Dermatology Practical & Conceptual

A Window Beneath the Skin: The History of Dermoscopy from Curiosity to Clinical Cornerstone

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If you've ever placed a dermatoscope on the skin and marveled at the hidden world revealed beneath the surface, you are part of a long continuum of clinicians who have sought to see beyond what the naked eye can perceive. Dermoscopy, the simple yet transformative act of illuminating and magnifying the skin, has changed how we diagnose, teach, and think about dermatology. Today, it is difficult to imagine practicing without it [1]. Yet this powerful tool was not always so readily embraced.

Like many medical innovations, dermoscopy's journey from skepticism to acceptance was slow. In the early 1800s, when René Laennec introduced the stethoscope, his contemporary Sir John Forbes remarked, "I have no doubt whatever, from my own experience of its value, that it will be acknowledged to be one of the greatest discoveries in medicine… That it will ever come into general use, notwithstanding its value, I am extremely doubtful; because its beneficial application requires much time, and gives a good deal of trouble both to the patient and the practitioner"[2]. His words could just as easily have been written about dermoscopy 150 years later.

There were eight key milestones that culminated in the invention of the current dermatoscopes, transforming them from a mere scientific curiosity into an indispensable tool for clinicians evaluating the primary morphology of skin lesions. In this editorial, we aim to honor and reflect upon this extraordinary journey.

The Early Foundations

Long before the term dermoscopy was coined, physicians sought ways to better visualize, analyze, and characterize skin lesions. The pioneering work of Joseph Plenck (1732–1807) and Robert Willan (1757–1812) revolutionized dermatology by shifting diagnosis from symptom-based observation to classification grounded in primary morphology (Figures 1–2). These *primary morphological elements*, the initial lesions arising directly from a disease process (e.g., macule, papule, vesicle), formed the basis for categorizing disorders into overarching groups such as vesiculobullous or papulosquamous diseases. Their framework provided dermatology with

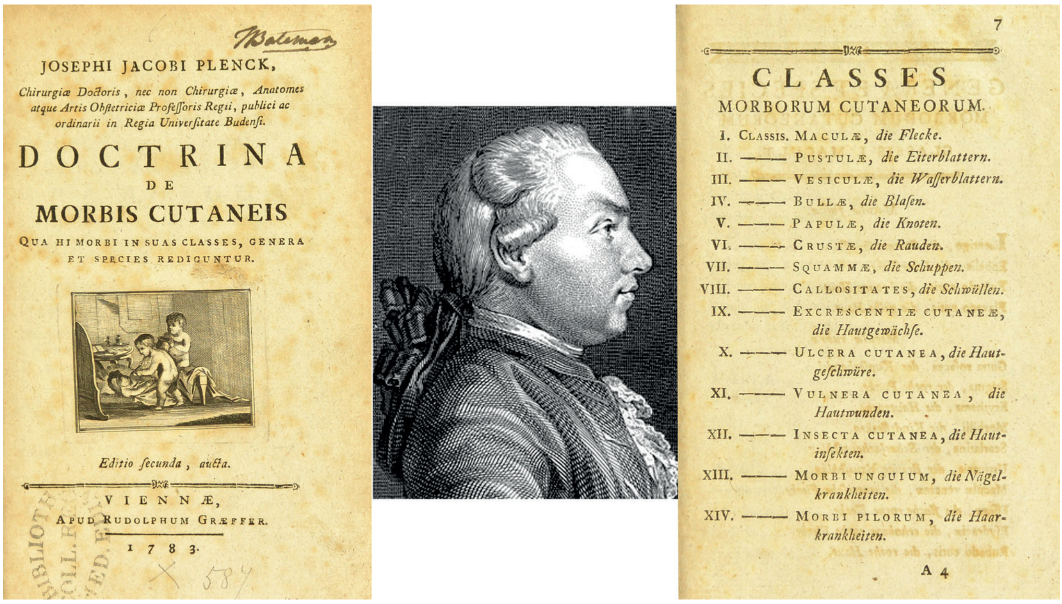


Figure 1. Josephi Jacobi Plenck (1735-1807) introduced the concept of classifying skin diseases based on primary morphology in a book titled "Doctrina De Morbis Cutaneis" published in 1783.

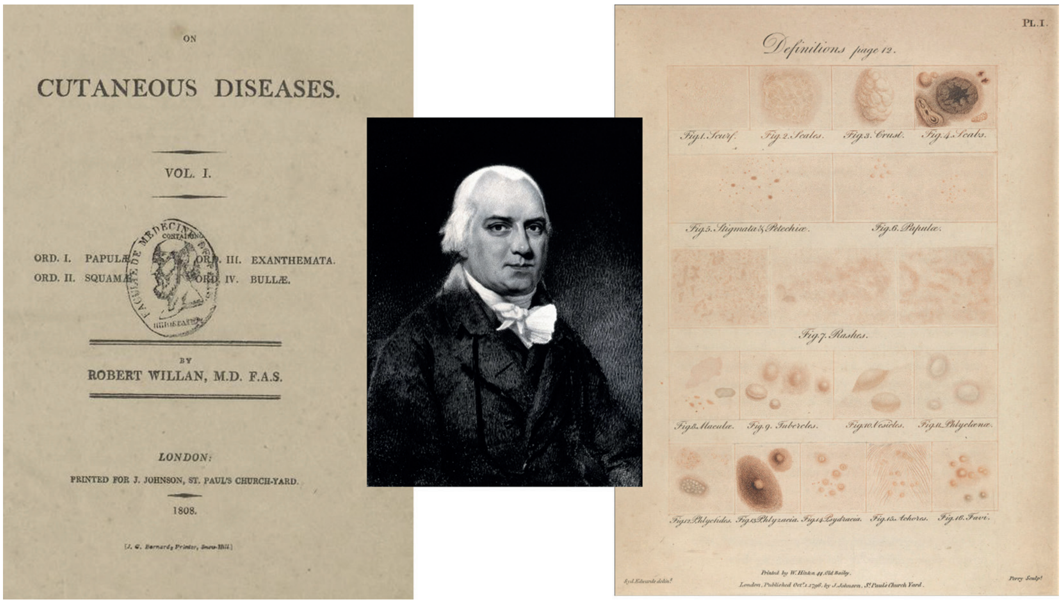
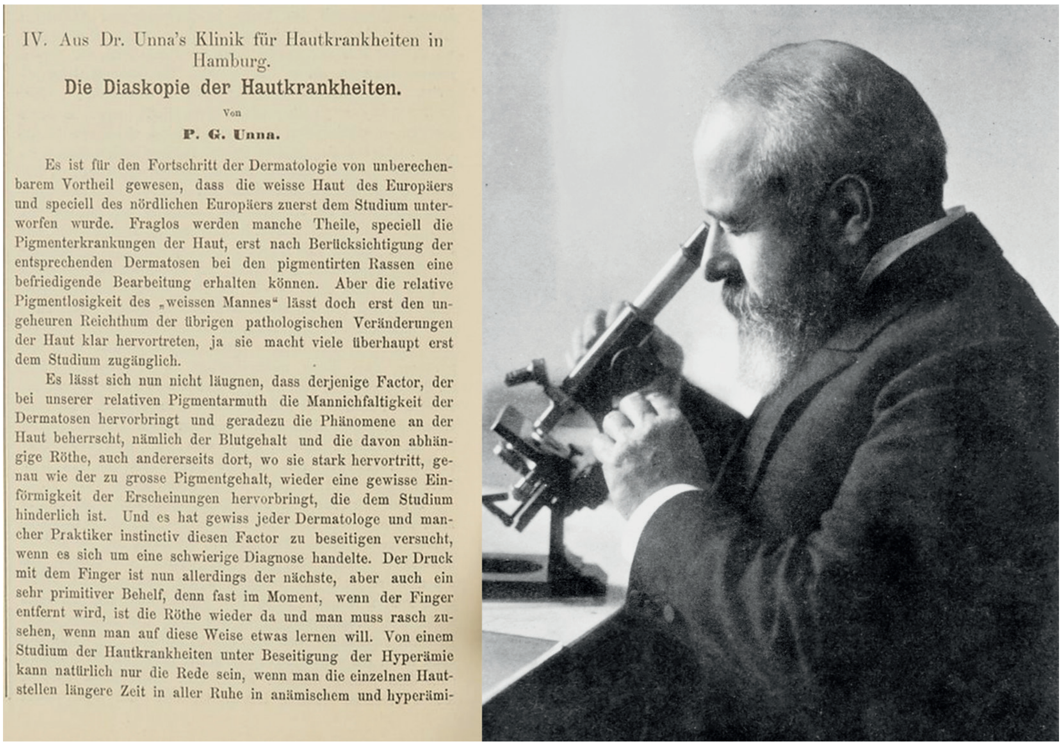


Figure 2. Robert Willan (1757-1812) solidified the concept of classifying skin diseases based on primary morphology in his book titled "Cutaneous Diseases" published in 1808.

a systematic visual language defined by the size, shape, color, arrangement, and distribution of lesions. Thus, a description such as "a cluster of vesicles on an erythematous base and distributed in a dermatomal pattern" could instantly evoke the image of herpes zoster. Add to this the works of physicians such as Pierre Borel in the 1600s and Carl Hueter in the 1800s, who are credited with recognizing the importance of magnification and illumination, and it becomes easy to appreciate why the handheld magnifying glass became an indispensable tool in the dermatologist's armamentarium [3,4].

However, the first milestone on the road to dermoscopy occurred in late 1800s, when a German dermatologist named Paul Gerson Unna in Hamburg made a deceptively simple observation (Figure 3). When he applied a glass plate to the skin, a technique called diascopy, he was able to appreciate colors not readily visible to the naked eye [5]. This marked the birth of the idea that the skin's optical properties could be manipulated to aid in diagnosis. It was, in essence, the first step toward dermoscopy.



IV. Aus Dr. Unna's Klinik für Hautkrankheiten in Hamburg.

Die Diaskopie der Hautkrankheiten.

Von

P. G. Unna.

Es ist für den Fortschritt der Dermatologie von unberechenbarem Vortheil gewesen, dass die weisse Haut des Europäers und speciell des nördlichen Europäers zuerst dem Studium unterworfen wurde. Fraglos werden manche Theile, speciell die Pigmenterkrankungen der Haut, erst nach Berücksichtigung der entsprechenden Dermatosen bei den pigmentirten Rassen eine befriedigende Bearbeitung erhalten können. Aber die relative Pigmentlosigkeit des „weissen Mannes" lässt doch erst den ungeheuren Reichthum der übrigen pathologischen Veränderungen der Haut klar hervortreten, ja sie macht viele überhaupt erst dem Studium zugänglich.

Es lässt sich nun nicht läugnen, dass derjenige Factor, der bei unserer relativen Pigmentarmuth die Mannichfaltigkeit der Dermatosen hervorbringt und geradezu die Phänomene an der Haut beherrscht, nämlich der Blutgehalt und die davon abhängige Röthe, auch andererseits dort, wo sie stark hervortritt, genau wie der zu grosse Pigmentgehalt, wieder eine gewisse Einförmigkeit der Erscheinungen hervorbringt, die dem Studium hinderlich ist. Und es hat gewiss jeder Dermatologe und mancher Praktiker instinctiv diesen Factor zu beseitigen versucht, wenn es sich um eine schwierige Diagnose handelte. Der Druck mit dem Finger ist nun allerdings der nächste, aber auch ein sehr primitiver Behelf, denn fast im Moment, wenn der Finger entfernt wird, ist die Röthe wieder da und man muss rasch zusehen, wenn man auf diese Weise etwas lernen will. Von einem Studium der Hautkrankheiten unter Beseitigung der Hyperämie kann natürlich nur die Rede sein, wenn man die einzelnen Hautstellen längere Zeit in aller Ruhe in anämischem und hyperämi-

Figure 3. Paul Gerson Unna (1850-1929) introduced the procedure of diascopy in an article "Die Diaskopie der Hautkrankheiten" published in 1893. This marks the first milestone towards modern day dermoscopy.

Optics and Opportunity: The Birth of Skin Surface Microscopy

In the early 20th century, technological innovation met clinical curiosity. Otfried Müller, collaborating with optical pioneer Carl Zeiss, designed a microscope capable of illuminating and magnifying the skin's surface (Figure 4). This development marked the second milestone, paving the way for the introduction of various monocular and binocular instruments, initially used to examine nail fold capillaries.

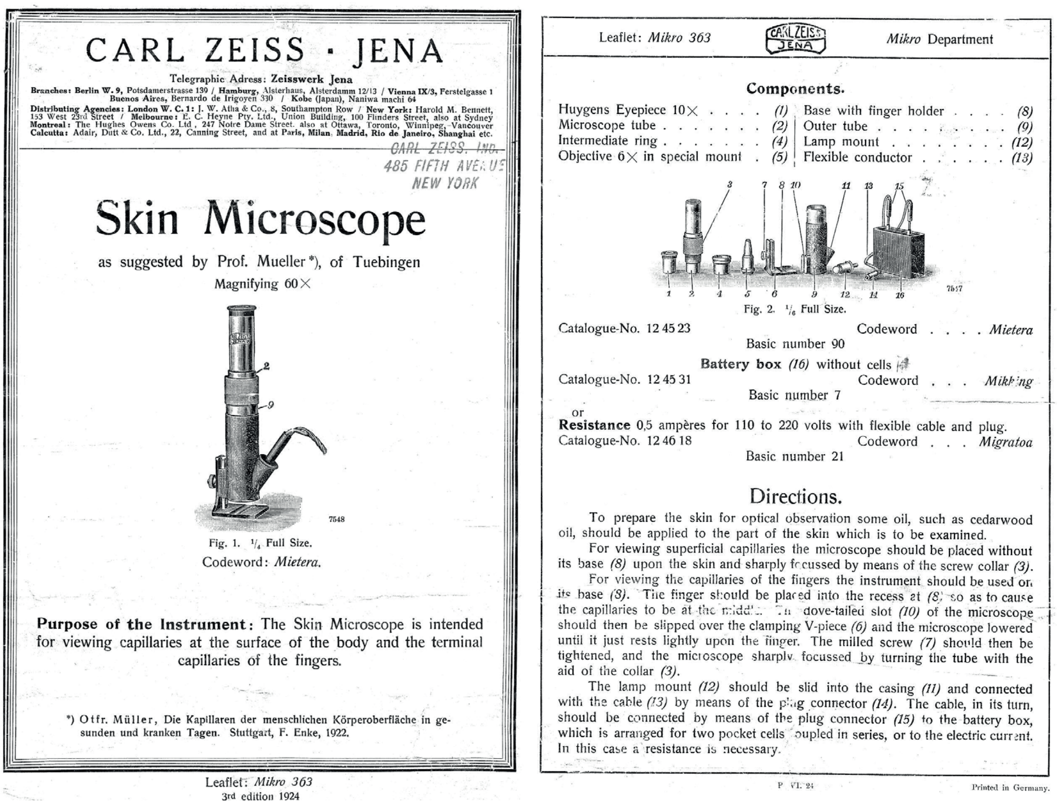
A true breakthrough followed, the third milestone, representing the birth of modern dermoscopy (aka dermatoscopy). Around 1920, Munich physician Johann Saphier began systematically investigating subsurface skin structures using a binocular microscope. In a series of four papers published between 1920 and 1922, Saphier coined the term *dermatoskopie* and produced detailed illustrations correlating his in vivo observations with ex vivo histopathological findings, including the correlation between a network pattern visible via *dermatoskopie* and the histological rete ridge pattern of the epidermis (Figure 5) [6-9].

Saphier's contributions, largely forgotten for decades, were remarkably ahead of their time. He recognized that the patterns beneath the skin's surface held diagnostic significance, a visionary insight that would only gain widespread appreciation more than half a century later. In addition, other developments such as the advent of colposcopy helped clinicians appreciate that a moist skin surface, by reducing light reflection, made the subsurface structures more conspicuous [10-11].

From Curiosity to Clinical Tool: The 1970s Awakening

It is important to emphasize, and to remind the reader, that the eight milestones outlined in this article represent pivotal moments that profoundly influenced the trajectory of dermoscopy as it is practiced today. Each of these advances, however, was built upon the foundational work and insights of countless earlier investigators. For example, in the 1950s, Leon Goldman applied cutaneous microscopy to the study of pigmented nevi, while Oscar Gilje employed capillary microscopy to assist in the differential diagnosis of skin diseases [12-14]. Between 1958 and 1972, German dermatologists, including Franz Ehring and Johannes Schumann, used high-magnification reflected-light microscopy to examine the morphology of the skin [15-16]. In 1968, Schumann applied reflected-light microscopy to the study of pigmented skin structures, and in 1971 he presented his findings on the vital histology (aka dermoscopy) of melanoma in vivo at the German Dermatological Society meeting in Berlin, proposing its use as a diagnostic tool for pigmented tumors.

Nevertheless, despite these important contributions, skin surface microscopy persisted as little more than a scientific



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Skin Microscope

as suggested by Prof. Mueller *), of Tuebingen

Magnifying 60×

Fig. 1. 1/4 Full Size.

Codeword: *Mietera.*

Purpose of the Instrument: The Skin Microscope is intended for viewing capillaries at the surface of the body and the terminal capillaries of the fingers.

*) Otfr. Müller, Die Kapillaren der menschlichen Körperoberfläche in gesunden und kranken Tagen. Stuttgart, F. Enke, 1922.

Leaflet: *Mikro 363*
3rd edition 1924

Leaflet: *Mikro 363* CARL ZEISS JENA *Mikro* Department

Components.

Huygens Eyepiece 10× . . . . *(1)*
Microscope tube . . . . *(2)*
Intermediate ring . . . . *(4)*
Objective 6× in special mount . *(5)*
Base with finger holder . . . . *(8)*
Outer tube . . . . *(9)*
Lamp mount . . . . *(12)*
Flexible conductor . . . . . . *(13)*

Fig. 2. 1/6 Full Size.

Catalogue-No. 12 45 23 Codeword . . . . *Mietera*
Basic number 90

Battery box *(16)* without cells

Catalogue-No. 12 45 31 Codeword . . . *Mikking*
Basic number 7

or

Resistance 0,5 ampères for 110 to 220 volts with flexible cable and plug.

Catalogue-No. 12 46 18 Codeword . . . *Migratoa*
Basic number 21

Directions.

To prepare the skin for optical observation some oil, such as cedarwood oil, should be applied to the part of the skin which is to be examined.

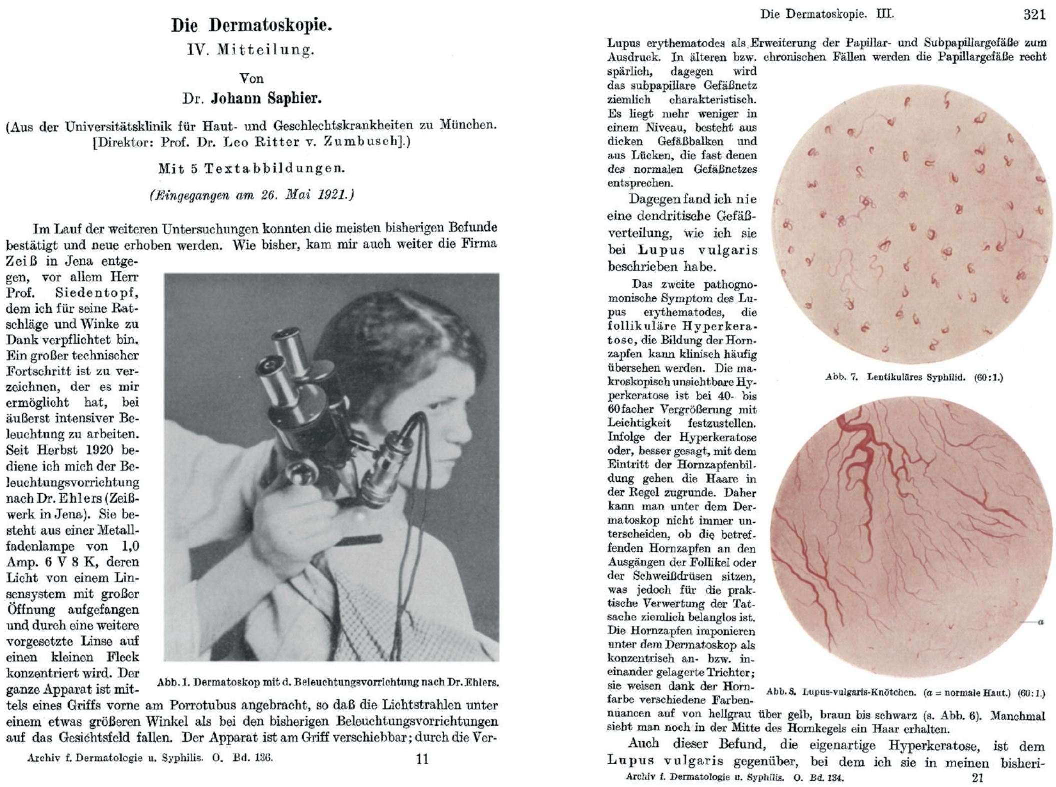
For viewing superficial capillaries the microscope should be placed without its base *(8)* upon the skin and sharply focussed by means of the screw collar *(3)*.

For viewing the capillaries of the fingers the instrument should be used on its base *(8)*. The finger should be placed into the recess at *(8)* so as to cause the capillaries to be at the middle. The dove-tailed slot *(10)* of the microscope should then be slipped over the clamping V-piece *(6)* and the microscope lowered until it just rests lightly upon the finger. The milled screw *(7)* should then be tightened, and the microscope sharply focussed by turning the tube with the aid of the collar *(3)*.

The lamp mount *(12)* should be slid into the casing *(11)* and connected with the cable *(13)* by means of the plug connector *(14)*. The cable, in its turn, should be connected by means of the plug connector *(15)* to the battery box, which is arranged for two pocket cells coupled in series, or to the electric current. In this case a resistance is necessary.

P VI. 24 Printed in Germany.

Figure 4. Professor Otfried Mueller collaborated with Carl Zeiss to create a skin microscope with build in illumination. This is the second milestone on the path to the modern day dermatoscope.



Die Dermatoskopie.

IV. Mitteilung.

Von

Dr. **Johann Saphier.**

(Aus der Universitätsklinik für Haut- und Geschlechtskrankheiten zu München. [Direktor: Prof. Dr. Leo Ritter v. Zumbusch].)

Mit 5 Textabbildungen.

(Eingegangen am 26. Mai 1921.)

Im Lauf der weiteren Untersuchungen konnten die meisten bisherigen Befunde bestätigt und neue erhoben werden. Wie bisher, kam mir auch weiter die Firma Zeiß in Jena entgegen, vor allem Herr Prof. Siedentopf, dem ich für seine Ratschläge und Winke zu Dank verpflichtet bin. Ein großer technischer Fortschritt ist zu verzeichnen, der es mir ermöglicht hat, bei äußerst intensiver Beleuchtung zu arbeiten. Seit Herbst 1920 bediene ich mich der Beleuchtungsvorrichtung nach Dr. Ehlers (Zeißwerk in Jena). Sie besteht aus einer Metallfadenlampe von 1,0 Amp. 6 V 8 K, deren Licht von einem Linsensystem mit großer Öffnung aufgefangen und durch eine weitere vorgesetzte Linse auf einen kleinen Fleck konzentriert wird. Der ganze Apparat ist mittels eines Griffs vorne am Porrotubus angebracht, so daß die Lichtstrahlen unter einem etwas größeren Winkel als bei den bisherigen Beleuchtungsvorrichtungen auf das Gesichtsfeld fallen. Der Apparat ist am Griff verschiebbar; durch die Ver-

Abb. 1. Dermatoskop mit d. Beleuchtungsvorrichtung nach Dr. Ehlers.

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Lupus erythematodes als Erweiterung der Papillar- und Subpapillargefäße zum Ausdruck. In älteren bzw. chronischen Fällen werden die Papillargefäße recht spärlich, dagegen wird das subpapillare Gefäßnetz ziemlich charakteristisch. Es liegt mehr weniger in einem Niveau, besteht aus dicken Gefäßbalken und aus Lücken, die fast denen des normalen Gefäßnetzes entsprechen.

Dagegen fand ich nie eine dendritische Gefäßverteilung, wie ich sie bei Lupus vulgaris beschrieben habe.

Das zweite pathognomonische Symptom des Lupus erythematodes, die follikuläre Hyperkeratose, die Bildung der Hornzapfen kann klinisch häufig übersehen werden. Die makroskopisch unsichtbare Hyperkeratose ist bei 40- bis 60facher Vergrößerung mit Leichtigkeit festzustellen. Infolge der Hyperkeratose oder, besser gesagt, mit dem Eintritt der Hornzapfenbildung gehen die Haare in der Regel zugrunde. Daher kann man unter dem Dermatoskop nicht immer unterscheiden, ob die betreffenden Hornzapfen an den Ausgängen der Follikel oder der Schweißdrüsen sitzen, was jedoch für die praktische Verwertung der Tatsache ziemlich belanglos ist. Die Hornzapfen imponieren unter dem Dermatoskop als konzentrisch an- bzw. ineinander gelagerte Trichter; sie weisen dank der Hornfarbe verschiedene Farbennuancen auf von hellgrau über gelb, braun bis schwarz (s. Abb. 6). Manchmal sieht man noch in der Mitte des Hornkegels ein Haar erhalten.

Auch dieser Befund, die eigenartige Hyperkeratose, ist dem Lupus vulgaris gegenüber, bei dem ich sie in meinen bisheri-

Abb. 7. Lentikuläres Syphilid. (60:1.)

Abb. 8. Lupus-vulgaris-Knötchen. (*a* = normale Haut.) (60:1.)

Archiv f. Dermatologie u. Syphilis. O. Bd. 134. 21

Figure 5. The third milestone is credited to the work of Johann Saphier. He was the first to introduce the term "dermatoskopie" in a series of four landmark papers. In these publications, he outlined the examination technique and meticulously described the subsurface structures visible through a handheld binocular scope, including a detailed account of the vascular patterns he observed.

novelty. It was not until the fourth milestone, with the pioneering work of Rona MacKie in the 1970s, that clinicians began to recognize its diagnostic potential [17]. Rona MacKie applied oil to the skin surface to make it more translucent and used a binocular microscope to study melanocytic tumors, realizing that certain subsurface patterns could help distinguish nevi from melanoma (Figure 6). This was a turning point: for the first time, looking beneath the skin's surface was not just fascinating, it was potentially lifesaving.

Vienna and Munich Usher in the Age of Epiluminescence

Peter Fritsch, during his tenure in the Department of Dermatology in Vienna, applied incident light microscopy to compare the pigment network of nevi and melanoma, publishing his observations in 1981 [18]. Although he later left Vienna to chair the Department of Dermatology in Innsbruck, the Vienna group continued advancing this line of investigation. Their sustained efforts ultimately culminated in two landmark publications that form the foundation of the fifth milestone.

The fifth milestone and next great leap forward occurred in the 1980s, when Hubert Pehamberger, Andreas Steiner, and Klaus Wolff at the University of Vienna introduced a novel method for examining pigmented skin lesions. Using a binocular, colposcopy-like instrument, they applied immersion oil and a glass plate to the skin surface, enabling visualization of subsurface structures (Figure 7) [19-20]. They coined the term "epiluminescence microscopy" to describe this technique and demonstrated that the recognition of specific pigment structures and patterns significantly improved diagnostic accuracy.

Their landmark 1987 publications in the *Journal of the American Academy of Dermatology* established epiluminescence microscopy, also known as dermatoscopy, dermoscopy, and skin surface microscopy, as a validated diagnostic method and ushered it into clinical practice [19-20]. However, the large size and weight of the equipment limited its widespread adoption, setting the stage for the sixth milestone that was to emerge out of Munich.

This sixth breakthrough came from the keen insight of a medical photographer, Peter Bilek, and a dermatology resident, Wilhelm Stolz, who together revolutionized the field. They modified a philatelic magnifier equipped with a built-in light source by adding a glass plate at one end and applying immersion oil for direct skin contact microscopy [21]. This simple yet ingenious adaptation allowed visualization of the same subsurface skin structures seen with the bulky, heavy, non-portable devices used by Rona MacKie and the Vienna group. In essence, their innovation created the prototype for all modern handheld optical dermatoscopes on the market to date. The chairman in Munich, Otto Braun-Falco, recognized the value of this retrofitted

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The lesion being studied is examined at these magnifications and photographed routinely at × 10 and × 16. Occasionally a small lesion is photographed at × 25. Kodachrome II daylight colour film is used, with the appropriate flash attachment. A thin layer of olive oil applied to the lesion before examination renders it more translucent. After surgical removal of the lesion the histological appearances are studied in conjunction with the colour transparency of the lesion *in vivo*.

RESULTS

The numbers of lesions in each histological group specially studied are shown in Table I, as is the percentage accuracy of this method as confirmed by subsequent histology. Representative surface patterns of 6 different types of pigmented lesions are shown in Fig. 2.

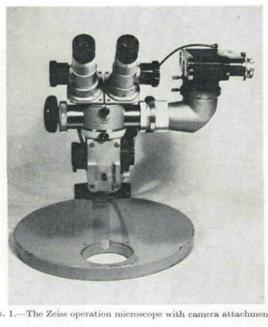

Fig. 1.—The Zeiss operation microscope with camera attachment.

Junctional naevi.—The magnified surface appearance of the junctional naevi shows 2 distinct components; the first is a background of uniform pale brown pigmentation, and the second is a collection of highly irregular darker brown pigmented areas superimposed on the paler pigmentation. This superficial pigmentation varies widely, both in area and colour density, and in the heavily keratinized skin of the palms and soles it is deposited in the lines of the skin creases. The quantity of pigment and the area over which it is distributed bear no relationship to the age of the lesion. The lateral margin of these lesions merges gradually into the surrounding skin and can be very difficult to define. There are no dilated or otherwise abnormal capillaries visible on the surface of junctional naevi.

Figure 6. The fourth milestone is awarded to Professor Rona MacKie, who used a binocular skin microscope to study melanocytic tumors. She recognized that certain subsurface characteristics help distinguish nevi from melanoma. This was the first time that dermoscopy was used to assist in melanoma detection.

prototype and approached Helmut Heine, founder of Heine Optotechnik, to develop the first commercially available portable dermatoscope in 1989 – the Heine Delta 10 (Figure 8). For the first time, dermoscopy was not confined to the laboratory. It could now fit in a clinician's pocket and be used routinely at the bedside to evaluate skin lesions during any patient encounter. That same year the German and Austrian researchers gathered in Hamburg, Germany, for the first consensus meeting regarding terminology in skin surface microscopy [22].

Figure 7. The fifth milestone came in 1987, when two seminal articles published in the *Journal of the American Academy of Dermatology* established epiluminescence microscopy as a valid technique for visualizing subsurface structures in melanocytic tumors, allowing clinicians to differentiate nevi from melanoma. The Vienna group conducted their examinations using a binocular microscope (WILD M650, Wild Heerbrugg AG, Heerbrugg, Switzerland), similar to the one shown here, to study pigmented skin lesions in vivo.

A New Lens and Evolving Language

As the handheld dermatoscope spread, so did the need for a common name for the technique of evaluating the skin with this looking glass. In the 1980s and 1990s, dermatologists debated what to call this new technique. "Dermatoscopy," "epiluminescence microscopy," and "skin surface microscopy" were all in use. The term dermoscopy, promoted by Dr. Alfred Kopf and later adopted by the international community, ultimately prevailed—short, clear, and easily spoken across languages [23].

The seventh milestone arose from innovation within the medical device industry. In 2001, Nizar Mullani, Thorsten Trotzenberg and John Bottjer formed a start-up company named 3GEN and introduced the *DermLite DL100*, the first cross-polarized dermatoscope (Figure 9). This marked a turning point in dermoscopy's evolution. The use of polarized light eliminated the need for immersion fluids, allowing for a faster, cleaner, and more convenient examination process. Beyond convenience, subsequent research revealed that polarized and non-polarized light each highlight distinct and complementary morphological features, thereby enhancing both the sensitivity and specificity of dermoscopic evaluation [24]. Based on these insights, Ashfaq Marghoob requested 3GEN to design dual-mode dermatoscope, the *DermLite Hybrid M*, which allow clinicians to toggle seamlessly between polarized and non-polarized illumination, a feature that remains the clinical and industry standard to this day.

Figure 8. The sixth milestone revolutionized dermoscopy when Peter Bilek and Wilhelm Stolz modified a philatelic magnifier to create the prototype of the first handheld dermatoscope. This prototype became the blueprint that Heine later used to develop the first commercially available portable dermatoscope (the *Heine Delta 10*) in 1989. (Image of Bilek from W. Stolz. In memoriam Peter Bilek (1936-2009). Hautarzt 2009; 60:839-840).

Figure 9. The seventh milestone marked the advent of polarized light dermoscopy, which simplified the technique by eliminating the need for immersion fluid or direct skin contact. This breakthrough was led by the company 3GEN, founded by Nizar Mullani, Thorsten Trotzenberg, and John Bottjer, which developed the first polarized dermatoscope, the *DermLite DL100,* and later introduced the first dual-mode device, the *DermLite Hybrid M,* capable of toggling between polarized and non-polarized illumination.

Figure 10. The collaboration between Peter Soyer and Giuseppe Argenziano was transformative for the field of dermoscopy, catalyzing global engagement through their research and involvement in the founding of the International Dermoscopy Society (IDS). The establishment of the IDS marks the eighth and final milestone in dermoscopy's evolution: a freely accessible, worldwide platform devoted to education and research. Today, the IDS continues to inspire and empower new generations of clinicians and scientists to refine and expand the art and science of in vivo diagnosis of skin diseases.

Around the same time, digital dermoscopy and image archiving began to transform practice, enabling side-by-side lesion monitoring and teleconsultation. What had started as an optical curiosity was about to become a global diagnostic standard.

The Catalyst and Global Adoption

All the pieces were in place, waiting for a catalyst. That catalyst arrived in the form of a young dermatopathologist named H. Peter Soyer, who, encouraged by his chairman, set out to master the art of dermoscopy. During his journey of learning and teaching, he encountered an equally passionate dermatologist, Giuseppe Argenziano. The collaboration that followed would prove transformative.

Together, this dynamic duo authored more than a hundred scientific papers, lectured around the world, and harnessed emerging internet technologies to bring the global dermoscopy community together. In 2000, they organized the Second Consensus Meeting on Dermoscopy, which, building on the pioneering first consensus of 1989 that standardized descriptive terminology, used the Internet to unite experts worldwide. The result was the creation of structured diagnostic algorithms that advanced dermoscopic interpretation and training [25].

Their most lasting achievement came in 2003 when, together with Rainer Hofmann-Wellenhof, they founded the International Dermoscopy Society (IDS), a freely accessible, global platform dedicated to education and research (Figure 10). The journal *Dermatology Practical & Conceptual*, which rose from relative obscurity to prominence largely through the efforts of Harald Kittler, became the official journal of the IDS in 2013. It is the creation of the IDS that marks the eighth milestone as it became the engine that solidified dermoscopy as a scientific discipline, inspired worldwide engagement, and fueled tens of thousands of publications [26]. Dermoscopy was no longer the pursuit of a few enthusiasts; it had become an essential skill embraced by clinicians across the globe.

Looking Forward: The Next Chapter

For clinicians, dermoscopy is more than a tool, it is a mindset. It challenges us to look beyond what seems obvious. As many seasoned users know, the real power of dermoscopy lies not in identifying what is clearly malignant, but in recognizing what is subtly suspicious: the lesions that do not look worrisome at first glance. By expanding our field of vision, dermoscopy improves sensitivity while maintaining specificity.

The pace of innovation shows no sign of slowing. Today's AI-assisted dermoscopy systems can compare thousands of images in seconds, providing decision support to clinicians across the globe [27]. New wavelengths of light are being tested to reveal biochemical and structural details beyond the reach of visible light [28]. Yet, even as we enter an era of algorithmic analysis and multimodal imaging, the essence of dermoscopy remains beautifully human—a tool that rewards curiosity, observation, and pattern recognition. It continues to teach us how to see.

Conclusion

The history of dermoscopy is, in many ways, the history of dermatology itself: a journey from description to visualization, from art to science, from surface to structure. What began with oil and glass in Unna's Hamburg clinic has become a global discipline that reshapes how clinicians evaluate skin, hair, and nail diseases.

For the general clinician, dermoscopy represents the marriage of simplicity and sophistication; it is a window beneath the skin that deepens both our diagnostic accuracy and our appreciation for the intricate beauty of the human integument.

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