

The evolution of current medical and popular attitudes toward ultraviolet light exposure: Part 1

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Ultraviolet radiation is the most important carcinogenic agent related to the development of melanoma and nonmelanoma skin cancer, and primary prevention efforts focus on reducing exposure to sunlight and ultraviolet sunlamps. Favorable societal views of suntanning serve as an obstacle to skin cancer prevention. Although the education of patients and the public regarding the risks of excessive ultraviolet light exposure is an important goal in medicine today, few physicians have more than a vague knowledge of how current attitudes actually developed during the past century. Opinions about ultraviolet light exposure were not static, but evolved with increasing scientific knowledge and changing social mores. A critical interplay occurred between the prevailing medical and nonmedical views on the subject. In this article, we focus on the century's start (1900-1920)—a time when vigilance against significant sun exposure, a relic of the 19th century, was eroding, and the roots of later attitudes toward sunbathing were already manifest. Medically, the view of sunlight as salutary was bolstered by the success of phototherapy, which was introduced in the 1890s. The first clinical observations associating long-term sunlight exposure with skin cancer were also reported during this time. The association, however, was poorly understood, and this work was largely ignored by the medical profession and remained essentially unknown to the public. (*J Am Acad Dermatol* 2002;47:930-7.)

Sun protection at the beginning of the 20th century

During the 19th century, many individuals, particularly women of the upper social classes, were vigilant in avoiding excessive sunlight (Fig 1).¹ Such attitudes carried over to some degree into the early part of the next century. The association between sunlight exposure and skin cancer was not yet known, and sun avoidance and protection were motivated by the desire to avoid sunburn, suntan, and damage to the complexion. The primary means of protection was clothing, including brimmed hats and veils. In addition, the parasol (sunshade) gained great popularity with women in the United States and Europe in the latter 19th century both as a means of sun protection and as a fashion accessory.^{2,3} An observer of fashion wrote in 1884: "The Sunshade is found to-day in the hands of every one, as it should be in this practical and utilitarian age. . . . On Sundays and holidays, in the jostlings of the



Fig 1. *Punch* cartoon from 1848 lampooning the reaction to collapsible hoods worn by women for sun protection. (From *Punch* 1848;15:134.)

crowd at suburban fêtes, it is like an eddy of Sun-shades. . . ."⁴

Popular magazines instructed women on sun and wind protection to preserve their complexions: "The

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care of her complexion during the summer season is a matter that may very well engage the attention of any woman. An open-air complexion is all very well in a novel, but in real life it too often means sunburn, blisters, and freckles—disagreeable conditions that are neither comfortable nor becoming.”⁵ Topical sun protectants were already employed at the century’s start, and advice was given on their use. Homemade recipes included agents such as white petrolatum or almond oil combined with a heavy powder or chalky magnesia. Mixed powders might include zinc oxide and bismuth.⁶ Because these preparations worked as physical blockers, readers were advised, “If you do not care for looks, put it on thickly, and it acts as a mask to protect the skin.”⁷ Although topical sun protectants were used primarily by women, one article noted, “Men even, with extremely thin sensitive skins, defend [their skin] from the ravages of wind and sun while on the water, in the same way.”⁵ Commercial preparations were also advertised as sun protectants. A 1912 Pond’s advertisement cited the eminent American dermatologist, William Allen Pusey, as an authority who advised against excessive sun exposure to maintain a healthy complexion (Fig 2).⁸

Although it was emphasized that “prevention is the best remedy,”⁷ instructions were also given for the treatment of sunburn and freckles, should they occur. One example of a homemade recipe for treating sunburn involved mixing cucumbers or strawberries with almond oil, lanolin, white wax, a tincture of benzoin, and spermaceti (a waxy substance obtained from the sperm whale).⁹ Bleaching of ephelides and lentigines was commonly attempted. Frequently, this was performed with preparations containing the toxic chemical, mercury bichloride (corrosive sublimate),^{6,7,10,11} which was included in various over-the-counter patent medicines marketed for the care of the complexion.¹² Other treatments included arsenic, caustic potash, lactic acid with glycerine and rose water, hydrogen peroxide, iodine, lemon or cucumber juice, quince seed mucilage, and buttermilk baths.^{5-7,9,11,13}

The emergence of suntanning

As is true today, the advice of protecting oneself from sunlight was not necessarily heeded. Indeed, although suntanning had not yet achieved the mass acceptance that it would beginning in the 1920s in the United States, the trend had already started at the end of the 19th century. A writer in 1894 remarked: “Most girls of the period recklessly defy wind and weather and are very proud of being tanned, but there are others who hesitate at so much exposure to the sun.”¹⁴



Fig 2. Pond’s Vanishing Cream advertisement from 1912. (Courtesy of the John W. Hartman Center for Sales, Advertising and Marketing History; Duke University Rare Book, Manuscript and Special Collections Library.)

The growing popularity of sunbathing reflected a number of social changes that had taken place during the 19th century. Women were now engaged in many activities that resulted in significant sun exposure. A physician writing in *Harper’s Bazar* observed: “The summer girl of 1900 is ready to take a spin in an automobile; or to speed forth on her bicycle; or to hold her own with a racquet in her hand at the tennis nets; or with her sticks to speed her ball over the short or long course of the golf-links; or to take her ocean bath, and with sturdy strokes to swim and disport herself like a mermaid in her abbreviated bathing costume; or to row and sail and yacht from early morn until late at night, letting the sun leave what impress upon her it can or may.”⁷

Attitudes related to recreational swimming were also changing. Earlier in the 19th century, a vacation to the seashore was a luxury that had more to do with entertainment, romance, and making one’s “appearance” on the promenade than swimming. Entering the water was viewed by many as “an unpleasant if wholesome ritual to be performed as

early in the day as possible.”¹⁵ By 1900, however, excursions to bathe at lakes or ocean beaches were commonplace and enjoyed by all social classes. One article in 1900 already described “the favorite seaside amusement of lying flat on the back on the hot sands, taking a sunbath. . . .”¹⁶ Bathing suits, too, were changing, to the detriment of sun protection. More revealing, streamlined bathing suit designs were already being introduced before World War I.¹⁵

Finally, the popular perception that a suntan was a sign of good health had emerged: “[A] fine brown color suggests health and good times, and is a pleasant thing to see.”¹⁴ The British medical journal *The Lancet* remarked on this belief in a 1910 editorial: “Rightly or wrongly, the face browned by the sun is regarded as an index of health, and there are some persons who feel that the money spent upon a holiday has been well spent if they come back sunburnt. This view is in general justifiable, since the sun-burnt face implies that the individual has been exposed to a fresh healthy, and open environment. . . .”¹⁷

Despite the growing popularity of acquiring a suntan, before the 1920s its importance as a fashion was limited.^{9,18} In addition, there were still many who looked askance at the practice. One writer commented derisively in 1900: “[N]owadays the average summer girl, in order to acquire a coat of tan, makes efforts that horrify those persons who still think that a young lady’s complexion should differ from that of a member of the varsity crew. The girl of today goes hatless, rolls up her sleeves to the elbow or higher, washes her hands and face in salt water, and holds them in the sun, and is not content unless she is freckled like a turkey egg, and burned an Indian red or a coffee brown.”¹⁶

The introduction and growth of phototherapy

As suntanning was gaining popularity during this period, ultraviolet light exposure was also being extolled in the medical literature. Sunlight, along with “fresh air,” had previously been viewed as a kind of tonic, able to renew health and vigor. As a 1912 editorial in the *Journal of the American Medical Association (JAMA)* noted: “An abundance of direct sunlight, especially in some of the popular health resorts, has always claimed a due share of the credit ascribed to the invigorating climate.”¹⁹

The view of sunlight as beneficial to health was further advanced in the late 1800s with the introduction of phototherapy into modern medicine. The ultraviolet wavelengths or nonvisible “chemical rays” had been known to exist since 1800 after being demonstrated in independent experiments by Her-

schel and Ritter (cited in Urbach et al²⁰). Sunlight was shown by Downes and Blunt²¹ in 1877 to have bactericidal and fungicidal activity in vitro. These authors determined that this was “chiefly, but perhaps not entirely, associated with the actinic rays of the spectrum.” Then, in the 1890s, the Danish physician, Niels Finsen, became the “father of modern phototherapy” when he reported the successful clinical use of ultraviolet radiation in treating cutaneous tuberculosis.²²

Phototherapy was enthusiastically embraced by the medical profession. It ranked as one of the major physical therapies of the early 20th century, along with x-ray therapy, radium treatment, and fever therapy. This last treatment was used primarily for patients with certain forms of neurosyphilis and consisted of raising body temperature by means of intentional infection with malaria or, later, by artificial means such as the “Kettering box.”²³ Although crude and with still unrecognized adverse effects, these physical therapies were efficacious in an era that preceded the advances of the pharmaceutical revolution. Their impact on medicine and science at the century’s start is reflected by the fact that each resulted in a Nobel Prize: Röntgen in Physics in 1901 for the x-ray, Finsen in Medicine for phototherapy in 1903, Pierre and Marie Curie and Becquerel in Physics for radium in 1903, and Wagner-Jauregg in Medicine for fever therapy in 1927.

Two methods of phototherapy were introduced by Finsen. The first (Fig 3)²⁴ passed sunlight through a large biconvex glass lens filled with a copper sulfate solution intended to absorb longer wavelength “heat rays” while allowing transmission of ultraviolet light.²⁵ He also designed the first carbon-arc apparatus for phototherapy—the Finsen ultraviolet lamp (Fig 4)²⁴—which was soon favored over the use of sunlight. By 1900, Finsen was reported to have “. . . effected 311 cures out of 462 cases of lupus [vulgaris]” treated at the Finsen Light Institution, which was founded in Copenhagen in 1896.²⁴ Successful results with phototherapy were also reported in treating lupus erythematosus, alopecia areata, epithelioma, acne vulgaris, acne rosacea, tinea capitis, and vascular nevi. By 1905, phototherapy was being utilized for other common dermatologic conditions such as eczematous dermatitis and psoriasis.²⁶

New methods of phototherapy were introduced over the next decade. The Finsen carbon-arc lamp was large and expensive to operate, making it impractical for most clinical settings. By 1907, small and relatively inexpensive mercury vapor ultraviolet lamps had been designed that were commercially available and could be easily used in a physician’s office.^{27,28} The Swiss physicians, Oskar Bernhard



Fig 3. 1901 Illustration from *Scientific American* showing phototherapy with sunlight at the Finsen Institute. (From Phototherapy. *Sci Am* 1901;51(Suppl 1324):21215-7.)

and Auguste Rollier, were pioneers in phototherapy with sunlight (heliotherapy). Bernhard introduced the use of sunlight on “torpid wounds” in 1902.²⁹ By 1913, he employed heliotherapy for the treatment of numerous types of chronic ulcers and wounds, cutaneous and other forms of tuberculosis, skin cancer, leukemia and “pseudoleukemia.”³⁰ Rollier established a sanatorium for heliotherapy of surgical tuberculosis in Leysin, Switzerland in 1903. He treated principally noncutaneous disease, and unlike the localized treatment of Finsen and Bernhard, he emphasized general exposure of the body to light.³¹

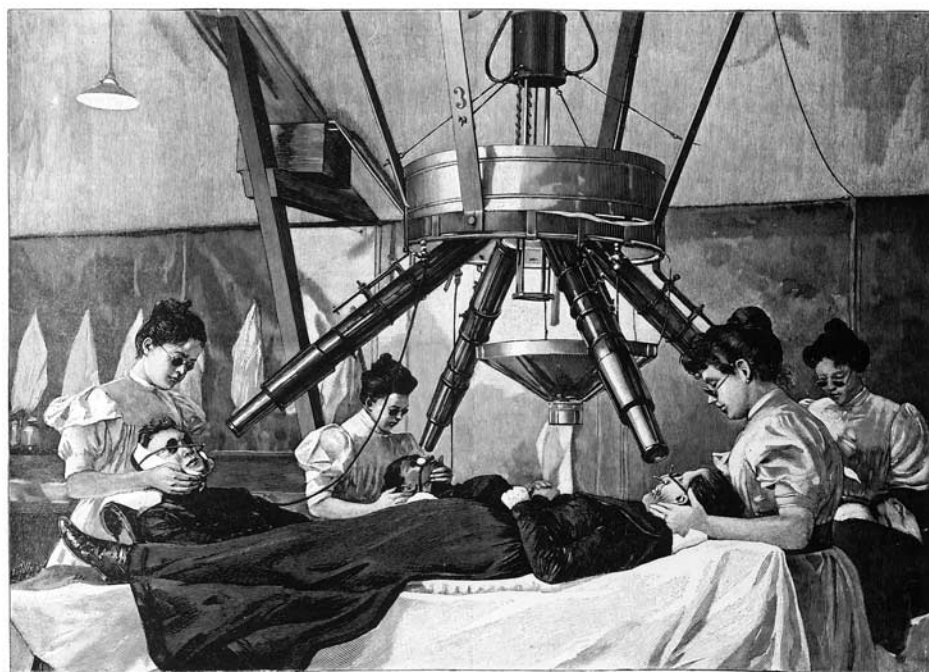
Two developments occurred in pre-1920 phototherapy that foreshadowed significant later events in the field. First, Rollier and his followers were already advocating ultraviolet light as a means of prophylaxis against infectious disease, declaring that, “preventive heliotherapy should form part of the hygiene for every child.”³² The recommendation to obtain ultraviolet light exposure as a method of preventive medicine would gain widespread acceptance in the 1920s. Also, some phototherapy devotees were touting the treatment for a host of medical conditions. Indications for phototherapy listed in one 1915 review included rheumatic and gouty affections, Bright’s disease of the kidney, diabetes, obesity, and acute catarrhal affections of the respiratory tract.³³

The introduction of phototherapy and the recognition of the germicidal action of ultraviolet light were celebrated in the popular press and contributed further to the popular perception of sun exposure as healthful. For example, *McClure’s Magazine* featured an article in 1903 on Finsen’s “remarkable discovery of healing rays.”³⁴ *Scientific American* published several laudatory articles about phototherapy at this time.^{24,35-37} Later, during World War I, attention was focused on the use of ultraviolet light in treating infected wounds in soldiers.³⁸

Sunlight and skin cancer

During the same time that ultraviolet light exposure was achieving greater popularity in both medical and nonmedical circles, the first reports appeared associating sunlight exposure with skin cancer. Already, potential deleterious effects of sunlight on the skin were recognized. Charcot in 1858 demonstrated that the ultraviolet wavelengths caused erythema of the skin. By 1900, a number of uncommon dermatologic conditions related to sun exposure had been described including xeroderma pigmentosum, hydroa vacciniforme, prurigo aestivalis, and eczema solare.²⁰

It was the great Hamburg dermatologist Paul Gerson Unna who is credited with first associating long-term exposure to the elements and precancerous changes in the skin. In his 1894 textbook on the



TREATMENT BY ELECTRIC LIGHT AT THE FINSEN INSTITUTE, COPENHAGEN.

Fig 4. 1901 Illustration from *Scientific American* showing phototherapy with the Finsen carbon-arc ultraviolet lamp. (From Phototherapy. *Sci Am* 1901;51(Suppl 1324):21215-7.)

histopathology of skin diseases, Unna³⁹ described degenerative changes of the skin commonly seen in sailors. Reports implicating sunlight in the etiology of skin cancer followed Unna's description. In 1906, James Nevins Hyde, a prominent American dermatologist at Rush Medical College in Chicago, wrote an article entitled, "On the Influence of Light in the Production of Cancer of the Skin" (Fig 5).⁴⁰ Referring to the occurrence of skin cancers in patients with xeroderma pigmentosum and Unna's description of "carcinoma of the sailor's skin," Hyde remarked: "These instances of malignant cancer occurring obviously as a result of exposure to light justify the inquiry whether all cutaneous cancers are not influenced in their origin and career by the actinic rays."⁴⁰ He also observed that "colored races enjoy a certain degree of immunity from cancer of the skin. . ."⁴⁰ In 1907, the French dermatologist William Dubreuilh⁴¹ reported epidemiologic data suggesting that precancerous keratoses and skin cancer occurred more commonly in outdoor workers and on the sun-exposed parts of the body. Dubreuilh concluded (translated from French): "[S]enile epitheliomatosis of the face is not solely caused by aging. It is mostly the result of chronic sun exposure and must be connected to chronic radiodermatitis. It affects mostly farmers and people who work outside all their life under direct sun exposure. Light skinned people whose skin contains less pigment, seem to

be more affected than darker skinned people."⁴¹ Pusey, writing in 1911, also made the analogy between sun damage and x-ray damage in the skin: "[T]he identity of chronic radium and X-ray changes in the skin with those of the senile skin, strongly indicate that the senile changes of the skin are in good part the result of the less powerful action over a long period of years of sunlight."⁴² A report by Corlett in 1915 of 2 cases of xeroderma pigmentosum was notable for the author's call to warn the public about the need for sun protection: ". . . I believe it would be well to advise against the indiscriminate sun exposure now so prevalent, and particularly against sudden or too protracted exposure in a class of people unprotected by an immunizing coat of tan. This is especially important in infants in whom the overzealous back-to-nature principles of the nurse may in certain instances lead to irreparable harm."⁴³ Other early clinical reports implicating sunlight as a causal agent of skin cancer included one by McCoy⁴⁴ in 1920, in which he observed that nearly half of cutaneous cancers he had treated occurred on the face, neck and hands, despite the much smaller percentage of the total body surface area constituted by these anatomic sites.

Another important contribution was made by the Australian dermatologist Norman Paul,⁴⁵ who published the textbook, *The Influence of Sunlight in the Production of Cancer of the Skin*, in 1918. Paul

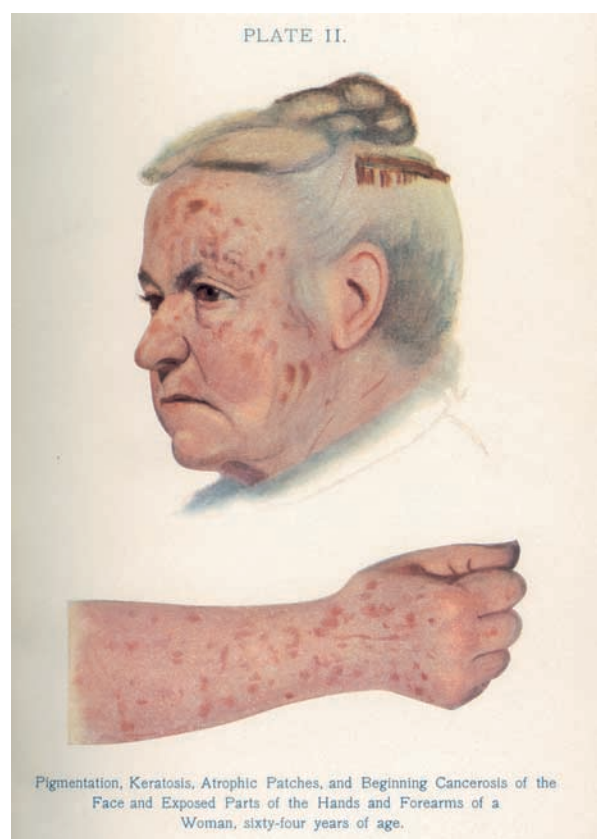


Fig 5. Illustration from Hyde's 1906 article, "On the Influence of Light in the Production of Cancer of the Skin." (From *Am J Med Sci* 1906;131:1-22.)

wrote: "Factors which play a significant role in [skin cancer's] causation and prevention are the actinic rays of light, and the pigmentation of the skin. . . [M]elanin, the pigment of the skin, stands as a sentinel, guarding the underlying tissues from the baneful effects of sunlight. . . The common occurrence of these cancerous and precancerous diseases of the skin in Australia is to be regarded as one of the penalties to be paid for inhabiting a country normally destined [in geographical location] to be occupied by a coloured race."⁴⁶

Early clinical observations associating the risk of skin cancer with the extent of exposure and susceptibility to sunlight received very little attention from the medical profession, especially outside of the field of dermatology. As a result, these reports did not translate into articles in the popular press or public health efforts, and they would have been completely unknown to almost all laypersons. One reason these early reports attracted so little notice was that the mechanisms underlying malignancy were so poorly understood at the time that there did not exist a framework within which the findings could easily be placed. In addition, the association

between sunlight exposure and skin cancer was undoubtedly dismissed by some physicians as speculative, particularly given the prevailing attitudes of sunlight as healthful. A point of confusion to clinicians at the time was the fact that most individuals did not develop skin cancer, despite sun exposure. Hyde, for example, argued not that sunlight could cause skin cancer in normal individuals, but rather, in those with an abnormality, such as patients with xeroderma pigmentosum, which somehow made them susceptible: "So far as can be determined at the present time the majority of all human beings are wholly incapable of developing the symptoms of the disorder [cancer]. . ."⁴⁰

Another difficulty lay in sorting out the relative importance of a variety of putative causes of cancer. Sunlight was listed among other potential causes of skin cancer in dermatologic textbooks and generally merited only a few lines of discussion. One of the better analyses of the time on the origin of epithelioma (basal cell and squamous cell skin cancer) is from Jay Frank Schamberg's 1915 dermatology textbook, *Diseases of the Skin and the Eruptive Fevers*:

The cause of cutaneous cancer is, like the entire question of the origin of neoplasms, involved in obscurity. Accumulated experience points strongly toward continuous or frequently repeated irritation as the most important factor in the production of epithelioma. Cancer of the lower lip is almost exclusively a disease of males, because pipe-smoking is largely limited to that sex. The friction of a jagged tooth against the tongue, the continued pinching of eye-glasses, and like causes may evoke the development of epithelioma. Chemic rays of light are certainly a factor in the production of many skin cancers, particularly those which begin as keratoses. Skin cancer is far more common on the face and hands—parts exposed to light—than elsewhere. Cancer of the skin of the face in negroes is extremely rare. Among about 3000 negroes with skin diseases I have seen a facial cancer only once, and this was in a mulatto woman. The dark pigment acts as a protective barrier against the irritative actinic rays of light. X-Ray cancers are produced perhaps in an analogous manner. Cancer of the skin is not rare in those who work in tar and crude paraffin for many years. The long-continued ingestion of arsenic may, in rare instances, lead to the development of multiple skin cancer. Skin cancers most commonly occur after middle age; it is not rare, however, to observe small, superficial, pearly epitheliomata in comparatively young persons."⁴⁷

Melanosarcoma (melanoma) was considered separately, and Schamberg wrote: "We are in complete darkness as to the cause of sarcoma."⁴⁸

Mention of evidence implicating sunlight as a cause of skin cancer is difficult to find in nonderma-

ULTRAVIOLET AND CANCER

To the Editor:—Kindly advise whether or not an exposure of the entire nude body, say fifteen minutes the first day and the time increased fifteen minutes each succeeding day to a total of two hours, and two hours' daily exposure continued indefinitely in the direct sun in and around Key West, for instance, could in any manner be injurious to one's general health. Might this exposure predispose to epithelioma of the skin?

L. L. SCHWARTZ, M.D., Pittsburgh.

ANSWER.—In applying heliotherapy in mountain institutions such as the clinic of Dr. Rollier or at Saranac Lake, the routine is to expose only the feet three times for five minutes on the first day, working up by the end of the first week to the exposure of the entire anterior surface for twenty minutes, and within two weeks to three hours divided between the front and the back.

At the ocean level there is increased reflection of the sun, and this, added to the semitropical latitude, should make the actinic power of the sun's rays at Key West at least equal to that in the mountains. For a healthy normal person, however, the dosage suggested and its increase does not seem excessive.

The head and neck should always be protected in order to avoid heat stroke. Alcoholism predisposes to the latter. It is also advisable to wear a loin cloth. Arteriosclerosis, acute or progressive pulmonary tuberculosis and extreme nervous irritability are contraindications to solarization, according to Edgar Mayer. There is no evidence available that exposure to the sun predisposes to epithelioma of the skin.

Fig 6. Query to the editor in *JAMA*. Copyrighted 1929, American Medical Association (*JAMA* 1929;93:1087).

tologic articles before 1920, even in the occasional ones that warned about other risks of sunlight exposure, such as sunstroke.⁴⁹⁻⁵¹ The extent to which early observations relating skin cancer to sunlight were either unknown or dismissed within the medical profession is reflected in a 1929 query to the editor of *JAMA* on "ultraviolet and cancer."⁵² The answer to the query indicated, "There is no evidence available that exposure to the sun predisposes to epithelioma of the skin." (See Fig 6.)⁵²

Conclusion

Several salient events relating to attitudes toward ultraviolet light exposure occurred from 1900 through 1920. Despite admonitions in women's magazines that sunlight could harm the complexion, a suntan was already gaining limited popularity and was perceived as a sign of good health. Phototherapy became an established medical treatment embraced by the medical profession and reported in the popular press. Sunlight was also associated with skin cancer development based on clinical observations relating incidence to the amount of exposure and lack of protective pigmentation, although this work received little attention. As the 1920s began, therefore, sunlight exposure was viewed in largely favorable terms by both physicians and the public. This would set the stage for a period when ultraviolet light exposure attained unparalleled popularity, triggered by the scientific discovery that sunlight played a role in vitamin D synthesis and could, like dietary sources, prevent rickets in children.

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