stratum germinativum. It is composed of a single layer of constantly dividing cells that form new cells. Melanin, which determines skin color and protects the sensitive dermis from ultraviolet (UV) light, is produced in this layer as well.

The dermis is the thickest layer of the skin, varying in thickness from 0.2–4 mm. The reticular dermis anchors the skin to the body and contains sweat glands, hair follicles, nerves, and blood vessels. The dermis also contains the sebaceous glands, which secrete sebum and lubricate the skin. The major proteins found in the dermis are collagen and elastin. Collagen gives skin its tensile strength, while elastin provides the skin with elastic recoil. This characteristic prevents the skin from being permanently reshaped. The dermis is divided into two areas: the papillary dermis, which contains capillaries for blood flow, and the reticular layer, which is comprised of thick collagen fibers. The dermis also contains the receptors that sense pain and pressure.

Beneath the dermis lies subcutaneous tissue, which attaches the skin to the underlying structures. Subcutaneous tissue contains fat, connective tissue, blood vessels, lymphatics, and nerve endings [13].

NAILS AND NAIL EXTENSIONS

The nail is made of keratin, a waterproof and durable protein, and grows in a similar way to hair. Nail growth begins with the matrix, a layer that produces the keratin cells that are pushed outward from the base of the nail. The shape and size of the matrix also influences the shape and thickness of the nail [1]. The cells multiply and push upward and harden into three layers: the cuticle, cortex, and medulla. Nail growth is effected by hormones. exercise, nutrition, and an individual's overall health. On average, nails grow 1/10 to 1/8 inch per month in adults; in younger people nail growth can be faster because of more rapid cell reproduction. The thumb nail grows slowest, while the middle finger grows fastest. Toenails are harder and thicker than fingernails and grow more slowly [2].

Artificial nails or nail extensions can be applied over a plastic tip or directly on the nail when nails are too thin or weak to grow to the length that a client desires. There are three general systems to create artificial nails:

- Powder and liquid acrylic
- Wraps and no-light gels
- Light-cured gels

In addition, fabric wraps (made of silk, linen, paper, or fiberglass) may be added to nails to strengthen weak nails or help a cracked nail grow out.

HAIR AND SCALP

The main purpose of hair is to protect the body from heat, cold, and injury. The root of the hair is located below the surface of the skin, enclosed within the follicle; the hair shaft is the exposed portion. The hair root includes the follicle, bulb, papilla, arrector pili muscle, and sebaceous glands. Numerous factors affect the quality of hair growth, including an unhealthy scalp.

Follicle Structure

The hair follicle is a tube-like pocket in the skin that encases the hair root (Image 2). It is created when cells in the basal layer of the epidermis travel down to the lower layer to seek nourishment. The structure of the follicle or root sheath is similar to a sleeve in the skin from which the hair will grow. A sebaceous gland is attached to the follicle and is the source of sebum, which lubricates the hair during growth. The follicle extends from the epidermis through the dermis. The hair bulb is the lowest area of the follicle and receives nutrients from the dermal papilla. The arrector pili muscle is a small muscle near the base of the follicle that reacts to responds to emotional stresses or cold to create the sensation of "goose bumps" [2]. There are no hair follicles on the palms of the hands or the soles of the feet.



Keratinization

Growing hair is made up of keratin. As these protein cells mature, they become fibrous and die in a process called keratinization. When this process is over, the cells that form the hair strand are no longer alive [1].

Physical Properties

Hair texture includes three classifications: coarse, medium, or fine. The texture of hair is related to the thickness or diameter of the hair strand. Coarse hair has the largest diameter, while fine hair has the smallest. Coarse hair is stronger and is therefore more resistant to lighteners, coloring, and other chemical processes, including relaxing or waving solutions.

Hair density refers to the number of hairs per square inch of scalp. The average hair density is 2,200 hairs per square inch. However, naturally blonde hair is more dense, and naturally red hair is less dense. People with the same hair texture may have different hair density and vice versa.

#P2012 Chemical Makeup of Hair, Skin, and Nails

The porosity of hair refers to the ability of the hair to absorb moisture. Low porosity results in resistance to chemical treatment; high porosity may result in over processing.

Hair elasticity refers to the stretchiness of the hair or the ability of hair to stretch and return to its original form without breaking. Hair with low elasticity is brittle and, unlike normal hair, fails to stretch without breaking.

Dryness of the hair and scalp can be related to inactive sebaceous glands, excessive shampooing, or weather (winter or dry climates). Conversely, overactive sebaceous glands can cause oily hair and scalp. Poor diet, lack of exercise, and incorrect hygiene can aggravate both dryness and oiliness, as can medical conditions and prescription and non-prescription medications [2].

CHEMICALS COMMONLY ENCOUNTERED IN SALONS

Cosmetologists and beauty professionals must be aware of all the inherent risks when mixing or using any products or combinations of products on the skin, hair, or nails.

NAILS

Nail salon workers continuously come into contact with nail care products and solvents, some of which can cause lasting health effects. It has been suggested that nail salon workers have significantly higher exposure to dangerous chemicals than the average person. While research on nail salon workers is limited, studies provide reason for concern for this vulnerable population.

According to the Federal Food, Drug, and Cosmetic Act, nail care products are considered cosmetics and are regulated under the same law as makeup. Nail products for use both in the home and in the salon are regulated by the U.S. Food and Drug Administration.

Methyl Methacrylate (MMA) Monomers

Artificial nails are composed primarily of acrylic polymers and are made by reacting together acrylic monomers with acrylic polymers. When the reaction is completed, traces of the monomer are likely to remain in the polymer. For example, traces of methyl methacrylate (MMA) monomers remain after artificial nails are formed. The polymers themselves are typically quite safe, but traces of the reactive monomers can result in an adverse reaction in sensitive individuals, including redness, swelling, and pain in the nail bed. Today, ethyl methacrylate monomer is commonly used in the creation of acrylic nails, although MMA monomer may still be found in some artificial nail products. In the early 1970s, the FDA received a number of complaints of injury associated with the use of artificial nails containing MMA. Among these injuries were reports of fingernail damage and deformity, as well as contact dermatitis. Unlike MMA monomers, methyl methacrylate polymers were not associated with these injuries. Based on its investigations of the injuries and discussions with medical experts in the field of dermatology, the agency chose to remove from the market products containing 100% MMA monomer. The FDA has declared MMA "poisonous and deleterious" and considers it use in artificial nail products inappropriate [5; 6]. In 2004, the Florida Legislature voted to ban MMA in salons. Thirty-eight states now prohibit the use of products with MMA monomers, and in Florida, using or possessing MMA is a second-degree misdemeanor punishable by a \$500 fine and/or imprisonment not to exceed 60 days [6]. Although MMA has been banned in Florida for more than a decade, it continues to be found in salons by Florida Department of Business and Professional Regulation inspectors [19].

HAIR

Permanent Waving

Permanent waving makes physical and chemical changes to the makeup of hair. The process of permanent waving of hair has remained generally the same since the 1930s. Usually, the hair is wrapped onto rods, and a lotion containing ammonium thioglycolate is applied, changing the protein structure in the hair. This is referred to as an alkaline perm. When the solution is applied, the cuticle of the hair opens and is penetrated to the cortex, breaking the salt bonds. Other types of substances may be used for this purpose, including glycerol monothioglycolate ("acid perm"), a mixture of acid and alkaline ("exothermic perm"), or neutral lotions. After a neutralizer is applied to close the structure again, the hair takes the shape of the rod. Conditioners are also used to decrease damage to the hair. An alkaline perm is generally used for hair that will be less likely to respond to the curling, including coarse, thick, or resistant types. Acid and neutral perms are useful for clients with damaged hair and fragile hair types [2].

Hair Coloring and Bleaching

Four types of hair color will fit the desires of most clients: temporary color, semi-permanent color, demi-permanent color, and permanent color. Temporary hair coloring coats the cuticle of the hair shaft and remains visible until the next shampoo. Temporary color can only be used to attain a darker color. Semi-permanent coloring contains a low level of hydrogen peroxide and partially penetrates the cuticle of the hair shaft. This color typically remains for 4 to 5 shampoos. Demi-permanent coloring penetrates deeper through the cuticle to the cortex through the use of an alkaline agent, such as ethanolamine or sodium carbonate. Because it penetrates deeper, it lasts longer, usually between 20 and 28 shampoos. Finally, permanent hair coloring lasts until natural hair grows out or until the coloring fades. These coloring products contain a developer or an oxidizing agent and an alkalizing agent, usually ammonia. Ammonia allows color to enter the hair shaft by swelling the cuticle to the point at which it can best be penetrated.

Hair bleaching or lightening is achieved through oxidation of the melanin in hair and is considered a type of permanent hair coloring. In this process, hydrogen peroxide is mixed with an alkaline product (e.g., ammonia), which reacts with melanin in the hair and removes the color. Most bleaches should be kept away from the skin to prevent burns, but there are gentle oil or cream lighteners that can be applied directly to the scalp. Oil lighteners are very mild and can be used on the face and body as well. Strong lighteners, containing alkaline mixed with hydrogen peroxide, can irritate the scalp and are therefore used most often for highlighting [1].

Chemical Hair Relaxing

Hair relaxing, or lanthionization, reforms or relaxes hair with excessive curl or wave to a straight position. The process is similar to that used for permanent waving, but the absence of the curling rods changes the end result. There are two types of chemical relaxers: sodium hydroxide and ammonium thioglycolate. Sodium hydroxide relaxers (also referred to as lye relaxers) have 2% to 3% sodium hydroxide in a cream base; lithium hydroxide, potassium hydroxide, calcium hydroxide, and guanidine hydroxide are also available and are slightly milder. The pH for this type ranges from 11.5 to 14 [1]. Ammonium thioglycolate relaxers contain 4% to 6% thioglycolate acid and 1% ammonium hydroxide; the pH range is 8.8 to 9.5. The relaxer is applied to the roots of the hair, where it alters the hair shaft's structure. Some relaxers require a protective base (e.g., petroleum jelly) be placed on the scalp prior to the procedure to prevent burning or irritation. After the relaxing phase is completed, neutralizer is applied to stop the relaxing process and balance the pH. Neutralizers, usually either hydrogen peroxide, sodium perborate, or sodium bromate, are known as fixatives or stabilizers. These bonding agents can cause the hair to be fragile, and hair can be significantly damaged by excessive application of relaxers.

SKIN-CARE PRODUCTS AND COSMETICS

Skin-care products and cosmetics often contain combinations of methyl, propyl, and ethyl parabens. Common ingredients in this group include glycerine, propylene glycol, sorbitol, and hyaluronic acid. Propylene glycol is a petroleum-based humectant used to retain water and is used in the manufacture of many skin-care products. Synthetic colors, usually labeled as FD&C or D&C followed by a number, may be toxic to sensitive individuals. They are coal-tar based additives and known cancer-causing agents. Triethanolamine (TEA) and diethanolamine (DEA) are common ingredients used to adjust pH balances. These are very toxic and are associated with eye problems and skin dryness. The simple ingredient "fragrance" can include a variety of chemicals including phthalates, a substance known to cause cancer and birth defects in lab animals.

The FDA has created a guide outlining its rules for labeling on cosmetics. The guide sets guidelines for the use of certain terms and claims, including [17; 18]:

- Cosmetic: A product, except soap, intended to be applied to the human body for cleansing, beautifying, promoting attractiveness, or altering the appearance.
- Alcohol-free: In cosmetic labeling, the term "alcohol," used by itself, refers to ethyl alcohol. Cosmetic products, including those labeled "alcohol free," may contain other alcohols, such as cetyl, stearyl, cetearyl, or lanolin alcohol.
- Hypoallergenic: The term means whatever a particular company wants it to mean; there are no Federal standards or definitions that govern the use of the term.

CONDITIONS AND DISORDERS

CONDITIONS AND DISORDERS OF THE HAIR AND SCALP

Dandruff

Dandruff, or pityriasis, is a medical condition characterized by excessive shedding of dead skin cells from the scalp. Dandruff is a result of the fungus *Malassezia*. *Malassezia* is present on all skin and is only problematic when the cell growth increases to an abnormal level, interfering with natural cell renewal [7].

Dandruff may be accompanied by inflammation and redness and should be treated with mild antifungal shampoos containing pyrithione zinc, selenium sulfide, or ketoconazole. Consultation with a doctor and topical steroids may be required [2].

Alopecia

Alopecia is the technical term for any abnormal hair loss (Image 3). The most common types are androgenic alopecia, alopecia areata, and postpartum alopecia. Alopecia usually is the result of hormonal, age-related, or genetic changes. Androgenic alopecia is often referred to as malepattern baldness. This type of alopecia is genetically inherited and usually starts at about 35 years of age in both men and women. Alopecia areata is characterized by sudden onset of hair loss, often in patches, resulting from an autoimmune response. In people with alopecia areata, white blood cells attack the hair follicles, preventing hair growth. Males and females of all races can be affected, and onset is usually in childhood. Postpartum alopecia affects women shortly after the birth of a child and is temporary, usually lasting less than one year.



Trichotillomania

Trichotillomania is a disorder characterized by the non-cosmetic pulling of hair, resulting in significant hair loss. Trichotillomania is commonly associated with considerable distress and is a diagnosable mental disorder. The majority of individuals start pulling hair during childhood or adolescence, though hair pulling can begin at any age. While most adults with trichotillomania are women, hair pulling may be about as common in young boys as it is in girls [8]. Adults most commonly pull from the scalp, eyelashes, eyebrows, beard, and pubic area. Children may also pull hair from other people or from pets. Specific signs of trichotillomania include broken hairs, flame hairs (residual hair left after pulling and breaking a strand), tulip hairs (short and darker hairs with tulip flower-shaped ends), and coiled hairs (the remaining, coiled hair that remains after a pulling force fractures a hair shaft) [4].



Individuals with trichotillomania often engage in other damaging body-focused behaviors, such as skin-picking or nail-biting. Trichotillomania also has been viewed as a form of obsessive compulsive disorder because of the repetitive and seemingly compulsive nature the action. Treatment may include cognitive-behavioral therapy and medications prescribed by a doctor.

Infestations

Parasites like head lice obtain their nutrients by attaching to another organism (a "host"). Head lice are transferred from one person to another through close contact or sharing grooming equipment (*Image 4*). Treatment includes lice-killing shampoo and removal and sterilization of bed linens, grooming equipment, and clothing. Another potential infestation is scabies, caused by the itch mite *Sarcoptes scabiei*. These mites burrow into the skin and produce intense itching (especially at night) and a pimple-like rash. An extended period of direct skin-to-skin contact is usually required to transmit scabies; however, transmission by infected bed linens is possible because the mites can live up to 48 hours off of the host [9; 12].

CONDITIONS AFFECTING THE NAILS

Diseases, disorders, and conditions of the nail are called onychosis. These diseases require referral to a doctor and careful handling by the cosmetology professional. No services should be provided when disease is present.

Onychomycosis, tinea unguium, or unguis is a fungal infection of the nail (*Image 5*). This fungal infection appears as a thickened, yellow, and brittle nail bed, but it is usually not painful. Some clients will lose the nail entirely. Treatment of onychomycosis involves prescription antifungal medications. Other possible infections include paronychia (bacterial infection of the skin around the nail) and onychoptosis (periodic nail loss). Each of these disorders requires treatment by a doctor.

Other nail diseases and conditions do not require medical intervention but can be irritating irregularities that interfere with the client receiving nail treatments [1]. Nails can be overly thick or thin, ridged, furrowed, concave, or ingrown. In these cases, the provision of service depends upon the condition of the nail and presence of infection. Clients may also have hangnails, bruised nails (dark red or purple blood clots under the nail plate), white spots on nails, overgrown cuticles, and bitten or split nails.



CONDITIONS AND DISORDERS OF THE SKIN

As discussed, the skin is a protective barrier and constantly comes into contact with pathogens that cause a variety of diseases. In some cases, the skin can become infected, which can threaten overall health and should be a consideration for cosmetologists. Skin infection can result from bacterial, fungal, or viral sources.

Bacterial Infections

Common bacterial infections include cellulitis, folliculitis, and impetigo. Cellulitis is often caused by *Streptococcus* or *Staphylococcus aureus* bacterial infections, animal bites, or wounds exposed to contaminated water. Clients with cellulitis will have skin inflammation and tenderness (*Image 6*). Treatment includes antibiotics and the application of cold compresses to the infection site.

Folliculitis occurs when bacteria infects the hair follicles. Symptoms include a rash, itching, redness, and pimple-like bumps. In extreme cases, there will be damage to the hair and follicles. Most of the time, the infection will clear up on its own, but persistent rashes may require antibiotics.



Impetigo is an infection usually caused by staphylococcal or streptococcal bacteria. It causes red sores or blisters that can break open, ooze, and develop a yellow-brown crust. Impetigo is highly contagious and can be spread to others through close contact or by sharing items like towels and toys. Antibiotic treatment is usually required.

Fungal Infections

Like bacteria, fungi exist on the healthy skin's surface, especially in moist areas of the body. However, fungi can become harmful if they begin to overgrow and invade the skin. Common fungal skin infections include candidiasis and tinea infections.

Candidiasis is an overgrowth of the fungus Candida albicans. Commonly referred to as a yeast infection, it can affect the mouth, nails, and/or genitals. It can result in white patches, redness, itchiness, and pain, depending on the area affected. Treatment with prescription creams and/or mouthwashes may be necessary.

A tinea infection causes red, itchy, scaly, ring-like blotches on the affected area. This infection is often referred to as ringworm, jock itch, or athlete's foot, depending on the area affected. Treatment is with antifungal medications and steroids to reduce inflammation in more serious cases. Another type, tinea versicolor, typically affects the torso and causes a series of lighter or darker blotches on the skin that will not tan. Antifungal medications and applying dandruff shampoo to the skin are two methods of treating this fungal skin infection [10].

Viral Infections

Viral infections of the skin are particularly concerning because they have no known cure. As such, treatment for viral conditions focuses on relieving symptoms and diminishing outbreaks. Common viral infections include herpes simplex and herpes zoster (shingles).

Herpes can develop on many parts of the body, but most commonly affects the mouth, lips, and/or genitals. Oral herpes, or cold sores, appear as small, itchy blisters around the mouth or on the lips or gums. Antiviral drugs and topical creams are used to shorten outbreaks and lessen pain and itching.

Shingles is caused by the reactivation of the chickenpox virus, mainly in older adults. It is characterized by a blistering rash, skin sensitivity, and severe pain and/or burning. Usually, the rash occurs on only one side of the body. Individuals with shingles cannot spread shingles but can transmit chickenpox [11].

Urticaria (Hives)

Urticaria, or hives, occur as a rash or welts and are often itchy, burning, or stinging. They can appear anywhere on the body and can signal a serious allergic reaction, especially if accompanied by difficulty breathing. Hives may be caused by a reaction to medications, such as aspirin or penicillin; foods, such as eggs, nuts, and shellfish; food additives; temperature extremes; or infections.

Other Skin Conditions

Psoriasis is an autoimmune disorder that causes the abnormal build-up of skin cells, resulting in thick, dry, scaly patches of rough skin. Psoriasis is chronic but not contagious.

Dermatitis is a general term used to describe inflammatory disorders of the skin. Types of dermatitis include eczema and seborrheic dermatitis (often associated with dandruff). Although these disorders are generally harmless, they can cause discomfort and self-consciousness.



Acne is a chronic inflammatory disorder of the sebaceous oil glands. Depending on the type of inflammation, people with acne may have blackheads, whiteheads, cysts, and/or scarring (*Image 7*). In severe cases, oral medications may be used to clear up breakouts.

Skin Cancer

Skin cancer is a constant concern. More than 5.4 million cases of nonmelanoma skin cancer are diagnosed each year, making it the most common cancer in the United States [14]. Exposure to UV radiation, primarily sun exposure, has been the most significant factor associated with the three primary types of skin cancers. Sources of UV radiation include the sun, sunlamps, sunbeds, and other types of tanning devices.

Skin cancers are categorized as either melanoma or nonmelanoma types. Nonmelanoma skin cancers vary greatly in appearance and can be pearly, waxy, or translucent bumps (papules), or scaly, shiny, gray-to-red patches (*Image 8* and *Image 9*). Melanomas can also vary in color, shape, and size and can resemble moles or freckles (*Image 10*). Generally, melanomas can be differentiated from noncancerous moles because they have at least one of the following features [15; 16]:

- Asymmetry
- Border irregularity
- Color variations
- Diameter of 6 mm or greater
- Evolving size, shape, surface, shades of color, or symptoms (such as itching or tenderness)

These characteristics are often grouped together and referred to as the ABCDE rule.

Skin Disorders in Children

Children are commonly affected by allergies and skin infections and are especially sensitive to exposure to extremes of temperature. "Fifth disease," a contagious viral rash, primarily affects children. It is usually a mild illness that lasts approximately two weeks. Treatment includes rest, fluids, and non-aspirin pain relievers.





Chickenpox may also affect children, although less so as a result of widespread vaccination. Chickenpox is characterized by an itchy rash of blisters all over the body and can lead to serious complications such as pneumonia, brain damage, or death.



Warts develop in some children. These skin growths are caused by contact with the contagious human papillomavirus and can spread from personto-person or through contact with toys and other objects. Treatments include freezing, surgery, lasers, and chemicals.

Coxsackievirus infection, or hand, foot, and mouth disease, usually occurs in children younger than 10 years of age. The illness starts with a fever, then progresses to painful mouth sores and a non-itchy rash with blisters. It spreads through coughing, sneezing, and used diapers. Treatment includes non-aspirin pain relievers to control the fever.

Scarlet fever is a rash caused by a *Streptococcus* infection, usually strep throat. Symptoms include sore throat, fever, headache, bright red rash (especially in the armpits and groin), abdominal pain, and swollen neck glands. After 7 to 14 days, the rash will slough off. Scarlet fever is very contagious, but good hand washing can reduce its spread.

Skin Disorders in the Elderly

As we age, our skin undergoes a number of changes influenced by lifestyle, diet, heredity, and smoking. UV light exposure from the sun is the main cause of skin damage. Skin begins to stretch, sag, and wrinkle as elastin is lost. Aging skin can be rough and dry and may begin to show both benign and pre-cancerous growths. Thinning skin and prescription medications can increase the appearance of age-spots on the face, hands, and forearms. Some diseases, including shingles, occur more frequently in older adults.

SUMMARY

Knowledge regarding the physical and chemical structures of hair, nails, and skin is essential for all salon professionals. This section has provided an overview of healthy hair, nails, and skin, and disorders and conditions that can affect these structures. An understanding of the variety of beauty and health products used in cosmetology will help to improve client satisfaction and salon safety.

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TEST QUESTIONS #P2012 CHEMICAL MAKEUP OF HAIR, SKIN, AND NAILS

This is an open book test. Please record your responses on the Answer Sheet. A passing grade of at least 75% must be achieved in order to receive credit for this course.

Accreditation: Paragon CET is approved as a provider of continuing education by the Illinois Division of Professional Regulation for Cosmetologists, Estheticians, and Nail Technicians. License number 190.000510.

 $Paragon \ CET \ courses \ meet \ the \ requirement \ for \ continuing \ education \ as \ set \ forth \ by \ the \ North \ Carolina \ Board \ of \ Cosmetic \ Art \ Examiners.$

Designation of Credit: Paragon CET designates this continuing education activity for 2 CE hours.

This 2 CE Hour course must be completed by October 31, 2021.

- 1. The two main layers of the skin are the epidermis and dermis.
 - A) True
 - B) False
- 2. Melanin is produced in the stratum lucidum.
 - A) True
 - B) False
- 3. There are no hair follicles on the palms of the hands.
 - A) True
 - B) False

- 4. Coarse hair has the largest diameter, while fine hair has the smallest.
 - A) True
 - B) False
- 5. Bruised nails are characterized by the presence of a dark red or purple blood clot under the nail plate.
 - A) True
 - B) False

Be sure to transfer your answers to the Answer Sheet/Evaluation. DO NOT send these test pages to Paragon CET. Retain them for your records. PLEASE NOTE: Your postmark or facsimile date will be used as your test completion date.