Dermatoscopy

The Basics

Dermoscopy

- Dermoscopy is a technique that employs a microscopic instrument to see structures that are not discernible to the naked eye.
- Also called epiluminescence microscopy, dermatoscopy, and magnified oil immersion diascopy.

History

- Dermatoscopy was introduced in 1920s with the introduction of a new diagnostic tool resembling a binocular microscope with a built-in light source.
- The term dermoscopy was used in 1950 by a dermatologist who used the instrument for the evaluation of pigmented skin lesions.
- In 1971 Rona MacKie established improvement in the preoperative diagnosis of pigmented skin lesions.
- Austrian, German and Italian investigators have refined the technique and established the diagnostic criteria that we use today.

History

- The first Consensus Conference on Skin Surface Microscopy was held in 1990 in Hamburg.
  - listed 22 different patterns and structures!
- The Consensus Net Meeting on Dermoscopy was held in Rome in 2001.
  - attempted to standardize the definitions of structures seen in benign and malignant pigmented lesions.

The Instruments

The Instruments

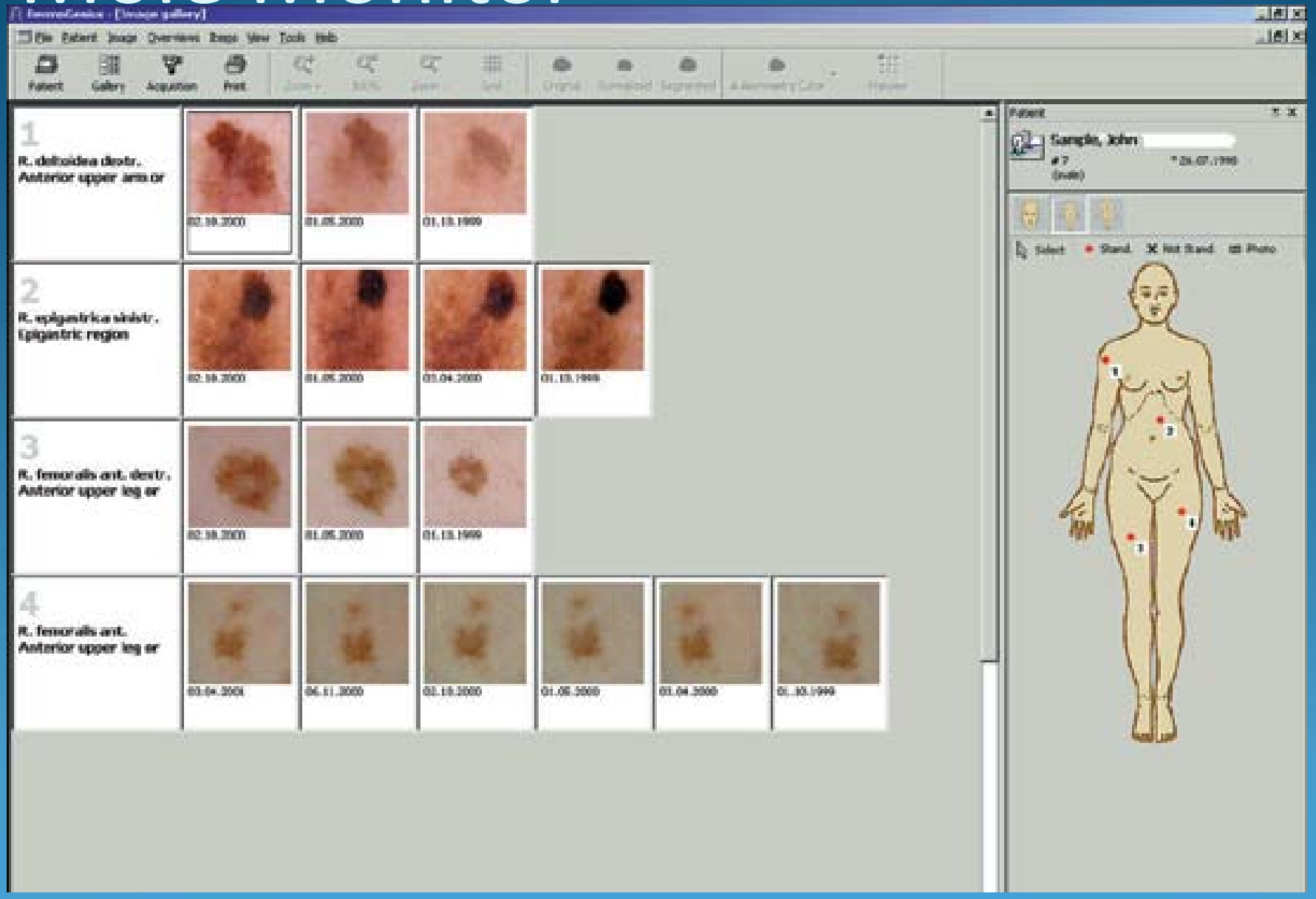
- **The DermLite and DermoGenius are highly accurate oil-free pocket epiluminescence microscopes.**
  - magnification lens
  - light-emitting diode (LED) lighting (very bright and efficient)
    - change the battery on the DermLite about every two years
  - polarizing filters for glare reduction (eliminate the need for skin contact and oil)

The Instruments

- Photographic documentation of pigmented lesions can be performed with a dermoscope attachment to a camera.
- DermLite and DermoGenius sell these photographic instruments . They can interface with computers for storage and follow-up

Mole Monitor

Mole Monitor



The Concepts

Basic Concepts: Color

- **Color correlates with location of melanin**
  - Upper epidermis/stratum corneum – Black
  - Dermoepidermal junction - Light-to-dark brown
  - Papillary dermis - Slate blue
  - Reticular dermis - Steel blue
- **Red**
  - associated with an increased number of blood vessels or dilatation of blood vessels, trauma, or neovascularization
- **White**
  - can be a sign of regression or scarring

Basic Concepts: Pigment Network

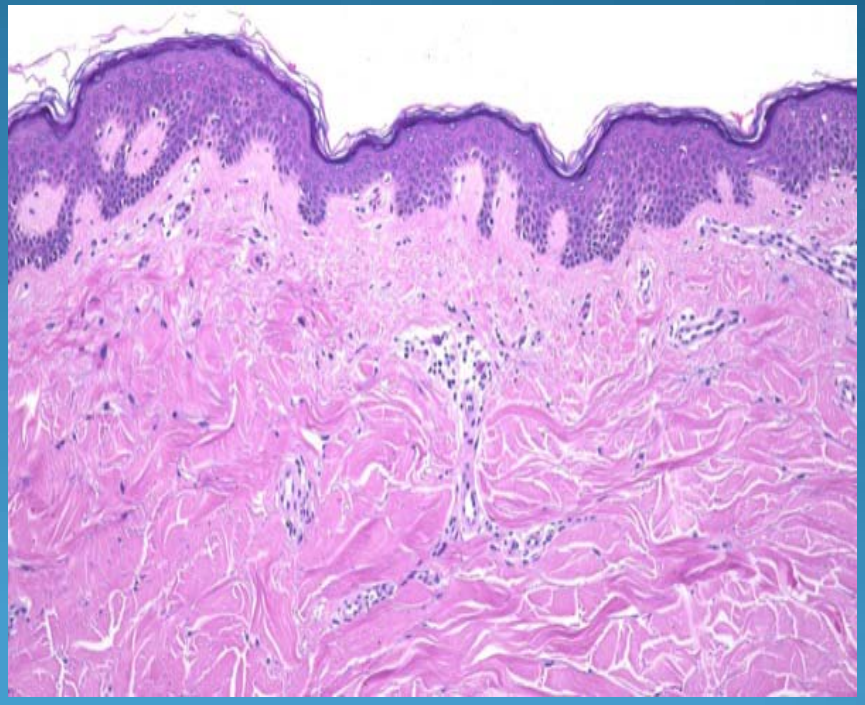
- The pigment network is the most important structure in dermoscopy.
  - A grid of thin brown lines over a diffuse light brown background.
- The network pattern is the dermoscopic hallmark of benign acquired melanocytic nevi **and of thin melanomas**.
- A pigment network is also found in lentigo simplex, solar lentigo and in dermatofibromas.

Pigment Network

- The pigment network is a net-like or honeycomb structure consisting of darkly pigmented “lines” and hypopigmented “holes.”

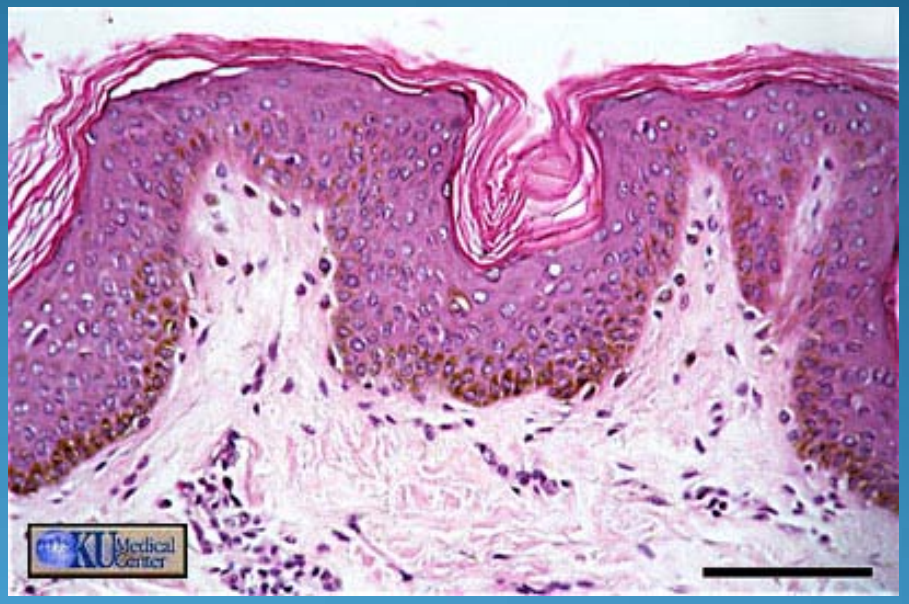
Pigment Network

- Imagine a vertical slice down through the epidermis and dermis.
  - The rete ridges project down vertically into the dermis
  - The epidermis looks like a wave with high and low points (rete ridge pattern.)
- Melanin is produced by melanocytes located in the basal layer of the epidermis and distributed to keratinocytes located along the basal layer at the DEJ

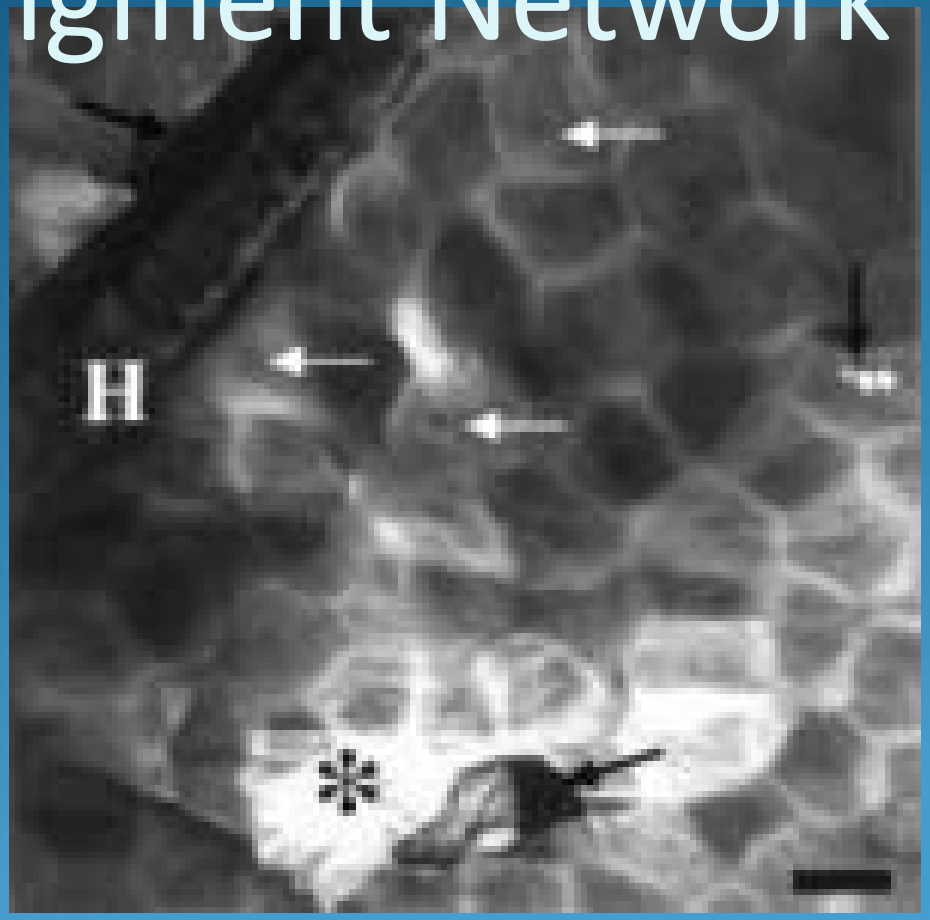


Pigment Network

- There is less melanin in the upper rete than in the lower rete.
  - The lower (deeper) rete ridges look like dark lines when viewed from above.
  - The epidermis at the top of the wave-like structure is thin, and appears as a light circle when viewed from above (upper rete ridges).
- The rete ridges are actually continuous and appear as walls with a hole in the middle. The lines are connected with adjacent rete ridges to give the characteristic net-like pattern



Pigment Network



Pigment Network

- The presence of a pigment network usually implies that the lesion is melanocytic.
- The pattern may be subtle or present only in a small area.
- The typical honeycomb-like pattern of the pigment network on the trunk and proximal extremities results from pigmentation along the rete ridges.
- A pseudo-network pattern occuring on the face results from junctional pigment outlining hair follicles.
- Pigment on the palms and soles outlines linear skin markings along or across the skin furrows resulting in a parallel, lattice, or fibrillar pattern. The pigment outlines eccrine ducts.

Pigment Network: Typical

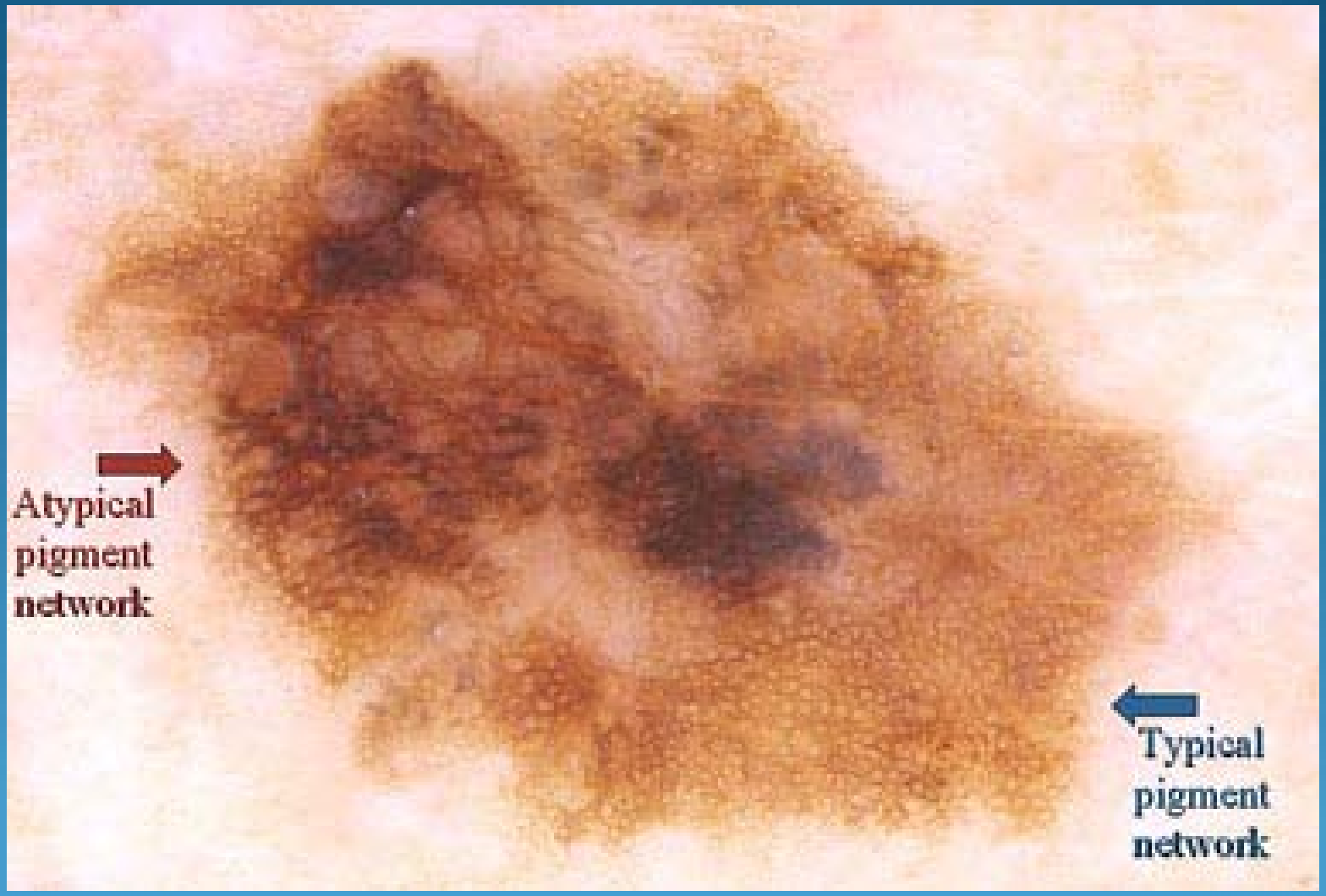
- Slowly growing benign pigmented lesions such as a lentigo or junctional nevus produce uniform network patterns.
- The lines are uniformly populated with benign pigment cells that grow at a slow rate.
- The network is homogeneous in color and usually **thins out at the periphery.**

Pigment Network: Atypical

- Melanomas consist of malignant melanocytes that vary in size and degree of pigmentation.
- Malignant cells move through the epidermis in all directions at varying rates to produce structures with bizarre patterns.
- Cells are numerous in some locations and sparse in others.

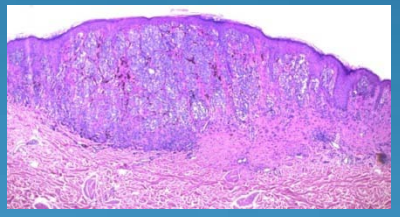
Pigment Network

- **Typical pigment network**
  - Light- to dark-brown pigment, regularly meshed and narrowly spaced network distributed more or less regularly throughout the lesion and usually thinning out at the periphery.
- **Atypical pigment network**
  - Black, brown or gray network with irregular meshes and thick lines


Atypical
pigment
network
Typical
pigment
network

Melanoma

- The rete ridges become thick and distorted.
- Thin melanomas and melanomas in situ may have only very subtle thickening and darkening of pigment network lines may be seen near the periphery in early lesions.
- As Breslow thickness increases, the lines become thick and dark. They become darker near the periphery.



The Criteria

1990 Consensus Meeting

1. Discrete Pigment Network
2. Prominent PN
3. Regular PN
4. Irregular PN
5. Wide PN
6. Narrow PN
7. Broad PN
8. Delicate PN
9. Pseudopods
10. Radial streaming
11. Brown globules

1. Black dots
2. Whitish veil
3. White scarlike areas
4. Gray - blue areas
5. Hypopigmented areas
6. Reticular depigmentation
7. Milia-like cysts
8. Comedo-like openings
9. Telangiectasia
10. Red-blue areas
11. Maple leaf-like areas

First, two steps

- **First Step:** Differentiate between melanocytic and non-melanocytic lesions
  - If not melanocytic, go to those criteria
  - Absence of all criteria suggests featureless melanoma
- **Second Step:** Differentiate between benign melanocytic lesions and melanoma
  - Choose your method

Diagnostic Algorithms for Differentiating Benign Melanocytic Lesions from Melanoma

- **Pattern Analysis**
  - Initially developed in 1990 consensus meeting
  - Modified according to Argenziano et al. Interactive Atlas of Dermoscopy 2000
- **ABCD Rule**
  - Stolz et al. Eur J Dermatol 1994
- **Menzies' Scoring Method**
  - Menzies et al. Arch Dermatol 1996
- **7-Point Checklist**
  - Argenziano et al. Arch Dermatol 1998

Pattern Analysis

Pattern Analysis

- The majority of physicians who participated in the 2001 Consensus Meeting were proponents of pattern analysis
- Pattern analysis allowed the best diagnostic performance

Pattern Analysis

1. Pigment Network
2. Global Pattern
3. Streaks
4. Dots/globules
5. Blue-white veil
6. Regression structures
7. Hypopigmented areas
8. Blotches
9. Vascular Pattern
10. Site-related features

Pigment Network

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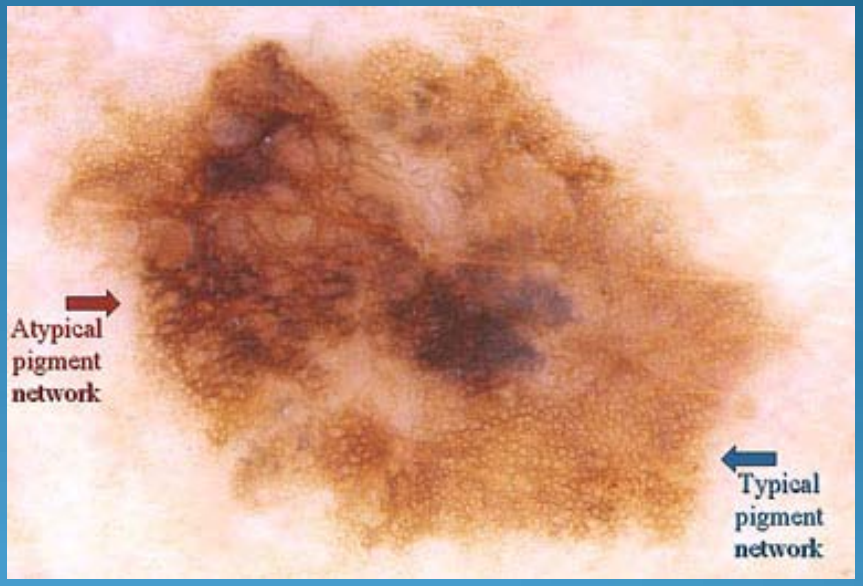
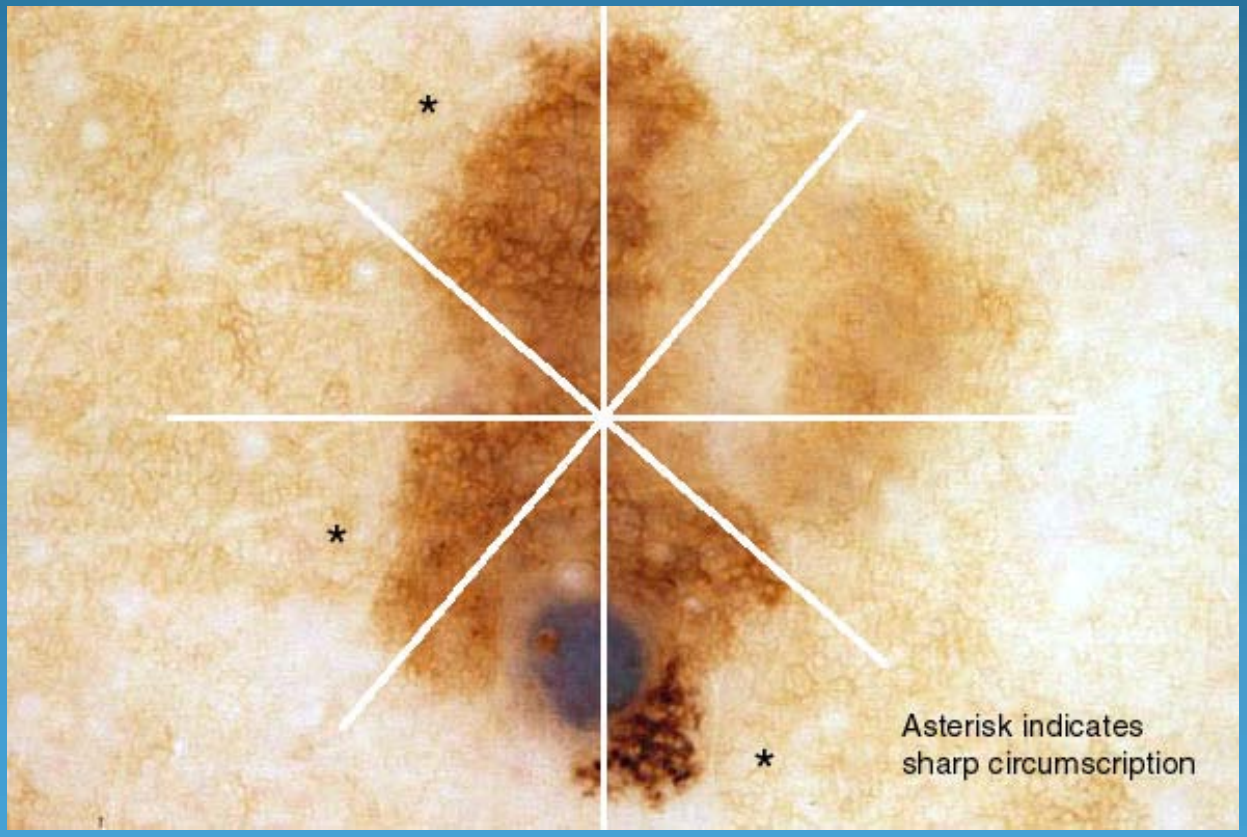
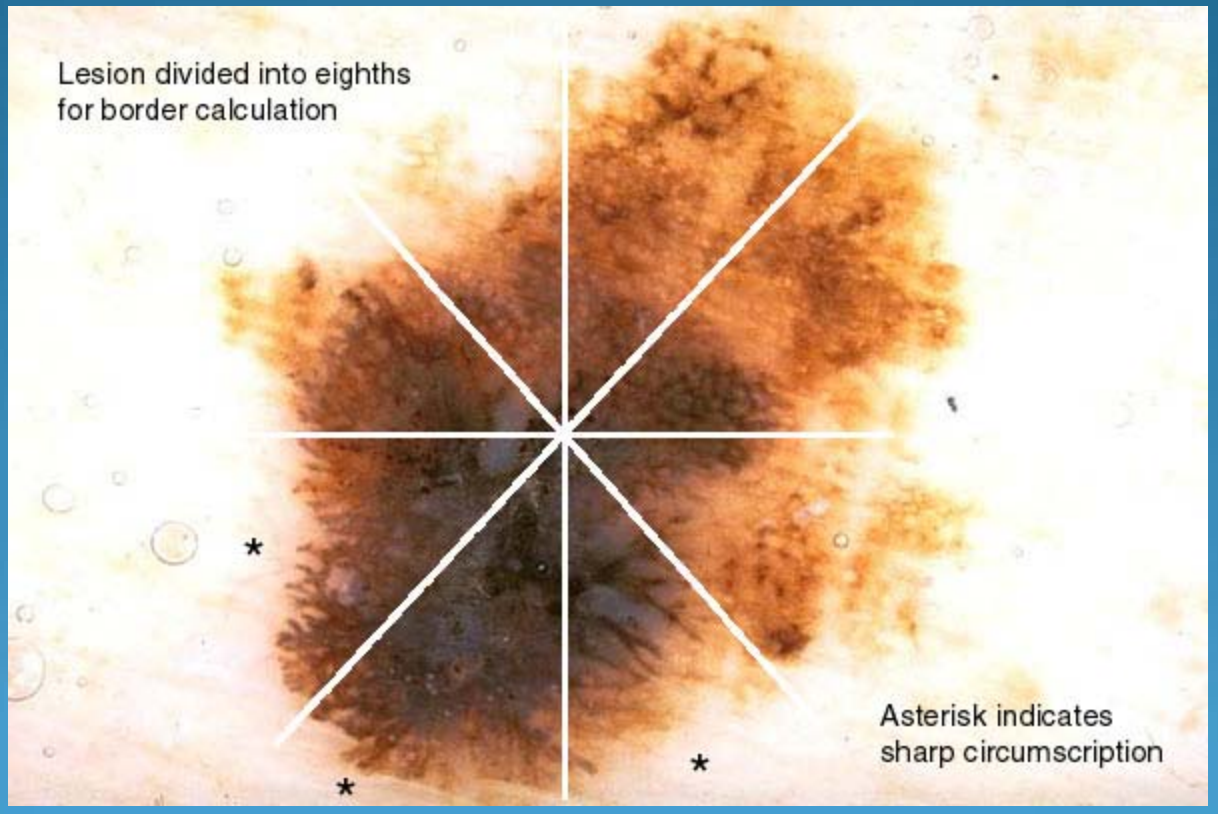


Pigment Network

- Sharp border at periphery is a bad sign



Pigment Network

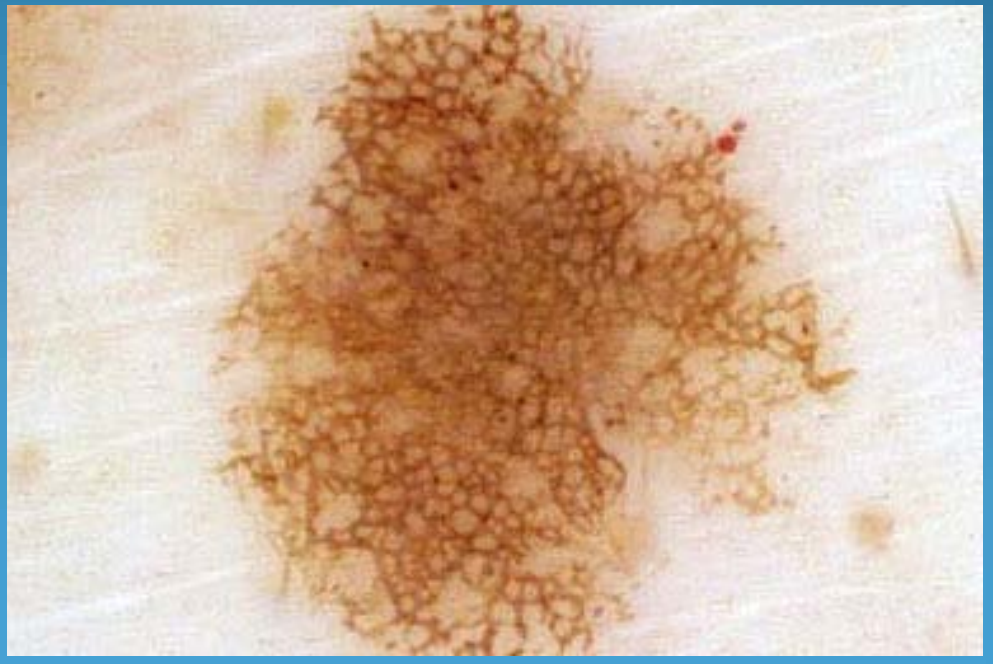


Pattern Analysis

- **Global Pattern**
  - Reticular
  - Globular
  - Cobblestone
  - Homogeneneous
  - Parallel
  - Starburst
  - Multicomponent
  - unspecific

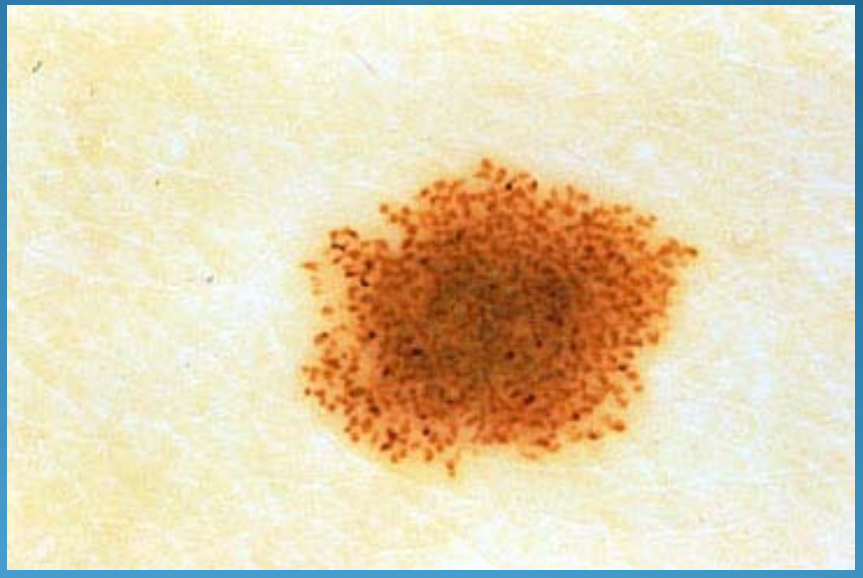
Global Pattern

- **Reticular Pattern in a Clark nevus**



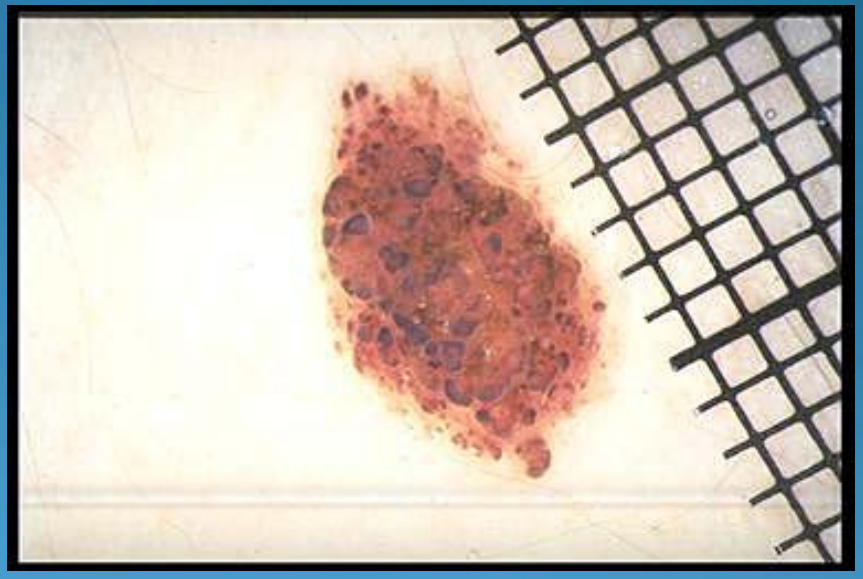
Global Pattern

- **Globular Pattern in a Clark nevus**
  - not multiple blue-gray globules



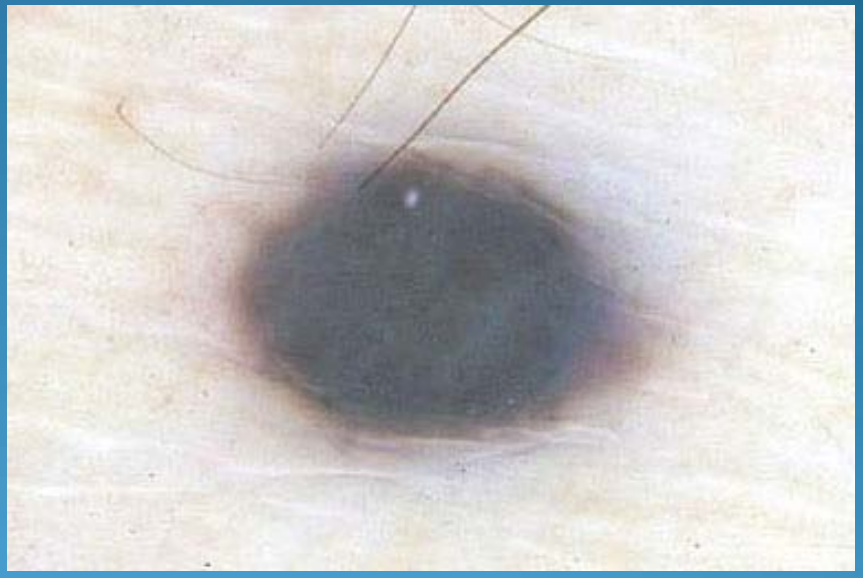
Global Pattern

- **Cobblestone pattern in a dermal nevus**



Global Pattern

- **Homogeneous blue pigmentation in a blue nevus**
  - Also seen (uncommonly) in some hemangiomas and basal cell carcinomas and (commonly) in intradermal melanoma metastases.

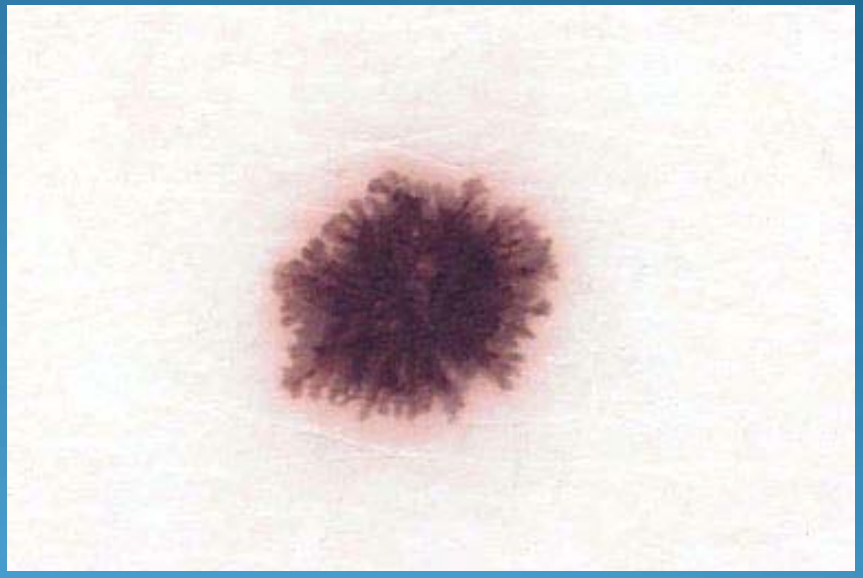


Global Pattern

- **Parallel pattern in an acral nevus**
  - on palms/soles and mucosal areas

Global Pattern

- **Starburst pattern in a Reed nevus/Spitz Nevus**

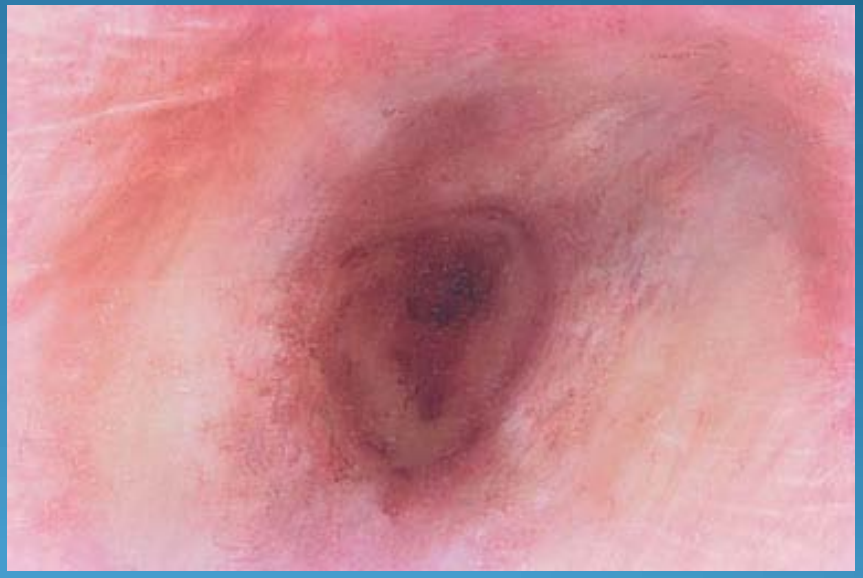


Global Pattern

- **Multicomponent pattern in a melanoma**
  - **(presence of 3 or more distinctive features)**

Global Pattern

- **Unspecific pattern in a melanocytic nevus**



Pattern Analysis

1. Pigment Network
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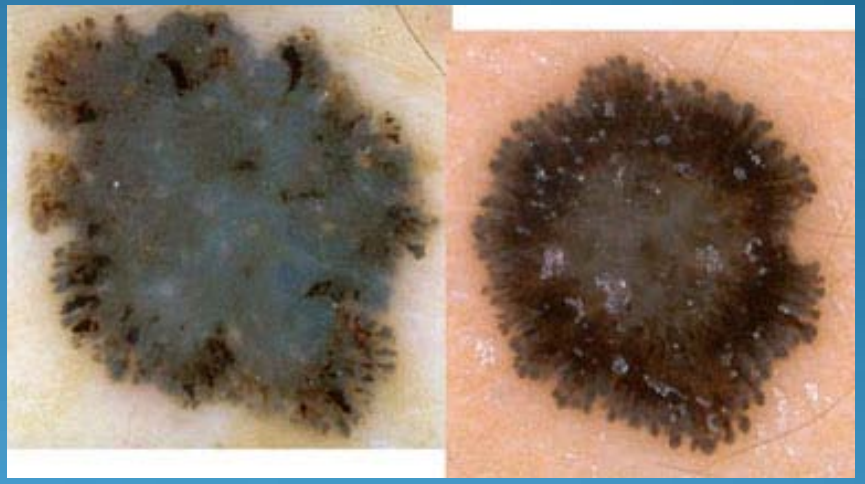
3. Streaks
4. Dots/globules
5. Blue-white veil
6. Regression structures
7. Hypopigmented areas
8. Blotches
9. Vascular Pattern
10. Site-related features

Streaks

- Also called **radial streaming** and **pseudopods**
- Linear structures
- Regularly or irregularly distributed at the edge of the lesion and not clearly associated with pigment network lines
- Correlate histopathologically to confluent junctional nests of melanocytes or streaming melanoma cells into the surrounding epidermis.

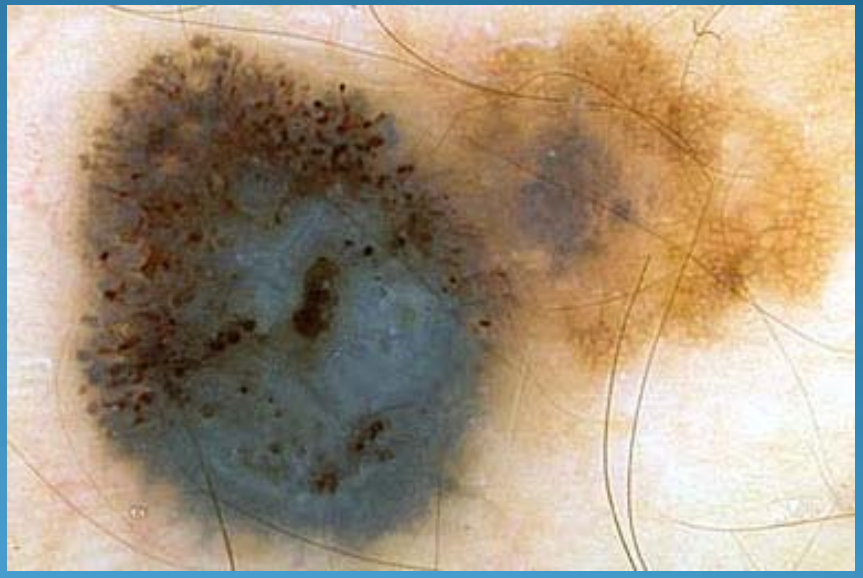


Dots and Globules

- Black, brown, and/or gray color
- Round to oval, variously sized and shaped structures
- Regularly or irregularly distributed within the lesion
- Brown globules and black dots may be considered as a single criterion
- Histologically represent clumps of melanin, melanocytes or melanophages

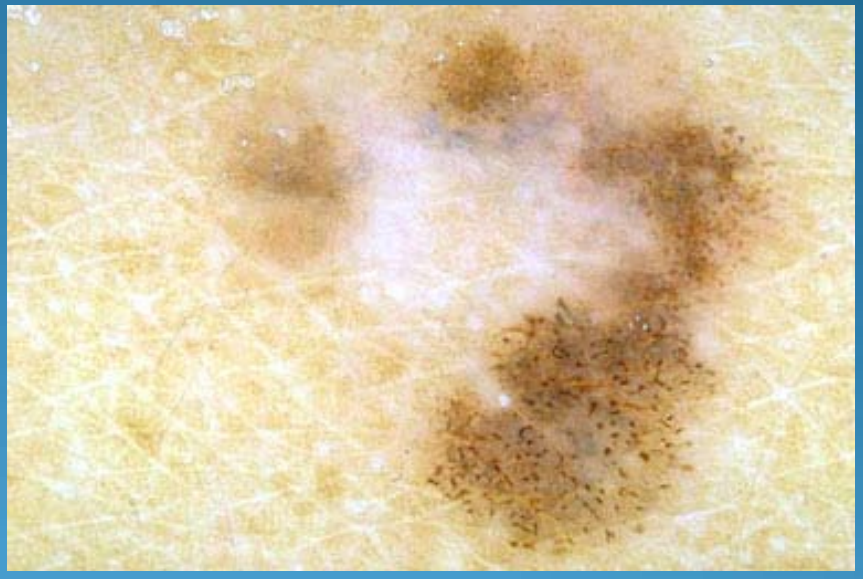
Blue-white Veil

- Irregular, confluent, gray-blue to whitish-blue diffuse pigmentation
- Histologicaly correlate with an acanthotic epidermis with compact orthokeratosis and hypergranulosis overlying a large melanin containing structure such as confluent nests, clusters of melanophages, or fibrosis



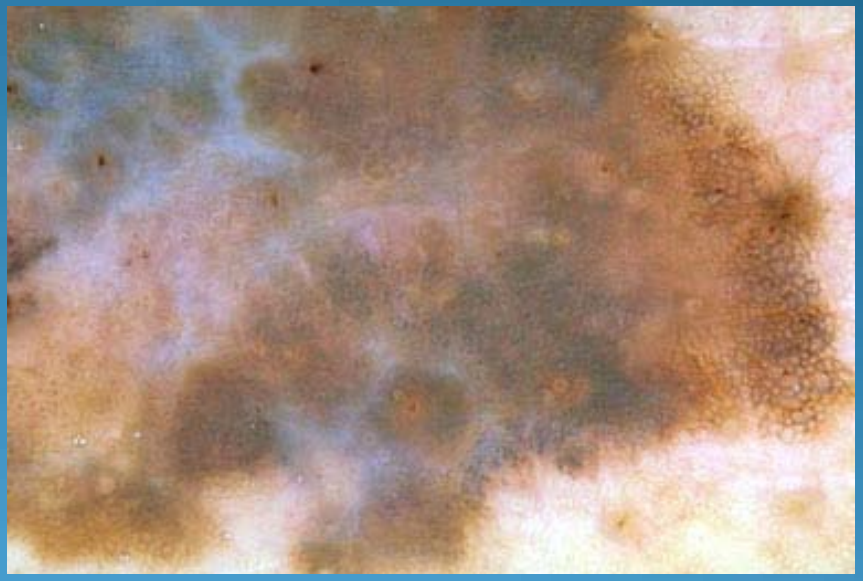
Regression Structures

- White areas and blue areas are considered together, reflecting the two main morphologic aspects of regression (fibrosis and melanosis)
- White areas (white scarlike areas) and blue areas (gray-blue areas, peppering, multiple blue-gray dots) are commonly associated, resulting in blue-white areas that can be indistinguishable from blue-white veil



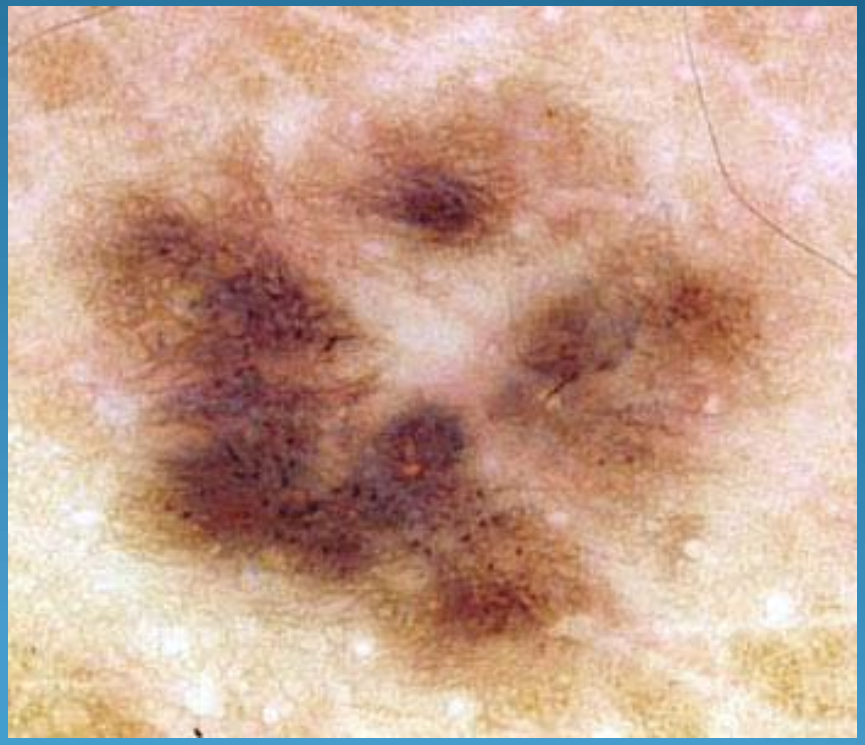
Regression Structures

- **Melanoma with intermingled white areas (fibrosis) and blue areas (melanosis.)**
- **Note that the blue-white areas are indistinguishable from blue-white veil.**



Hypopigmentation

- Diffuse or localized (focal and multifocal) areas of decreased pigmentation
- Commonly seen in benign lesions
- Do not confuse with blue-white structures
- This is a Clark nevus

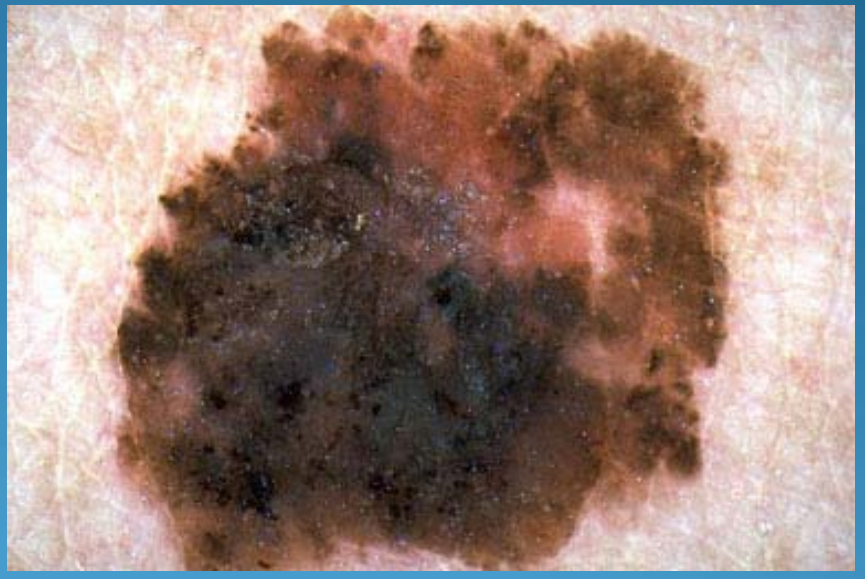


Hypopigmentation

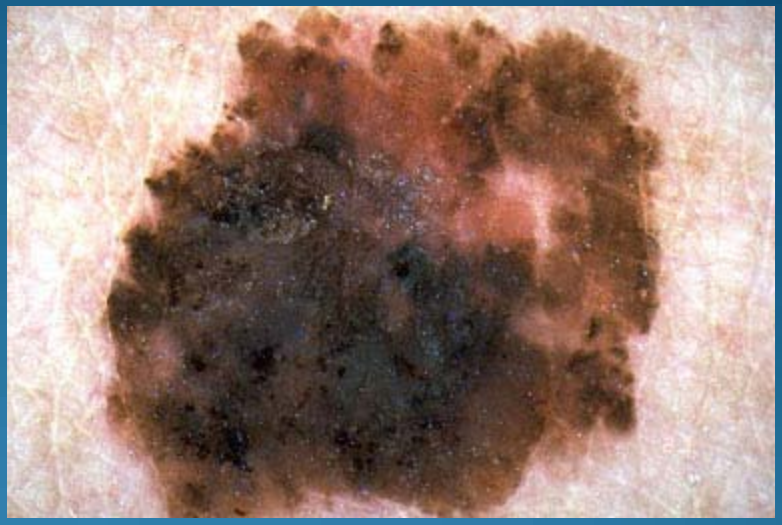
- Two more Clark nevi

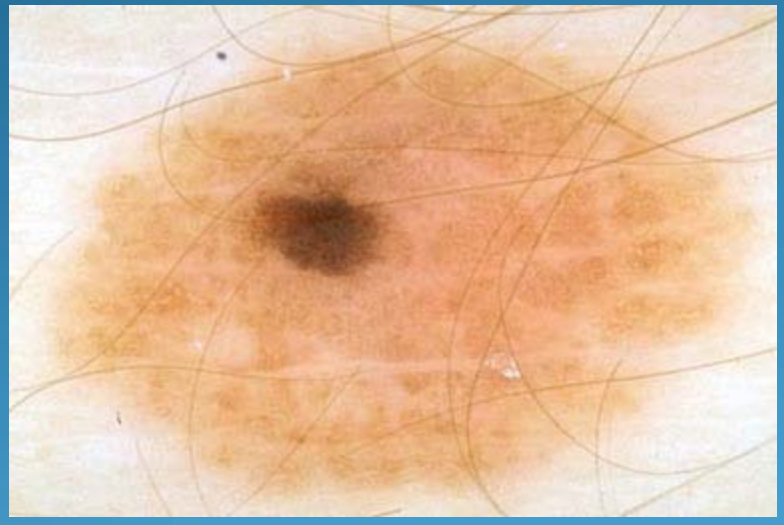
Blotches

- Black, brown, and/or gray, localized or diffuse pigmented areas with **regular or irregular** shape
- A well demarcated blotch at the periphery of a lesion is suggestive of melanoma
- Diffuse regular blotches suggest benign lesion



Blotches





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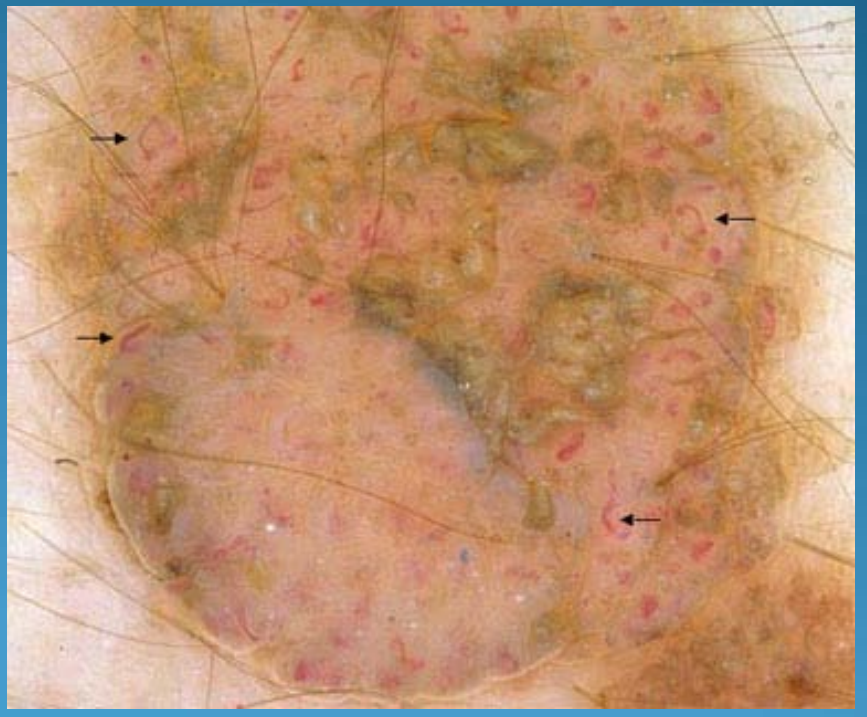
10. Site-related features

Vascular Pattern

- **Comma-like vessels in a dermal nevus**

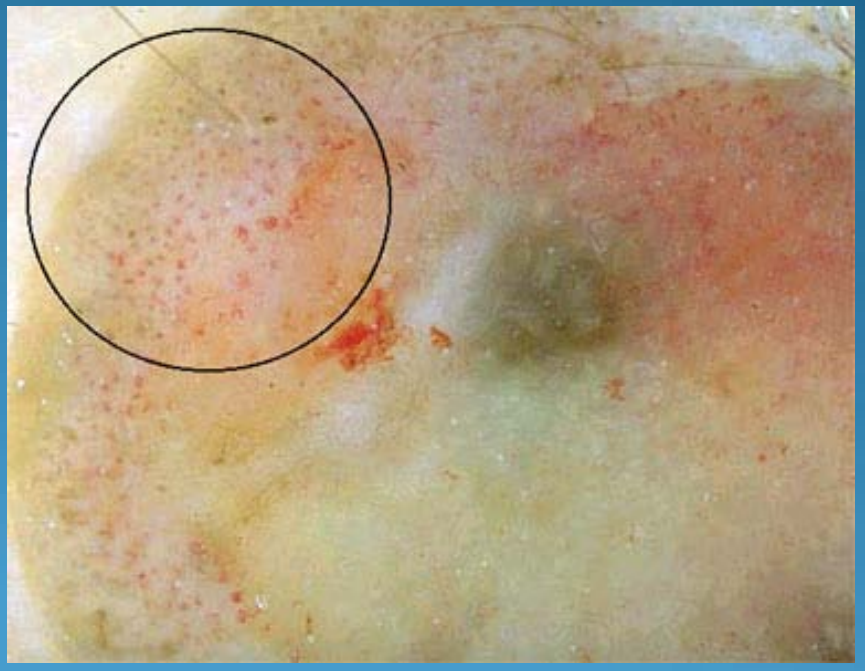


Vascular Pattern

- **Hairpin vessels in a melanoma**

Vascular Pattern

- **Dotted vessels in a melanoma**

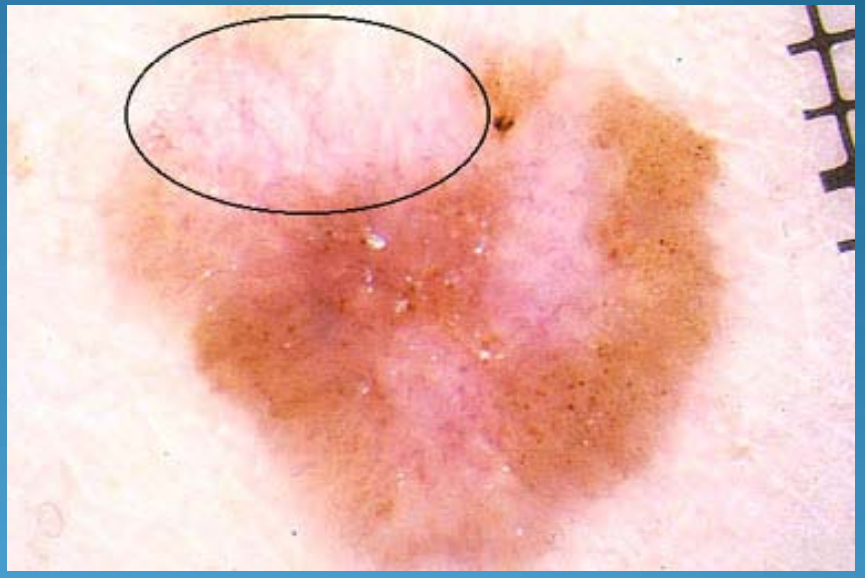


Vascular Pattern

- **Linear-irregular vessels in a melanoma**

Vascular Pattern

- **Vessels within regression structures in a melanoma**



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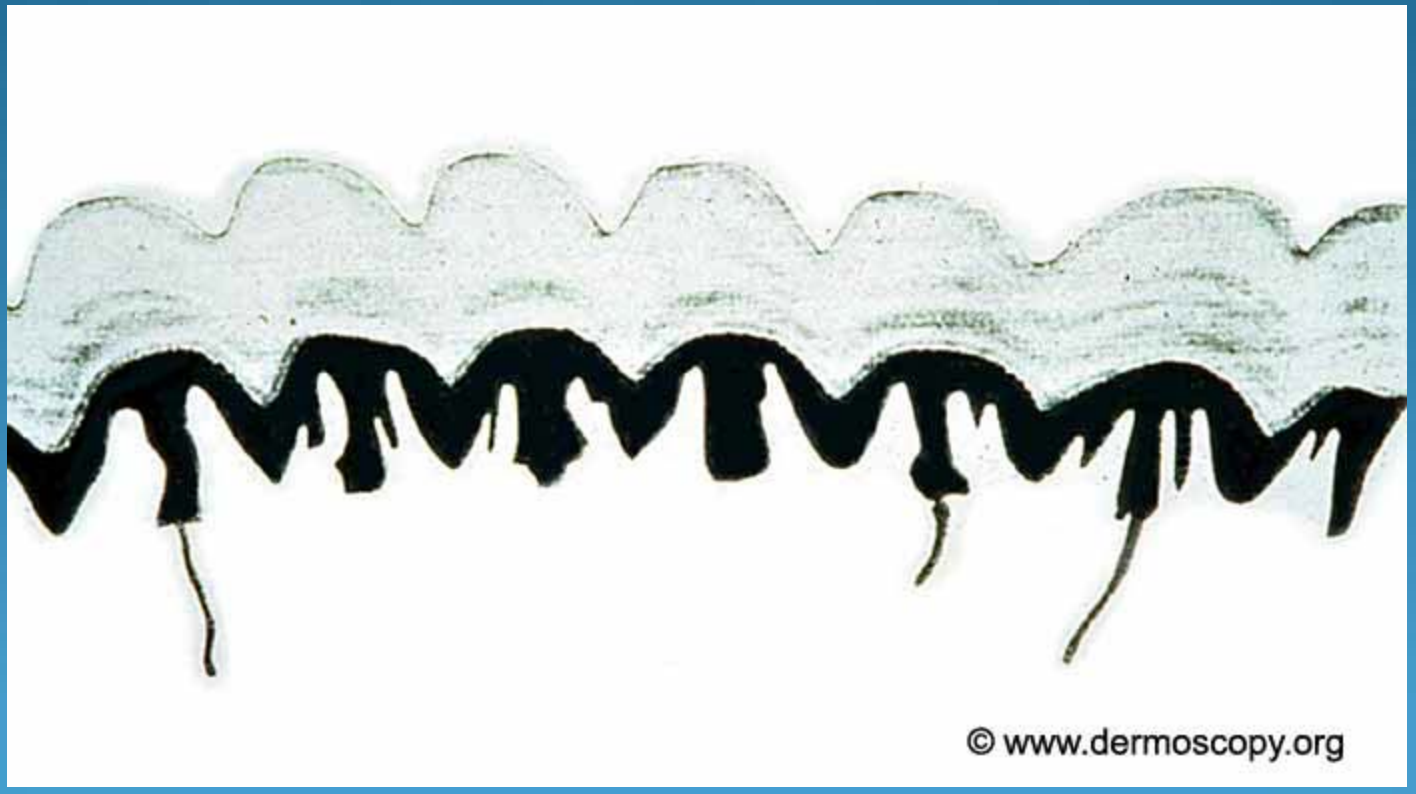
    1. Acral
    2. Facial

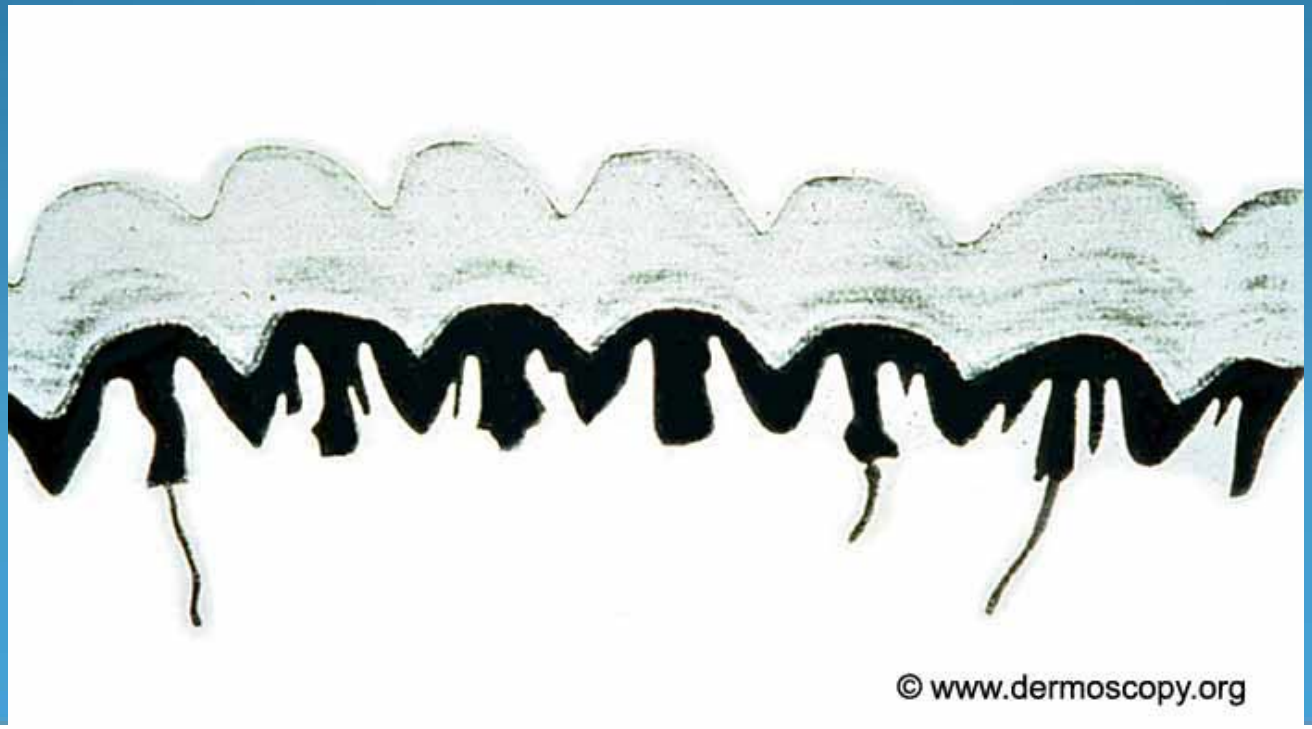
Acral Nevus

- Parallel-furrow pattern
  - Pigmentation following the sulci superficiales. The most common dermoscopic pattern in acral melanocytic nevi
  - Furrow=sulci=good

Acral Nevi



KU Medical Center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Acral Nevus

- Lattice-like pattern
  - Pigmentation following and crossing the furrows in acral melanocytic nevi

Acral Nevus

- Fibrillar pattern
  - Numerous, finely pigmented filaments perpendicular to the furrows in acral melanocytic nevi

Acral Nevus

- Acral congenital nevus showing parallel furrow pattern.

Acral Nevus

- Parallel-ridge pattern in a melanoma in situ
  - Pigmentation aligned along the cristae superficiales. Commonly found in melanoma in situ and in early invasive melanomas of palms and soles
  - Cristae=ridge=bad

Facial Lentigo

Facial melanocytic lesions

- **Lentigo Maligna:** atypical pseudonetwork consisting of the following:
  - **Annular-granular structures**
    - Multiple blue-gray dots surrounding the follicular ostia with an annular-granular appearance
  - **Gray pigment pseudonetwork**
    - Gray pigmentation surrounding the follicular ostia, formed by the confluence of annular-granular structures
  - **Rhomboidal structures**
    - Gray-brown pigmentation surrounding the follicular ostia with a rhomboidal appearance
  - **Asymmetric pigmented follicles**
    - Eccentric annular pigmentation around follicular openings

Facial melanocytic lesions

- **Rhomboidal structures (green arrow), annular-granular structures (black arrows), and asymmetric pigmented follicles (circle) in a lentigo maligna**

Facial melanocytic lesions

- **Gray pseudonetwork in a lentigo maligna**

The Not-So-Simple

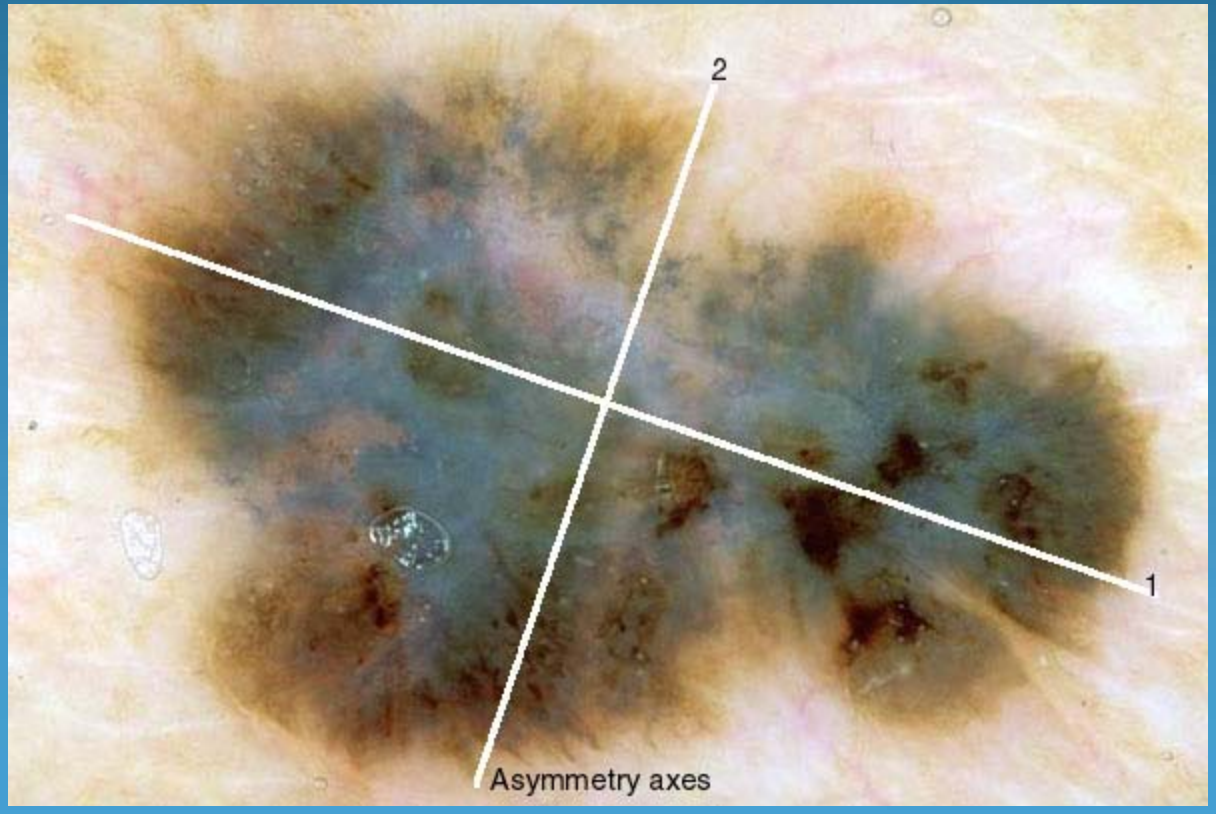
ABCD Rule
Stolz et al. Eur J Dermatol 1994

- Each of the criteria is multiplied by a given weight factor to yield a total dermoscopy score (TDS).
- **Asymmetry**
  - Lesion is bisected by two 90º axes and symmetry is assessed with regard to shape, colors and dermoscopic structures (each asymmetric axis gets a point)
- **Border**
  - The lesion is divided into eighths, and the pigment pattern is assessed (a sharp cut-off gets a point)

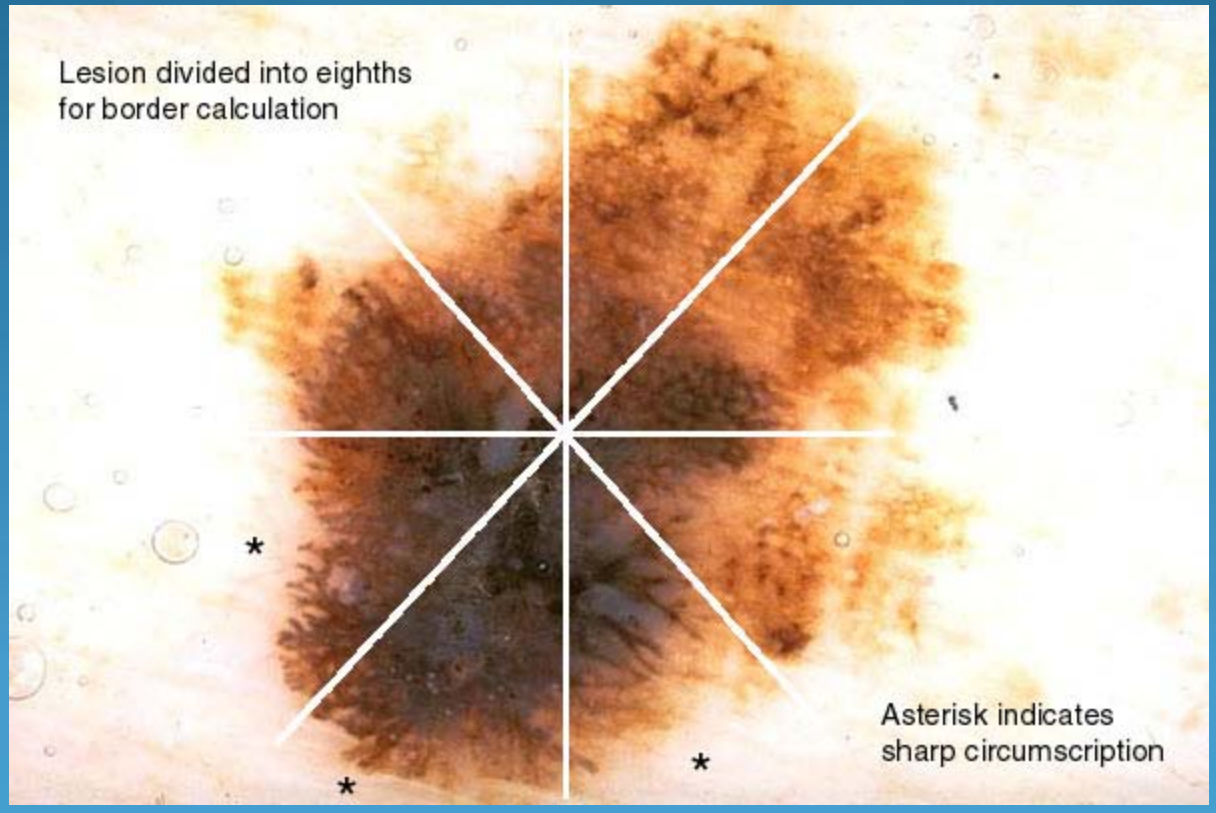
ABCD Rule

- **Color**
  - Six different colors are counted in determining the color score: white, red, light brown, dark brown, blue-gray, and black.
- **Dermoscopic structures**
  - Evaluation of dermoscopic structures focuses on 5 structural features: network, structureless (or homogeneous) areas, branched streaks, dots, and globules.

ABCD Rule: Asymmetry



ABCD Rule: Border



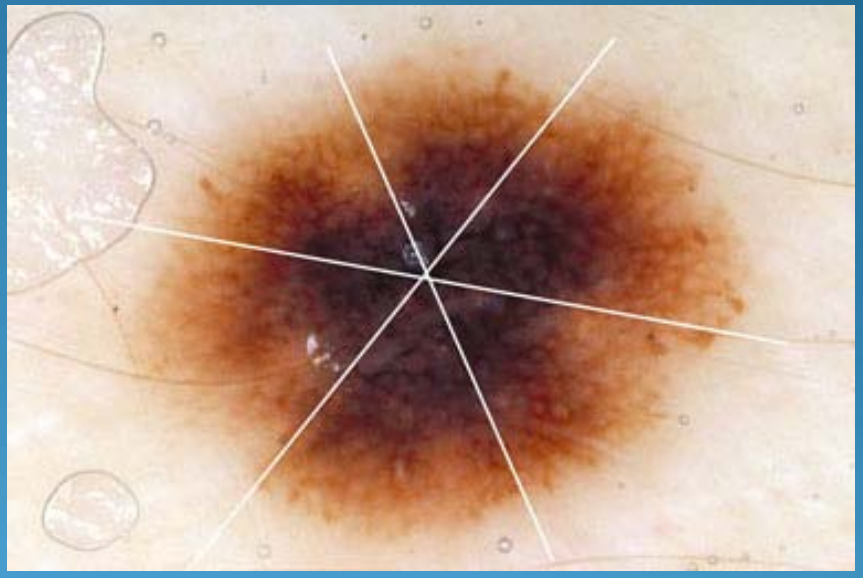
Menzies' Method

Menzies et al. Arch Dermatol 1996

- **Negative features (Cannot be present)**
  - Symmetry of pattern
  - Presence of a single color
- **Positive features (At least one must be present)**
  - Blue-white veil
  - Multiple brown dots
  - Pseudopods
  - Radial streaming
  - Scar-like depigmentation
  - Peripheral black dots/globules
  - Multiple (5-6) colors
  - Multiple blue/gray dots
  - Broadened network

Menzies' Method

- **Symmetry of pattern**
  - Required across all axes through the lesion's center of gravity (center of the lesion).
- **Symmetry of pattern does not require shape symmetry.**



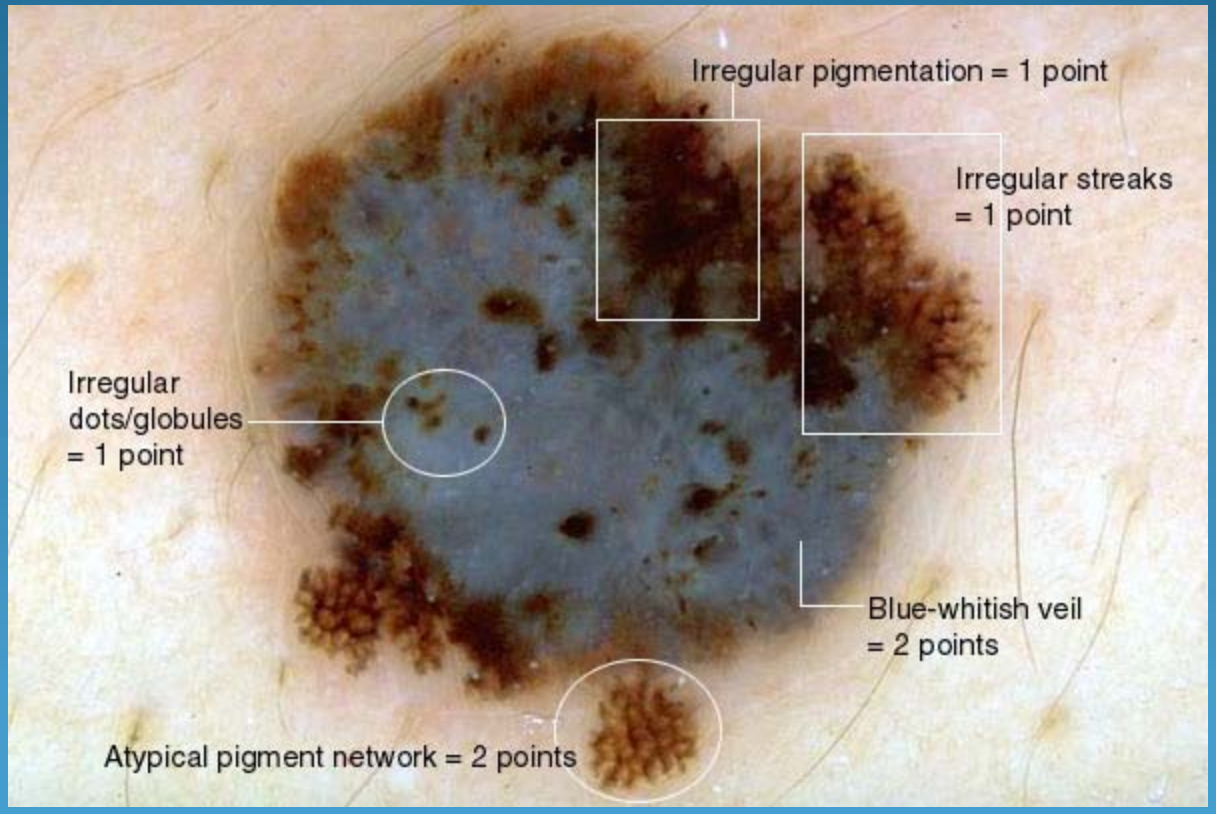
Menzies' Method

- **Presence of a single color**
  - Negative Feature
- **Multiple (5-6) colors**
  - Positive Feature
  - The colors scored are black, gray, blue, dark brown, tan and red. White is not scored as a color.

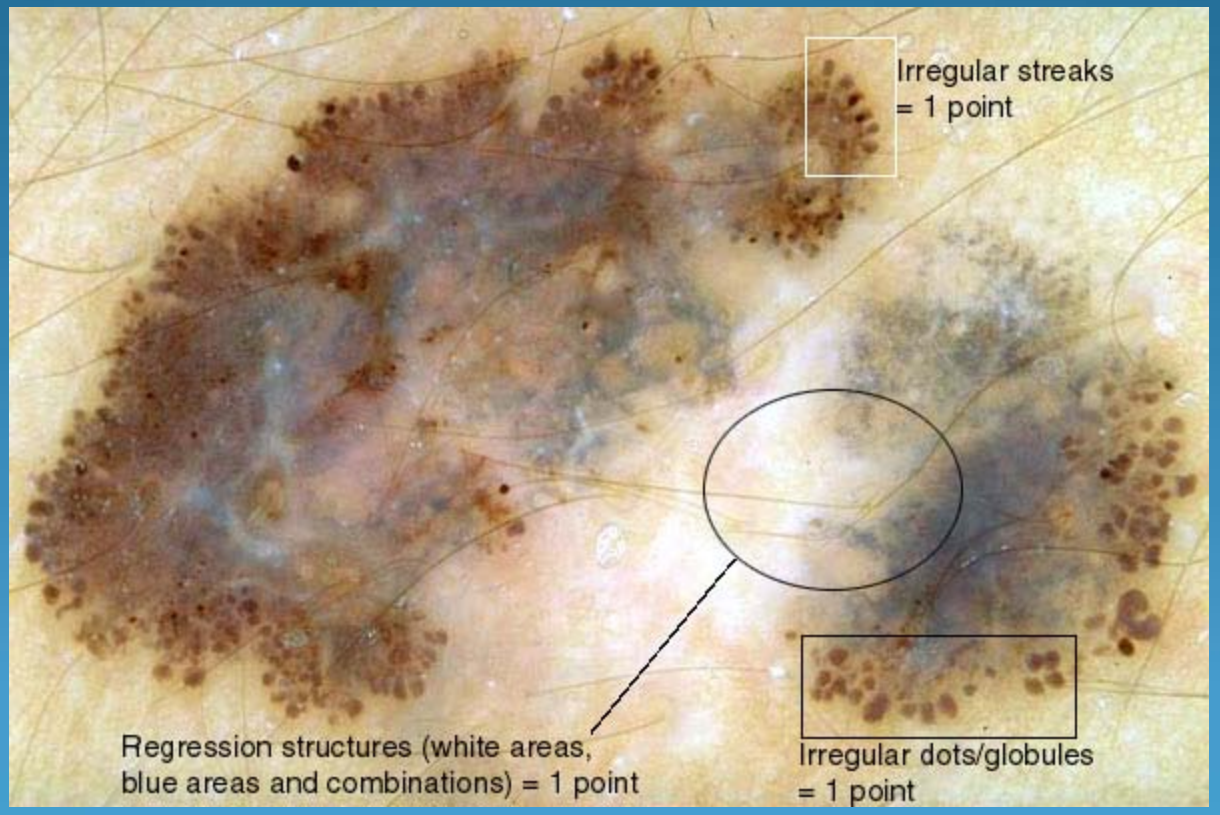
7-Point Checklist

- **Major criteria:**
  - Atypical pigment network
  - Blue-whitish veil
  - Atypical vascular pattern
- **Minor criteria:**
  - Irregular streaks
  - Irregular pigmentation
  - Irregular dots/globules
  - Regression structures
- **A minimum total score of 3 is required for the diagnosis of melanoma**

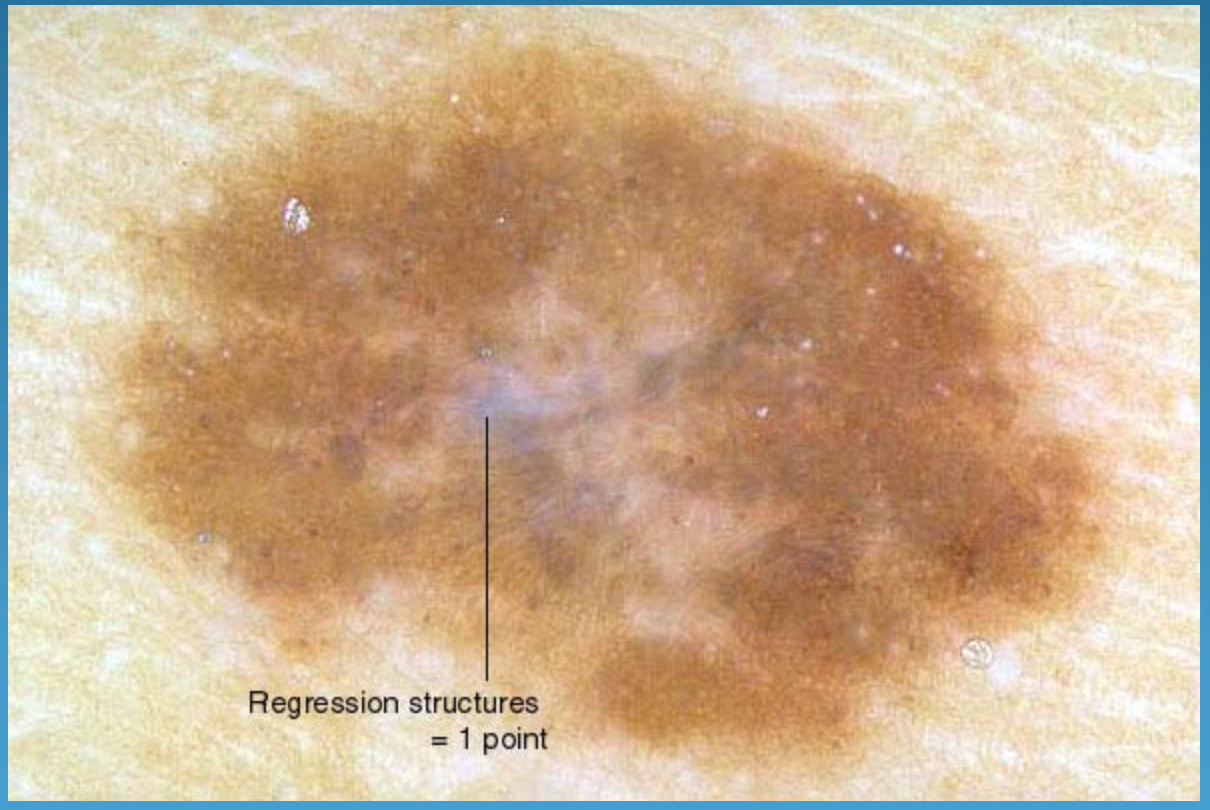
7-Point Checklist



7-Point Checklist



7-Point Checklist



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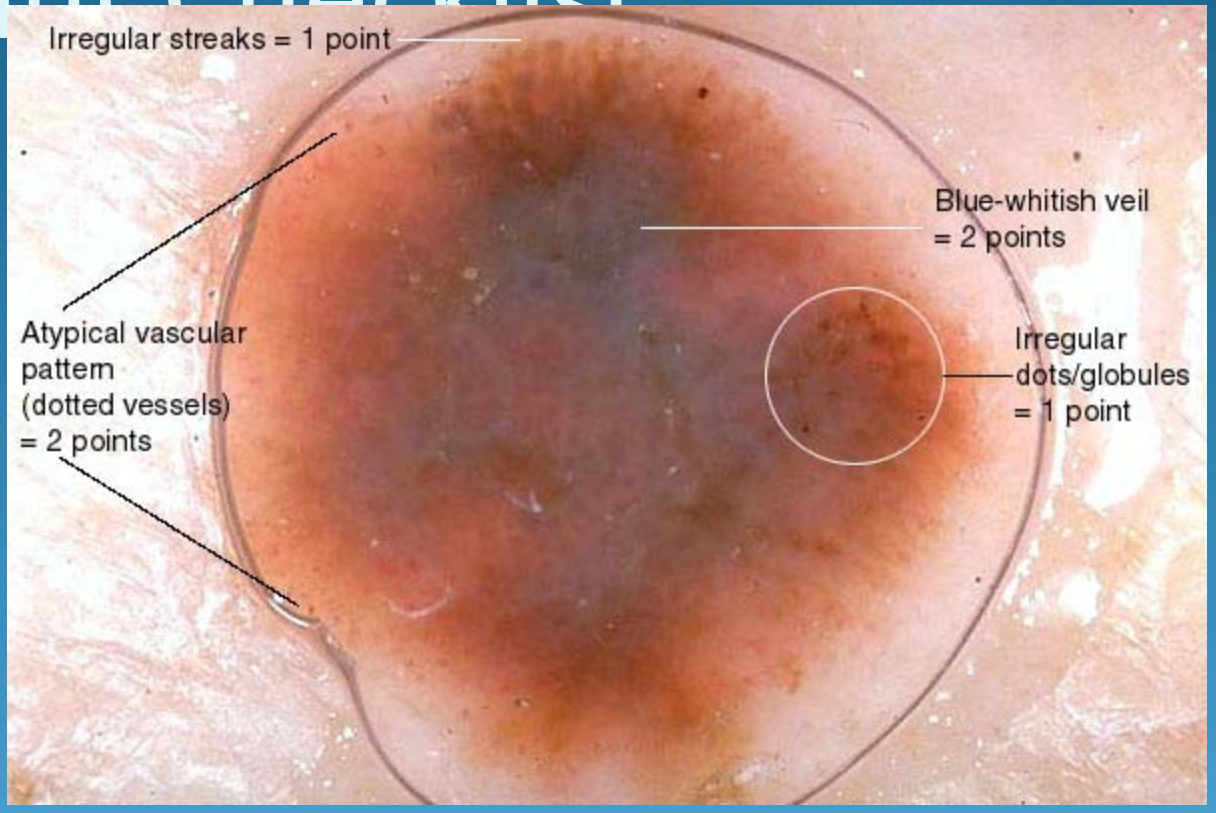
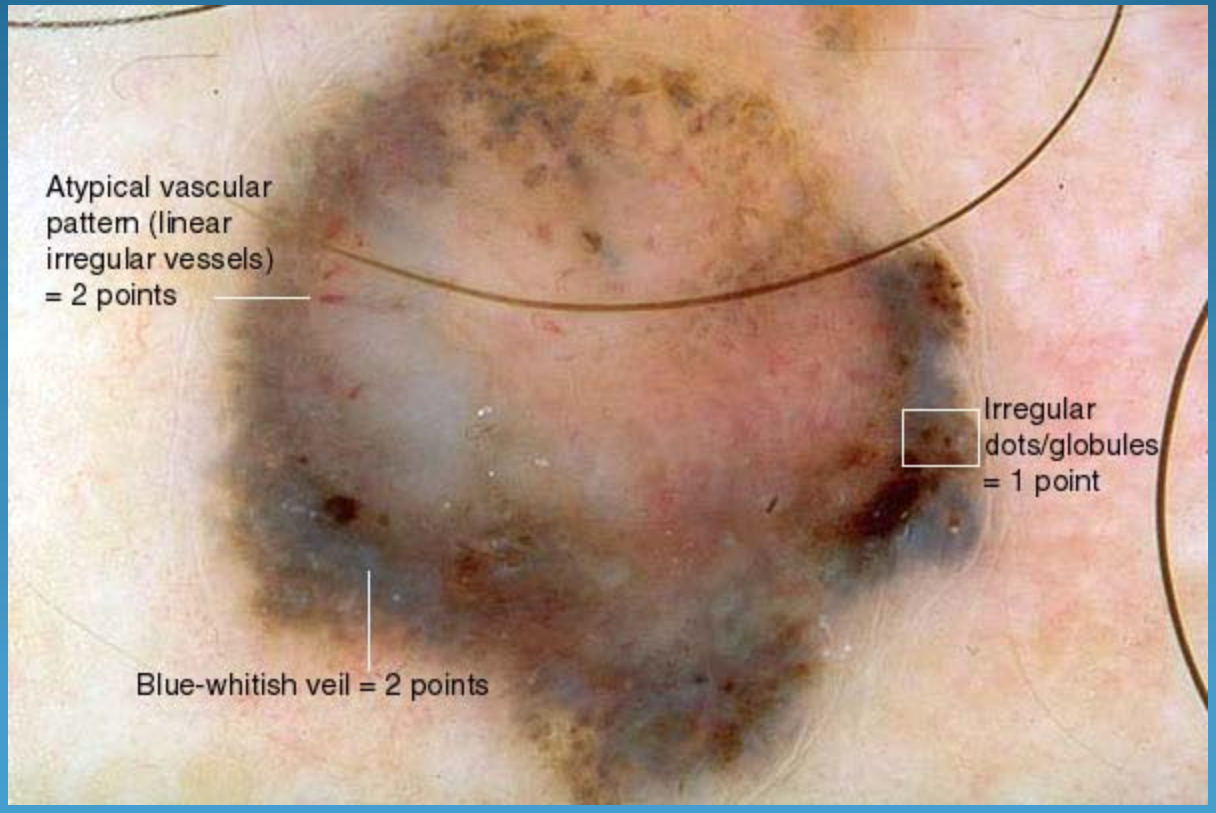


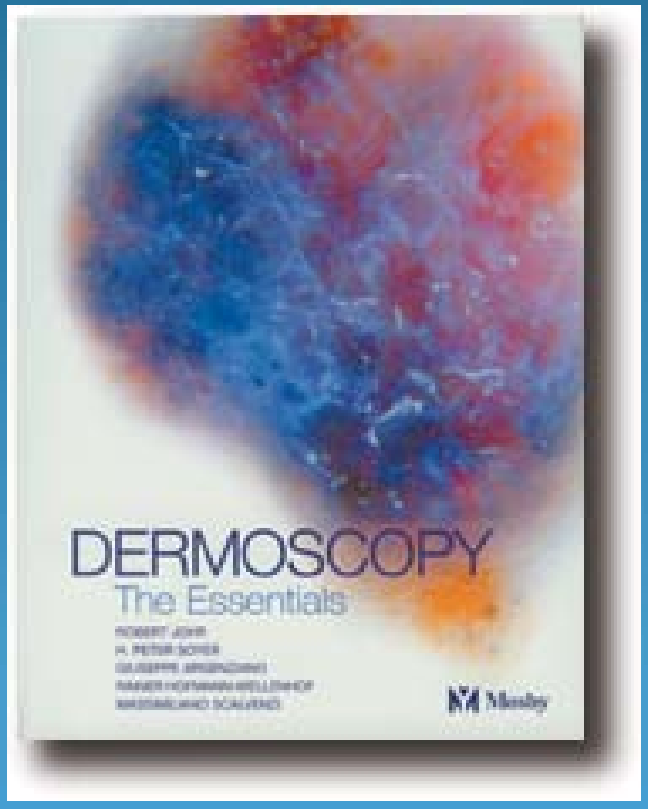
7-Point Checklist



The Simple

The three point checklist

in Johr, Soyer, Argenziano, et al : Dermoscopy, The Essentials



The three point checklist

- **"For the novice dermoscopist, the primary goal of dermoscopy is to determine whether a suspicious lesion should be biopsied or excised."**
- 3 groups of melanomas
  1. those that can be easily diagnosed with the unaided eye
  2. those that are missed by examination with the unaided eye but can be diagnosed by dermoscopy
  3. those that can be diagnosed neither with the unaided eye nor dermoscopically.

The three point checklist

- Designed to be used as a **screening** method (not a diagnostic algorithm)
  - Sensitivity is MUCH higher than specificity
- Excise all lesions with a score of 2 or 3

The three point checklist

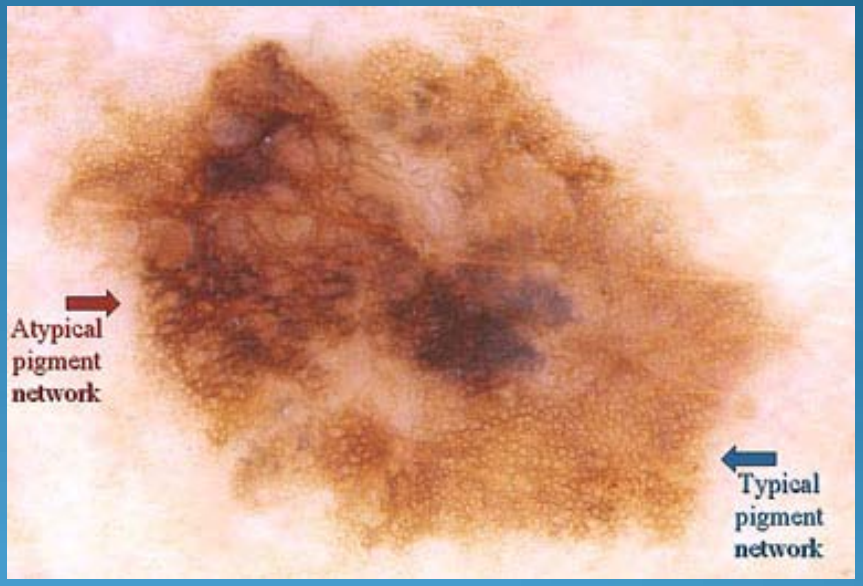
- **Asymmetry**
  - Asymmetry of *color and structure* in one or two perpendicular axes
- **Atypical Network**
  - Pigment network with irregular holes and thick lines
- **Blue-White Structures**
  - Any type of blue or white color
  - A combination of the categories of blue-white veil and regression structures

The three point checklist

- **2001 Consensus Net Meeting on Dermoscopy**
  - Argenziano G, Soyer HP, Chimenti S, et al. JAAD 2003;48:679-93
  - The presence of any two of these criteria indicates a high likelihood of melanoma

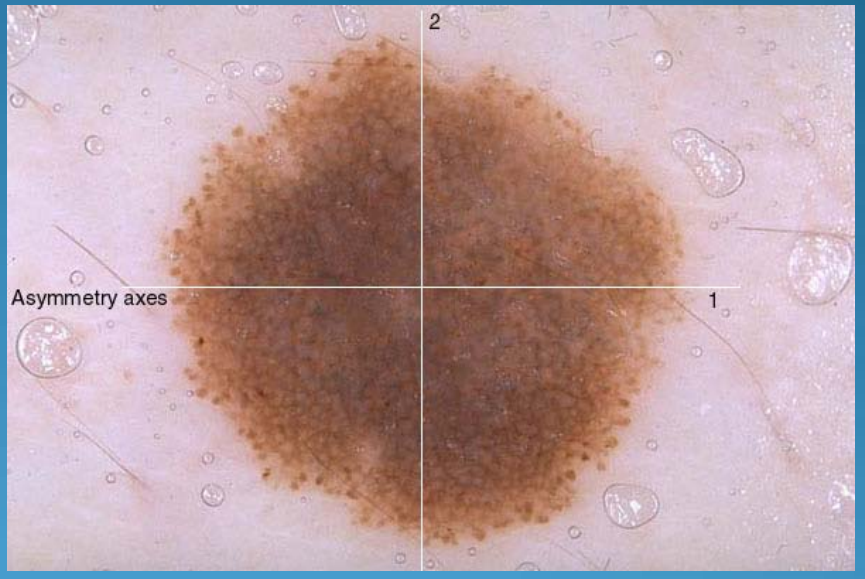
Pigment Network

- **Typical pigment network**
  - Light- to dark-brown pigment, regularly meshed and narrowly spaced network distributed more or less regularly throughout the lesion and usually thinning out at the periphery.
- **Atypical pigment network**
  - Black, brown or gray network with irregular meshes and thick lines

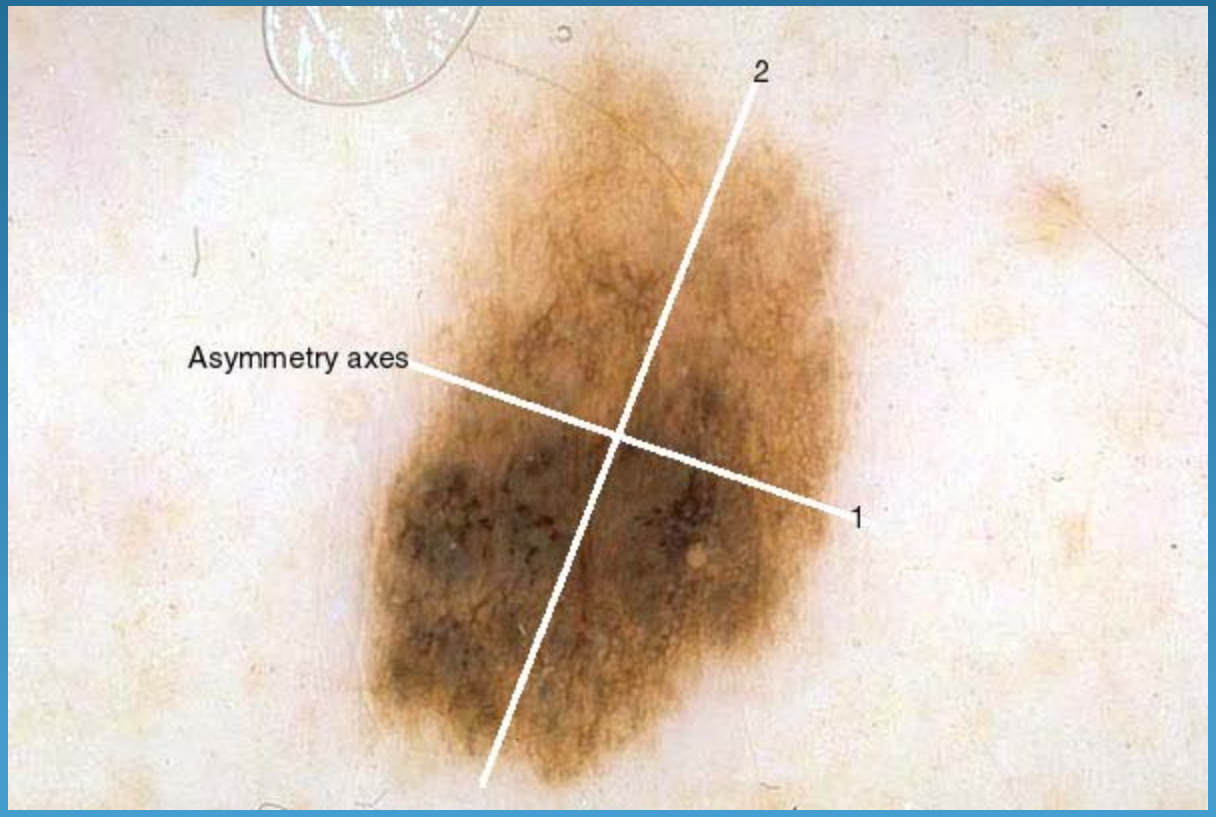


Asymmetry

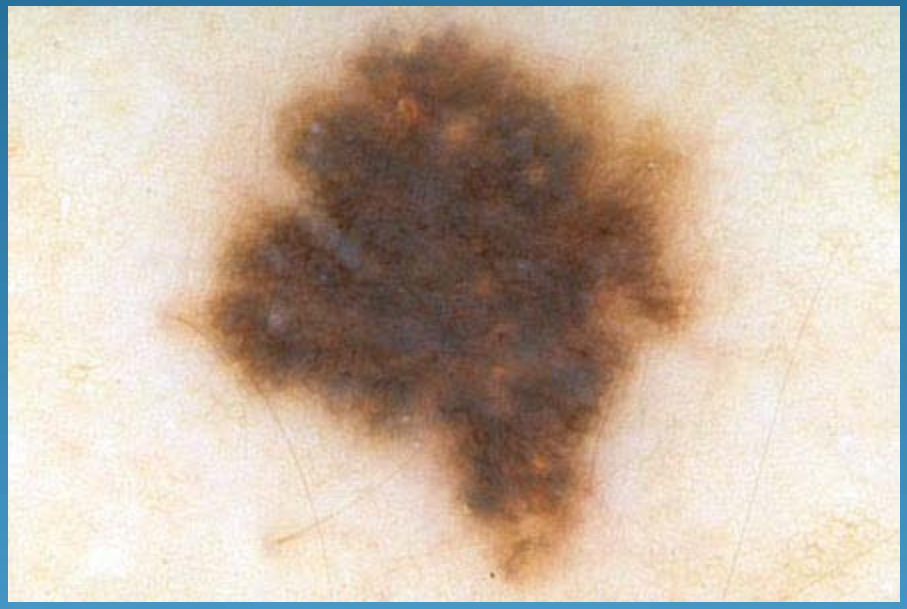
- Lesion is bisected by two 90º axes
- Can be asymmetric with regard to shape, colors and/or structures



Asymmetry



Symmetrical?



Symmetrical?

Diagnosis of melanoma using five melanoma-specific local criteria

- **Atypical Pigment Network**
- **Irregular streaks**
- **Irregular dots and globules**
- **Irregular blotches**
- **Blue-white structures**

Can all be seen in benign or malignant tumors, but are more specific for malignant. Excise for one or more criteria.

The Rest

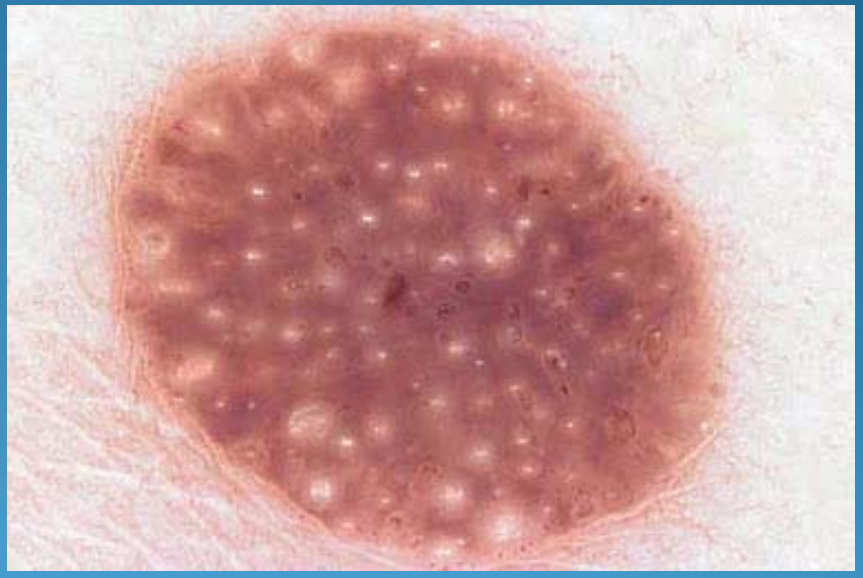
Non-melanocytic lesions

Criteria for seborrheic keratosis

- **Multiple milia-like cysts**
- **Comedo-like openings**
  (irregular crypts)
- **Light-brown fingerprint-like structures**
- **Fissures/ridges**
  (brain-like appearance)

Seborrheic Keratosis

- **Milia - like cysts in a seborrheic keratosis**

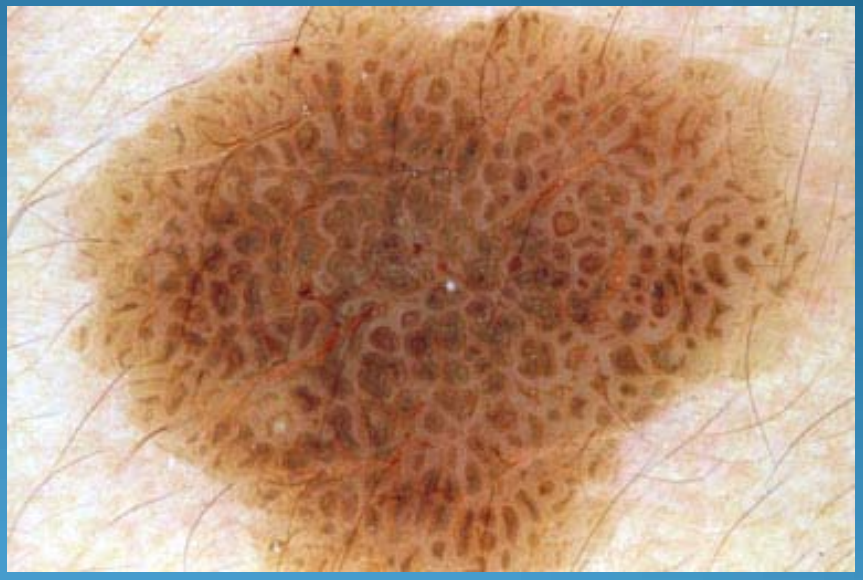


Seborrheic Keratosis

- **Comedo - like openings in a seborrheic keratosis**

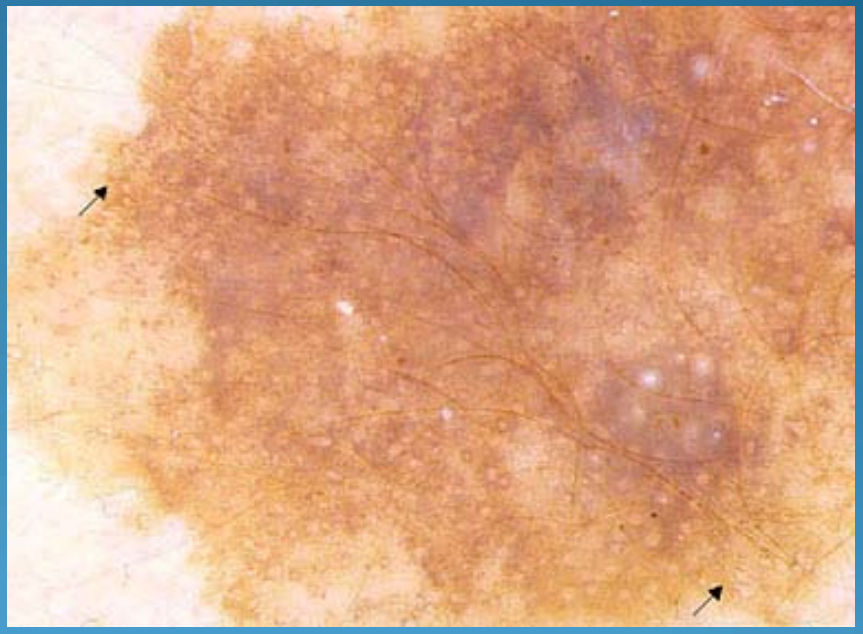
Seborrheic Keratosis

- **Irregular crypts (brain - like appearance with fissures and ridges) in a seborrheic keratosis**



Seborrheic Keratosis

- **Light-brown fingerprint - like structures**



Criteria for basal cell carcinoma

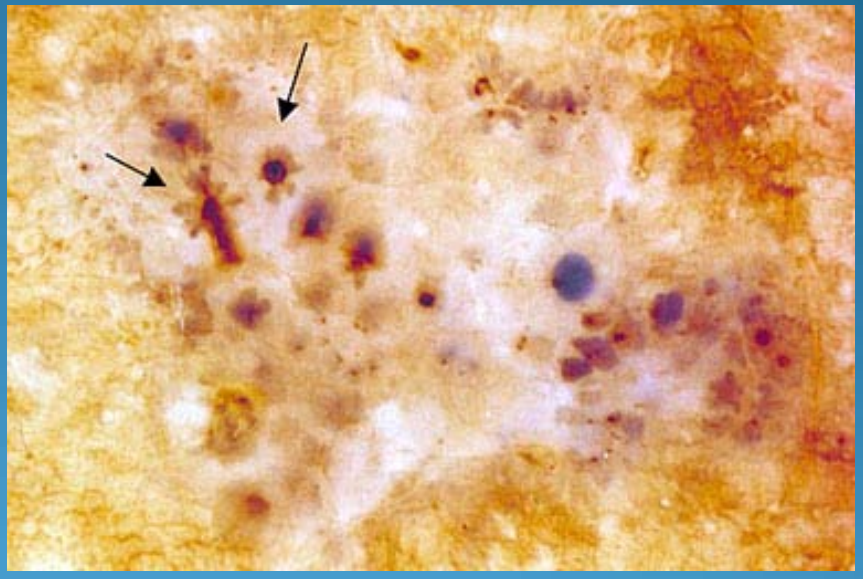
- **Negative Feature: Absence of pigment network**
- **Positive Features:**
  - **Leaf-like areas**
  - **Spoke wheel areas**
  - **Large blue-gray ovoid nests**
  - **Multiple blue-gray globules**
  - **Arborizing vessels**
  - **Ulceration**

Basal cell carcinoma

- **Leaf - like areas** are brown to gray-blue discrete bulbous extensions forming a leaf - like pattern.
- They should be distinguished from pseudopods.

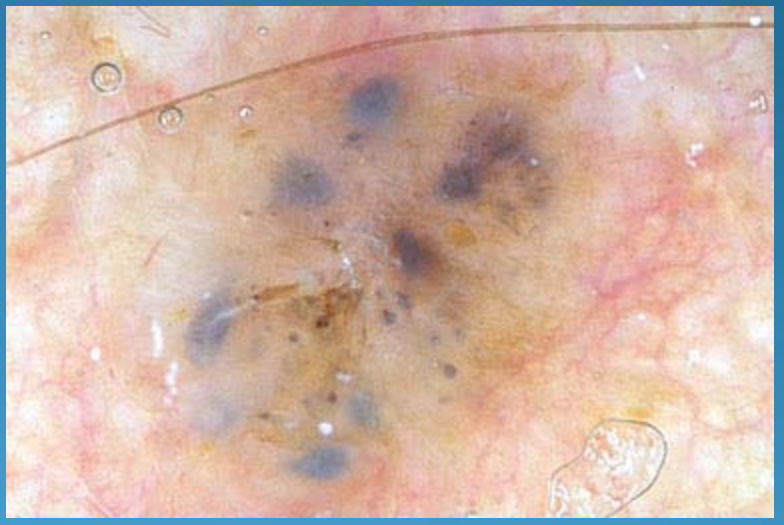
Basal cell carcinoma

- **Spoke wheel areas** are well circumscribed radial projections, usually tan in color but sometimes blue or gray, meeting at an often darker (dark brown, black or blue) central axis.



Basal cell carcinoma

- **Large blue - gray ovoid nests** are well circumscribed pigmented ovoid bodies, larger than globules, and not associated with a pigmented network

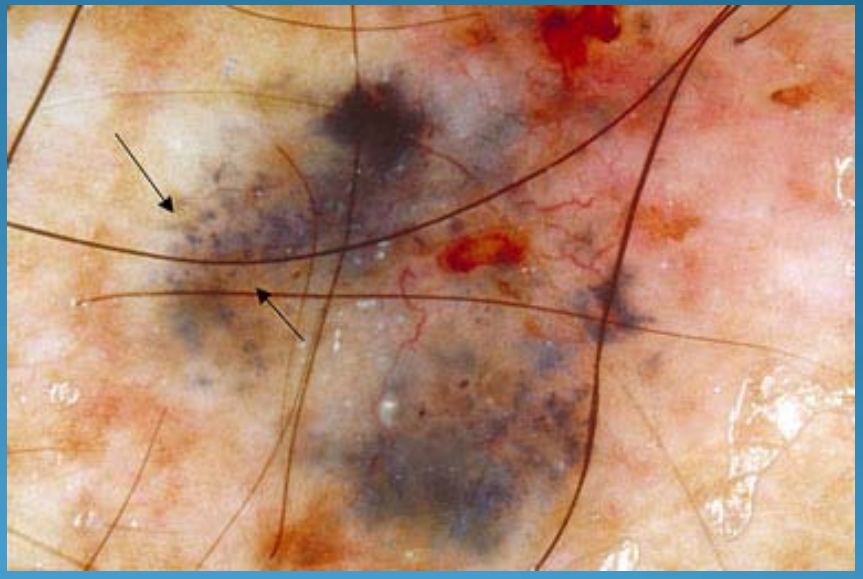


Basal cell carcinoma

- **Large blue - gray ovoid nests**

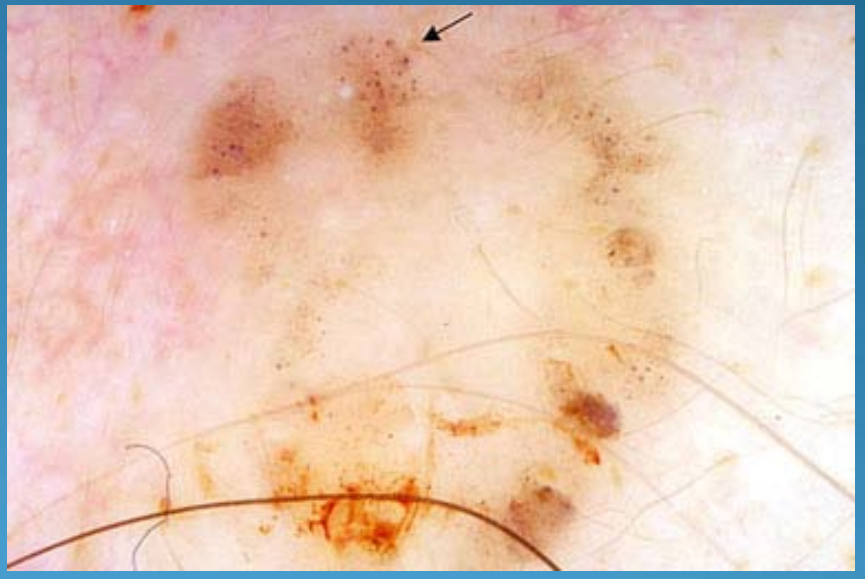
Basal cell carcinoma

- **Multiple blue-gray globules**
- **Arborizing vessels** are telangiectasias with distinct "tree - like" branching
- **Ulceration**



Basal cell carcinoma

- **Multiple blue-gray globules** are multiple globules (not dots). These are small but do not have the finer "pepper-like" morphology seen with multiple blue-gray dots (melanophages).

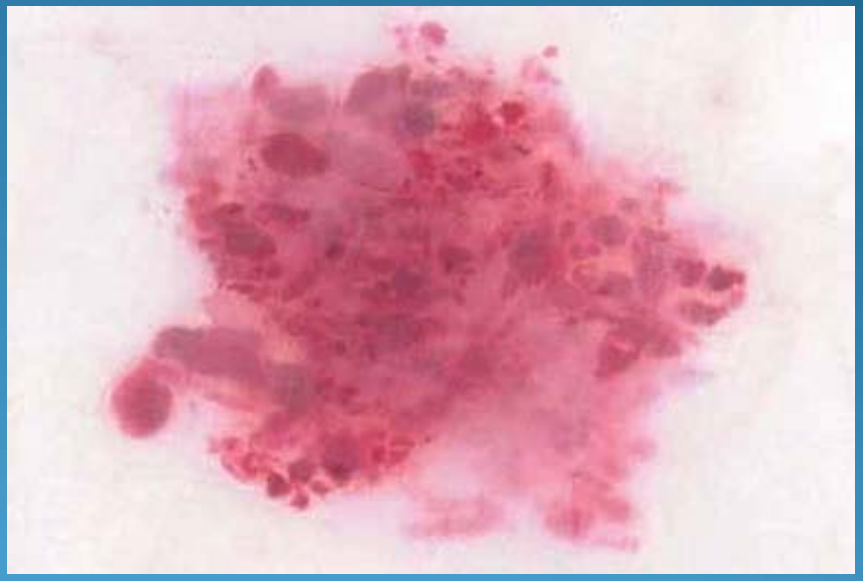


Criteria for vascular lesion

- **Red-blue lacunas**
- **Red-bluish to red-black homogeneus areas**

Vascular lesion

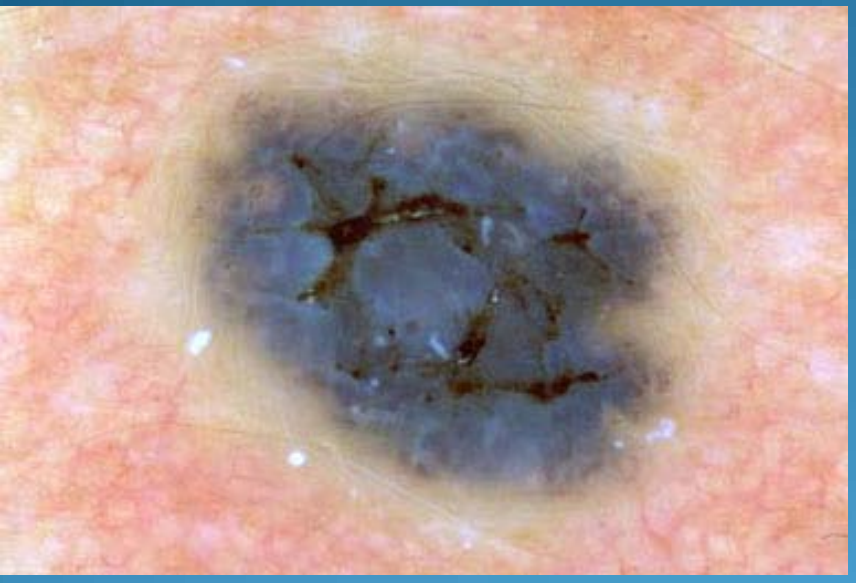
- **Red - blue lacunas in an angioma**



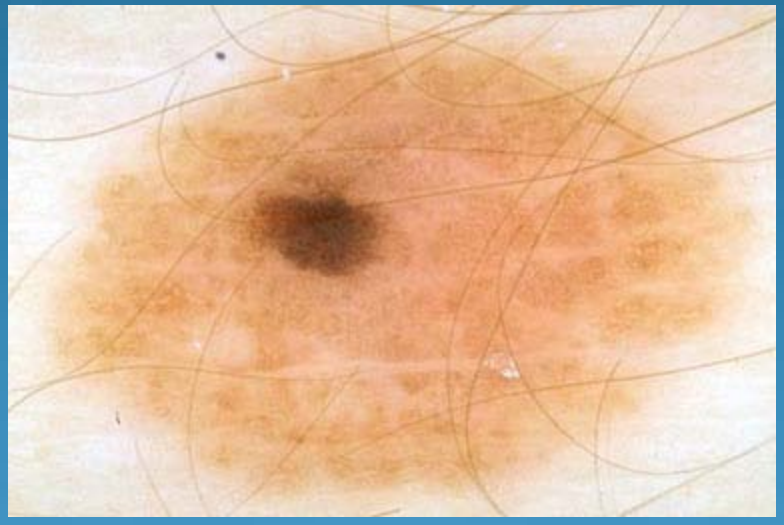
Vascular lesion

- **Red - black homogeneous areas in a black heel**

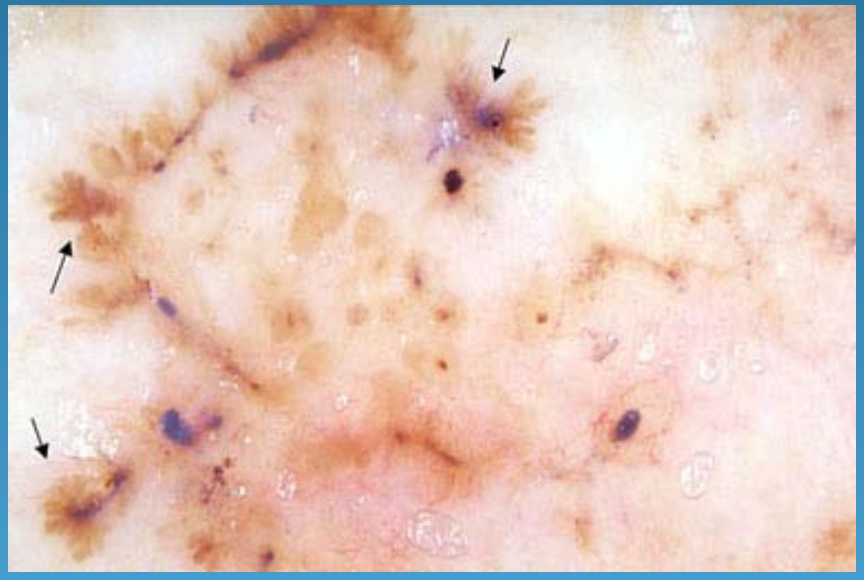
Diagnosis?



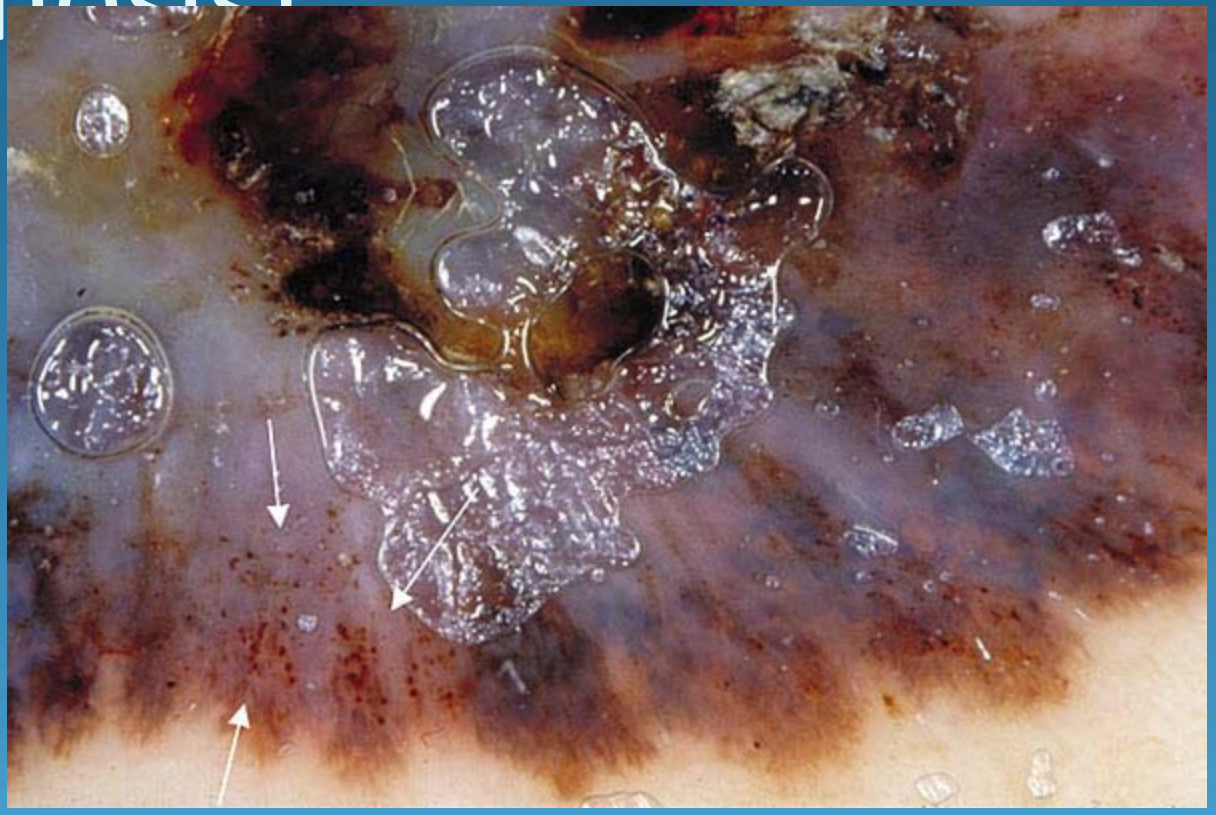
Diagnosis?



Diagnosis?



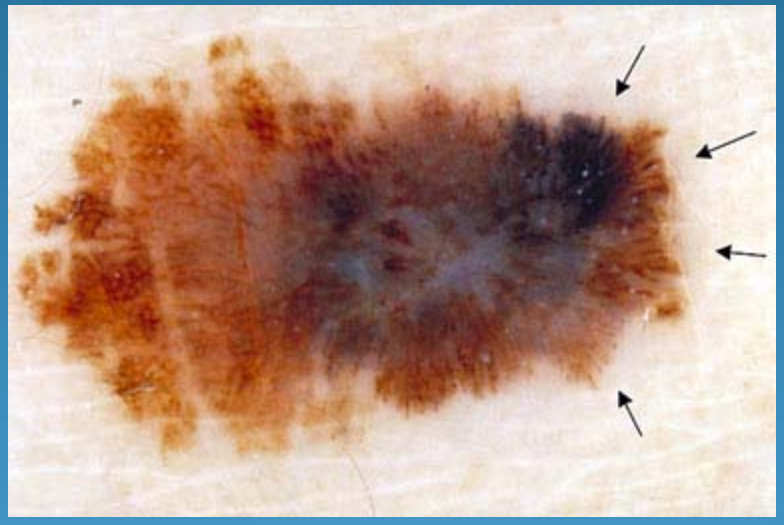
Diagnosis?



Diagnosis?

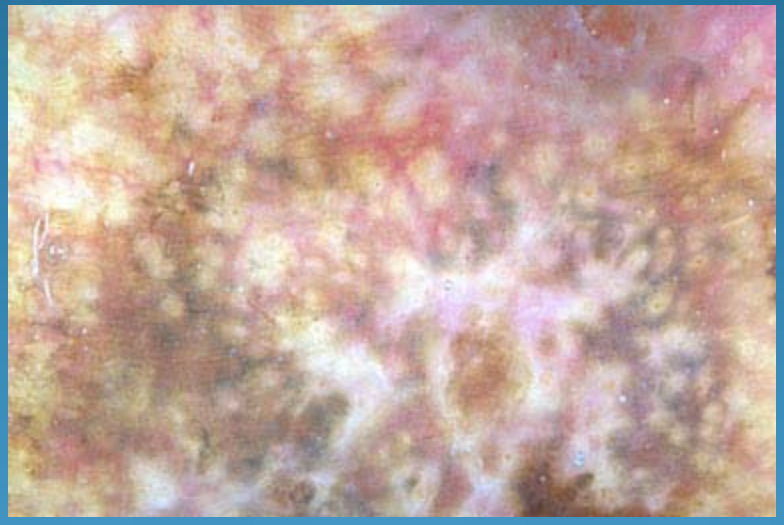
Diagnosis?

Diagnosis?



Diagnosis?

Diagnosis?



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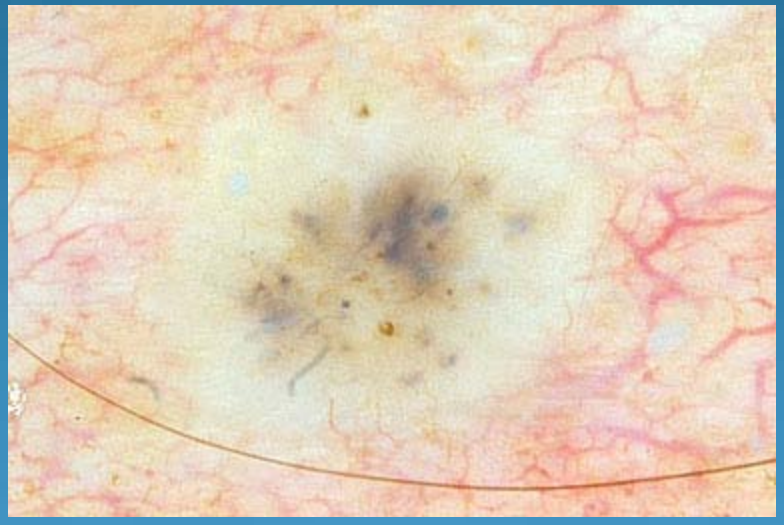
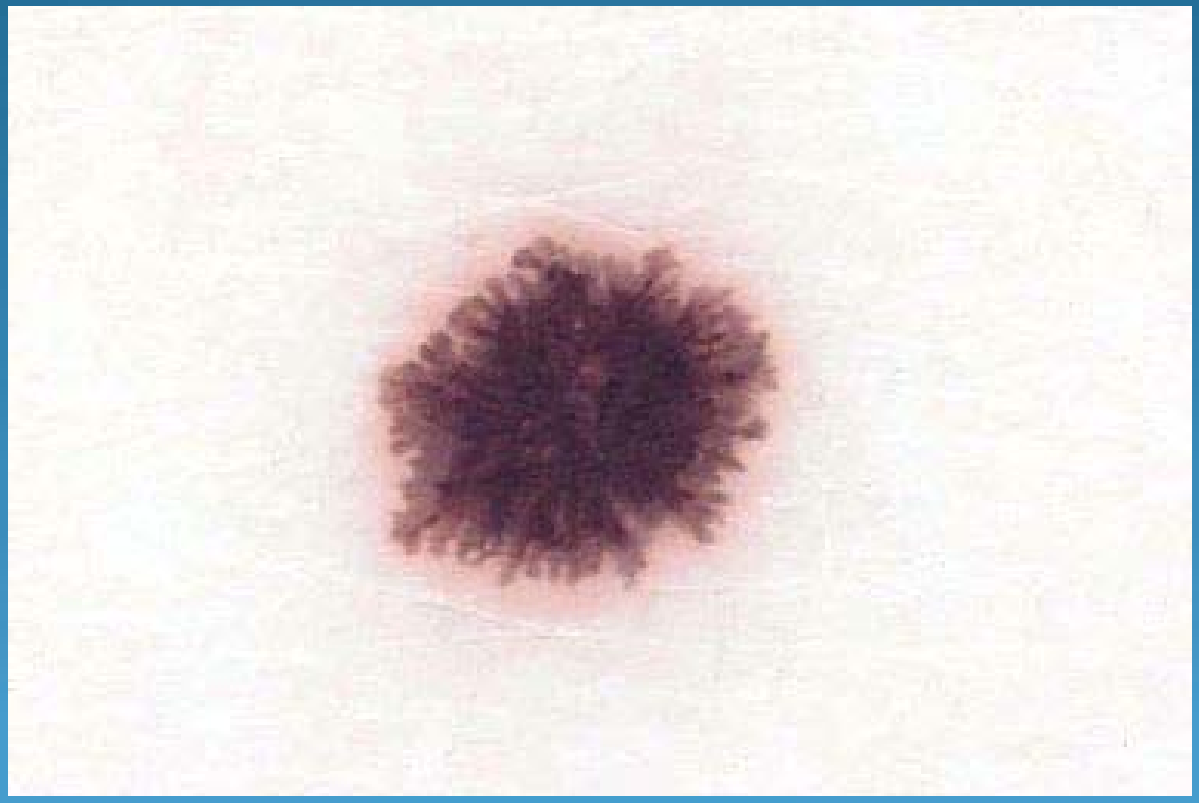


Diagnosis?

Diagnosis?

Diagnosis?



Diagnosis?

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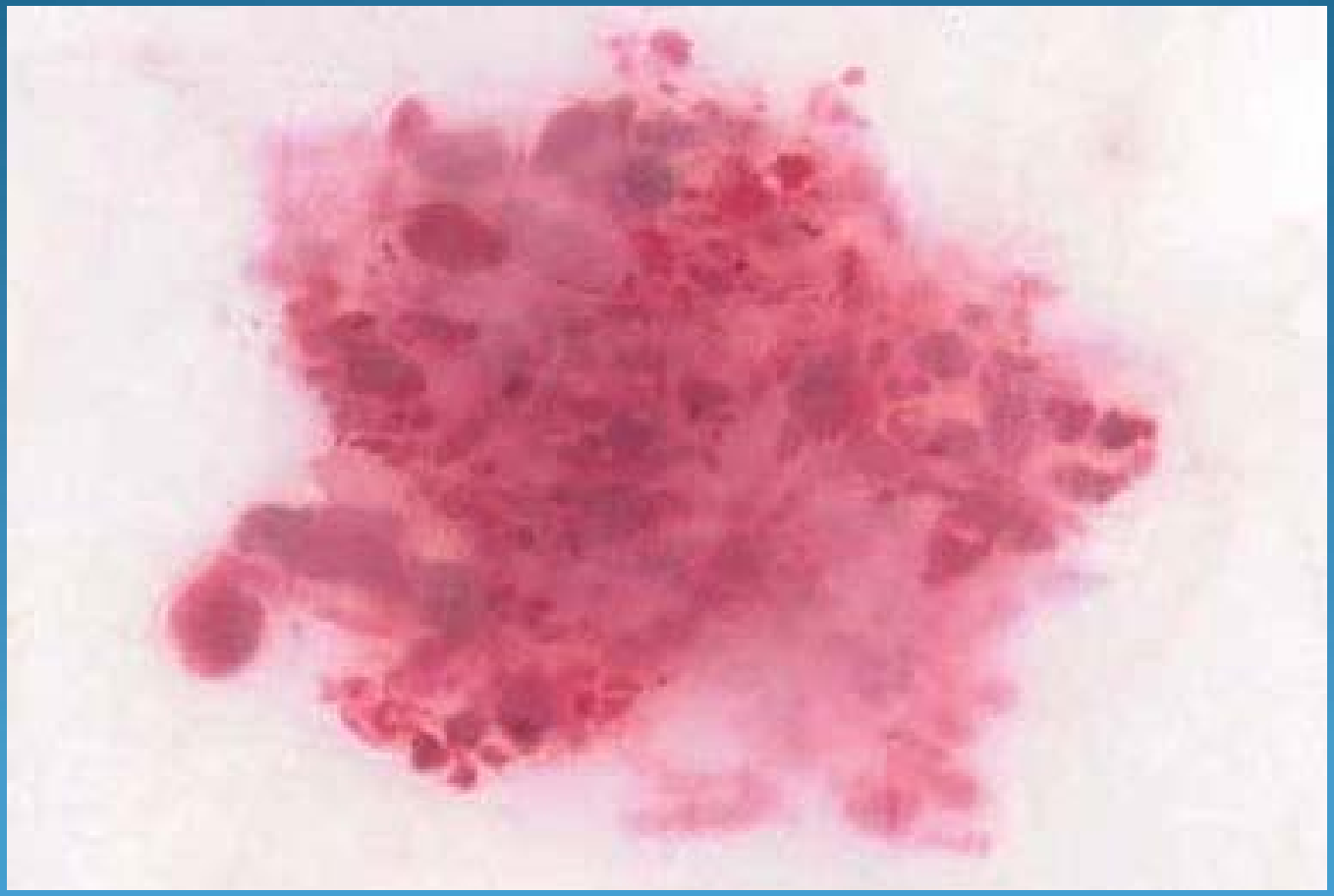

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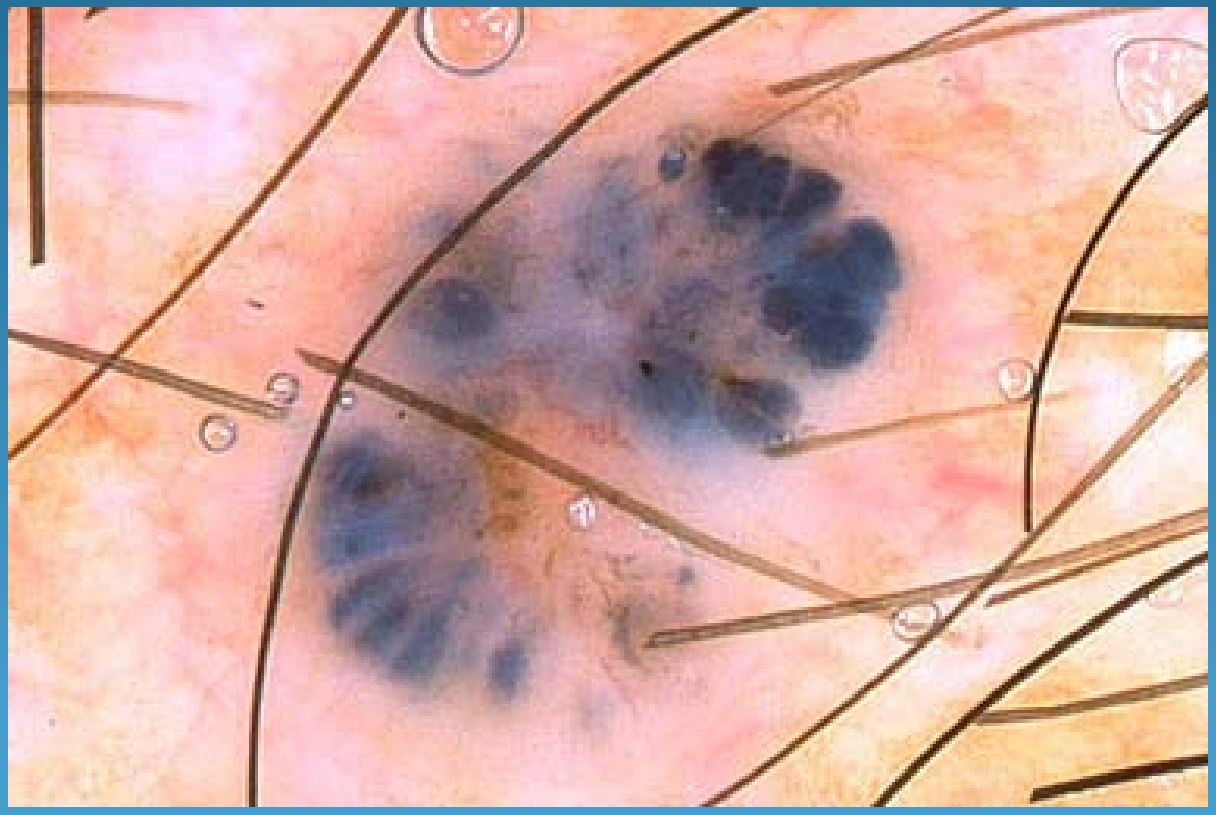

Diagnosis?