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Review Article

**EMERGING TRENDS IN DERMATOLOGICAL INFECTIONS:
A COMPREHENSIVE REVIEW****S.M. Shahidulla¹, M. Suresh Babu², Mariyam Fathima*¹, Rumaisa Afsheen²,
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Abstract:

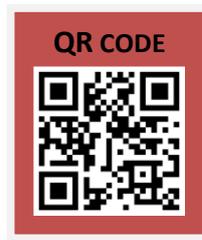
Skin illnesses develop when the normal structure or appropriate function of the skin and its layers is compromised. These conditions can affect anyone of any age, gender, race, or socioeconomic status. Among the most common skin conditions affecting a substantial portion of the global population are dry skin, acne, and hyperpigmentation. Additionally, it explains the skin's anatomy, highlighting the dermis and epidermis, the skin turnover process, and mechanical properties, including strain, stress, and absorption. Dry skin has received the greatest attention in the literature, consistent with earlier findings. Among the several diagnostic techniques used to identify skin disorders are skin Wood's lamp examination, microbial culture, biopsy, diascopy, and other specialised dermatological procedures.

Skin diseases are treated with both pharmaceutical and physical therapy. Medical treatment includes both topical therapies that are applied directly to the skin and systemic medications. Physical treatment methods include cryotherapy, phototherapy, photodynamic therapy, laser therapy, and surgical procedures. Topical medications are the primary treatment for many skin conditions. Conversely, systemic medications are administered orally or parenterally, enabling systemic distribution throughout the body.

Keywords: Skin disorders, bacterial, viral, fungal, treatment, skin anatomy, acne skin, dry skin

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1. INTRODUCTION:

Skin conditions affect millions of people worldwide and account for a significant portion of the global illness burden. These situations have existed throughout human history and have been recognised by humans from ancient times. They are now studied by researchers and medical experts in the area of dermatology.

With an average adult's skin covering over 20 square feet, it is the biggest organ in the body. Skin changes frequently indicate underlying health concerns in other organs or systems, such as cancer, liver illness, shock, anaemia, or respiratory disorders. The skin is the body's main defence against harmful outside chemicals, in addition to displaying overall well-being. Additionally, it is crucial for creating vitamin D, maintaining fluid balance, sustaining body temperature, and enabling sensory perception. The skin consists of three main layers. The protective surface is formed by the outermost layer, called the epidermis, which is comparatively thin but strong. The sweat glands, sebum (oil) glands, and several sensory nerves reside in the dermis, a thicker intermediate layer composed of fibrous and elastic connective fibres. Before this position, the skin was usually thought of as a straightforward, passive barrier that shielded the body from injuries and prevented the loss of fluid^{1,3}.

The numerous associated cell types and structural elements that make up the skin work together to protect the body. For instance, squamous epithelial cells emit cytokines, which constitute signalling molecules, along with keratin. Melanocytes, another key cell type, are the source of melanin, the pigment that provides skin its brown tone. The study of skin tribology is one specialised field that has drawn more interest from scholars all around the world.

The progress of moving mechanical components to improve system performance, these products frequently function by minimising friction on the. The gradual deterioration of skin emerges as ageing or distinct dermatological diseases within the context of the study of Skincare and cosmetic items are used to preserve skin health to treat these problems. Similar to lubricating oils that reduce contact between moving mechanical components to improve system performance, these products are often effective by minimising friction on the outermost layer of the skin².

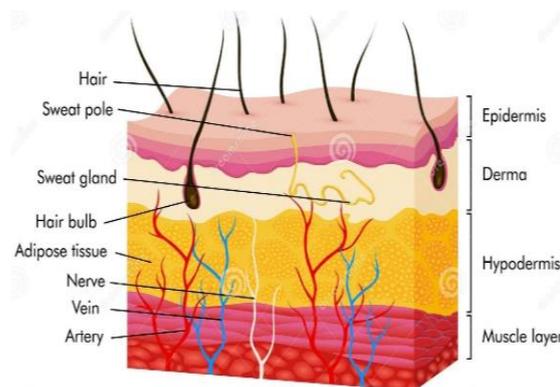


Figure 1: Anatomy of skin

2. Progress in Dermatological Research and Essential Aspects of Skin:

The examination of improvements in the research and treatment of skin diseases helps highlight the important nature of this field and demonstrates how scientific fascination has grown over several decades. Skin problems usually arise when anomalies develop within the various layers of the skin or when the regular functioning of skin tissues is disturbed. Many skin disorders affect people of different demographics, ages, and ethnic groups worldwide. These disorders have an impact not only on the afflicted human beings but also on the medical professionals who identify and manage them. Over the course of 20 years, from 1999 to 2019, publication trends pertaining to dermatology disorders were analysed in order to track the progression of research effort in this field of study^{3,4}.

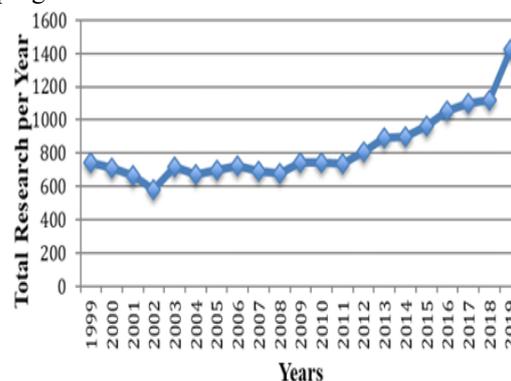


Figure 2: Analysis of research activity related to skin problems over twenty years (1999–2019).

3. Epidermal Cell Turnover Process: As it might influence the successful outcome of treatments for several kinds of dermatologic illnesses, researchers closely monitor the length of the epidermal rejuvenation cycle. The ongoing replacement of old epidermal cells with newly generated ones is referred to as epidermal turnover. It is generally accepted that the epidermal layer completes this healing cycle in healthy human skin in 27–28 days. However, as shown in Table 1, an array of clinical studies have revealed different projections for this period of time^{4,7}.

Transit time and the duration of renewal are the two primary measures that scientists typically use to assess skin turnover. The time it takes for a freshly created basal cell to get from the basal layer to the granular layer of the epidermis is known as the period of transit. The average time required for basal cells to migrate from their origin to the stratum

corneum, the outermost layer, is indicated by the renewal time.

Journey period and time for renewal would be the same if all epidermal cells traversed at a comparable pace. But in practice, the human epidermis's cell migration rate fluctuates, which typically leads to inconsistencies between these two parameters⁸.

Table 1: Turnover periods identified in different scientific investigations.

PUBLICATION	SKIN TURNOVER TIME
The concept of epidermal cell renewal was discussed in early dermatological studies (Pinkus, 1952).	A skin renewal period of approximately 26.7 days was estimated when the duration of the mitotic phase was assumed to be one hour.
Early investigations on epidermal turnover were also reported in dermatological research (Epstein & Maibach, 1965).	Estimated average cycle for epidermal cell regeneration in humans
Halprin (1972) studied the kinetics of epidermal cells and their role in skin renewal.	The estimated transit period for cells moving through the Malpighian layer is approximately 14 days.

4. Major Skin Disorders in Humans: When the skin's normal function or structure becomes altered, skin disorders occur. Irritation, inflammation, and prolonged itching are just a few of the symptoms that can result from abnormalities in the various layers of the skin. These disorders frequently stem from genetic or metabolic syndrome such as abnormalities in structural proteins, enzymes, or the breakdown of lipids. The stratum corneum, the skin's outermost layer, is critical for retaining the skin's protective layer. Defects in this layer can upset the equilibrium of both proteins and lipids that are necessary for the integrity of the barrier. These alterations hinder the skin's capacity to hold onto moisture, increasing trans-epidermal water loss through the pores and ultimately undermining the skin's ability to protect itself. Skin conditions can be categorised broadly into three main categories from a clinical perspective. The first group includes conditions, including psoriasis, xerosis, atopic dermatitis, and eczema, that are linked to dry skin^{7,9}. Pigmentation-related disorders like vitiligo, melasma, and post-inflammatory hyperpigmentation are included in the second category. Acne, one of the most prevalent inflammatory skin conditions, falls under the third category. The incidence of these disorders among patients was examined in a study of epidemiology carried out in Himatnagar. According to the results, 32% of the reported cases had eczema, 21% had xerosis, and 16% had acne. When taken as a whole, all three of these factors accounted for about four-fifths of all observed cases. Atopic dermatitis (10%) and hyperpigmentation following inflammation (9%) were among the other disorders; melasma (5%), vitiligo (4%), and psoriasis (3%) had smaller prevalence rates¹⁰.

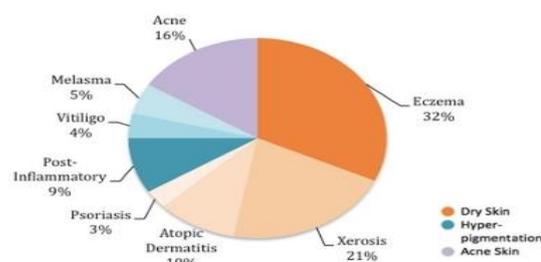


Figure 3: Outcomes of a recent skin disease survey conducted in Himatnagar.

Xerotic Skin Condition: A gritty texture and tiny flakes on the skin's surface are common signs of dry skin. This problem usually arises from insufficient production of sebum, the natural oils that keep the skin smooth and moist. This issue may be caused by several environmental and external sources. For example, residing in areas with low humidity or cold temperatures, as well as being exposed to specific chemicals or microbes, may raise the risk of acquiring dry skin. Additionally, studies have shown that frequent use of powerful cleaning solutions, such as harsh soaps, detergents, and astringents, and prolonged exposure to sunlight can exacerbate or cause dry skin. When creating effective strategies for the prevention and management of skin disorders, it is crucial to comprehend these contributing aspects, especially when treatment techniques need to be modified to satisfy specific needs. Dry skin can affect people of all ages, from young children to adults. If left untreated, this illness could get worse over time and result in more severe dermatological issues. In extreme circumstances, the skin may become drier than usual. This extreme dryness is commonly seen in some skin conditions like psoriasis, ichthyosis, atopic dermatitis, and contact dermatitis and is frequently associated with a compromised skin barrier^{11,4}.

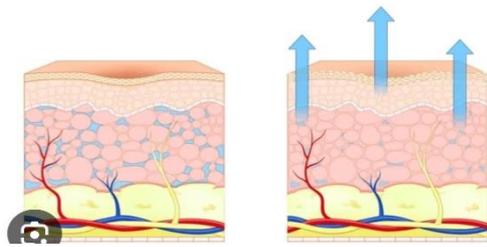


Figure 4: The skin surface of normal and dry skin subjects. (a) Normal; (b) Dry skin surface

Excess Pigmentation of the Skin: Disorders involving skin pigmentation arise when the processes responsible for producing or distributing pigment become abnormal, resulting in noticeable changes in skin colour. These alterations occur when the biological mechanisms that regulate normal skin appearance are disturbed.

Several factors can influence the development of pigmentation changes, including prolonged exposure to sunlight, inflammatory reactions, and other physiological processes occurring within the skin. Melanin, the pigment that determines skin colour, plays a central role in these conditions. Problems may develop when the body produces inadequate amounts of melanin or when melanosomes—the cellular structures responsible for transporting this pigment—do not function properly. While keratinocytes are involved in regulating pigmentation, other skin cells, such as mast cells, Langerhans cells, and lymphocytes, also contribute to this complex regulatory system¹².

Pigmentation disorders are generally categorised into three groups: depigmentation, hypopigmentation, and hyperpigmentation. Hypopigmentation refers to a reduction in melanin compared with normal skin levels, whereas depigmentation indicates the complete absence of pigment^{12,7}.

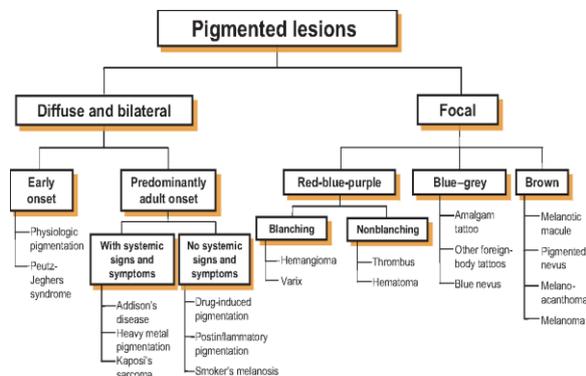


Figure 5: Pigment-related skin disorders can be grouped according to the level of melanin present in the skin.

Cutaneous Bacterial Infections: The skin normally acts as a barrier that protects the body from harmful microorganisms. However, certain bacteria can still penetrate this defense and lead to infection. Bacterial skin infections may vary in severity, ranging from mild conditions to serious and potentially life-threatening diseases. These infections often develop when bacteria enter the body through openings in the skin, such as hair follicles or small breaks caused by injuries. Surgical incisions, burns, puncture wounds, sunburn, or other forms of skin damage can create pathways for microorganisms to invade.

Several types of bacteria are capable of infecting the skin, but the most frequently involved are *Staphylococcus aureus* and *Streptococcus* species. A particularly concerning strain is Methicillin-resistant *Staphylococcus aureus* (MRSA), which is widely recognised as a common cause of skin infections in the United States^{14,5}.

Bacterial skin infections can present in different forms. More serious conditions include Cellulitis, Lymphangitis, and Necrotizing Fasciitis. Less severe infections may appear as Folliculitis, Carbuncle, Ecthyma, Impetigo, or Skin Abscess. Certain groups of people have a higher risk of developing bacterial skin infections. These include individuals with diabetes, patients who are hospitalised, and those living or working in long-term care facilities such as nursing homes. Treatment typically involves the use of appropriate antibiotics, and in some cases, surgical drainage of abscesses may be required to control the infection.

Viral Infections of the Skin: Numerous viruses can cause skin infections and dermatological disorders. Poxvirus, herpesvirus, coronavirus, hepatitis virus, and human papillomavirus are some of the main viral agents linked to skin infections. One of the biggest and most structurally complicated classes of DNA viruses is represented by poxviruses. They can infect people as well as a number of animal species, including cats, sheep, cattle, and primates. There are various subgroups of poxviruses. Smallpox, cowpox, monkeypox, and illnesses linked to the Vaccinia virus are all included in the orthopoxvirus category. Conditions like Milker's Nodule are caused by parapoxviruses, another subtype. Molluscum Contagiosum is also caused by several poxvirus infections. The Variola virus, which causes smallpox, was once thought to be a highly contagious viral disease with a high fatality rate. The illness frequently manifested as fever, chills, and the development of skin lesions including pustules and blisters. Firm, dome-shaped nodules on the skin are the hallmark of Milker's nodule, a viral infection that is usually spread from sick cattle to people who work closely with them, particularly farmers. Molluscum contagiosum, a contagious skin condition that

causes tiny, raised, dome-shaped pimples that may be pink or white in color, is another example^{16,3}.
Vitiligo as a Depigmenting Skin Disease: A skin condition called vitiligo is characterised by a loss of pigmentation because the epidermis produces less or no melanin. Usually, this ailment develops as distinct, pigment-free, chalky-white spots on the skin that do not exhibit scaling. About 0.5–1% of people worldwide suffer from vitiligo, which is regarded as one of the most prevalent depigmentation conditions. Numerous variables, such as oxidative stress, autoimmune mechanisms, inflammatory mediators, melanocyte destruction or absence, and hereditary susceptibility, are linked to the development of this disorder. Consequently, depigmented patches on the skin and mucous membranes may appear locally or widely in vitiligo sufferers. Segmental and non-segmental forms of vitiligo are the two basic clinical classifications. Segmental vitiligo typically manifests as a confined pattern on one side of the body. Early on, it frequently develops quickly before stabilising, occasionally accompanied by alterations in neighbouring hair follicles. Non-segmental vitiligo, on the other hand, typically manifests as symmetrical depigmented patches dispersed throughout various body parts. This type often develops gradually, can happen in recurrent periods, and occasionally also involves scalp hair depigmentation. While segmental vitiligo is less common and makes up about 5–16% of all occurrences of vitiligo, non-segmental vitiligo is the most prevalent type of the condition^{3,17}.

Chronic Pruritic Skin Disorder: Eczema, another name for atopic dermatitis, is a chronic inflammatory skin condition that causes continuous itching. Globally, it affects 1–3% of adults and 10–20% of children. Lesions might appear as dry, reddish, flaky spots, little blister-like structures, or plaques of varied thickness. They usually appear on flexural areas, such as the inner elbows and behind the knees. In contrast to psoriasis, it is typically difficult to distinguish between skin that is affected and skin that is not. Immune system abnormalities, namely a Th2-skewed response, are the cause of the illness. Interleukin (IL)-4, IL-5, and IL-13 are major inflammatory mediators that contribute to the persistent skin inflammation, breakdown of the barrier, and persistent pruritus associated with atopic dermatitis¹⁵.

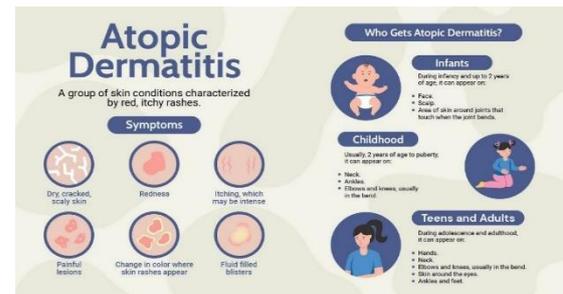


Figure 6: Atopic Dermatitis

5. Factors Contributing to Autoimmune Diseases:

Genetics: Research shows that the development of autoimmune illnesses is significantly influenced by inherited genetic variables. The importance of heredity is shown by the fact that many autoimmune skin disorders are more common within families and exhibit more resemblance in identical (monozygotic) twins than in fraternal (dizygotic) twins. For instance, compared to dizygotic twins, the concordance rate for Systemic Lupus Erythematosus (SLE) is about 25% in monozygotic twins, indicating a genetic component, however genetics cannot completely account for the development of the disease.

The most important genetic component influencing immune system regulation is the Major Histocompatibility Complex (MHC). Certain HLA types have a 2–12% relative risk for SLE, while the DRB1 and DQ8 genes are linked to a 15% relative risk for Pemphigus vulgaris. Certain HLA alleles are linked to increased risks of autoimmune illnesses. About 90% of individuals with dermatitis herpetiformis and celiac disease have the HLA-DQ2 gene, while the remaining patients have the HLA-DQ8 gene, which translates to an 11.6% relative risk¹¹.

The existence of vulnerable loci in conjunction with particular autoantibodies significantly raises the risk of developing autoimmune diseases, even while genetic vulnerability itself cannot be changed. Accurate risk prediction and the development of precise treatment plans depend on the recognition of these genetic and immunological characteristics. Important immune components that might target skin tissue and contribute to the pathological alterations typical of autoimmune skin diseases include T cells, B cells, autoantibodies, and different cytokines^{18,8}.

Table 2: Key Autoantibodies, Genetic Markers, and Triggers in Autoimmune Skin Disorders

Autoimmunity-Related Skin Conditions	Self-Antigens in Autoimmune Diseases	Inherited Risk Factors	Environmental and External Triggers
Systemic Lupus Erythematosus	Nuclear Autoantigens: dsDNA, Ro, and Nucleosomes	HLA Alleles: A1, B8, and DR3	Cigarette, Crystalline silica, smoking, Sunlight
Autoantibody-Mediated Skin Disease: Pemphigus	Acetylcholine-receptor	HLA-DRB1*0402 allele is a specific human leukocyte antigen (HLA)	Penicillamine, Captopril, rifampicin

Environmental Contributors to Disease Onset: Numerous environmental variables, such as UV radiation, vitamin D deficiency, infections, vaccines, adjuvants, xenobiotics, nutrition, psychological stress, smoking, and some drugs, can cause or exacerbate autoimmune responses. Many of these triggers can be controlled or avoided to lower the risk of disease once a person's autoimmune susceptibility is known. One common cause of autoimmune skin symptoms is sun exposure. UVB radiation can have a pro-autoimmune effect. While moderate UVB exposure causes apoptosis, an anti-inflammatory mechanism, high UVB exposure causes necrosis, which increases inflammation, exposes autoantigens to antigen-presenting cells, and can exacerbate autoimmune reactions.

Anti-Ro antibodies, UV exposure, and outbreaks of systemic and cutaneous lesions in Systemic Lupus Erythematosus (SLE) have all been implicated. Autoimmune skin problems are also linked to a number of infectious pathogens. For example, infections with Streptococcus, Staphylococcus, and Candida albicans are linked to exacerbations of psoriasis, whereas Epstein-Barr virus has been linked to SLE and Herpes virus to Pemphigus vulgaris. These infections have a tendency to trigger immunological reactions that impair self-tolerance and cause autoimmune dermatological disorders to develop or aggravate.

Inflammatory Mechanisms in Autoimmune Disorders: The body exploits inflammation as a defence mechanism to safeguard tissues from viruses, chemical irritants, and physical trauma. Exposure to allergens, pathogenic agents, or autoimmune triggers prompts an immunological response in the skin that appears as pain, redness, oedema, and heat. Short-term inflammation is necessary for healing, but long-term or severe inflammation can cause chronic skin conditions to develop and exacerbate. By encouraging the release of pro-inflammatory molecules like substance P and calcitonin gene-related peptide (CGRP), which are linked to diseases like psoriasis, atopic dermatitis, prurigo, and rosacea, transient receptor potential vanilloid (TRPV) ion channels play a crucial role in

this process. Mast cells, dendritic cells, and mononuclear cells are examples of skin-resident immune cells that carry TRPV1 channels, which increase inflammation by secreting cytokines and neuropeptides. Prolonged activation of these pathways could result in aberrant expansion of cells during tissue regeneration, establishing a tumour stroma-like environment and perhaps increasing the possibility of developing skin cancer^{4,9,19}.



Figure 7: Inflammation in Skin
Disruption of Immune Homeostasis: Inflammation is a fundamental immune reaction to foreign or hazardous substances; immune regulatory deficiencies frequently associate with inflammatory dysfunction. Many T cell subsets, including less common populations like $\gamma\delta$ T cells, are essential for regulating allergic inflammation and preserving tissue balance in the skin. Skin immunity is maintained by a finely coordinated network of effector and memory T cells, natural killer (NK) cells, and MHC-restricted T cells. This system can be compromised by aberrant antigen presentation or disruption of signaling pathways, which increases susceptibility to illness. HIV infection is a prime example, as it compromises immune function and drastically increases the incidence of non-melanoma skin cancers (NMSCs) in comparison to the general population. Similarly, by interfering with normal immune monitoring in the skin, human papillomaviruses (HPVs) can alter immune system responses resulting in the development of cancers of squamous cells¹⁶.

6. Correlation Between Autoantibody Levels and Disease Severity:

Autoantibodies are being explored increasingly for prognostic and predictive reasons in addition to identifying illnesses and classification. These antibodies frequently show up prior to clinical signs, which enables an early diagnosis, particularly in people who are at higher risk. Type I mucocutaneous autoantibodies target self-antigens expressed in the skin and extracutaneous tissues, whereas Type II mucocutaneous autoantibodies target antigens associated with mucocutaneous cells. The majority of Type I autoantibodies identify well-known autoantigens that were initially discovered in individuals with systemic autoimmune diseases such as thymositis, Sjögren's syndrome, scleroderma, and Systemic Lupus Erythematosus (SLE).

On the other hand, Type II autoantibodies are mainly linked to conditions that affect the skin. For instance, autoantibodies that target melanocytes are linked to vitiligo, whereas those that target adhesion molecules are involved in immune-mediated blistering disorders. Epidermal antigens produced by keratinocytes can cause non-blistering conditions like vitiligo as well as blistering diseases like the pemphigoid group. Conditions including cutaneous SLE and dermatitis herpetiformis target dermal antigens. Both Type I and Type II abnormalities are useful diagnostic markers and may offer prognostic knowledge regarding the severity and duration of autoimmune skin disorders, even when other immune pathways have a role in the progression of the disease^{18,8,7}.

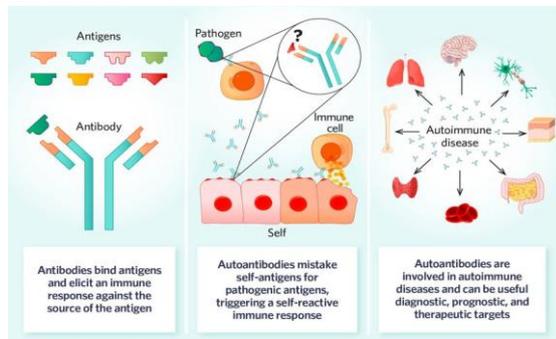


Figure 8: Autoantibodies cause disease

7. Diagnostic Approaches in Dermatology:

Physical Assessment Techniques in Dermatology: When assessing dermatological issues, clinicians use either visual inspection or the patient's medical history. During consultations, they conduct an extensive checkup of the entire skin surface and obtain information about recent lifestyle changes, the beginning of symptoms, and any previous skin concerns. Additional instruments like dermatoscopes, skin scrapings, cultures, and Wood's lamp illumination are frequently employed to improve diagnosis accuracy.

Although a simple visual inspection might not be enough for a thorough assessment, dermatoscopes are especially useful for distinguishing subtle

pigmentation patterns, disease depth, or tiny pathogens. Biopsies and scrapings are frequently used to cultivate cells and pathogens or to analyse tissue under a microscope. In a gloomy environment, UV light from a Wood's lamp can reveal luminous characteristics for bacterial and fungal diseases. A Tzanck smear, in which blister fluid is analysed under a microscope, may be necessary to diagnose viral infections. Use tests, such as patch tests, prick tests, and intradermal testing, are all acceptable methods to determine allergies; the latter two need careful monitoring because of the potential for anaphylactic reactions. Dermatoscopes are crucial for distinguishing benign from malignant pigmented lesions, which increases diagnostic accuracy. They also help detect concealed lesions, such as scabies colonies²⁰.

Histopathological Analysis of Skin Disorders: The principal techniques for microscopically examining skin samples are presented in this section. Tissue specimens are typically examined with a low-power microscope to determine typical areas, then examined under a high-power magnification for in-depth study. To show anatomical and cellular details, dermatopathology uses a range of staining techniques and molecular markers. The most used techniques include the following:

- Hematoxylin and eosin (H&E) staining: for cellular architecture and broadly tissue morphology.
- IHC, or immunohistochemistry, is used to identify specific amino acids in skin cells.
- Direct and indirect immunofluorescence: the use of fluorescent labels for identifying antigens or antibodies.
- To find certain DNA or RNA sequences in tissue sections, use in situ hybridization (ISH) and fluorescence in situ hybridisation (FISH)^{20,4}.

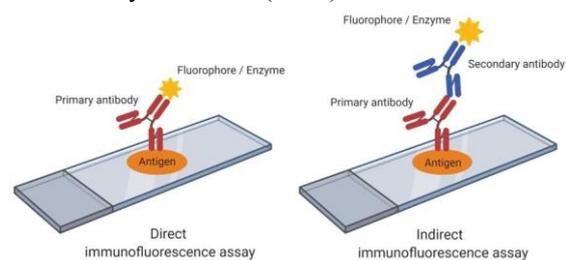


Figure 9: Immunofluorescence

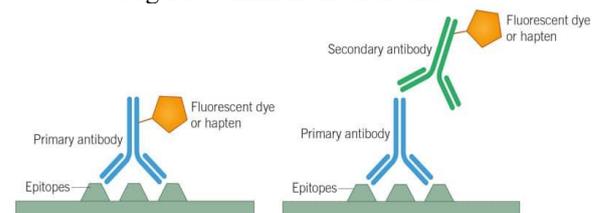


Figure 10: Immunohistochemistry

8. Standard Dermatological Approaches for Skin Disease Therapy

Topical applications and oral pharmaceutical therapies: A description of the several modalities of therapy used to treat ailments of the skin are provided in this section.

Overview of Dermatological Topical Preparations: Topical medications typically comprise an inert base, sometimes known as the vehicle, and an active medicinal ingredient. The preparation's consistency

and spread ability, as well as the degree to which the drug penetrates and interacts with the skin, are all influenced by the vehicle that is used. In addition, it is crucial to take into consideration any possible negative responses or systemic consequences of these medicines. As an illustration, corticosteroids reduce inflammation by suppressing the immune system, yet this cytotoxic effect can make infections more likely. To mitigate problems, they must be taken carefully occasionally in conjunction with antifungal, antibiotic, or antiviral medications¹¹.

Table 3: Forms of Topical Drug Preparations

Pharmaceutical base	Therapeutic benefits	Potential risks
Topical Ointment Preparations	They help retain moisture in the skin and provide a protective barrier against environmental irritants	Reduce patient comfort and preference
Dermatological emulsion base	Spread smoothly over the skin, moderate moisturization while allowing the skin to breathe	Less occlusive protection compared to ointments, skin irritation or allergic reactions
Liquid topical formulation	Hydrate the skin, soothe irritation, and deliver active therapeutic agents	Less protective and occlusive coverage
Topical foam formulations	Light and non-greasy texture	Propellants or chemical additives that can cause skin irritation or sensitivity

When administered to the skin, various kinds of vehicles can produce distinct impressions and have been developed to fulfil different functions. For particular therapeutic purposes, some vehicles are more suitable than others. For example, ointments and powders are frequently chosen for their insulating characteristics, but liquid solutions are frequently used for cleaning because water is an efficient solvent. Sunscreen is a recognised example of a topical therapeutic product.

Based upon the way drugs work, topical drugs are typically separated into eight groups: (1) cleansing agents; (2) protective agents; (3) moisturising agents; (4) drying agents; (5) antipruritic (anti-itch) agents; (6) anti-inflammatory agents; (7) anti-infective agents; and (8) keratolytic agents^{16,9}.

Fundamentals of Oral Drug Administration: Oral medications, which allow the treatment to go throughout the body through the bloodstream, are frequently used to treat skin disorders that call for systemic therapy. The capacity to deliver precise and consistent doses, which contributes to dependable therapeutic effects, is one of the primary benefits of this mode of administration. Patients with extensive or severe skin involvement, for whom topical

treatments might not be adequate, benefit most from oral therapies.

Still, these medications could impact systems other than the epidermis because they circulate throughout the body. Because of this, close medical supervision is frequently required to assess therapy efficacy and detect any potential side effects. Frequent monitoring contributes to the medication's continued safety and efficacy over an extended period of use. Pills (including chewable, effervescent, buccal, and sublingual varieties), capsules that are transparent, solution-based suspensions, and pulverised preparations are examples of common oral dose forms^{3,14}.



Figure 11: Oral medications

Topically Applied and Systemic Oral Antibiotic Therapies: Creams, ointments, gels, lotions, and powders are among the pharmaceutical forms in which antibacterial drugs intended for external use are manufactured. Depending on the location and

features of the afflicted area, the availability of these various formulations enables medical professionals to choose the best treatment for infections affecting the skin and mucous membranes.

Table 4: Antibiotic Therapy for Dermatological Conditions

Dermatological disorder	Typical antibiotic medications
Inflammatory facial dermatosis	Topical azelaic acid preparation, Minocycline antibiotic therapy
Acneiform skin disease	Benzoyl peroxide-based dermatological agent, Clindamycin antibiotic therapy
Dermatologic inflammatory disorders	Immune system-suppressing medications

The importance of the skin microbiome in maintaining healthy skin has been brought to light by recent research, underscoring the necessity of using topical and oral antibiotic treatments with greater caution. Antibiotic-resistant bacterial strains are a rising concern, especially with systemic (oral) antibiotic therapy, and can be caused by overuse or incorrect administration of antibiotics. The decreased use of older tetracycline-based oral antibiotics, which were once often given for acne, is an illustration of this problem because of worries about resistance. Additionally, a variety of microorganisms that support and preserve the skin's regular protective activities are found naturally.

Cutaneous and Systemic Retinoid Therapy: Topical retinoids are skin remedies made from vitamin A compounds that help cure skin issues by promoting collagen synthesis, cleaning clogged pores, and speeding up skin cell regeneration. They are helpful in treating conditions like acne and other dermatological issues because of these activities. However, using them can occasionally result in adverse effects like dryness, peeling, inflammation, and increased sensitivity to sunlight. Furthermore, because retinoid chemicals have a part in embryonic growth processes, they can disrupt normal fetal development, which is why these drugs are not advised during pregnancy¹⁹.

Regulatory bodies including Health Canada and the Food and Drug Administration (FDA) in the United States have granted approval for four major topical retinoid medications. These are composed of trifarotene, adapalene, tazarotene, and tretinoin. All of these vitamin A-based remedies are frequently prescribed to treat acne vulgaris, and tazarotene is also employed in treating plaque psoriasis.

Topically Applied and Systemic Antifungal Therapies: Topical antifungal agents are intended for managing fungal infections involving the skin, nails, and mucous membranes. These therapies work by stopping fungal organisms from growing and proliferating. They frequently serve for the

treatment of diseases, including ringworm, athlete's foot, and fungal nail disorders. They are typically accessible in forms like creams, ointments, and liquid solutions. Onychomycosis and tinea pedis are two of the most widespread maladies.

Oral antifungal drugs may also be recommended as a substitute treatment for conditions like onychomycosis. Compared to topical medicines, systemic medication may have more severe side effects and more contraindications; nevertheless, it may frequently result in faster resolution.

Tavaborole, ciclopirox, amorolfine, and efinaconazole are a few examples of commonly used topical antifungal medications. Terbinafine, itraconazole, and fluconazole are common oral antifungal drugs. Newer or different choices like posaconazole, fosravuconazole, voriconazole, and oteseconazole are also being investigated in clinical practice^{2,12,19}.

Table 5: Therapeutic Agents for Fungal Infections: Dosing Guidelines

Therapeutic agent	Therapeutic dose
Azole-class systemic antifungal	Weekly oral dose of 150 mg
Systemic keratin-targeting antifungal	500 mg dose once per week
Clotrimazole topical therapy	two to three times per day
Ketoconazole topical therapy	two to three times each day

Dermatological Corticosteroids for Skin and Systemic Use: Powerful pharmaceuticals called corticosteroids are used for the relief of dermatological conditions such dermatitis, psoriasis, and eczema through minimizing inflammation, redness, and itching. These medications can be applied directly on damaged areas in a number of topical formulations, such as creams, ointments, lotions, gels, foams, solutions, and medicated shampoos. Oral corticosteroids may be used to treat

severe or extensive skin diseases in order to produce systemic effects.

Even if it works well, prolonged or incorrect use can have negative effects such skin thinning, adrenal gland suppression, and the onset or aggravation of dermatitis and rosacea. Betamethasone, clobetasol, fluocinonide, flurandrenolide, halobetasol, amcinonide, desoximetasone, hydrocortisone, triamcinolone, and desonide are examples of commonly used topical corticosteroids. Usually used to treat psoriasis, eczema, and other inflammatory skin conditions, these drugs fluctuate in intensity and effectiveness.

Corticosteroids continue to be the most prevalent treatment of choice for autoimmune diseases like pemphigus, which serve to limit the course of the disease and lessen immune-mediated irritation of the skin^{21,22}.

CONCLUSION:

Dermatology is still developing quickly, with emerging areas like digital histopathology and genome editing making customized therapy accessible to an increasing number of patients with skin diseases. It is anticipated that developments in technologies such as gene editing will provide important discoveries, expanding our knowledge of cellular and protein interactions and offering mechanistic insights into both healthy and diseased biological processes. This information will be crucial for the creation of tailored treatments and treatment plans, which will eventually save patients' time and enhance clinical results.

Public views of health and beauty as well as one's own self-image are greatly influenced by the appearance and state of one's skin and hair. Doctors need to understand that even seemingly "benign" skin disorders can have significant psychological repercussions. Patient care should take into account a condition's effects on mental and emotional health in addition to its clinical severity. The psychological effects of skin conditions can frequently outweigh the physical discomfort in a society where appearance is highly valued. Therefore, via careful and compassionate dermatological care, clinicians have the chance—and obligation—to enhance a patient's whole quality of life in addition to their physical health.

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