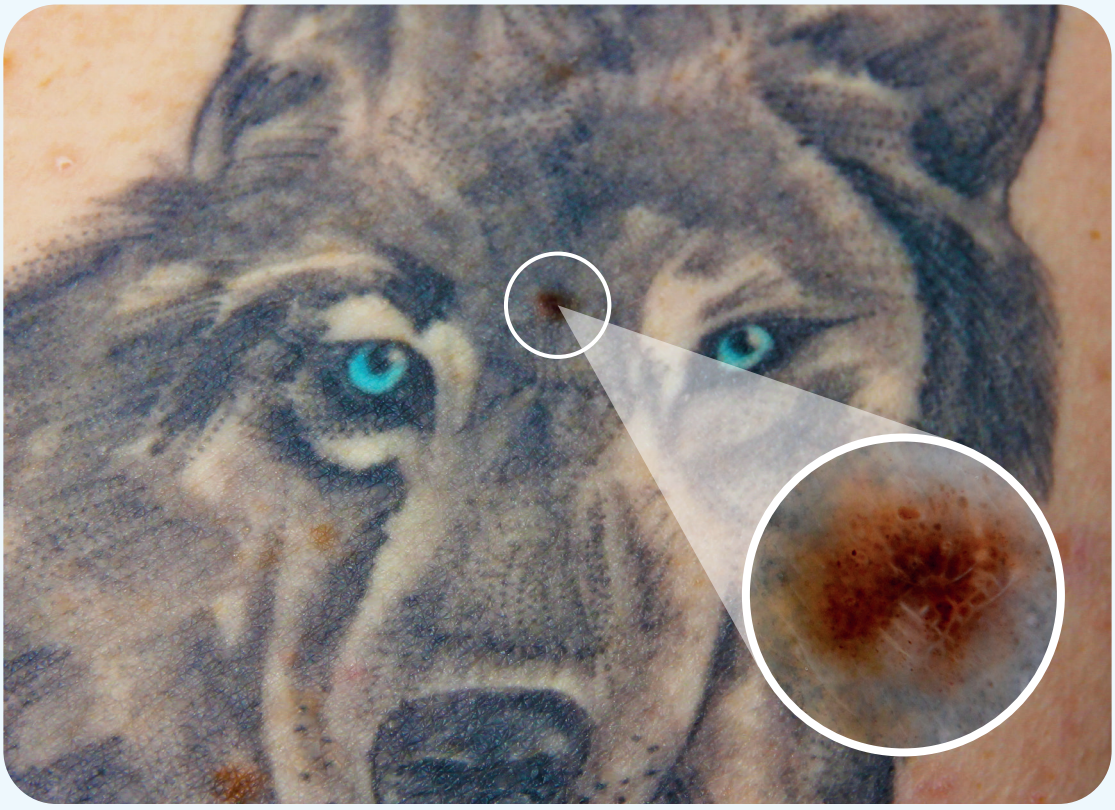
SECOND EDITION

DERMATOSCOPY AND SKIN CANCER

A HANDBOOK FOR HUNTERS OF SKIN CANCER AND MELANOMA



CLIFF ROSENDAHL, AKSANA MAROZAVA, MOHAMMADREZA HASSANI & SIMON CLARK

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Preface to the second edition

The success of the first edition of this book has reflected its utility as an effective 'hunter's manual'. Feedback has been consistently positive and after making a few streamlining changes in the updated edition in 2023, the time is now ripe for a new expanded version.

The book has been reorganised and contains both updated and new content.

Advances in photographic technology, coupled with our evolving experience with it, have led to a chapter dedicated to outlining both its relevance and risks. Risk-free practices, including the use of baseline total body photography during skin examinations, and using serial total body photography coupled with detection software to discover small invasive melanomas are presented, along with the resulting hunting trophies.

New co-author Mohammadreza Hassani has created new graphics and collages, and provided valuable intellectual contributions, as has co-author Simon Clark, rewriting the dermatopathology chapter and ensuring that my rendition of the English language is accurate throughout the book.

The 'Prediction without Pigment' flowchart is expanded as not only a decision algorithm, but a diagnostic one, and 'Chaos and Clues' is presented as 'Chaos, Clues and Exceptions' to maximise safety in its application.

An expanded chapter on melanomas now includes, in addition to previous content, collages of nail matrix melanomas, mucosal melanomas, and melanomas with adverse outcomes including metastasis and death.

A dedicated chapter on melanocytic naevi concludes with the compellingly referenced revelation that the 'dysplastic naevus' is actually the least likely naevus to be associated with a melanoma.

As a finishing touch, the new cover displays, with the patient's consent, a wolf-tattoo, with an invasive melanoma exactly positioned between the eyes. My publisher prevailed on me not to place a hunting-scope's crosshairs on that spot, but I have to admit to a certain reluctance in that regard.

Creation of this book, including this second edition, has been a rewarding team effort, and I thank you, the readers, for being major players in that team!

Cliff Rosendahl
June 2025

Preface to the first edition

Fifty years ago when I entered my first year of medical studies in 1969, the same year that Neil Armstrong stepped onto the moon, dermatoscopy as we know it was science fiction. Much has changed. Dermatoscopy is now standard of care in the management of skin cancer and melanoma.

My interest in this novel science became focused after a family member, Graham, developed metastatic melanoma. Graham did not blame the GP who dismissed a lesion of concern on his thigh a couple of years earlier, and he made the point to me that GPs were not prepared for this challenge in their training, a challenge that was thrust on them due to a rising incidence of melanoma and an inexplicable shortage of dermatologists in Australia. Graham's GP looked after him well. Right up to the moment of his death, a death which was predictably terrible, aggravated by multi-organ metastases and finally necrotising fasciitis.

My journey since then, commencing with a PhD expertly supervised by David Wilkinson and Peter Soyer and focused on improving skin cancer management in Australia, has been a very steep learning curve. I have been mentored by men of undoubted genius: Harald Kittler and David Weedon, men whose genius was only matched by their generosity. I have been assisted by exceptional colleagues: Ian McColl, Iris Zalaudek, Alan Cameron, Jeff Keir, Greg Canning, Phil Tschandl, Agata Bulinska, Simon Clark and Nisa Akay. I am particularly grateful to Harald Kittler, Stephen Hayes and Jeff Keir for their critical review of the book and to Simon Clark for reviewing and correcting the dermatopathology chapter.

This book would never have been possible without my co-author Aksana Marozava. Aksana worked with me for two years, taught me how to do a skin examination and dispelled any delusions of grandeur by repeatedly discovering significant lesions I had passed over. Her diligence and skill in collating my image collection for the book and preparing all of the graphics has hopefully made this book the masterpiece we wanted to produce.

The hunting metaphor is no accident. Hunting and gathering (Aksana insists that she is a gatherer) are as natural to *Homo sapiens* as is falling in love. The romance and thrill of the hunt elevates what we do to more than the drudgery of repetitive work, and the satisfaction of every success motivates further effort.

Finally, I am indebted to my wife Debbie for putting up with me through this journey and for effectively managing our practice and business affairs so I could focus on hunting, research, teaching and writing.

To conclude, I quote Vice Admiral Horatio Nelson, hunter extraordinaire, speaking at the battle of Copenhagen in 1801:

"It is warm work; and this day may be the last to any of us at a moment. But mark you! I would not be elsewhere for thousands".

Cliff Rosendahl
Brisbane March 2019

Foreword

This new book is an important step forward in the developing art and science of dermatoscopy for skin lesion recognition. The debate as to whether the technique is any good is surely over, but more help as to how to best do it, and (vitally) to best teach it, is most welcome.

Over the last decade or so, Cliff Rosendahl, and more recently Aksana Marozava, have documented some 19,000 excised skin lesions in Cliff's clinic in Capalaba, Brisbane, and fed the data into the SCARD online database which he set up with Tobias Wilson. This book summarises the knowledge gained from the analysis of that histopathological data and the lesion images, plain and dermatoscopic. The sheer scale of the data behind this book gives it an authority that can't be ignored.

The book is built around two algorithms, 'Chaos and Clues' and 'Prediction without Pigment' which, as explained, may not always lead to a diagnosis, but to a safe decision as to whether excision is required. The selected colour images illustrate well the dermatoscopic features and terms set out in the text.

Cliff is fully committed to revised pattern analysis and the use of what he calls objective geometric terminology to describe dermatoscopic structures, building on the 'descriptive' terminology often associated with co-worker Harald Kittler of Vienna. There are no 'arborising' vessels here (if vessels are 'tree-like', then what sort of tree?) but branched serpentine (admittedly, 'serpentine', i.e. snake-like, is still a metaphor, but a much more consistent one than tree-like). And it is further explained that the apparent sharp focus of such vessels in BCC is due to the superficial cutaneous vascular plexus being clarified by the translucent BCC stroma, rather than that vessel morphology being unique to BCC.

There is more basic science here than is usual in a book aimed at beginners, but the extra effort put into appreciating the embryology, anatomy and histopathology pays rewards, particularly with regard to dermatoscopic–pathological correlation. Recognising structures like blue clods and polarising-specific white lines is good, but understanding what they mean at the microanatomical level gives insight into the modus operandi of the target of the hunt: malignant tissue.

More recently described signs such as white circles in early invasive SCC and angulated lines and polygons in melanoma *in situ* are detailed. I have witnessed Cliff working in his clinic and I can say that the author has a zero tolerance approach to such lesions, with approximately 80% of the melanomas diagnosed in his clinic being pre-invasive.

Dermatoscopy and Skin Cancer is a more challenging read than some earlier textbooks on this subject, but builds on hard-won, audit-backed knowledge to take us to the next level of advanced pattern analysis. It can be commended to the beginner/improver and indeed expert, who is willing to put in some work to embrace the latest evidence-based approach and terminology, which seems likely to supersede the earlier algorithms based on metaphorical language. This may mean some effort for those of us who learned dermoscopy/dermatoscopy with terms like maple leaf, arborising, comedo-like, ovoid nests, etc., but the new approach makes sense

if for no other reasons than the need for translation and utility for international research, for dermatoscopy is now highly globalised.

Dr Stephen Hayes
Independent dermatoscopy educator
Associate Specialist in Dermatology, University Hospital Southampton
UK board member, International Dermoscopy Society

Abbreviations

AK	actinic keratosis
BCC	basal cell carcinoma
DEZ	dermoepidermal zone
DF	dermatofibroma
DOPA	dihydroxyphenylalanine
EFG	elevated, firm and continuously growing
FEP	fibroepithelioma of Pinkus
GP	general practitioner
H&E	haematoxylin and eosin
HPV	human papilloma virus
IEC	intraepidermal carcinoma
IHC	immunohistochemical
KA	keratoacanthoma
LM	lentigo maligna
LMM	lentigo maligna melanoma
LN	lymph nodes
LPLK	lichen planus-like keratosis
MCC	Merkel cell carcinoma
NM	nodular melanoma
NMSC	non-melanoma skin cancer
pAK	pigmented actinic keratosis
PAM	primary acquired melanosis
pBCC	pigmented basal cell carcinoma
pIEC	pigmented intraepidermal carcinoma
PG	pyogenic granuloma
pSCC	pigmented squamous cell carcinoma
RPA	revised pattern analysis
RPE	retinal pigmented epithelial
RR	relative risk
SCARD	Skin Cancer Audit Research Database
SCC	squamous cell carcinoma
SDDI	serial digital dermatoscopic imaging
SSM	superficial spreading melanoma
TBP	total body photography
TBPD	TBP with Detection
UV	ultraviolet
WHO	World Health Organization

CHAPTER 4

The language of dermatoscopy: naming and defining structures and patterns

4.1 The evolution of terminology for dermatoscopic structures and patterns

The advent of dermatoscopy created the need for a vocabulary and not surprisingly, this evolved and flourished rapidly, parallel to the publication of research into this novel science. Dermatoscopy is a colourful and totally visual science and the proliferation of graphic metaphorical terms to describe structures created a blend of science and art which, although appealing to many, was problematic at the same time. The vocabulary grew extensively, which posed a challenge for students. More concerning, however, was the manner in which these metaphoric terms emerged – each carrying inherent, preconceived diagnostic implications. For example, if segmental radial lines were seen in a lesion believed to be a melanoma they would be labelled 'radial streaming', but if the lesion was believed to be a BCC they would be called 'leaf-like' or even 'maple leaf-like' structures. In no other field of medicine does diagnosis precede description, but that is what happened with the evolution of metaphoric terminology in dermatoscopy.

In 2007 Kittler introduced revised pattern analysis (RPA) and with it, geometric descriptive terminology[1]. Then in 2008 Kittler *et al*. introduced a classification of vessel morphology also based on pattern analysis[2]. A consensus meeting in Vienna in 2015 found that the descriptive geometric terminology was preferred over metaphorical terminology by a margin, although the majority stated that they used both languages[3].

4.1.1 Structures in revised pattern analysis

Revised pattern analysis can be applied to all skin lesions and involves an analysis of pigmented structures as well as white, skin-coloured and vessel structures[4]. Structureless areas have the same significance as patterns formed by structures (*Figure 4.1*).

Pigmented structures are coloured by melanin, resulting in black, brown, grey or blue colour, or by other pigmentary sources, including air-exposed keratin (manifesting as yellow, orange or brown) and blood or its by-products (red, purple and black). As a general rule, if blue, purple or black are seen in association with any brown colour they should be interpreted as colours of melanin rather than of blood[5].

White structures are defined as being *whiter than perilesional skin* and include lines (polarising-specific and non-polarising-specific), circles, clods (including dots) and structureless (including surface keratin/scale)[5].

4.2 Revised pattern analysis of lesions pigmented by melanin

4.2.1 Basic structures

In the language of RPA, there are only three basic pigmented structures: lines (including pseudopods), circles and clods (including dots) (*Figure 4.1*). Because lines are a very specific structure they are further subdivided into six different types: reticular, branched, angulated, parallel, radial and curved (*Figure 4.1*). A pattern is an area made up of multiple repetitions of a basic structure. Lines (reticular and branched), circles and clods can be white as well as pigmented. Any area large enough to form a pattern, with no basic structure predominating, is termed structureless. A structureless area, just like a structure, can have any colour.

The terms used for structures are clearly defined[4] and are described in the sections which follow.

4.2.2 Lines

A **line** is a structure extending in one direction with its length usually greatly exceeding its width.

Reticular lines: a group of straight lines which intersect sensibly at right angles to form a net-like pattern (*Figure 4.2*). With respect to pigmented reticular lines, they are the surface projection of a pattern produced by pigmented rete ridges and non-pigmented dermal papillae (*Figure 4.3*). The pigment on the rete ridges may be in keratinocytes or melanocytes.

Reticular lines can be found in melanocytic naevi, melanomas, solar lentigo, seborrhoeic keratosis and dermatofibroma. They generally rule out a diagnosis of BCC or SCC.

Branched lines: a group of straight lines similar to reticular lines, intersecting less regularly and not always at right angles (*Figure 4.4*). Their significance generally coincides with that of reticular lines.

Angulated lines: straight pigmented lines, not reticulated or branched, usually meeting at angles of 90° or more, but not crossing (*Figure 4.5*). These lines may join to form complete or incomplete polygons[6]. Patterns formed by angulated lines are much larger in scale than a rete-ridge-based reticular pattern.

Parallel lines: straight pigmented lines arranged in a parallel pattern, found on volar skin and nails (*Figure 4.6*). On volar skin they may be arranged on ridges, in furrows, or crossing the ridges and furrows.

Radial lines: a group of pigmented lines which converge at a central point or would do so if extended (for example, at a point at the centre of a lesion) (*Figure 4.7*). Radial lines may radiate from a location within a lesion or from the perimeter of a lesion, at which location they can either be circumferential or segmental. A pseudopod is one type of radial line which is defined as a radial line with a terminal clod (*Figure 4.8*).

Curved lines: pigmented lines which are not straight, have few intersections and may be parallel or distributed randomly (*Figure 4.9*). Parallel curved lines usually occur in pairs.

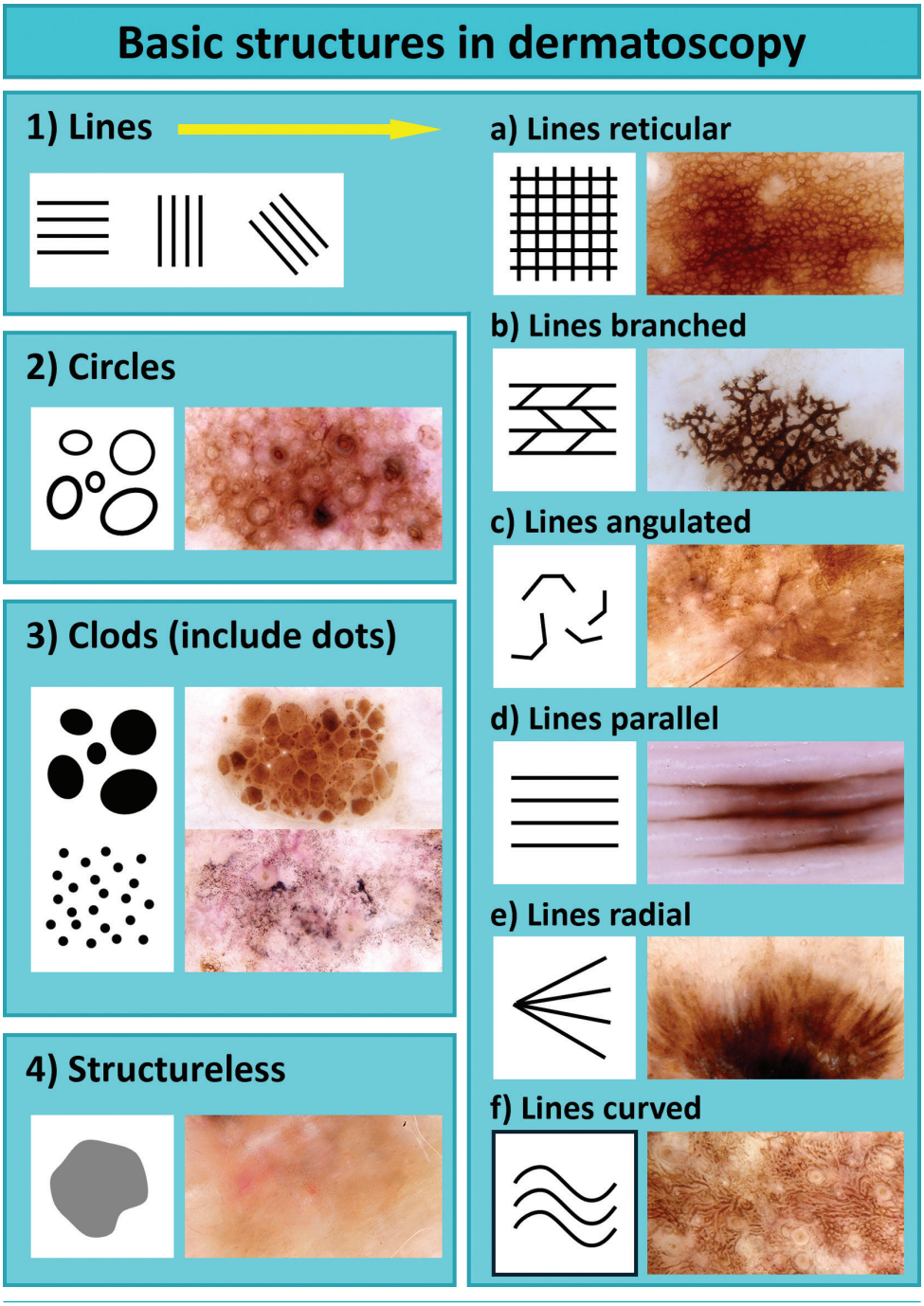

Figure 4.1: *Non-vessel structures in revised pattern analysis. There are three basic structures (1–3) including six types of lines (a–f). An area with no basic structure predominating is termed structureless (4).*

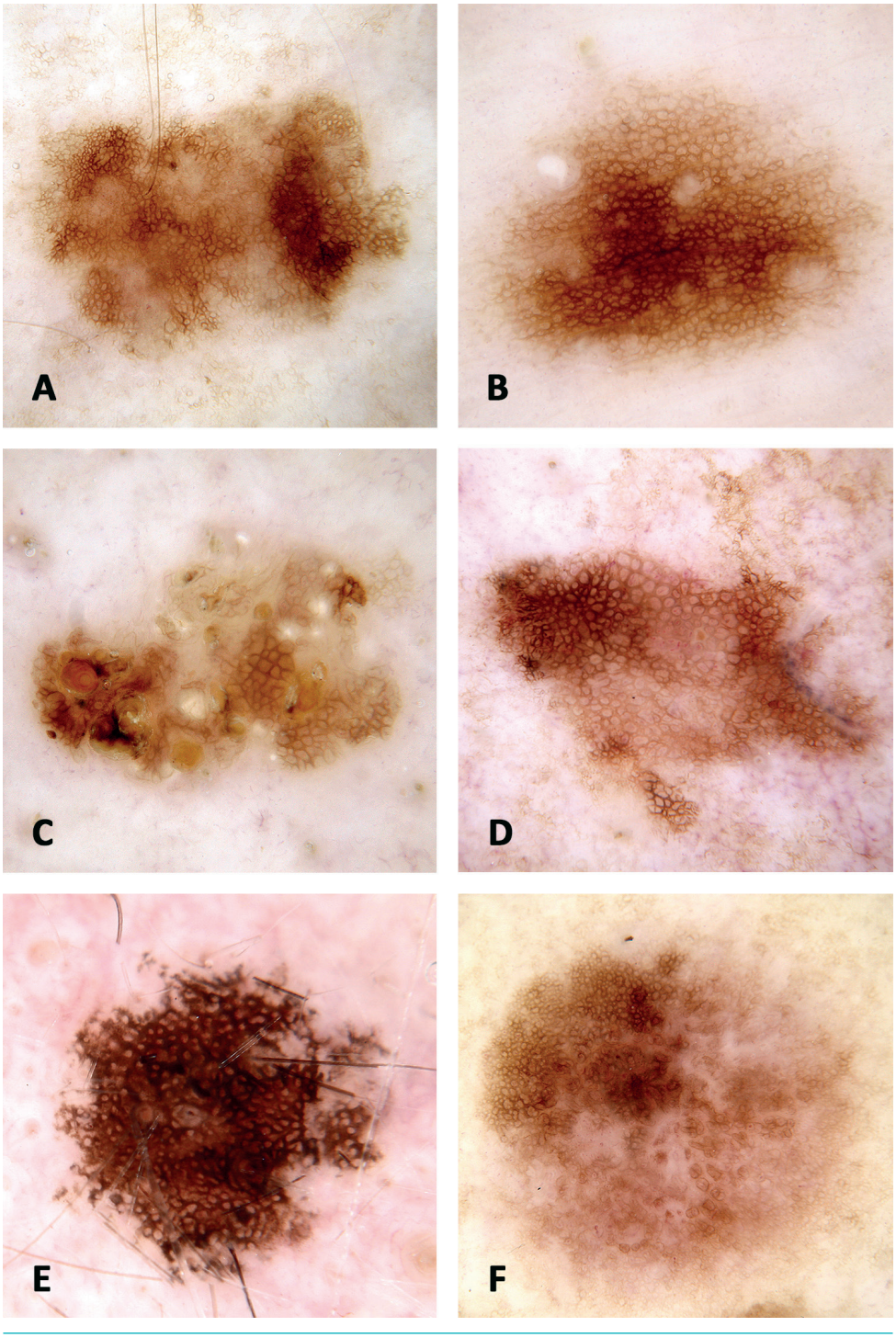

Figure 4.2: *Six lesions each exhibiting a pattern of reticular lines: (A) melanoma* in situ*; (B) naevus; (C) seborrhoeic keratosis; (D) solar lentigo; (E) ink spot lentigo; (F) dermatofibroma.*

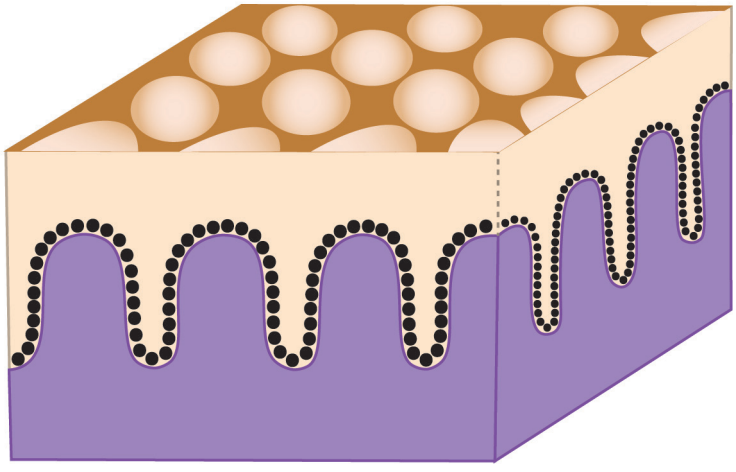

Figure 4.3: *Diagrammatic representation of a pattern of reticular lines formed by pigmented rete ridges alternating with non-pigmented dermal papillae. A single layer of pigmented cells, represented by black dots, is shown arranged at the basal layer of the epidermis. Light is absorbed by multiple pigmented cells on the sides of rete ridges compared to only a single layer over the tops of dermal papillae producing a reticular pattern dermatoscopically.*

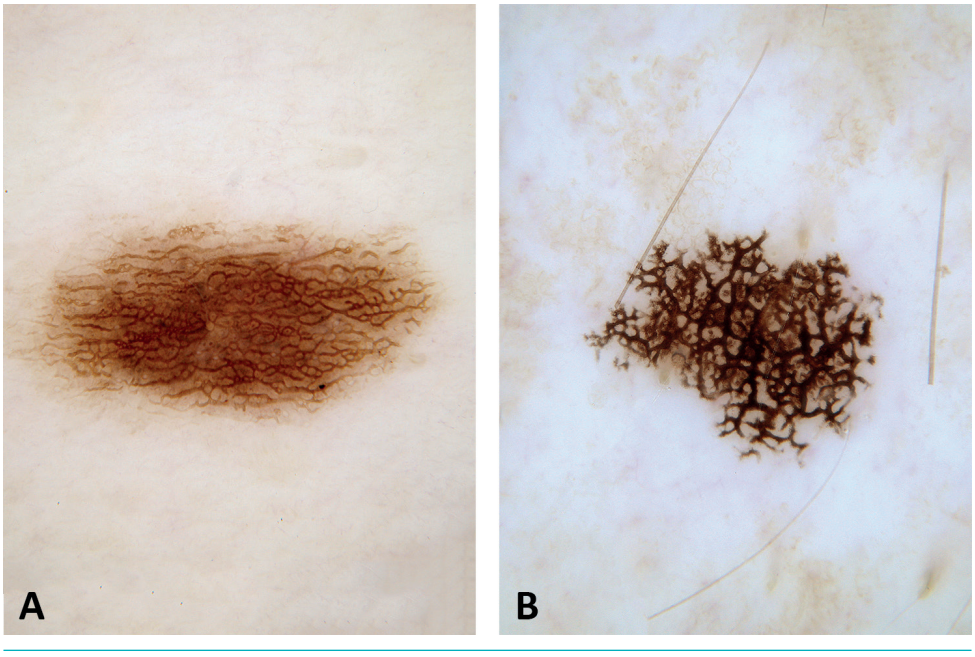

Figure 4.4: *Two lesions exhibiting a pattern of branched lines: (A) congenital naevus; (B) ink spot lentigo.*

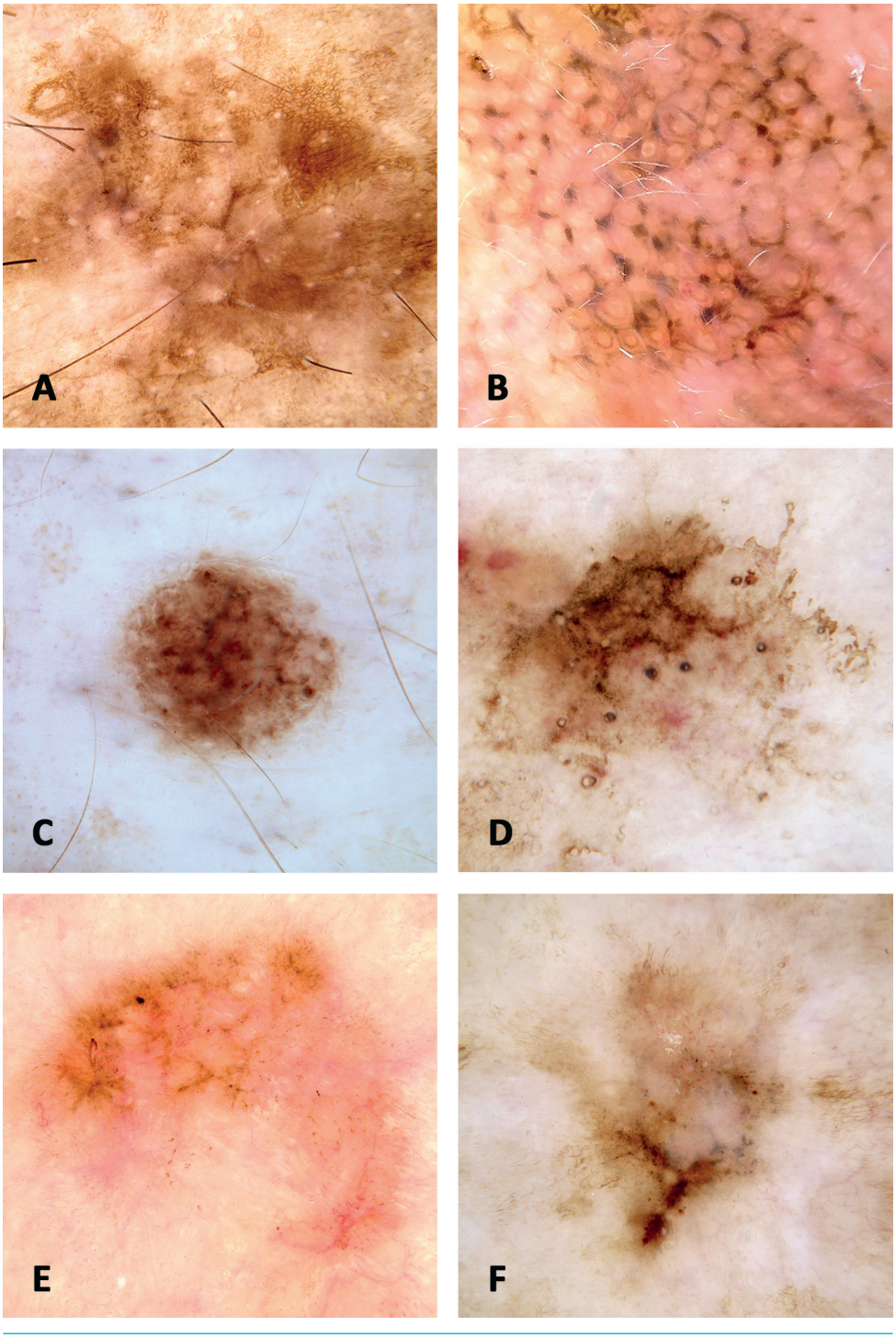

Figure 4.5: *Six lesions each exhibiting a pattern of angulated lines: (A and B) melanoma; (C) naevus; (D) solar lentigo; (E) basal cell carcinoma; (F) squamous cell carcinoma* in situ.

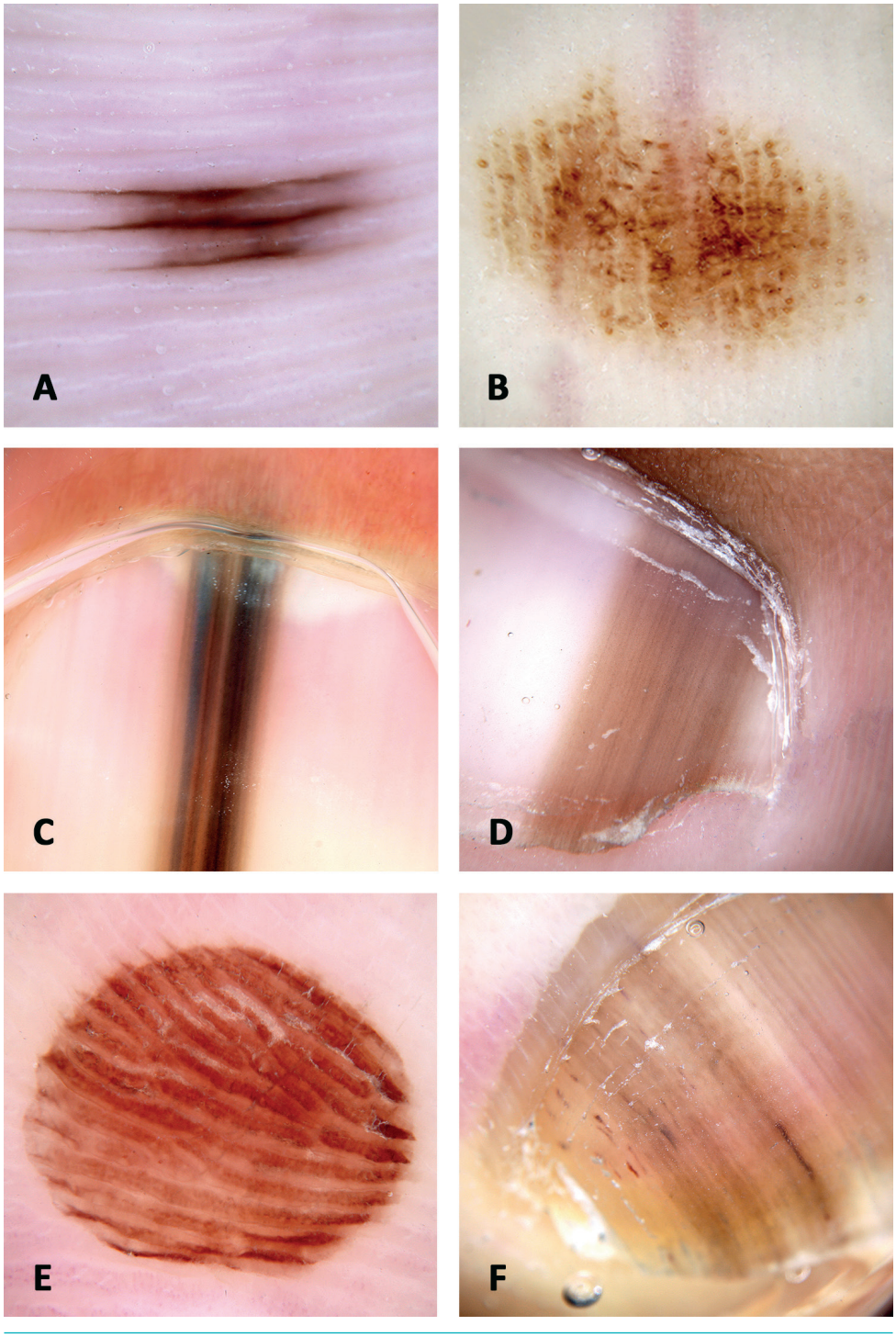

Figure 4.6: *Six lesions exhibiting a pattern of parallel lines: (A) volar naevus; (B) volar melanoma; (C) nail matrix melanoma; (D) nail matrix naevus; (E) volar corneal haemorrhage; (F) nail matrix melanotic macule.*

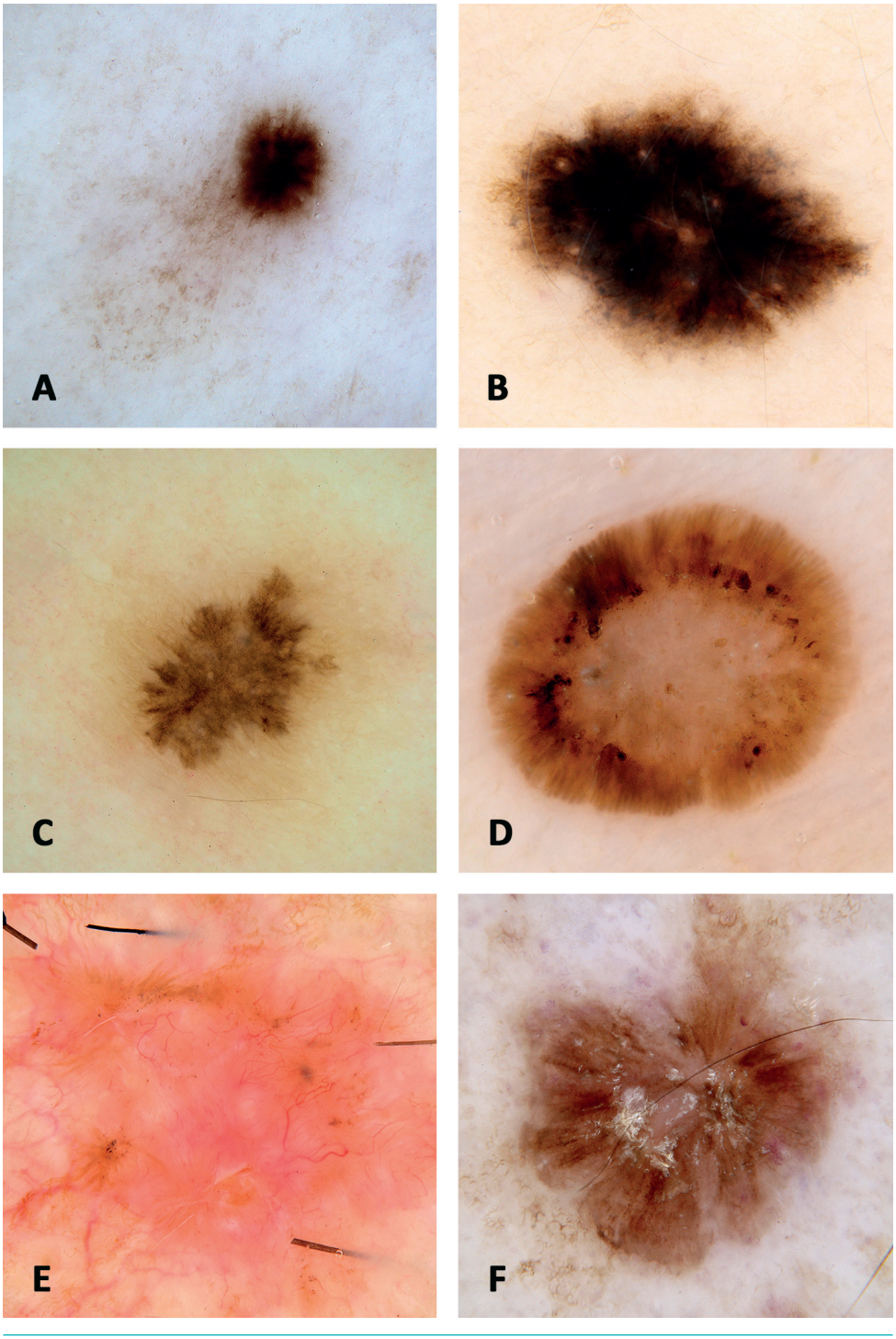

Figure 4.7: *Six lesions each exhibiting a pattern (in E it is a clue rather than a pattern) of radial lines: (A) melanoma; (B) Reed naevus; (C) recurrent naevus; (D) seborrhoeic keratosis; (E) basal cell carcinoma (also see* Figure 6.21*); (F) squamous cell carcinoma* in situ.

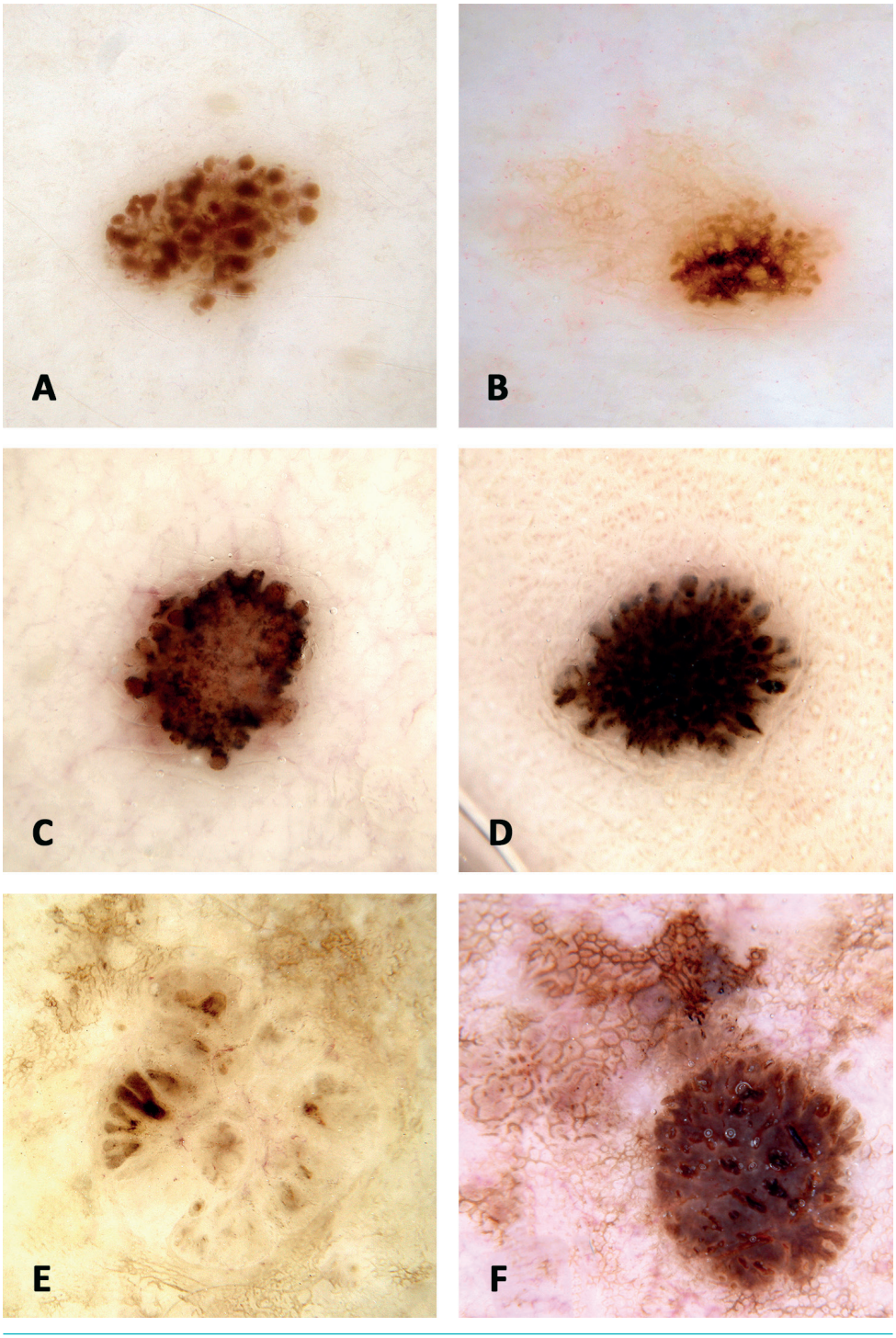

Figure 4.8: *Six lesions each appearing to exhibit the presence of lines radial (pseudopod type): (A) melanoma; (B) naevus; (C) spitzoid melanoma; (D) Reed naevus; (E) basal cell carcinoma; (F) seborrhoeic keratosis. Note that the radial lines in (E) radiate from a hypopigmented area as is specific for basal cell carcinoma.*

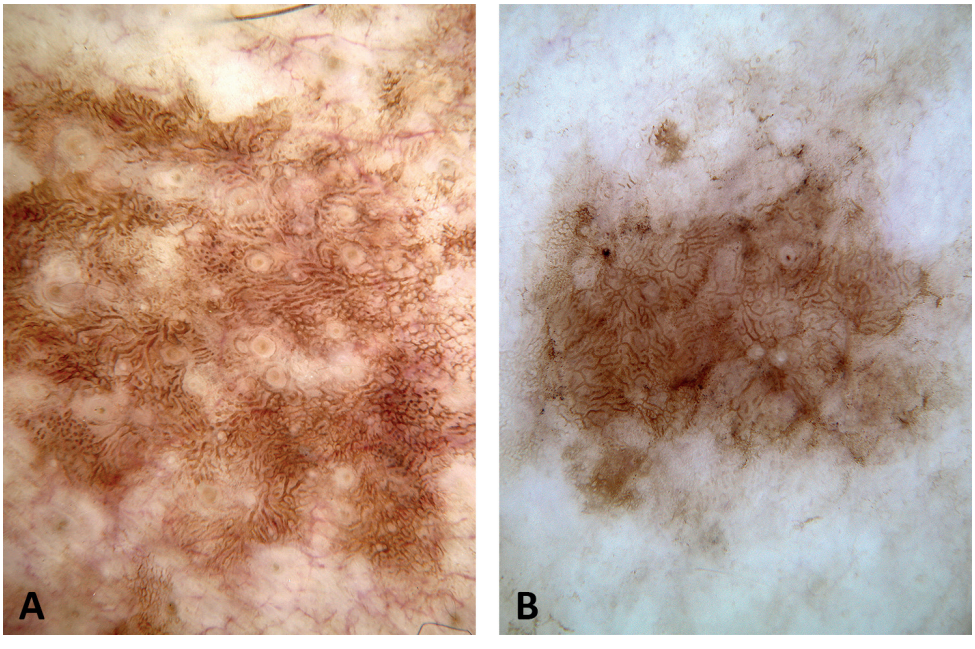

Figure 4.9: *Two lesions each exhibiting a pattern of curved lines: (A) solar lentigo; (B) melanoma – note that angulated lines are also evident.*

4.2.3 Circles

A circle is a curved line sensibly equidistant from a central point (this includes ellipses) and may be melanin-pigmented or white. Skin-coloured circles have no diagnostic significance, nor do follicular openings in a pigmented background, unless a defined circular line, either pigmented or white, is present.

If the centre of the structure is paler than its periphery, and the periphery is characterised by a circular line, then the structure should be described as a circle rather than a clod (the latter being defined as a solid object) (*Figures 4.1*, *4.10* and *4.11*).

Pigmented circles defining an adnexal structure

When melanin is present in the cells lining adnexal structures, rather than merely surrounding them, pigmented circles can be observed using dermatoscopy. While brown circles might be expected, the oblique orientation of follicles can carry the melanin pigment below the dermis, even when the pigmented cells are confined to follicular epidermis, causing dermatoscopic grey circles to be seen (*Figure 4.11*)[7]. This is an explanation for dermatoscopic grey circles in *in situ* melanomas on the face. Brown and grey circles defining follicles can also be seen in benign conditions such as solar lentigo and seborrhoeic keratosis, and even on normal skin with phototypes 5 and 6. However, in lighter skin phototypes, when the compelling morphology of such a benign lesion is not present, pigmented circles on the head or neck, related to follicular openings, are a clue to melanoma[8] as well as to pigmented AK/SCC *in situ*. Pigmented circles that do not relate to adnexal structures represent a pattern of reticular lines modified by acanthosis, and are a clue to seborrhoeic keratosis (*Figure 4.10E*).

4.2.4 Clods

A clod is a well-defined, solid object, and it can be of any size, colour and shape (*Figures 4.1, 4.12–4.14*). A dot is a minute clod that is

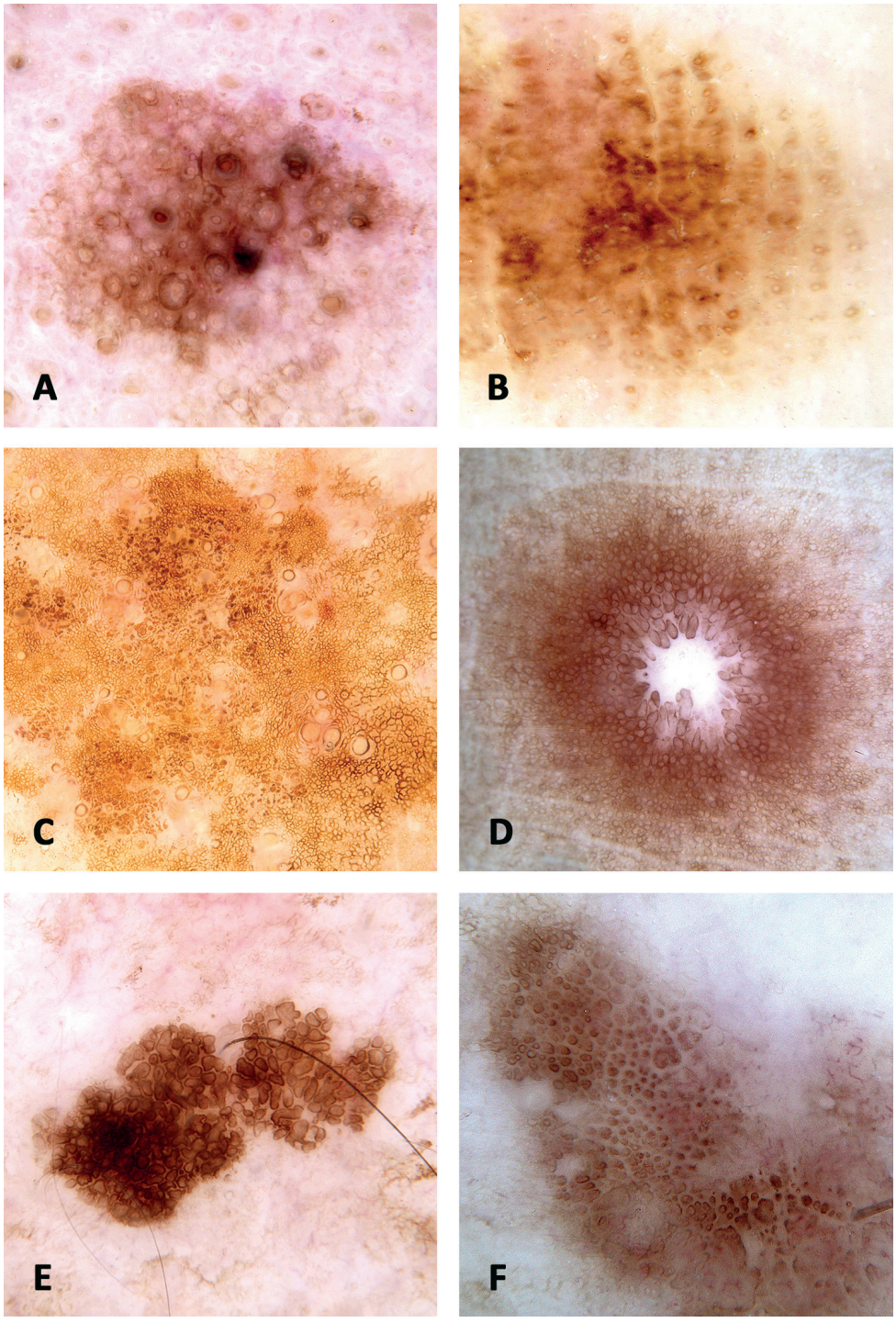

Figure 4.10: *Six lesions each exhibiting the structure (in B the pattern is lines parallel on the ridges) of circles: (A) melanoma; (B) melanoma (volar); (C) solar lentigo; (D) dermatofibroma; (E) seborrhoeic keratosis; (F) squamous cell carcinoma* in situ. *Note that a discrete structure with the centre lighter in colour than the periphery fulfils the definition of a circle rather than a clod.*

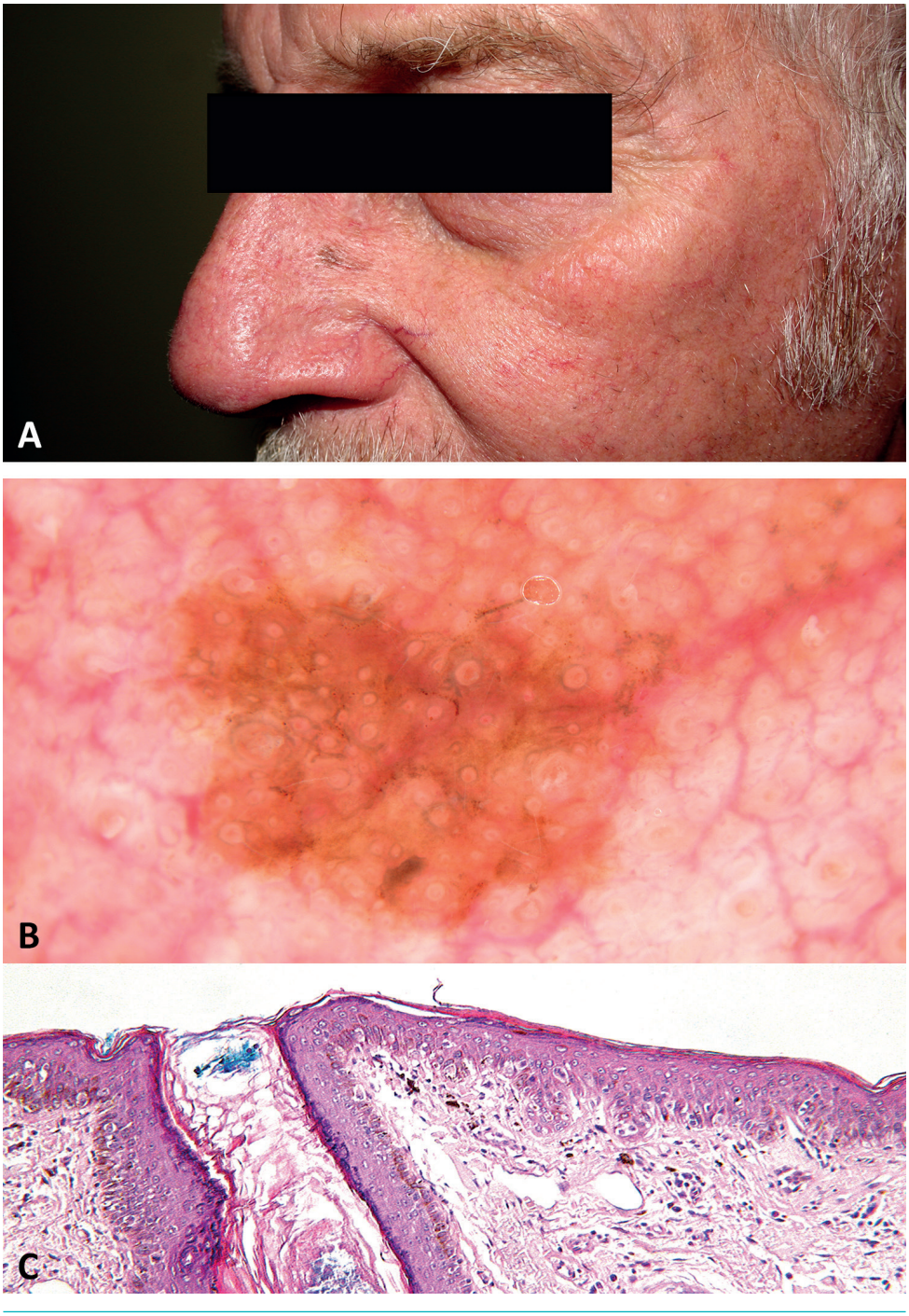

Figure 4.11: *A melanoma* in situ *on the nasal sidewall (A) displays prominent dermatoscopic grey circles (B). Although the melanoma is confined to the epidermis, pigmented melanocytes lining the follicle are seen through dermal collagen because the follicle is oblique (C). Due to the scattering of light by dermal collagen (Tyndall effect) this melanin is seen as grey*[7].

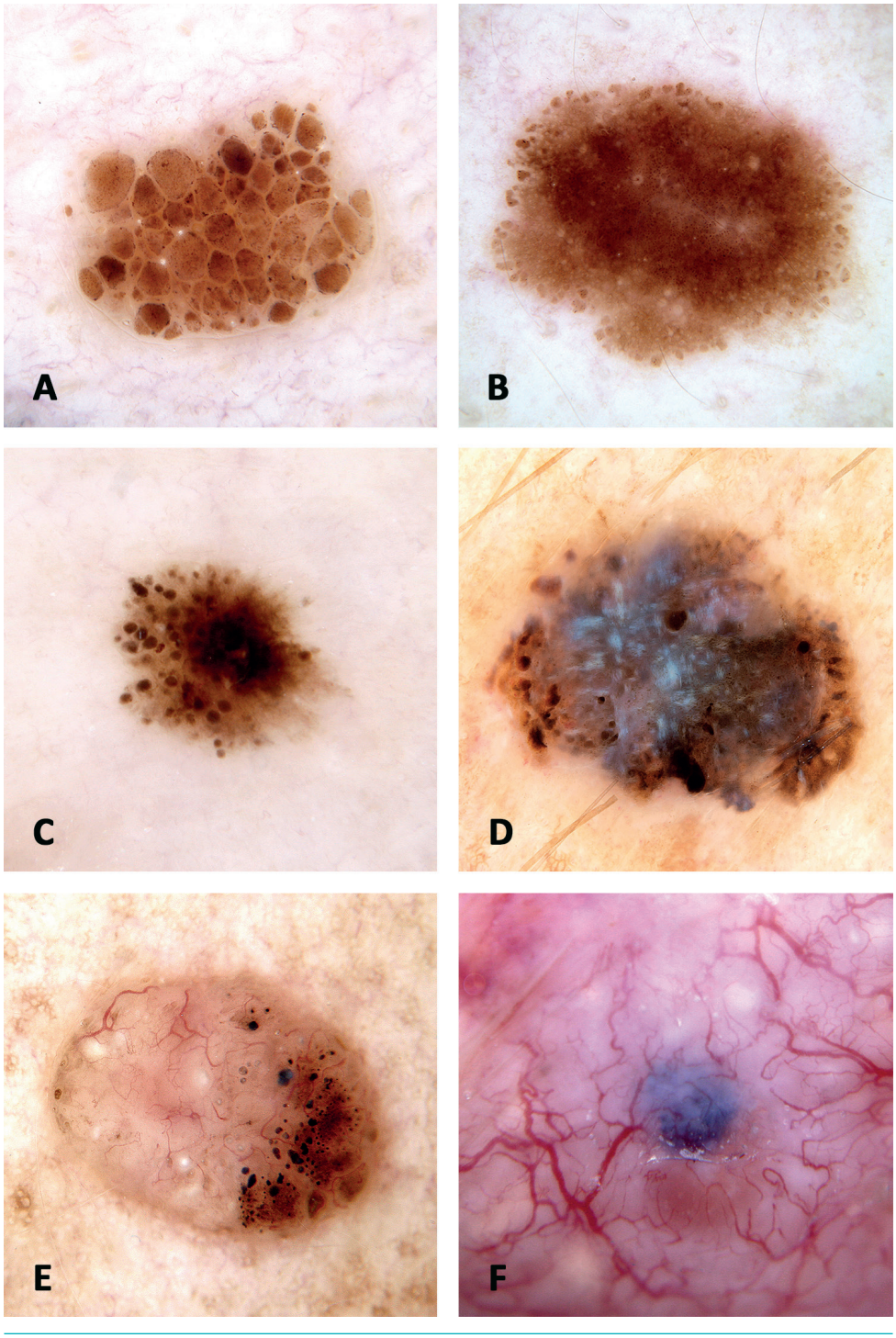

Figure 4.12: *Six lesions each exhibiting the presence of clods: (A) congenital naevus; (B) growing naevus; (C, D) melanoma; (E, F) basal cell carcinoma.*

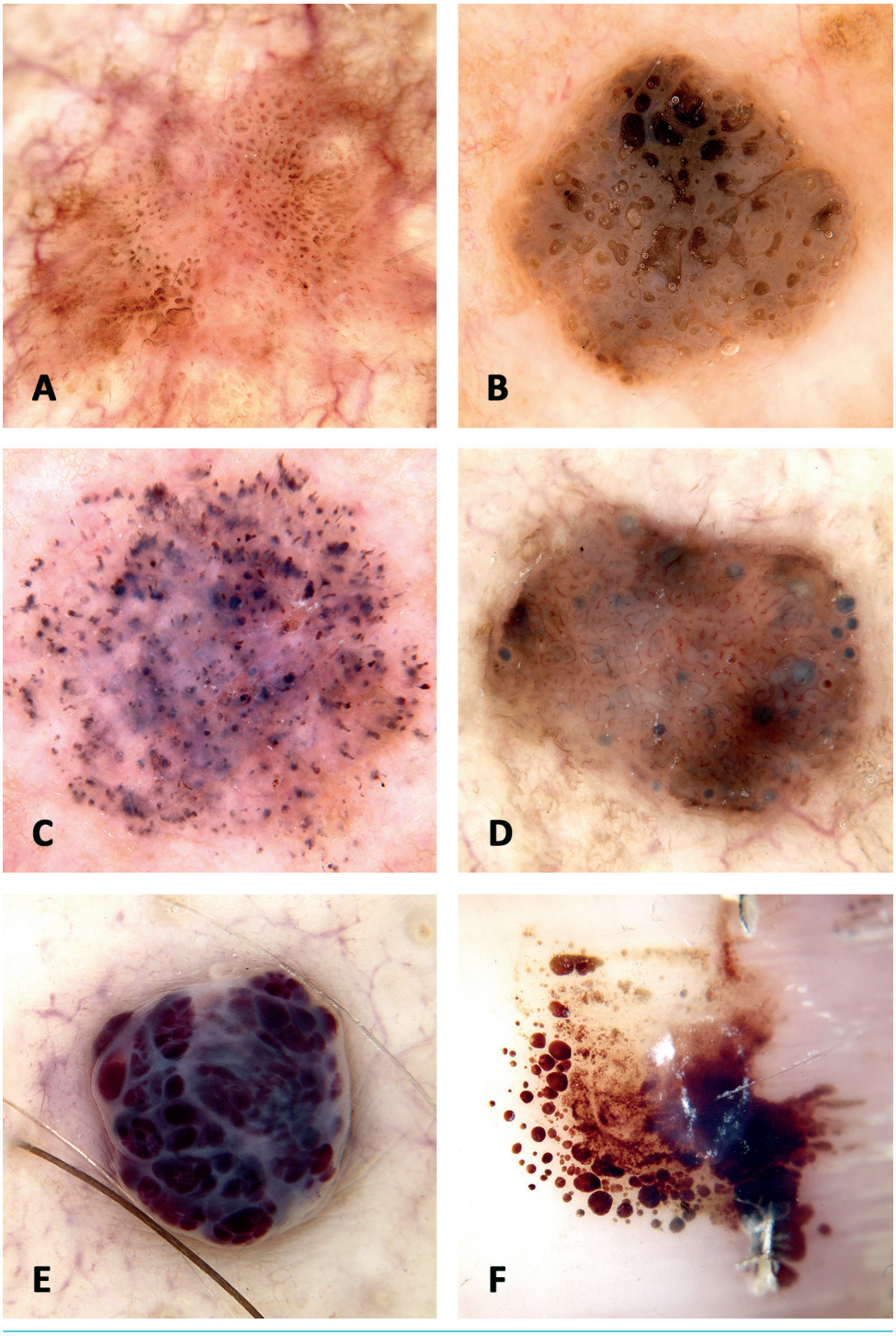

Figure 4.13: *Six lesions each exhibiting a pattern of clods: (A) squamous cell carcinoma* in situ*; (B) seborrhoeic keratosis; (C) lichen planus-like keratosis; (D) clonal seborrhoeic keratosis; (E) haemangioma; (F) subungual haemorrhage.*