# Dictionary of Terms

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

## A

**Abrasion** - In dermatology, an abrasion is a wound caused by superficial damage to the skin, no deeper than the epidermis
**Accutane** - Powerful drug derived from vitamin A that's used in the treatment of severe acne. The generic name is *isotretinoin*. If taken during pregnancy, it's highly likely to cause severe birth defects.
**Acne** - Skin condition characterized by plugging and inflammation that involves the hair follicles and sebaceous glands. It can take many forms including blackheads, whiteheads, papules, pustules, and nodules.
**Acne Vulgaris** - Medical term used to describe acne.
**Actin** - is a protein of two types of filaments in cells: microfilaments, one of the three major components of the cytoskeleton, and thin filaments, part of the contractile apparatus in muscle cells.
**Actinic Keratoses** - are a common condition of sun-induced, precancerous skin lesions
**Adipose tissue** - adipose tissue or body fat or just fat is loose connective tissue composed of a dipocytes.
**Adult-onset acne** - Overwhelmingly a condition of females, this type of acne turns up after the age of 18. It can crop up in women's 20s, 30s, or even later in life. It's sometimes referred to as female adult acne or post-adolescent acne.
**AFT** – Advanced fluorescence tech – light based.
**Aging** - is a process that begins at the deepest cellular level caused by free radicals
**Allantion** - A derivative of uric acid that is soothing and calming to the skin.
**Alpha hydroxy acids (AHAs)** - Fruit acids found in plants, constituents of many over the counter acne and cosmetic products, such as moisturizers and sunscreens. Also used in chemical peels.
**Androgens** - General term for hormones that have masculinizing features. Both males and females produce them. They cause the sebaceous gland to enlarge and produce more sebum, an important factor in the development of acne.
**Angiogenesis** - physiological process through which new blood vessels form from pre-existing vessels. Angiogenesis is a normal and vital process in growth and development, as well as in wound healing and in the formation of granulation tissue.
**Antioxidants** - Chemicals that neutralize free radicals that cause damage to the body and skin. These come from eating fruits and vegetables and also can be applied topically to help heal the surface of the skin.
**Apocrine glands** - scent glands found in armpits and groins
**Astringent** - Solution that removes oil from the skin. Often used after a facial wash to remove any remaining traces of a cleanser.
**Azelaic acid** - Natural chemical produced by yeast. Used as a topical agent to treat acne and rosacea. It can also also be used to lighten the skin.

## B

**Basal Layer** (Stratum basale) - The lowermost layer of the epidermis. This layer provides replacement cells that travel upward and replenish the skin with new cells.
**Benzoyl peroxide** - Topical antibacterial agent used to treat acne. Found in more over the counter and prescription products than any other topical agent.
**Beta hydroxy acids (BHAs)** - A class of acids, including salicylic acid, that are used as exfoliants. They're found in many over the counter acne and cosmetic products, such as moisturizers and sunscreens. They're also used in chemical peels.
**Blackhead** - An *open comedon*. The dark acne lesion that consists of a plug of keratin and sebum. The dark color is due to a buildup of melanin.

**Blue light therapy** - Visible light treatment that works by killing the acne producing bacteria, p.acnes, for a short period of time.
**Board Certified Physician** - In relation to plastic surgery, surgeons who are certified by the American Board of Plastic Surgery (ABPS). They undergo rigorous training, including medical school, a plastic surgery residency program, and an additional minimum of five years of surgical training. A surgeon must also pass comprehensive oral written exams in order to be ABPS certified. The ABPS is the only board recognized to certify surgeons in plastic surgery of the face and body by the American Board of Medical Specialties.

## C

**Cellulite** - Cellulite is a common term used to describe superficial pockets of trapped fat, which cause uneven dimpling or "orange peel" skin.
**Chemical peel** - Application of chemicals to the face in order to exfoliate the outer layer of skin cells.
**Chromophore** - light-sensitive molecule in the skin.
**Chronological aging** - irreversible progressive loss of homeostatic capacity.
**Clindamycin** - Topical antibiotic often used to treat acne.
**Closed comedon** - See Whitehead.
**Cold-expeller pressed oils** - Oils that are extracted from vegetables without heat. Most other vegetables oils in the grocery stores, such as canola and corn oils, are heat extracted. Purchase only cold-expeller pressed vegetable oils are heat extracted. Purchase only cold expeller pressed vegetable oils because they don't contain trans-fatty acids. You can find them at the health food store or health food section of your grocery store.
**Collagen** - A protein that forms the chief constituent of the connective tissue and bones. It gives skin strength and durability. Age related declines in collagen production cause thinning of the skin, wrinkles, and sagging. Cosmeceuticals such as vitamin C and eating foods rich in amino acids stimulate collagen production.
**Comedo** - Plug of keratin and sebum within a hair follicle. It can appear as a blackhead or a whitehead.
**Comedo extraction** - A procedure performed with a round loop that's used to apply pressure to dislodge the contents of blackheads and whiteheads.
**Comedogenesis** - Medical term for the process that forms whiteheads and blackheads.
**Comedogenic** - Products that induce the formation of comedones.
**Comedolytic** - Signifies that the product breaks up and inhibits comedo formation.
**Comedonal acne** - See non-inflammatory acne.
**Comedone** - A pore clogged with sebum and dead skin cells.
**Complete protein** - A food that contains all nine essential amino acids. Only animal based foods contain complete protein.
**Congestion** - This is skin that's bumpy and stopped up. The natural oils and skin sloughing has slowed down leaving the skin looking unclear and dull.
**Connective tissue** - is a form of fibrous tissue.
**Contact dermatitis** - Allergic reaction or irritant response to things that have touched your skin. Poison ivy and poison oak are examples.
**CORE™ -** Channeling Optimized RF Energy
**Corticosteroid** - Natural hormones produced in the adrenal glands. When used therapeutically, they are powerful anti-inflammatory drugs used to treat many types of inflammation.
**Cortisol** - An adrenal-cortex hormone. Any type pf physical or mental stress induces the release of cortisol. Too much ongoing cortisol in the body causes inflammation and irritation. It's thought to be a cause of chronic disease conditions, such as diabetes, heart disease, and autoimmune disorders.

**Cosmeceutical** - A skin care ingredient that actually alters the skin and its underlying health. Cosmeceuticals are often combined with cosmetic ingredients in skin care products.
**Couperose** - Describes skin that has dilated or broken capillaries.
**CRF** - Capacitive Radiofrequency (technology)
**Cross-linking of collagen** - There is some covalent bonds within the triple helices, and a variable amount of covalent bonds between helices forming well organized aggregates – fibrils.
**Cyst** - A fluid filled mass that is usually benign. When someone has acne, the term cyst is often used interchangeably to mean nodule because of the resemblance of a nodular acne lesion to a cyst.

## D

**Decollete** - The area in women from the base of the neck to the top of the bosom. We include this area when we talk about facial skin.
**Depilatories** - Creams, lotions, or powders that contain chemicals that split the chemical bonds in hair, are breaking them off slightly below the surface of the skin.
**Dermabrasion** - Method to remove the skin's top layers and reduce acne scars using a rapidly rotating wheel or brush attached to a motorized handle to perform high speed sanding. Newer technologies, such as lasers, have largely supplanted this procedure.
**Dermatitis** - Irritation or inflammation of the skin. A general term that refers to an itchy red rash. It is sometimes called eczma.
**Dermis** - Layer of the skin just beneath the Epidermis. Contains blood and lymphatic vessels, hair follicles, nerves, and glands. Also called cutis.
**DMAE (dimethylaminoethanol)** - Occurs naturally in fish. It's used for treatment of autism, dementia, mood disorders, and to improve vision. DMAE is proving beneficial in reversing the effects of skin aging, such as wrinkles and sagging. DMAE is used both topically and internally.
**Doxycycline** - An oral tetracycline used to treat acne and rosacea.

## E

**Eccrine glands** – glands which produce sweat
**ECM** - extra cellular matrix
**Eczema** - See dermatitis.
**Edema** - An abnormal swelling of the fluid in the tissues.
**Elastin** - A protein component of skin that helps maintain skin resilience and elasticity. When elastin is abundant and undamaged, the skin regains its shape after being folded or stretched.
**Elastin fibers** - Found in the dermis, these protein structures are able to coil and recoil like a spring. They give the skin its elasticity.
**Electrolysis** - Needle-based electrolysis is distinguished by three modalities – galvanic, thermolysis and blend
**Electrolytes** - Mineral salts that, in solution, conduct a current of electricity. Electrolytes are required by cells to regulate the flow of water molecules across cell membranes. Major electrolytes are sodium, potassium, chloride, calcium, magnesium, bicarbonate, phosphate, and sulfate.
**Electroporation** - Based on a Nobel winning prize discovery relating to the cell structure. Precisely crafted pulse waves temporarily open micro channels through the cell membrane to bypass the stratum corneum layer without puncturing the skin.
**Emollient** - Topical applications that are used to correct dryness and scaling of the skin.
**Emulsifier** - A substance that helps keep oils and liquids in suspension to prevent separation of the ingredients. Without the benefits of emulsifiers, products would separate and cleansers couldn't clean your face.

**Energy fluence** - measures the rate of energy delivery per unit area ($cm^2$) - measured in Joules/$cm^2$
**Enzymes** - Food products or supplements that aid in digestion. Papaya contains the enzyme papain, and pineapple contains the enzyme bromelain. Both are commonly used as aids to the stomach to enhance digestion. These same enzymes, when used on the face, "digest" or break down dead skin cells and other cellular waste. They clear out the gunk and leave a brightened complexion.
**Epidermis** - Outer layer of the skin that lies upon the dermis.
**Er:YAG** –lasers are solid-state lasers whose lasing medium is erbium-doped yttrium aluminium garnet (Er:Y3Al5O12).
**Erythema** - redness of the skin, caused by hyperemia of the capillaries in the lower layers of the skin. It occurs with any skin injury, infection, or inflammation
**Erythromycin** - Oral and topical antibiotic that's often used to treat acne.
**Exfoliants** - Skin care products that break down and remove keratinized cells that naturally build up on the skin's surface. Even skin functioning at peak performance and normal skin can benefit from an exfoliant. Exfoliants help restore that healthy, translucent glow we all strive for.
**Extrinsic factors** - These factors that affect the skin are caused by the environment, your health, and how you treat your skin. For the most part, you can control the extrinsic factors that affect the condition of your skin.
**Extracellular matrix** - (ECM) is the extracellular part of tissue that provides structural support to the animal cells in addition to performing various other important functions. ECM includes the interstitial matrix and the basement membrane. Gels of polysaccharides and fibrous proteins fill the interstitial space and act as a compression buffer against the stress placed on the ECM.

## F

**Fibroblasts** - Cells located in the dermis that produce collagen and extracellular matrix.
**Fitzpatrick Skin Type Definition** - is a numerical classification schema for the color of skin.
**Folliculitis** - Inflammation of the hair follicles. It can be due to infections or eczema.
**Free radicals** - Highly active chemicals in the body.
**Frequency** - number of waves that pass a point in space during any time interval.

## G

**Gluconeogenesis** - is a metabolic pathway that results in the generation of glucose from non-carbohydrate carbon substrates such as lactate, glycerol, and glucogenic amino acids.
**Glycerin** = Glycerol - Glycerol forms the backbone of triglycerides, and can be produced by saponification of animal fats, e.g. a byproduct of soap-making.
**Glycolic Acid Peel** - A glycolic peel uses the most popular *Alpha Hydroxy Acid* (a natural fruit acid, also known as *AHA*). It is a light skin treatment that gently penetrates the uppermost layer of skin.
**Glycolysis** - Is the metabolic pathway that converts glucose, into pyruvate.

## H

**Hair** - Filamentous biomaterial, that grows from follicles found in the Dermis.
**Hair growth cycle** - Hair follows a specific growth cycle with three distinct and concurrent phases: anagen, catagen, and telogen phases.
**Hemangioma** - benign and usually self-involuting tumor (swelling or growth) of the endothelial cells that line blood vessels, and is characterized by increased number of normal or abnormal vessels filled with blood.
**Heredity** - Genetic transmission of a particular quality or trait from parent to offspring.

**Hyaluronic Acid (HA)** - is an anionic, nonsulfated glycosaminoglycan distributed widely throughout connective, epithelial, and neural tissues.
**Hydroquinone** - An antioxidant and skin lightener that in high concentrations is a prescription-only topical medication. Hydroquinone in low concentrations is used as an ingredient in skin care products.
**Hyperpigmentation** - Abnormal darkening of the skin that can follow inflammation, caused by higher amounts of melanin in a particular spot. It can also result from hormones and sun exposure.
**Hypertrophic scar** - Scars that bulge outward like hard lumps. The word hypertrophy means "enlargement" or "overgrowth".

## I

**IACS** - International Annealed Copper Standard, a unit of electrical conductivity for metals and alloys relative to a standard annealed copper conductor; an IACS value of 100% refers to a conductivity of $5.80 \times 10^7$ siemens per meter (58.0 MS/m).
**Inflammation** - A reaction of the skin to disease or injury.
**Inflammatory acne** - In this type of acne, papules or pustules, red or purple macules, and nodules, often termed "cysts", are predominant. There are a few, if any, conditions.
**Intrinsic factors** - Caused by your biological and genetic makeup. You were born with a certain type of skin and your DNA determines in part how it ages, your skin tone, and its overall plumpness and glow.
**Iontophoresis** - Low voltage direct electrical currents – Galvanic current (*direct current*).
**IPL** - Intense Pulsed Light.
**IR** - Infrared radiation or Infrared.
**Isotretinoin** - Chemical (generic) name for Accutane.

## J

## K

**Keloid** - Large scar whose size goes far beyond what would be expected from what seems to be a minor injury.
**Keratin** - Tough, fibrous protein that is inside the cells of the Epidermis. It's also a constituent of hair and nails.
**Keratinization** - The development of a rough quality in skin tissue. Keratin is a fiber protein in skin tissue. Keratin is a fiber protein in skin tissue. Keratin is made soluble with AHAs and BHAs, and can be broken down by enzyme exfoliants.
**Keratinized skin** - When dead skin cells build up and cover up the newer skin underneath, leading to blemishes and dull skin. To remedy, use a physical exfoliant, such as cleansing grains.
**Keratinocytes** - Make up the majority of the cells in the Epidermis.
**Keratosis pilaris** - A condition of small, rough patches that tends to be mistaken for acne. It usually appears on the arms and sometimes on the cheeks.

## L

**Laser** - Light Amplification by the Stimulated Emission of Radiation
**Laser Spot -** Spot size refers to the diameter of the beam emitted
**Labia majora** – vaginal “big lips” - are two prominent longitudinal cutaneous folds that extend downward and backward from the mons pubis to the perineum.
**Labia minora** - also known as the inner labia, inner lips, vaginal lips, or nymphae, are two flaps of skin on either side of the human vaginal opening, situated between the labia majora (outer lips). Inner lips vary widely in size, color, and shape from female to female.
**LCD -** Liquid crystal display

**LED** - A light-emitting diode (LED) is a semiconductor light source.
**Lesion** - A mark in the skin. In dermatology, refers to a sore, growth, blister, or any other type of tissue damage caused by disease or injury.
**LHE** – light heat energy
**Light** - electromagnetic radiation of any wavelength.
**Lipolysis** - The hydrolysis of lipids. Metabolically it is the breakdown of triglycerides into free fatty acids within cells.
**LPG** – on name of **L**ouis-**P**aul **G**uitay. Is the world leader in cellular stimulation with the Cellu M6® with its exclusive and 100% natural slimming and anti-aging technology (LPG patents).
**Lymphatic drainage** - network of conduits that carry a clear fluid called lymph

## M

**Macule** - Flat red, purple, or brown lesion that forms where a papule or pustule used to be. Remains visible for a while after an acne lesion has healed or is in the process of healing.
**Magnetophoresis** – needle free mesotherpy: Magnetic charge repel products with same charge into the skin.
**Melanin** - Substance that gives the skin and hair its color and protects against UV radiation.
**Melanocytes** - The cells that produce the pigment melanin. This pigment colors our hair, skin, and eyes. Melanin is heavily concentrated in skin moles.
**Mesotherapy** – Any material injected into the skin, fat or tissues of Mesoderm (middle layer of skin) is considered Mesotherapy.
**Metronidazole** - An antibiotic and antiparasitic drug that's used topically to treat rosacea.
**Microcomedo** - First stage of comedo formation, a comedo so small that it can only be seen with a microscope.
**Microdermabrasion** - is a method of mechanical exfoliation aimed at fighting photo aging symptoms
**Microlacerations** - Miniscule or tiny tears or scrapes on the surface of the skin. Can be caused by using physical exfoliants that are too harsh, such as ground-up nutshells, buff puffs, or loofahs, and especially by using too much pressure when using physical exfoliants.
**Milia** - Small, whitish, pear like bumps in the skin due to retention of sebum. Another name for whiteheads.
**Minocycline** - An oral tetracycline antibiotic used to treat acne and rosacea.
**MTZ** - Microscopic Thermal Zones: multiple noncontiguous arrays of thermal (unique damage patterns) achieved via fractional photothermolysis

## N

**Nd:YAG -** crystal were Neodymium (Nd) is Doped into YAG
**Nd:YAG Laser – laser with w**avelength of 1064 nm (IR), absorbed by water and body fluids, uses for photocoagulation and photoepilation (best for darkly pigmented people)
**Needle-free injections** - Releases molecules onto skin at high velocity using high pressure
**Neodymium (Nd)** - a soft silvery metal
**Nodule** - A large lumpy, pus filled, frequently reddish bump that is lodged more deeply in the skin. They are inflammatory lesions that are sometimes referred to as cysts.
**Noncomedogenic** - A type of skin care product that doesn't promote the formation of blackheads and whiteheads and won't cause breakouts. Some skin care products, such as lanolin are comedogenic and can promote blackheads and breakouts.
**Noncomedonal acne** - See inflammatory acne.

**Non-inflammatory acne** - This category of acne is identified when a person's lesions are primarily whiteheads and blackheads. It is also called comedonal acne.
**Nutrient dense** - A term that refers to skin care products that contain a high concentration of added vitamins, minerals, and antioxidants. These nourish the skin and provide added protection from free radicals.

## O

**Ocular rosacea** - Rosacea that involves the eyes.
**Open comedon** - See Blackhead.
**Oral contraceptives** - Drugs used to help prevent an unwanted pregnancy. If you're a female, your doctor may also prescribe them to fight acne by virtue of their anti-androgenic effects.
**Oral therapy** - Something that's taken by mouth such as a pill, capsule, or liquid.

## P

**Papule** - Pimples (zits) that appear as small, firm, reddish bumps on the skin. They are inflammatory lesions.
**Perioral dermatitis** - Also known as periorificial dermatitis, this condition is a rosacea like skin eruption seen almost exclusively in young women.
**Periorbital** - Situated around the orbit of the eye.
**Phonophoresis** - Is the use of ultrasound to enhance the delivery of topically applied drugs.
**Photo aging** - A term that refers to skin damage from the sun.
**Photoaging** - results in changes in gene expression that are distinct from chronological aging from exposure to ultraviolet radiation.
**Photodynamic Therapy (PDT)** - Matured as a feasible medical technology in the 1980s at several institutions throughout the world is a third-level treatment for cancer involving three key components: a photosensitizer, light, and tissue oxygen.
**Photoepilation** - Hair removal by light.
**Phototherapy** - Light therapy that consists of exposure to daylight or to specific wavelengths of light using lasers, light-emitting diodes, fluorescent lamps, dichroic lamps.
**Photothermolysis** - localized damage by selectively heating dark target matter, (*chromophore*).
**Phytoestrogens** - Estrogenlike compounds found in foods. When you eat these foods, they act like the estrogens produced in the body. Phytoestrogens are weaker than the estrogen your body produces. Estrogen helps keep your skin thicker with higher levels of elastin and collagen.
**Pilosebaceous structures** - containing hair and sebaceous glands (oil glands)
**Pomade acne** - Type of acne seen in African Americans and other individuals who have tight curly hair and frequently use pomade (oils and greasy ointments) to style or improve their hair's manageability.
**Porphyrins** - Are a group of organic compounds of which many occur in nature, most well-known as the pigment in red blood cells.
**Postinflammatory hyperpigmentation** - These dark spots are also called postinflammatory pigmentation, or PIP, for short. The original insult (and injury) that caused PIP can be a cut, a burn, a rash, or the after effect from a healing acne lesion. The dark spots are limited to the sites of previous inflammation.
**Prednisone** - Synthetic corticosteroid that's used to treat inflammatory conditions.
**Propionibacterium acne (P. acnes)** - These bacteria are an integral part of producing inflammatory lesions of acne. They live in the pilosebaceous glands of the skin.
**Pseudofolliculitis barbae (razor bumps)** - Acnelike lesions that occur mainly on the beard area of men of African heritage. This condition is due to ingrown hairs.

**Psoriasis** - is a red, scaly rash that affects an estimated 2% of the world's population, or about 120 million people.
**Pulse dye laser (PDL)** - This laser is "tuned" to a specific wavelength of light. It produces a bright light that is absorbed by the superficial blood vessels of the skin. The abnormal blood vessels are destroyed without damaging the surrounding skin. This laser has been used to successfully treat acne scars and rosacea telangiectasias.
**Pulse Repetition Rate (or pulse repetition frequency - PRF)** – describes the ability of the system, to produce new pulses via number of pulses of a repeating signal in a specific time unit. Normally measured in number of pulses per second (Hz). It also can be described as 1 pulse every X sec. in other words, what is the time delay between pulses. For example, if pulse repetition rate is 2 Hz, it means 2 pulses every sec. or 1 pulse every ½ sec (500 ms).
**Punch excision** - Surgical technique that is sometimes used to cut out and reduce certain types of acne scars.
**Pustule** - A papule that contains pus. It's also known as a pus pimple. An inflammatory lesion.

## Q

## R

**Repetition Rate –** see **Pulse Repetition Rate**
**Resorcinol** - A weakly acidic organic chemical obtained from various resins, found in some topical agents used to treat acne.
**Retention hyperkeratosis** - Excessive buildup of skin cells that, combined with sebum and trapped bacteria, creates a plug in hair follicles that results in acne lesions.
**RF -** Radio Frequency - treatment uses electrical pulses to effectively tighten skin and reduce wrinkles. It works by selectively delivering heat energy to the middle and lower levels of skin stimulating new collagen growth**.**
**Rhinophyma** - Enlarged nose that results from enlarged sebaceous glands and overgrowth of collagen, and is a feature of rosacea that's seen primarily in men.
**Rosacea** - Acne like condition characterized by redness, papules, and sometimes pustules in the center one third of the face in certain fair-complexioned adults. It's often mistaken for acne.

## S

**Salicylic acid** - Ingredient found in many over the counter acne products. Helps to exfoliate the outer layers of the skin.
**Sebaceous duct** - Tiny tube that steers the sebum (and the dead skin cells it carries) from the sebaceous gland into the hair canal.
**Sebaceous glands** - Are microscopic glands in the skin which secrete sebum, to lubricate the skin and hair. Located in the dermis next to hair follicles, these are small, sack shaped glands that release sebum onto the hair and moisturize the skin.
**Sebum** - The semifluid secretion of the sebaceous glands, consisting chiefly of fat, keratin, and cellular material.
**Selective photothermolysis** - selective heating of a target chromophore is achieved when the light wavelength is preferentially absorbed by the chromophore, without harming surrounding tissue.
**Silicone derivatives** - Ingredients in moisturizers that sit on the surface of the skin and lock in moisture without clogging pores and causing breakouts. They also give the skin a soft and smooth texture.
**Skin** - is a soft outer covering of an animal, in particular a vertebrate. In mammals, the skin is the largest organ of the integumentary system made up of multiple layers

of ectodermal tissue, and guards the underlying muscles, bones, ligaments and internal organs.
**Skin aging** - is a process that begins at the deepest cellular level caused by free radicals
**Skin care line** - A term that refers to a brand's skin care products. This is a common usage in the skin care industry and at department store sales counters.
**Skin Rejuvenation** – targets skin cells by coagulation and necrosis of dermal and epidermal layers which as response promotes body to create new cells - all over skin renewal .
**Skin Resurfacing** – targets the skin surface by removal of epidermal and papillary dermal cells (ablation, peeling, etc.) to create new surface - improvement of skin tone and texture, pores, fine lines and pigmentation. Skin Tightening – targets the fibroblasts for creating of lifting effect, Skin Resurfacing – targets most of the skin cells to stimulate all over skin rejuvenation.
**Skin Tightening** – targets dermis for collagen remodeling and fibroblast stimulation (neocollagenesis) via volumetric heating for creating lifting and tightening effect.
**Slip** - The sensation that the skin is smooth and ever so slightly slippery. Slip lets you apply foundation easily, allowing it to glide on smoothly and evenly. You have a healthy amount of slip when you touch your skin ad your hand easily glides over the surface without catching on rough or dry patches.
**Sonophoresis** - Low frequency ultrasonic energy disrupts the stratum corneum to introduce materials
**SPF (Sun Protection Factor)** - All sunscreens are currently labeled with an SPF that lets you know how long you can stay in the sun before burning. Wear a sunscreen with an SPF of 15 or more to get adequate sun protection.
**Spironolactone** - An anti-androgen medication sometimes used in combination with oral contraceptives to treat acne in women.
**Stratum basale** - Is the deepest layer of the 5 layers of the epidermis.
**Stratum corneum** - Also known as the horny layer, it is the outer-most layer of the epidermis. It is comprised of dead skin cells that protect deeper cells from damage, infection, and from drying out.
**Stratum granulosum** - Is a layer of the epidermis found between the stratum corneum and stratum spinosum.
**Stratum lucidum** - Is a layer of the epidermis found throughout the body.
**Stratum spinosum** - This is the middle ("spiny") layer of the epidermis. These cells are always actively dividing.
**Subcutaneous tissue** - Fatty layer of tissue located under the dermis.
**Sulfacetamide** - Anti-infective used topically to treat acne and rosacea. Often combined with sulfer.
**Sweat glands** - are exocrine glands found under the skin which are used for body temperature regulation (thermoregulation).

## T

**Telangiectasia** (Telangiectasias / angioectasias / spider veins) - are small dilated blood vessels near the surface of the skin or mucous membranes, measuring between 0.5 and 1 millimeter in diameter, commonly seen on the face around the nose, cheeks, and chin.
**Tetracycline** - Oral antibiotic typically used to treat acne and rosacea.
**Thermal relaxation time** (**TRT**) - time needed for appropriate cooling of a given light-absorbing target within skin.
**Topical therapy** - Something that's applied onto the skin, such as a cream, gel, or ointment.
**Triglyceride** - (triacylglycerol, TAG or triacylglyceride) is an ester derived from glycerol and three fatty acids.

**U**

**UAL** - Ultrasound-assisted lipectomy, a surgical procedure

**UV** - **Ultraviolet radiation** - Is electromagnetic radiation with a wavelength shorter than that of visible light, but longer than X-rays.

**V**

**Varicose (Leg) veins -** veins that have become enlarged and twisted. The term commonly refers to the veins on the leg, although varicose veins can occur elsewhere. Veins have pairs of leaflet valves to prevent blood from flowing backwards (retrograde flow or venous reflux).

**Vasodilation** - widening of blood vessels.

**Visible light** – radiation of wavelength between 380 (violet) – 760 (red).

**W**

**Whitehead** - Small, pearly white acne lesion that consists of a plug of keratin and sebum. Occurs when the comedo stays below the surface of the skin. Also called closed comedo

**X**

**Y**

**YAG -** Yttrium Aluminium Garnet ($Y_3Al_5O_{12}$) - synthetic crystalline material of the garnet group

**Z**

## Reaction™ related terms

**Skin** - Is a soft outer covering of an animal, in particular a vertebrate. In mammals, the skin is the largest organ of the integumentary system made up of multiple layers of ectodermal tissue, and guards the underlying muscles, bones, ligaments and internal organs. The skin is composed of three primary layers: the outer Epidermis, middle Dermis and deep Subcutaneous tissue. There is a basement membrane that separates the Epidermis from the Dermis and acts as a communication channel between the two layers.

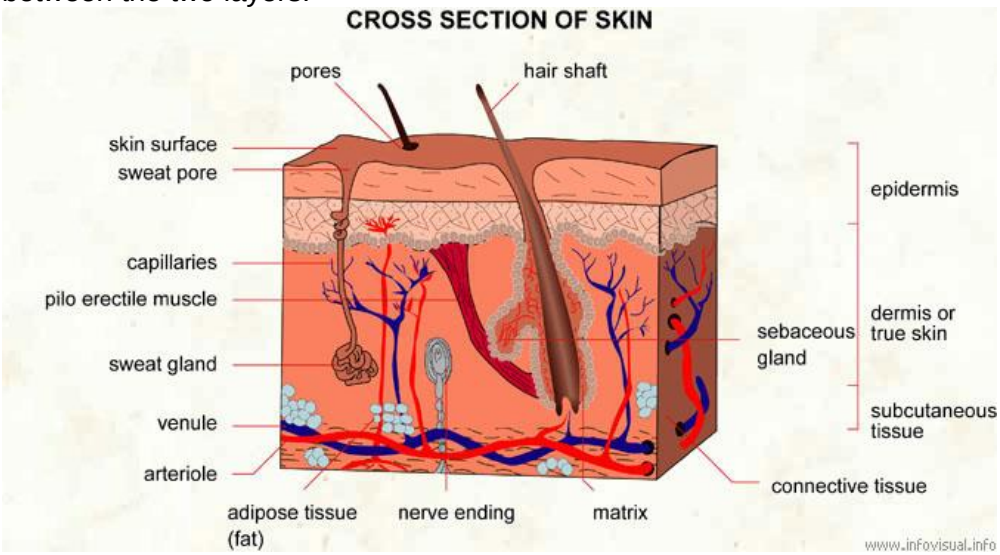



**Fig**: Cross section of skin

**Epidermis** - The outer layer of the skin which provides waterproofing and serves as a barrier to infection. In human, it is thinnest on the eyelids at 0.10 mm and thickest on the palms and soles at 1.5 mm. The epidermis is avascular, nourished by diffusion from the dermis. Is a complex 'brick wall' that contains keratinocytes (which produce a protein called keratin), melanocytes (pigment cells which produce melanin), Langerhans cells (which present antigens to the immune system), Merkel cells (which have a sensory function), and inflammatory cells. Keratinocytes are the major constituent, constituting 95% of the epidermis. Average life span of a skin cell is about 14-28 days.
The epidermis is composed of 4-5 layers depending on the region of skin being considered. Those layers in descending order are the cornified layer (*stratum corneum*), clear/translucent layer (*stratum lucidum*), granular layer (*stratum granulosum*), spinous layer (*stratum spinosum*), and basal/germinal layer (*stratum basale/germinativum*).
Epidermal appendages include:

- **Eccrine glands**, which produce sweat
- **Apocrine glands**, scent glands found in armpits and groins
- **Pilosebaceous structures** containing hair and sebaceous glands (oil glands)
- **Nails**

**Stratum corneum** - Is the outermost layer of the epidermis, composed of large, flat, polyhedral, plate-like envelopes filled with keratin, which is made up of dead cells that have migrated up from the stratum granulosum.

**Stratum lucidum** - Is a layer of the epidermis found throughout the body, but is thickest on the palms of the hands and the soles of the feet. Located between the stratum granulosum and stratum corneum layers. It is composed of three to five layers of dead, flattened keratinocytes. The thickness of the lucidum is controled by the rate of mitosis of the epidermal cells. In addition, melanocytes determine the darkness of the stratum lucidum.

**Stratum granulosum** (or **granular layer**) - Is a layer of the epidermis found between the stratum corneum (and possibly stratum lucidum) and stratum spinosum. In this layer, keratinocytes are now called granular cells, and contain keratohyalin and lamellar granules.

**Stratum spinosum** (or **spinous layer**) - Is a layer of the epidermis found between the stratum granulosum and stratum basale. This layer is also referred to as the "spinous" or "prickle-cell" layer. This appearance is due to desmosomal connections of adjacent cells. The cells in the stratum spinosum produce and secrete bipolar lipids which prevent evaporation, helping to "water-proof" the skin. Keratinization begins in the stratum spinosum.

**Stratum basale** (or **basal layer**, *Stratum germinativum*) - Is the deepest layer of the 5 layers of the epidermis, which is the outer covering of skin in mammals. The stratum germinativum is a continuous layer of cells. It is often described as one cell thick, though it may in fact be two to three cells thick in glabrous (hairless) skin and hyperproliferative epidermis (from a skin disease).
The basal cells of the stratum germinativum can be considered the stem cells of the epidermis. They are undifferentiated, and they proliferate. They create 'daughter' cells that migrate superficially, differentiating as they do so. The keratinocytes of the stratum germinativum undergo mitosis continually throughout the individual's life. Melanocytes, the pigment producing cells of the epidermis, are primarily found in the stratum germinativum. Human nails grow from Stratum germinativum.

**Dermis** - The dermis is made up of Connective tissue that supports the epidermis, providing nutrients and protecting it. The papillary dermis is the upper portion beneath the epidermis and the lower portion is the reticular dermis.

- Collagen: protein fibres arranged in bundles providing strength to the skin.
- Elastin: protein making up fibres that allow the skin to stretch
- Ground substance: gel containing hyaluronic acid and other polysaccharides.
- Fibroblasts: cells that produce collagen, elastin and ground substance.
- Nerves: sensory and autonomic fibres with distinct nerve endings for touch, heat, cold, pressure and pain.
- Blood vessels: arteries, arterioles, capillaries, venules and veins carrying blood to and from the skin.
- Lymphatic system: extensive network of thin-walled vessels nourishing and draining the skin.
- Arector pili muscles: attached to hair follicles. Contraction results in goose bumps.
- Cellular infiltrations: immune cells around blood vessels, and recruited in great numbers to heal wounds and fight infection.
- Sebaceous glands: microscopic glands in the skin which secrete an oily/waxy matter, called sebum, to lubricate the skin and hair.
- Sweat glands: or sudoriferous glands, are exocrine glands found under the skin which are used for body temperature regulation (thermoregulation).
- Hair follicles

**Sweat glands** - In humans, apocrine and merocrine sweat glands form the primary method of cooling. Many other mammals rely on panting or other means as a primary source of cooling, but still have sweat glands which aid in thermoregulation. Sweat also serves to increase friction on the palms of hands or the pads of paws.
Both apocrine and merocrine sweat glands contain myoepithelial cells (from Greek *myo-*, "muscle"), specialized epithelial cells located between the gland cells and the underlying basal lamina. Myoepithelial cell contractions squeeze the gland and discharge the accumulated secretions. The secretory activities of the gland cells and the contractions of myoepithelial cells are controlled by both the autonomic nervous system and by the circulating hormones. Additionally, ceruminous glands, which produce ear wax, and mammary glands, which produce milk, are frequently considered to be modified sweat glands.

**Subcutaneous tissue** - The hypodermis, also called the hypoderm, subcutaneous tissue, or superficial fascia is the lowermost layer of the integumentary system. Types of cells that are found in the hypodermis are Fibroblasts, Adipose cells, and macrophages. This cell is also used to supervise the outer skin from burns and other such articulates. The hypodermis is used mainly for fat storage. A layer of tissue that lies immediately below the dermis of vertebrate skin. It is often referred to as subcutaneous tissue though this is a less precise and anatomically inaccurate term. The hypodermis consists primarily of loose connective tissue and lobules of fat. It contains larger blood vessels and nerves than those found in the dermis.
Specifically, the hypodermis contains:

- Loosely arranged elastic fibers
- Fibrous bands anchoring the skin to the deep fascia
- Fat, except in the eyelid, scrotum, penis, nipple and areola
- Blood vessels on route to the dermis
- Lymphatic vessels on route from dermis
- Hair follicle roots
- The glandular part of some sudiferous glands
- Nerves: free endings and Pacinian corpuscles

- Bursae, in the space overlying joints in order to facilitate smooth passage of overlying skin
- Fine, flat sheets of muscle, in certain locations, including the scalp, face, hand, nipple, and scrotum, called the panniculus carnosus

**Adipose tissue** - Adipose tissue or fat is loose connective tissue composed of adipocyte. Adipose tissue is derived from lipoblasts. Its main role is to store energy in the form of fat, although it also cushions and insulates the body. Obesity or being overweight in humans and most animals does not depend on body weight but on the amount of body fat—specifically, adipose tissue. Adipose tissue also serves as an important endocrine organ by producing hormones.
There are two types of adipose tissue: white fat cells or monovacuolar cells contain a large lipid droplet surrounded by a layer of cytoplasm and brown fat cells or plurivacuolar cells are polygonal in shape. The brown color comes from the large quantity of mitochondria. Brown fat, also known as "baby fat," is used to generate heat.

**Connective tissue** - Fibrous connective tissue is composed of collagenous and elastic fibers. Most of the tissue does not contain living cells and is primarily composed of polysaccharides, proteins (Collagen and Elastin), and water. The most commonly secreted protein is collagen which represents one-fourth of all vertebrate protein.

**Collagen** - It is the main component of Connective tissue, and is the most abundant protein in mammals, making up about 25% to 35% of the whole-body protein content. The collagen molecule is a subunit of larger collagen aggregates such as fibrils. It is approximately 300 nm long and 1.5 nm in diameter, made up of three polypeptide strands. These three helices are twisted together into a right-handed coiled coil, a triple helix or "super helix. There is some covalent cross-linking within the triple helices, and a variable amount of covalent cross-linking between tropocollagen helices forming well organized aggregates (such as fibrils). Collagen occurs in many places throughout the body. So far, 29 types of collagen have been identified and described. Over 90% of the collagen in the body, however, is of type I, II, III, and IV. Type I and type III collagen are present in the highest levels in the skin, forming 80% and 15% of the total collagen present, respectively.

- **Collagen One**: skin, tendon, vascular, ligature, organs, bone (main component of bone). This is the most abundant collagen of the human body. It is present in scar tissue, the end product when tissue heals by repair.
- Collagen Two: cartilage (main component of cartilage)
- **Collagen Three**: reticulate (main component of reticular fibers), commonly found alongside type I. This is the collagen of granulation tissue, and is produced quickly by young Fibroblasts before the tougher type I collagen is synthesized. Also found in artery walls, skin, intestines and the uterus
- Collagen Four: forms bases of cell basement membrane
- Collagen Five: cells surfaces, hair and placenta

**Cross-linking of collagen** - There are 2 types of Cross-linking of collagen, good and bad.
**Good** - Short segments at either end of the collagen chains are of particular importance in the formation of collagen fibrils. These segments do not assume the triple-helical conformation and contain the unusual amino acid *hydroxylysine*. Covalent aldol cross-links form between two lysine or hydroxylysine residues at the C-terminus of one collagen molecule with two similar residues at the N-terminus of an adjacent molecule. These cross-links stabilize the side-by-side packing of

collagen molecules and generate a strong fibril. Type I collagen fibrils have enormous tensile strength; that is, such collagen can be stretched without being broken. These fibrils, roughly 50 nm in diameter and several micrometers long, are packed side-by-side in parallel bundles, called *collagen fibers,* in tendons, where they connect muscles with bones and must withstand enormous forces. Gram for gram, type I collagen is stronger than steel.
**Bad** - Collagen and Elastin become more fragmented as a person grows older, particularly due to UV and glycation (cross-linking of proteins by sugar). Glycation of Collagen and Elastin is accelerated in diabetics due to high blood sugar.

**Elastin** - Elastin fibres are thinner than collagen fibres and are also secreted by fibroblasts. These protein fibres have longer cross-links than collagen fibres, which gives elastin fibres great elasticity.

**Fibroblasts cells** - A fibroblast is a type of cell that synthesizes the extracellular matrix and collagen and plays a critical role in wound healing. Fibroblasts are the most common cells of connective tissue in animals.
**Stress Model**
Mechanical stretch play important role on the healing and remodeling process of the Connective tissue. It was found that cyclic (and not axial) stretch on fibroblasts cells increase the expression of collagen I and III. In the early phase of healing there is more collagen Type III than I.
Stress-relaxation of fibroblasts in collagen matrices riggers ectocytosis (secretion of vesicles out of the cell membrane) of Actin, annexins II and VI, and β1 integrin receptors. This probably play important role in extracellular matrix remodeling after wound contraction.

**Lymphatic drainage** - The lymphatic system has three interrelated functions: it is responsible for the removal of extra cellular matrix (ECM), absorption and transportation of fatty acids and fats in the form of chyle to the circulatory system; finally it transports immune cells to and from the lymph nodes.
The lymphatic system takes toxins and metabolic wastes from the intracellular space in order to maintain homeostasis in terms of tissue volume and isotonic ECM. Functions of this system include; carrying fluids, proteins and bacteria from tissues, transporting fat, removing excess fluids and taking active part in the immune system functions. The level of lymphatic flow in the body may be stimulated by mechanical tissue massage.

**Skin aging** - First proposed in 1956 by Denham Harman – ageing is a process that begins at the deepest cellular level caused by free radicals (Oxygen molecules that lost an electron) – damaged cells that replicate and attack healthy cells. They are natural byproduct of bodily processes – but increased by sun light and pollutants (cigarettes, pollution, etc). They're created from many metabolic processes and also from inflammation and sun damage. They contain one or more unpaired electrons and scavenge, or steal, electrons from other molecules, thus damaging those molecules. In terms of your skin, free radicals can damage collagen and elastin.

- Attack collagen > diminishing skin's ability to regenerate and heal.
- Stimulate production of collagen digesting enzymes – amplified by UV light.
- Cause inflammation
- Skin becomes thinner - because the underlying fat is slowly lost
- The skin’s connective tissue (collagen and elastin) undergoes changes, causing the skin to lose firmness and become dry.
- The sweat- and oil-secreting glands decrease > harder for the skin to hold moisture.

- The blood vessels become more fragile > more likely to rupture and leak into the skin. Also blood flow decreases.
- Oxygen-free radicals. They are the waste products that result from all the chemical reactions that normally occur in the body. Believed to accelerate cancers and age-related diseases.
- Skin changes can also be caused by years of sun damage, poor nutrition, high stress levels, exposure to environmental pollution, and destructive lifestyle choices, such as cigarette smoking or alcohol and drug abuse.
- The stratum corneum remains essentially invariant during a normal lifespan.

There are two types of skin aging: Chronological aging and Photoaging:

1. **Chronological aging** - irreversible progressive loss of homeostatic capacity. Assumed to be a genetically programmed phenomenon. Results from thinning of the epidermis and dermis and loss of elasticity. The dermal-epidermal junction flattens, the dermis becomes thin, decrease in elastic fibers, collagen production, vascularity, and ground substance > fine wrinkling of the skin and sagging of the tissues that overlay the facial skeleton.
2. **Photoaging** - results in changes in gene expression that are distinct from chronological aging from exposure to ultraviolet radiation. Results in coarse and dry skin, deep wrinkles, sallowness, dyschromia (discoloration), Hyperplasia and dysplasia (abnormal growth of tissues). Can also damage DNA.

- Upon contact with the skin, some light is scattered and reflected in the stratum corneum, while other light is absorbed in the epidermis or is transmitted.

The symptoms of aging are due to:

- **Thinning** - the basal cell layer of the epidermis slows rate of cell production > thins the epidermis. The dermis may become thinner > skin is more likely to crepe and wrinkle.
- **Sagging** - older skin produces less elastin and collagen > likely to sag and droop. Older skin is particularly vulnerable to the effects of gravity - for example, jowls along the jaw and bags under the eyes are simply skin that has yielded to gravity.
- **Wrinkles** - reduced elastin and collagen, and the thinning of skin, mean those 'high traffic' areas of the face (like the eyes and mouth) are especially prone to lines and wrinkles.
- **Age spots** - the remaining pigment cells (melanocytes) tend to increase in certain areas and cluster together, forming what's known as age or liver spots. Areas that have been exposed to the sun, such as the backs of the hands, are particularly prone to age spots.
- **Dryness** - older skin has fewer sweat glands and oil glands. This can make the skin more prone to dryness-related conditions, such as roughness and itching.
- **Broken blood vessels** - blood vessels in older, thinner skin are more likely to break and bruise. They may also become permanently widened. This is commonly known as broken vessels.
- **The loss of subcutaneous tissue**, often occuring with age, leads to facial sag and accentuates wrinkles. A common procedure performed by dermatologists to counteract this process is to inject fat (collected elsewhere in the body) under the wrinkles on the face

**Cellulite** - Is a common term used to describe superficial pockets of trapped fat, which cause uneven dimpling or "orange peel" skin. It appears in 90 percent of post-adolescent women and is rarely seen in men (less than 5%). Cellulite is typically found in the thighs, buttocks, and abdomen. Contrary to popular belief, cellulite is not

related to obesity; it occurs in overweight, normal, and thin women. Even very obese men rarely demonstrate cellulite, but cellulite is often evident in extremely slender women who maintain excellent muscle tone through regular exercise. Cellulite forms as a result of complex physiological changes to the subcutaneous fat layer. However, without a healthy lifestyle, the overall appearance of existing cellulite can worsen over time due to weight gain, poor nutrition, and inadequate water intake.
Theoretically, cellulite could reflect differences in adipose tissue biochemistry or connective tissue structure of affected versus unaffected individuals and/or of affected versus unaffected regions within an individual.
Generally, it is caused by the fibrous septae, the underlying supports of the skin, not holding the skin together evenly. The skin is tethered down by these string-like tissues that pull it inward, toward the interior of the body. The tension of these strings pulls sections of fat in along with them, causing the fat cells in the subcutaneous layer to increase as much as 300 times their original size and stick together within the connective tissue fibers. In women, the fibers extend from the muscle up through the fat and connect to the undersurface of the skin and run perpendicularly at a 90-degree angle, which allows bulging and puckering. In men, these fibers run at a 45-degree angle, so the fat is less likely to accumulate in pockets.

**Causes for Cellulite Formation**

The causes of cellulite are poorly understood and may involve changes in metabolism and physiology such as gender specific dimorphic skin architecture, alteration of connective tissue structure, hormonal factors, genetic factors, the microcirculatory system, the extracellular matrix, and subtle inflammatory alterations. A high stress lifestyle will cause an increase in the level of catecholamines (fight-or-flight" hormones that are released in response to stress), which have also been associated with the evolution of cellulite. An additional contributing factor to the appearance of cellulite relates to inter-cellular edema, which has been linked to inefficient lymphatic drainage.
Studies demonstrated that women had a diffuse pattern of irregular and discontinuous connective tissue immediately below the dermis, but this same layer of connective tissue was smooth and continuous in men.

**The Hormonal Connection**

Special importance is placed on hormonal factors since cellulite develops mainly in women during periods of hormonal change, such as puberty, pregnancy, menopause, premenstrual syndrome, and the initial months on birth control pills. Hormones are responsible for regulating the changes in blood flow, lymphatic drainage, fat, and connective tissue, all of which play a role in the formation of cellulite.

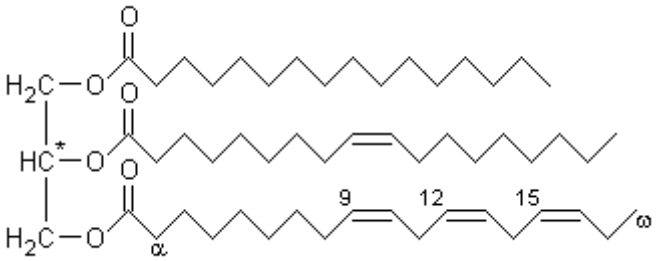
**Lipolysis** - Is the breakdown of fat stored in fat cells. During this process, free fatty acids are released into the bloodstream and circulate throughout the body. The following hormones induce lipolysis: epinephrine, norepinephrine, glucagon and adrenocorticotropic hormone. These activate lipases (a water-soluble enzyme that catalyzes the hydrolysis of triglycerides, fats, oils) found in adipose tissue. Triglycerides undergo lipolysis (hydrolysis by lipases) and are broken down into glycerol and fatty acids. Once released into the blood, the relatively hydrophobic free fatty acids bind to serum albumin for transport to tissues that require energy. The glycerol also enters the bloodstream and is absorbed by the liver or kidney where it is converted to glycerol 3-phosphate by the enzyme glycerol kinase. Hepatic glycerol 3-phosphate is mostly converted into dihydroxyacetonephosphate (DHAP) and then glyceraldehyde 3-phosphate (G3P) to rejoin the glycolysis and gluconeogenesis pathway.

**Glycolysis** - Is the metabolic pathway that converts glucose, into pyruvate. The free energy released in this process is used to form the high energy compound – ATP.

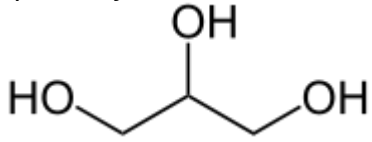
Glycolysis is a definite sequence of ten reactions involving ten intermediate compounds (one of the steps involves two intermediates). The intermediates provide entry points to glycolysis. For example, most monosaccharides, such as fructose, glucose, and galactose, can be converted to one of these intermediates. The intermediates may also be directly useful. For example, the intermediate dihydroxyacetone phosphate is a source of the glycerol that combines with fatty acids to form fat.
Glycolysis is thought to be the archetype of a universal metabolic pathway. It occurs, with variations, in nearly all organisms, both aerobic and anaerobic. The wide occurrence of glycolysis indicates that it is one of the most ancient known metabolic pathways.

**Gluconeogenesis** - abbreviated GNG - is a metabolic pathway that results in the generation of glucose from non-carbohydrate carbon substrates such as lactate, glycerol, and glucogenic amino acids.
It is one of the two main mechanisms the body uses to keep blood glucose levels from dropping too low (hypoglycemia). The other means of maintaining blood glucose levels is through the degradation of glycogen (glycogenolysis).
Gluconeogenesis is a ubiquitous process, present in plants, animals, fungi, and other microorganisms. In animals, gluconeogenesis takes place mainly in the liver and, to a smaller extent, in the cortex of kidneys. This process occurs during periods of fasting, starvation, low-carbohydrate diets, or intense exercise and is highly endergonic. Gluconeogenesis is often associated with ketosis. Gluconeogenesis is also a target of therapy for type II diabetes, such as metformin, which inhibits glucose formation and stimulates glucose uptake by cells.

**Triglyceride** - (triacylglycerol, TAG or triacylglyceride) is an ester derived from glycerol and three fatty acids. It is the main constituent of vegetable oil and animal fats.




**Glycerol** - Is an organic compound, also called glycerin or glycerine. It is a colorless, odourless, viscous liquid that is widely used in pharmaceutical formulations. Glycerol has three hydrophilic hydroxyl groups that are responsible for its solubility in water and its hygroscopic nature. The glycerol substructure is a central component of many lipids. Glycerol is sweet-tasting and of low toxicity.

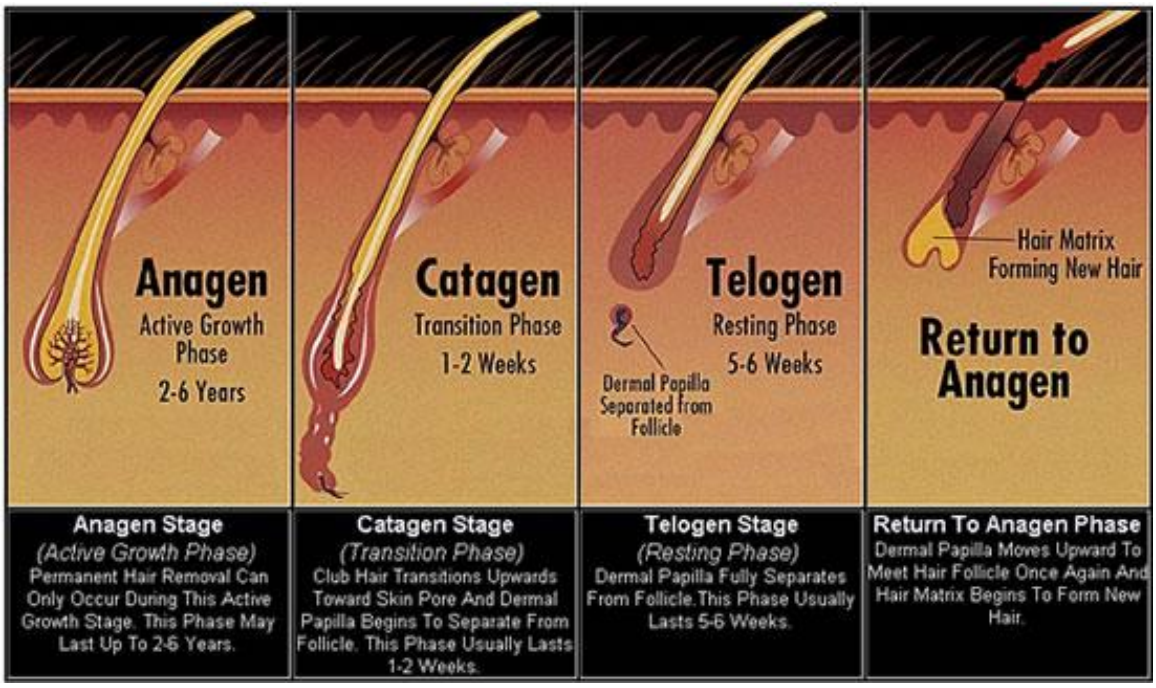



## Trios™ related terms

**Hair** - The human body, apart from its glabrous skin, is covered in follicles which produce thick terminal and fine vellus hair. Hair is an important biomaterial primarily

composed of protein, notably keratin. Hair often refers to two distinct structures: 1) the part beneath the skin, called the hair follicle or when pulled from the skin, called the bulb. This organ is located in the dermis and maintains stem cells which not only re-grow the hair after it falls out but also are recruited to regrow skin after a wound; and 2) the shaft, which is the hard filamentous part that extends above the skin surface. A cross section of the hair shaft can be divided roughly into three zones. Starting from the outside: 1) the cuticle which consists of several layers of flat, thin cells laid out like roof shingles, 2) the cortex which contain the keratin bundles in cell structures that remain roughly rod like and in some cases, 3) the medulla, a disorganized and open area at the fiber's center.
Hair growth begins under the skin in a hair follicle. The only "living" portion of the hair is found in the follicle. The hair that is visible is the hair shaft, which exhibits no biochemical activity and is considered dead. The base of the root is called the bulb, which contains the cells that produce the hair shaft. Other structures of the hair follicle include the oil producing sebaceous gland which lubricates the hair and the erector pili muscles, which are responsible for causing goose bumps.
Each strand of hair is made up of the medulla, cortex, and cuticle. The innermost region, the medulla, is not always present and is an open, unstructured region. The highly structured and organized cortex, or middle layer of the hair, is the primary source of mechanical strength, water uptake. The cortex contains Melanin, which colors the fiber based on the number, distribution and types of melanin granules. The shape of the follicle determines the shape of the cortex, and the shape of the fiber is related to how straight or curly the hair is. Asian hair typically has a round fiber and is quite straight. Oval and irregularly shaped fibers are generally more wavy or even curly. The cuticle is the outer covering. Its complex structure slides as the hair swells and is covered with a single molecular layer of lipid that makes the hair repel water.

**Hair growth cycle** - Hair follows a specific growth cycle with three distinct and concurrent phases: anagen, catagen, and telogen phases. Each phase has specific characteristics that determine the length of the hair. All three phases occur simultaneously; one strand of hair may be in the anagen phase, while another is in the telogen phase.
The body has different types of hair, including vellus hair and androgenic hair, each with its own type of cellular construction. The different construction gives the hair unique characteristics, serving specific purposes, mainly warmth and protection.
At any given time there is a percentage of hair in each phase of the growth cycle. Long term hair removal will only be achieved on hair that was in the *anagen stage.* Different areas in the body have different length of anagen stage Scalp hair; 2-6 years Body hair; 30-45 days.



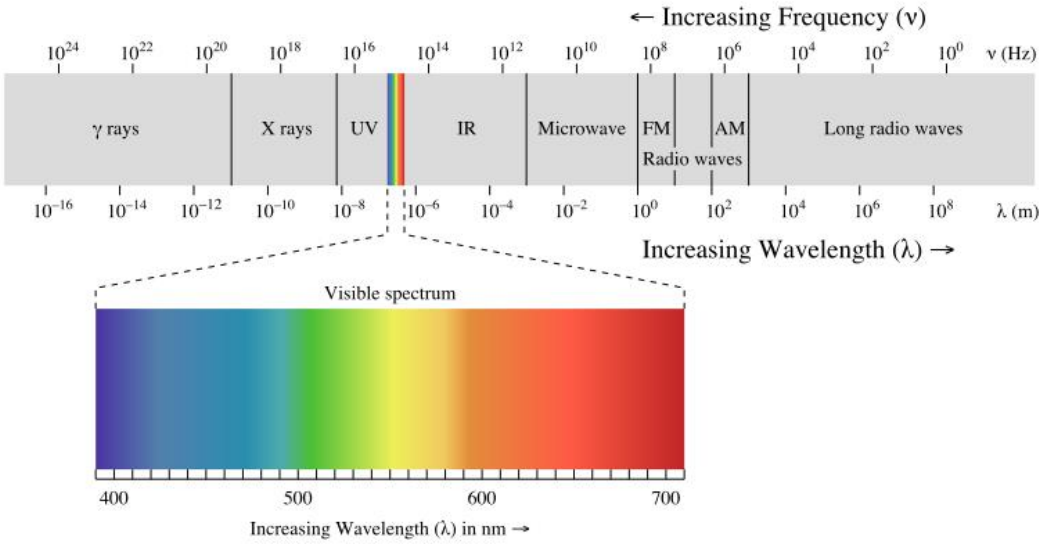

**Melanin** - Is a pigment that is ubiquitous in nature, being found in all organisms. The most common form of biological melanin is eumelanin, a brown-black polymer of dihydroxyindole carboxylic acids, and their reduced forms. Technically all melanins are derivatives of polyacetylene. Another common form of melanin is pheomelanin, a red-brown polymer of benzothiazine units largely responsible for red hair and freckles.
Melanin is synthesized by melanocytes (present in epidermis & hair follicle). Differences in skin color result from differences in the amount of melanin production. The increased production of melanin in human skin is called melanogenesis. All people have roughly the same number of melanocytes. Production of melanin is stimulated by DNA damage induced by UVB-radiation, and it leads to a delayed development of a tan. This melanogenesis-based tan takes more time to develop, but it is long lasting. Suntan fades when keratinocytes containing the extra melanin are shed. As Melanin absorbs harmful UV-radiation it transforms the energy into harmless heat through a process called "ultrafast internal conversion". This property enables melanin to dissipate more than 99.9% of the absorbed UV radiation as heat. This prevents the indirect DNA damage which is responsible for the formation of malignant melanoma and other skin cancers. Moreover, light that transformed into heat energy - leading to the coagulation of the hair bulb.

**Fitzpatrick Skin Type Definition** - The Fitzpatrick Scale (aka Fitzpatrick skin typing test or Fitzpatrick phototyping scale) is a numerical classification schema for the color of skin. It was developed in 1975 by T.B. Fitzpatrick, a Harvard dermatologist, as a way to classify the response of different types of skin to UV light. It remains a recognized tool for dermatologic research into skin of color.

I Always burns, never tans
II Always burns, tans less than average
III Sometimes burns, tans average
IV Rarely burns, tans with ease
V Moderately pigmented, always tans
VI Deeply pigmented, never burns

**Light** – Electromagnetic radiation of any wavelength. Five primary properties of light are intensity, Frequency or wavelength, polarization, phase and orbital angular momentum.

| ***Wavelength*** | 380-420 | 420-490 | 520-570 | 565-590 | 585-620 | 625-760 |
|---|---|---|---|---|---|---|
| ***Color*** | Violet | Blue | Green | Yellow | Orange | Red |




**Visible light** – radiation of wavelength between 380 (violet) – 760 (red).

**Frequency** - Number of waves that pass a point in space during any time interval, usually one second. It is measured in units of cycles (waves) per second, or Hertz (Hz).

**Laser** - The light is produced within an optical cavity containing a medium: which may be a gas (e.g. argon, krypton, carbon dioxide), liquid (e.g. dye) or solid (e.g. ruby, neodymium: yttrium-aluminium-garnet, alexandrite). Excitation of the molecules of the laser medium results in the release of a photon of light as it returns to a stable state. Each medium produces a specific wavelength of light, which may be within the visible spectrum (violet 400 through to red 700nm) or infrared spectrum (more than 700 nm). The Laser light (energy) - is monochromatic (single wavelength), coherent (light beam waves are in phase, both in time and space), and collimated (light waves are parallel). Laser light properties allow for the generation and delivery of high **fluence** (energy per area), and, the monochromaticity of laser light is essential for selective targeting of specific structures in the skin (chromophores).

**Aesthetic Laser Technologies**

The wavelength peaks of the laser light, pulse durations and how the target skin tissue absorbs this, determine the clinical applications of the laser types.

**Laser Types and Light Color**

| Light Color | Laser Type |
|---|---|
| colorless light | carbon dioxide, erbium Nd:YAG lasers |
| yellow light | pulsed dye and argon-pumped tunable dye lasers |
| green light | KTP copper vapor and krypton lasers |
| red light | ruby, alexandrite lasers |
| blue-green light | argon laser |

## Laser Types

| Technology | WL (nm) | HR | SR | VL | PL/T | AC | Comments |
|---|---|---|---|---|---|---|---|
| Alexandrite | 755 | Y | Y | | Y | | Red light. Very old |
| Copper Bromide | 511-578 | | | Y | Y | | Yellow L - absorbed by oxyhemoglobin of VL.<br>Green L - Absorbed by pigmented portions of lesions. |
| Diode | 532-1450 | Y | Y | Y | Y | Y | Safer than shorter W/L lasers b/c better avoid Melanin in epidermis - less injury. Can be used on darker skin |
| Nd:YAG | 532-1064 | Y | Y | Y | Y | Y | treat all 6 skin types, but patients report it painful. Reports of complete hair re-growth in 6 months. |
| Er:YAG | 2940 | | | | | | Frequency is at resonant frequency of water > limits use where water is present |
| Pulsed Dye | 500-585 | | Y | Y | Y | Y | Yellow L - mainly for P/V lesions. |
| Pulsed Light | Light | Y | Y | Y | Y | Y | High energy non-coherent L in CW<br>Using filter for different WL |
| Radiothermoplasty | N/A (RF) | | Y | | | | Uses electrical current, not Photonic. Monopolar energy heats collagen under skin - causes collagen to contract + thicken = denaturation. Can be used on all skin types. |
| Selective thermolysis | 400-980 & RF | Y | Y | Y | Y | Y | PL+RF. PL used to heat the targeted portion of the patient's skin. Then bipolar RF energy applied > naturally conduct through the portion of the patient with the least resistance—the heated part—enabling the physician to target the desired portion of the patient. |
| Ruby | 694 | Y | | | Y | | Red L for PL |
| **Technology** | **WL (nm)** | **HR** | **SR** | **VL** | **PL/T** | **AC** | **Comments** |

| | | |
|---|---|---|
| **HR** hair removal | Photothermolysis | Melanin |
| **AC** clearing up acne | Photochemical | Porphyrin |
| **PL** pigmented lesions | Photothermolysis | Melanin |
| **VL** vascular lesions | Photothermolysis | Hgb hemoglobin |
| **SR** skin revitalization | Photothermolysis | Hgb hemoglobin |

**Intense Pulsed Light** - IPL is a flashlamp device that employing a noncoherent-pulsed light source that emits light within the 400- to 1200-nm portion of the electromagnetic spectrum. It can be used to treat a variety of cutaneous vascular disorders. Depending on lesion type and size, cutoff filters of varying wavelengths are used to eliminate shorter wavelengths. Light is delivered in a train of single, double, or triple pulses (2-25 ms each) with varying time intervals between pulses (10-500 ms). This system is operator-dependent and allows treatment parameters (wavelength, pulse duration, delays between pulses) to be tailored for each use. Based on the principle of selective Photothermolysis, by concentrated pulses of light. The light emitted is absorbed by chromophores in the skin to induce a physiological or chemical change in the molecule formation, ultimately achieving the desired effect. IPL systems were first developed and introduced in the mid 1990's as an alternative to dermatological lasers and have since become extremely common for a wide range of dermatological and aesthetic applications. Monochromacticity which is a key feature of laser light was found not to be a prerequisite since the three main chromophores targeted in phototherapy applications (hemoglobin, melanin and water) in human skin all have broad absorption peaks. Therefore, the coherence of light generated by laser systems renders each laser wavelength as a single application. It follows that filtered, broadband, non-coherent, intense pulsed light can safely and effectively be applied for a range of dermatological and aesthetic applications under the same guidelines originally layed out by the Selective Photothermolysis theory for dermatological lasers.

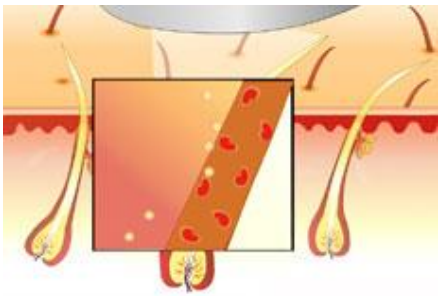
**IPL Cooling**

- Water Cooling – more power goes through the lamp > prevents energy output over 950nm > radiation goes through the water (dependant on the amount of water).
- Air cooling – Allows the utilization of complete long pass through 1,200nm

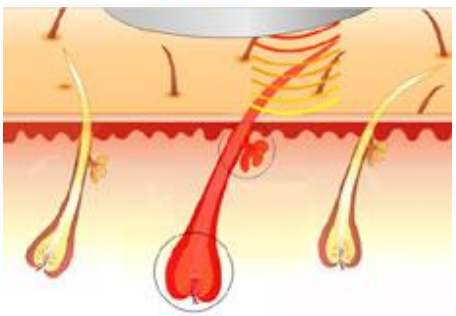
**Photothermolysis** - The word photothermolysis comes from three Greek root words -- "photo" meaning light, "thermo" meaning heat, and "lysis" meaning destruction. ***Selective*** photothermolysis therefore refers to the precise targeting of a structure or tissue using a specific wavelength of light with the intention of absorbing light into that target area alone. The energy directed into the target area produces sufficient heat to damage the target while allowing the surrounding area to remain relatively untouched.
Anderson and Parrish's theory of *selective photothermolysis* ('83) - selective heating of a target chromophore is achieved when the laser wavelength is preferentially absorbed by the chromophore, the energy of the laser is high enough to damage the chromophore, and the pulse duration is shorter than the thermal relaxation of the target (time it takes for the target to cool by 50% of its peak temperature after irradiation).

**Photoepilation** - Is a technique for long-term hair removal by thermal destruction of the hair follicle and its reproductive system (stem cells). Heat is generated by the conversion of light energy emitted from various light sources which is selectively absorbed by chromophores (light sensitive molecules) in the skin. Melanin is the main chromophore in hair follicles and the key target for the process of photoepilation.
Light penetration in skin increases with wave length and since hair follicles lie deep in the skin, optimal wavelengths for photoepilation are in the range of 550-1100 nm. Various light sources in this range (lasers and IPL's) emitting a broad light spectrum from 500nm to 1200nm were found to be safe and effective for photoepilation and received clearance for sale in both the US and Europe.

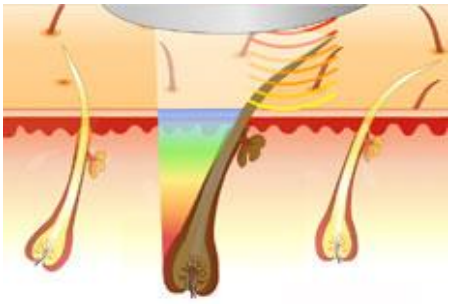
Flashes of broad spectrum light and heat are applied to the target area.



Light is drawn to the melanin in the hair, raising the temperature of the hair follicle.

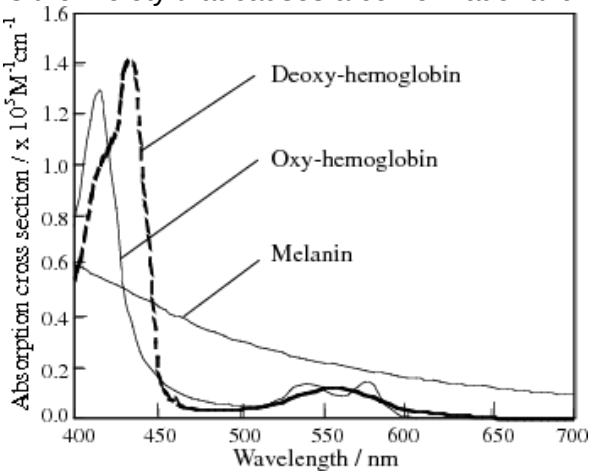


Heat energy from the lamp is conducted down the hair shaft, increasing the hair follicle temperature.



The combined energies of light and heat result in the destruction of the hair follicle.

**Chromophore** - Is the part of a molecule responsible for its color. The color arises when a molecule absorbs certain wavelengths of visible light and transmits or reflects others. The chromophore is a region in the molecule where the energy difference between two different molecular orbitals falls within the range of the visible spectrum. Visible light that hits the chromophore can thus be absorbed by exciting an electron from its ground state into an excited state.
In biological molecules that serve to capture or detect light energy, the chromophore is the moiety that causes a conformational change of the molecule when hit by light.




**Infrared** - (IR) light - is electromagnetic radiation with a wavelength between 0.7 and 300 micrometres, which equates to a frequency range between approximately 1 and 430 THz.
IR wavelengths are longer than that of visible light, but shorter than that of terahertz radiation microwaves. Bright sunlight provides an irradiance of just over 1 kilowatt per square meter at sea level. Of this energy, 527 watts is infrared radiation, 445 watts is visible light, and 32 watts is ultraviolet radiation.

**UV - Ultraviolet radiation** - Is electromagnetic radiation with a wavelength shorter than that of visible light, but longer than X-rays, in the range 10 nm to 400 nm, and energies from 3eV to 124 eV. It is so named because the spectrum consists of electromagnetic waves with frequencies higher than those that humans identify as the color violet.

UV light is found in sunlight and is emitted by electric arcs and specialized lights such as black lights. Classified as non-ionizing radiation, it can cause chemical reactions, and causes many substances to glow or fluoresce. Most people are aware of the effects of UV through the painful condition of sunburn, but the UV spectrum has many other effects, both beneficial and damaging, to human health.

- *UV A* - 50% of UV A radiation penetrates epidermis and absorbed > reaches papillary dermis > most of immediate and long-term changes of photodamage occur in epidermis + upper dermis.
- *Uv B* - shorter WL and more powerful (cause cancer). Only 10% absorbed by epidermis, with only approximately 10% penetrating to deeper layers of the skin.

**Thermal relaxation time** - There are several expressions for calculating thermal relaxation time. Physically this time constant represents the time required for the temperature rise in a heated region of tissue to drop to a factor of $e^{-1}$. TRT is time needed for appropriate cooling of a given light-absorbing target within skin. When heat is produced within the target at a rate faster than the thermal relaxation time, the target becomes hot compared to its surroundings. If heat is produced at a rate less than the thermal relaxation time, the target and its environment are heated accordingly. Pulse durations used by dermatologic Light capable of selective photothermolysis follow this principle and allow for the production of desired specificity. Epidermis TRT – 3-7 miliseconds > interval has to be longer. The hair TRT is between 40-100 msec.

**Photodynamic Therapy (PDT) –** Matured as a feasible medical technology in the 1980s at several institutions throughout the world is a third-level treatment for cancer involving three key components: a photosensitizer, light, and tissue oxygen. It is an approved treatment for wet macular degeneration, and is also being investigated for treatment of psoriasis. Treatment of internal organs may be achieved through the use of endoscopes and fiber optic catheters to deliver light and intravenously-administered photosensitizers.A great deal of research and clinical study is now underway to determine optimal combinations of photosensitizers, light sources, and treatment parameters for a wide variety of different cancers.It is currently being tested as a treatment for severe acne. Photodynamic therapy is a platform technology that utilizes light-activated drugs to treat a range of medical conditions. Any disease associated with rapidly growing tissue can potentially be treated with this technology. While PDT is still in its infancy as a medical treatment, it is being investigated more frequently as an alternative to conventional therapies and as a novel treatment for conditions that were previously untreatable.
Several firms are presently conducting clinical trials to evaluate the application of PDT for the treatment of acne. PDT operates on a similar principal as laser and light-based treatment. Light energy is used to kill the p. acnes bacteria that cause skin eruptions. However, while other devices require expensive, high-power equipment to generate this light, PDT uses a lower power light source whose effectiveness is amplified by the use of a topical agent.

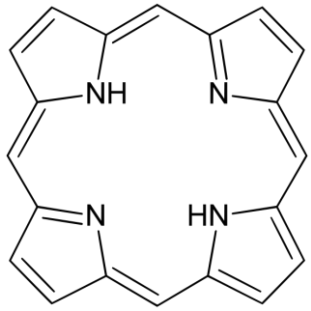
**Electrolysis** - Needle-based electrolysis is distinguished by three modalities – galvanic, thermolysis and blend. With thermolysis, an AC current passing through the needle causes vibration in the water molecules surrounding the hair follicle. This produces heat, which damages the hair follicle. If enough heat is produced, hair will be permanently destroyed. Some research says approximately 200 hairs an hour can be treated with thermolysis[1]. However, many practitioners say one treatment isn't enough for permanent hair removal. As many as 10 treatments of each hair could be required.

**Acne Vulgaris** - Is an exceedingly common chronic skin disorder that affects approximately 40 million adolescents in the U.S. alone and comprises more than 30% of all dermatological visits. 85% of the population between the ages 12-24 develops some level of acne.
The disorder is localized to skin regions with a high number of sebaceous follicles such as the face, back and chest. Acne Vulgaris may lead to long-term scarring and disfigurement, and often contributes to a state of psychological distress, social withdrawal, clinical depression and even suicide.
Propionibacterium acne (P. acnes), is a Gram positive, micro-aerophilic bacterium responsible for the outbreak of inflammatory acne produce and accumulate endogenous porphyrins (namely protoporphyrin, uroporphyrin, and coproporphyrin III) which are the target chromophores for the acne clearance application. Light-based therapy for acne was introduced a decade ago and has become an accepted modality in the armamentarium of acne treatments.
Exposure of inflammatory acne lesions to light utilizing blue, green and red wavelengths which are absorbed by the porphyrins induces a photochemical reaction which generates highly reactive, Free radical singlet oxygen that subsequently causes bacterial destruction.
**Comedonal acne** - see Non-inflammatory acne.
**Noncomedonal acne** – see inflammatory acne.
**Inflammatory acne** - In this type of acne, papules or pustules, red or purple macules, and nodules, often termed "cysts", are predominant. There are a few, if any, conditions.
**Non-inflammatory acne** - This category of acne is identified when a person's lesions are primarily whiteheads and blackheads. It is also called comedonal acne.
**Adult-onset acne** - Overwhelmingly a condition of females, this type of acne turns up after the age of 18. It can crop up in women's 20s, 30s, or even later in life. It's sometimes referred to as female adult acne or post-adolescent acne.
**Pomade acne** - Type of acne seen in African Americans and other individuals who have tight curly hair and frequently use pomade (oils and greasy ointments) to style or improve their hair's manageability.
**Rosacea** - Acne like condition characterized by redness, papules, and sometimes pustules in the center one third of the face in certain fair-complexioned adults. It's often mistaken for acne.

**Sebaceous glands** - Are microscopic glands in the skin which secrete an oily/waxy matter, called sebum, to lubricate the skin and hair of mammals. In humans, they are found in greatest abundance on the face and scalp, though they are distributed throughout all skin sites except the palms and soles. In the eyelids, meibomian sebaceous glands secrete a special type of sebum into tears. There are several related medical conditions, including: acne, sebaceous cysts, hyperplasia, sebaceous adenoma and sebaceous gland carcinoma.

**Porphyrins** – Are a group of organic compounds of which many occur in nature. One of the best-known porphyrins is heme, the pigment in red blood cells. Porphyrins are aromatic. As a consequence, they typically have very intense absorption bands in the visible region and may be deeply colored; the name porphyrin comes from a Greek word for *purple*. Porphyrins have been known to induce photosensitivity for nearly 100 years. In the middle of the 20th century, the photodynamic properties of hematoporphyrin derivatives were more closely studied, later resulting in the appearance of two commercial products for systemical application on the pharmaceutical market: Photofrin®, so far the only one registered for clinical use in the US and in Europe (Porfimer sodium), and Photosan® (polyhematoporphyrin). Both represent a mixture of hematoporphyrin esters and ethers of different lengths.

They represent the first generation of photosensitizers. A second generation of photosensitizers with improved pharmaceutical profiles, e.g. porphines, porphycenes, chlorins, phtalocyanines, has been developed. These substances, as well as antibody-conjugated photosensitizers (third generation), are currently the subject of preclinical or clinical investigations.




**Psoriasis** - is a red, scaly rash that affects an estimated 2% of the world's population, or about 120 million people. While the root cause of the condition is unknown, the rash develops from the rapid proliferation of skin cells. With normal growth, skin cells are created in the basal cell layer, and then move up through the epidermis to the stratum corneum, the topmost layer of the skin. Dead cells are shed from the skin at about the same rate as new cells are produced, about every 28 days. Psoriasis causes skin cells to be produced at a much faster rate. Such changes are accompanied by increased blood supply and localized inflammation. When a patient has psoriasis, the cells are pushed to the surface from the underlying basal cell layer in as little as two to four days, and the skin cannot shed the cells fast enough. The excessive skin cells build up and form elevated, scaly lesions. The white scale (called "plaque") that usually covers the lesion is composed of dead skin cells, and the redness of the lesion is caused by increased blood supply to the area of rapidly dividing skin cells. These changes result in the production of the typical psoriatic lesion.

**Actinic Keratoses** - (AKs) - are a common condition of sun-induced, precancerous skin lesions, affecting about 20 million people worldwide each year. Approximately 15% of these cases develop into various forms of skin cancer, killing 40,000 persons each year. Older individuals are more likely than younger ones to have AKs, because cumulative sun exposure increases with age. It is estimated that more than half of all men and a third of all women over age 65 develop the lesions. Also at high risk are those with fair skin and hair and individuals who spend more time in the sun. Those with dark skin rarely develop the lesions. While AKs are the third most frequently treated condition by dermatologists, many individuals with AKs go untreated because they aren't aware of their condition or don't have access to a physician. This creates an even larger base of potential patients than currently served by developers of AK treatments.
AKs are caused when Ultraviolet B (UVB) radiation from the sun strikes the skin and causes mutations in surface skin cells that can cause malfunctions in certain genes. One of these genes, p53, is a tumor suppressor gene that prevents abnormal, cancer-prone cells from dividing and growing into skin cancer. When the sun causes mutations in the skin, the p53 gene becomes damaged and therefore can no longer prevent cancer-prone cells from dividing. AKs appear as scaly or crusty bumps on the surface of the skin, usually on the face, ears, bald scalp, neck, backs of hands and forearms, and lips. The base may be light or dark, tan, pink, red, or a combination. The crust is horny, dry, and rough. The lesion develops slowly to reach a size that is most often from an eighth to a quarter of an inch. To prevent these lesions from developing into full-blown cancer, they must be removed.

# Infusion™ related terms

**Electroporation** - Involves the application of a high voltage pulse for a very short duration and could work alone or in conjunction with iontophoresis. Electroporation is best known as a physical transfection method in which cells are exposed to a brief electrical pulse, thereby opening pores in the cell membrane, allowing DNA or other macromolecules to enter the cell. The technique of electroporation is normally used on the unilamellar phospholipid bilayers of cell membranes. However, it has been demonstrated that electroporation of skin is feasible, even though the stratum corneum contains multilamellar, intercellular lipid bilayers with few phospholipids and no living cells. The electrical behavior of human epidermal membrane as a function of the magnitude and duration of applied voltage closely parallels the electrical breakdown/recovery of bilayer membranes seen during electroporation. The approximately 100 multilamellar bilayers of the stratum corneum need about 100 V pulses for electroporation, or about 1 V per bilayer. Electroporation sometimes termed 'electropermeabilization' involves changes in membranes of cells or artificial planar bilayer membranes which occur when large transmembrane voltages are applied. The changes in the membrane involve structural rearrangement and conductance changes leading to temporary loss of semipermeability of cell membranes suggesting formation of pores. These changes can lead to ion leakage, escape of metabolites, and increased uptake by cells of drugs and DNA. Electroporation reversibly permeabilizes lipid bilayers and possibly involves the creation of aqueous pathways during the application of an electric pulse. The exact mechanism for electroporation is not clear though the pore mechanism is generally believed to be the case. Changes in the behavior of membranes seen following electroporation such as changes in electrical or mechanical behavior or those seen in molecular transport are consistent with the theory of pore formation.

**Iontophoresis** - Utilizes a small amount of electric current to push the drug through the skin. Iontophoresis uses an electrode of the same polarity as the charge on the drug to drive ionic (charged) drugs into the body. While iontophoresis involves the use of relatively low transdermal voltages ($\ll$100 V), electroporation of skin takes place at high transdermal voltages ($\sim$100 V or more). There is considerable indirect evidence that high voltage pulses cause changes in the skin structure. The use of electroporation in conjunction with iontophoresis can expand the scope of transdermal delivery to larger molecules such as therapeutic proteins and oligonucleotides. While iontophoresis acts primarily on the drug, electroporation acts on the skin with some driving force on the drug during a pulse.
In iontophoresis the potential pathways for ingredients are restricted, forcing the majority of drugs to permeate the skin via appendageal pores such as hair follicles and sweat glands. These routes only account for about 0.1% of the skin's surface, making drug delivery via iontophoresis inefficient when a large area of tissue requires treatment. In contrast, the number of transdermal pathways, available via electroporation, is over 500 times greater than with iontophoresis.

**Magnetophoresis** - Is a novel approach in enhancing drug delivery across biological barriers. Benzoic acid, a diamagnetic substance, was selected as the drug candidate. The drug diffusion across rat abdominal skin was enhanced due to the influence of the magnetic field. The experiment with alternating on-off-fields in the same diffusion set-up confirmed that the difference in flux between passive and magnetic diffusion is not due to any variation in the experimental condition or membrane properties. The influence of magnetic field strength on diffusion flux was determined and was found to increase with increasing applied field strength.

**Phonophoresis** - Is the use of ultrasound to enhance the delivery of topically applied drugs. Phonophoresis has been used in an effort to enhance the absorption of topically applied analgesics and anti-inflammatory agents through the therapeutic application of ultrasound.

**Sonophoresis** - Low frequency ultrasonic energy disrupts the stratum corneum to introduce materials. Sonophoresis is a process that exponentially increases the absorption of semisolid topical compounds (transdermal delivery) into the epidermis, dermis and skin appendages. Sonophoresis occurs because ultrasound waves stimulate micro-vibrations within the skin epidermis and increase the overall kinetic energy of molecules making up topical agents. It is widely used in hospitals to deliver drugs through the skin. Pharmacists compound the drugs by mixing them with a coupling agent (gel, cream, ointment) that transfers ultrasonic energy from the ultrasound transducer to the skin. The ultrasound probably enhances drug transport by cavitation, microstreaming, and heating. Sonophoresis is also used without drug delivery in physical therapy, and as a complementary modality for iontophoresis.

**Hyaluronic Acid (HA)** - HA (Hyaluronan) is a glysosaminoglycan present in the extra cellular matrix (ECM) of all tissues mainly in the skin and synovial joints. HA may directly affect cell function through binding to CD44 receptor and up-regulate the expression of IGF-I which is an important collagen stimulating factor. It plays an important role in hydrating the extra cellular space and constitutes a matrix for supporting the normal functions of the cells. All type of wrinkles except dynamic lines can be improved by HA. HA has a protection action against IL-1 induced inhibition of collagen biosynthesis in cultured human skin fibroblasts at the level of IGF-IR signaling. It will Increases new cell growth; has a moisturizing effect on the skin and will smoothen and soften the skin.

## Pristine™ related terms

**Microdermabrasion** - is a method of mechanical exfoliation aimed at fighting photo aging symptoms such as age spot and fine lines and wrinkles, improving overall skin quality, as well addressing medical conditions such as acne or other scars. Microdermabrasion has become an increasingly popular method for facial rejuvenation. In 2010, microdermabrasion was one of the top 5 non-surgical procedures for men and women according to the American Society for Aesthetic Plastic Surgery (ASAPS). Microdermabrasion is a non-invasive mechanical exfoliation treatment that removes the outermost layer of dead skin cells on the face, chest, and neck or anywhere on the body. Mechanical exfoliation with or without particles, along with adjustable vacuum pressure, allows for safe controlled exfoliation of the top layers of the epidermis. It's an in-office procedure that is done by a trained skin care professional that uses a mechanical medium for exfoliation (crystals, diamond tips, bristle tips) along with vacuum to sweep away the dead skin and helps with circulation.
The skin's surface is disrupted; cell division occurs which stimulates fibroblast activity leading to collagen which leads to thicker, firmer skin. The suctioning and vacuuming stimulates blood flow bringing up $O_2$ and nutrients to the skin's surface and helps to nourish the dermis. $O_2$ also helps with acneic skin because oxygen kills the p-acne bacteria in blemishes. Our skin sloughs off at a slower rate with age, so the exfoliation of several layers of the stratum corneum leaves skin fresh and radiant. Microdermabrasion can be done to decrease the appearance of superficial hyperpigmentation, photo-damage, diminish fine lines, wrinkles, and shallow acne scars which helps to even out the texture. Removing the dead skin will aid in the penetration of skin care products by up to 50% and makeup will go on much

smoother. The patient's epidermis regenerates after 7-10 days while dermis regeneration occurs after several months.
The first microdermabrasion unit was developed in Italy in 1985, using small inert aluminum oxide crystals to abrade the skin. In 1986, other European markets had introduced the technology, which was immediately adopted by physicians for mechanical exfoliation. There were 10 microdermabrasion units on the market in Europe by the end 0f 1992. In 1996, Mattioli Engineering partnered with one of the Italian designed machines and started working towards meeting FDA requirements for the USA. By the end of 1996, the FDA issued the first clearance letter for microdermabrasion machines. In January 1997, the first microderm machine was being sold and marketed in the US. The diamond tip was introduced in 1999 and the bristle tip was introduced in 2005.
Microdermabrasion has evolved from rocks, stones and shells to cyrstals, particle-free diamond tips and particle-free bristle tips. The popular, preferred method of mechanical exfoliation is particle-free over crystals. Once the desired amount of exfoliation has been reached, some microdermabrasion units will then infuse a skin specific solution into the skin. By infusing the solution, it will penetrate deeper than if applied manually for 2 reasons; the first is because the dead skin has been removed, so product penetration increases, the second is because the vacuum pressure works in reverse to push it in deeper.

**Microdermabrasion Mediums (crystals, diamond tips, bristle tips)**

1. Aluminum Oxide Crystals: fourth most abundant compound in earth's crust; second to the diamond for hardness; known for its hardness & chemical inertness; inhaled crystals must be <5 microns to reach the alveoli, Aluminum Oxide Crystals are 100 microns; aluminum oxide crystals are chemically inert and pose no hazard; graded for purity; professional grade is 98.9% pure; irregularly shaped for effective exfoliation.
2. Sodium Bicarbonate & Sodium Chloride Crystals: soft & regular in shape; more uncomfortable because a higher velocity is required; water-soluble and can be absorbed into the skin; power to exfoliate is 25% that of aluminum oxide.
3. Organic Grains (crystals): used to buff & polish; crystals are made from trees, plants, agricultural crops, straw, reeds, maize, sunflower, cane sugar; non-toxic; great for sensitive skin; not as popular as other mediums used for microdermabrasion.
4. Diamond Tips: hardest natural substance; erythema (redness) is partially due to circulation rather than only irritation; no risk of inhalation or particles remaining imbedded in the skin; varied coarseness of diamond wands or tips; diamond tips able to fit some crystal microdermabrators; diamond tips tend to dull from buildup of dead skin during treatment.
5. Bristle Tips: bristles are pliable, so they move with the skin allowing for aggressive treatments without added irritation; made from polyester or nylon; less likely to stripe or mark the skin; erythema (redness) is due to circulation as well as abrasion; various bristle tips range from fine to coarse/abrasive; no risk of inhalation of particles or remaining particles imbedded in the skin.

**LED** (Light Emitting Diodes) – A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practical electronic component in 1962, early LEDs emitted low-intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness.
LAD classified as physician use only. Interaction of light delivered through LEDs activates cell receptors causing them to produce collagen or multiply. One of the original applications for LEDs was PhotoDynamic Therapy (PDT), using photo-

activated creams (Levulan®) for the treatment of actinic keratosis and pre-cancerous lesions.
LEDs do not rely on thermal energy and the related tissue trauma to effect change like laser and pulsed light devices. By manipulating the wavelengths, cells can be turned on and off. Pain free, can be used on all skin type

- Yellow light LEDs are used for photo-rejuvenation.
- Blue light LEDs are used in the treatment of acne.
- Red light LEDs are used for PhotoDynamic therapy.