



Tissue Repair

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Tissue Repair Lecture Objectives

- Define tissue repair, regeneration, and scarring.
- Explain the difference between labile, stable, and permanent tissues, and give an example or two of each.
- Explain the importance of stem cells in regeneration, and list the two types of tissues in which regeneration can occur.
- Outline the main steps involved in scarring, and be sure you know what granulation tissue is.

Tissue Repair Lecture Objectives

- Describe what you'd need to know in order to predict whether a wound will heal by regeneration or scarring.
- Compare and contrast first-intention and second-intention healing, and know the rough timeline for first-intention healing of small wounds.
- Describe in general how strong a wound is at suture removal, and explain how that wound strength changes over time.
- Explain how the wound healing process is abnormal in keloid scars and proud flesh.

Tissue Repair Lecture Outline

- Introduction and definitions
- Three types of tissues
- Repair by regeneration
- Repair by scarring
- A couple things about skin wounds
- Abnormal wound healing

Tissue Repair Lecture Outline

- Introduction and definitions

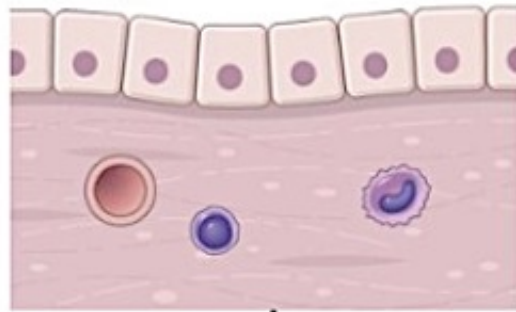
Tissue Repair

Tissue repair is defined as the restoration of tissue architecture and function after an injury.

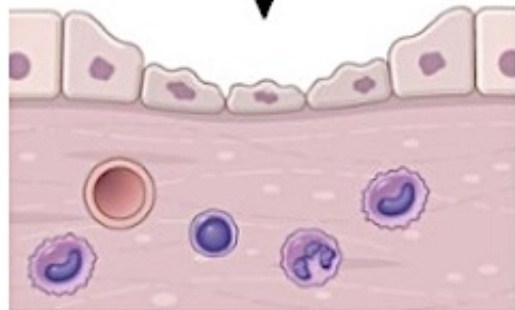
It involves two processes:

- Regeneration (full restoration to normal)
- Connective tissue deposition (scarring)

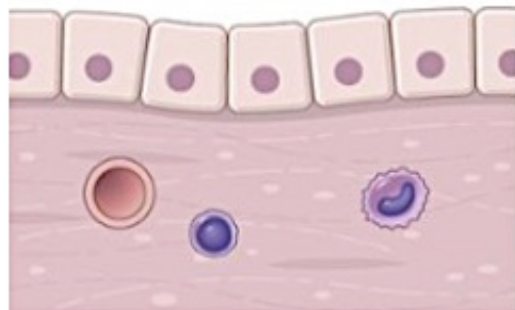
NORMAL



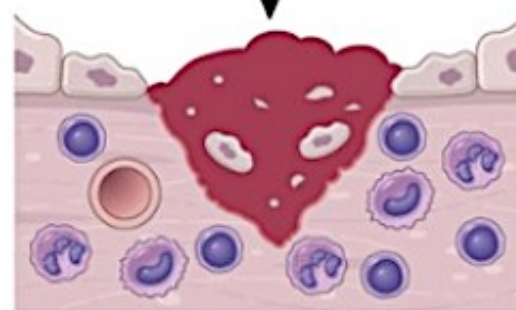
Mild, superficial injury



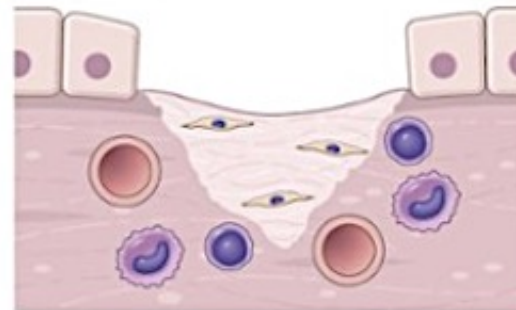
REGENERATION



Severe injury



SCAR FORMATION



Tissue Repair Lecture Outline

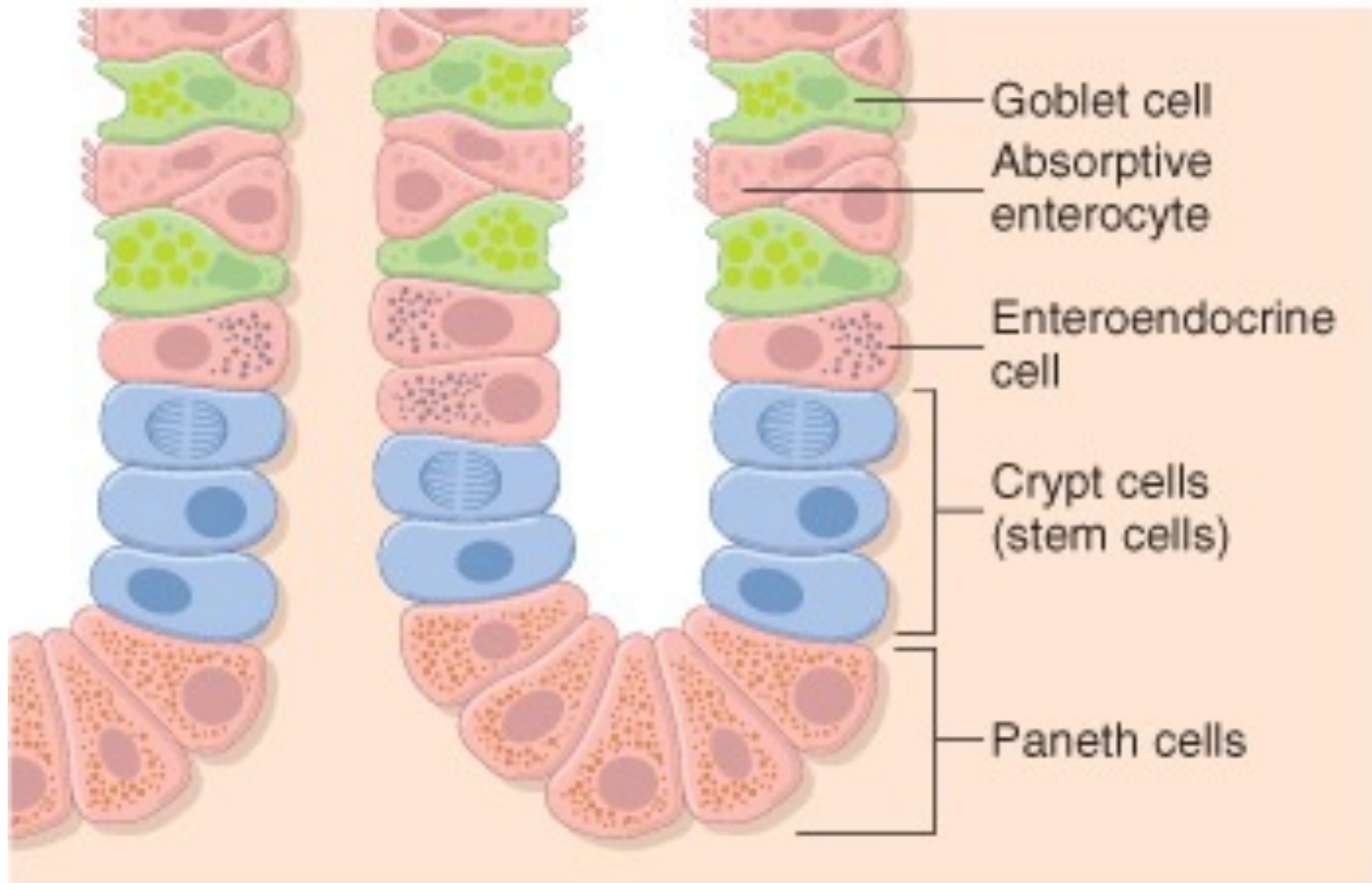
- Introduction and definitions
- Three types of tissues

Three Types of Tissues

Labile (continuously proliferating) tissues

- Composed of cells that are constantly being lost and replaced
- Replacement comes from stem cells and also from division of more mature cells
- Can easily regenerate after injury
- Examples: epithelium (epidermis, GI lining)

Stem cells in GI epithelium



Three Types of Tissues

Labile tissues

Stable (quiescent) tissues

- Composed of cells that have a minimal ability to proliferate
- Can undergo some regeneration after injury
- Example: liver

Three Types of Tissues

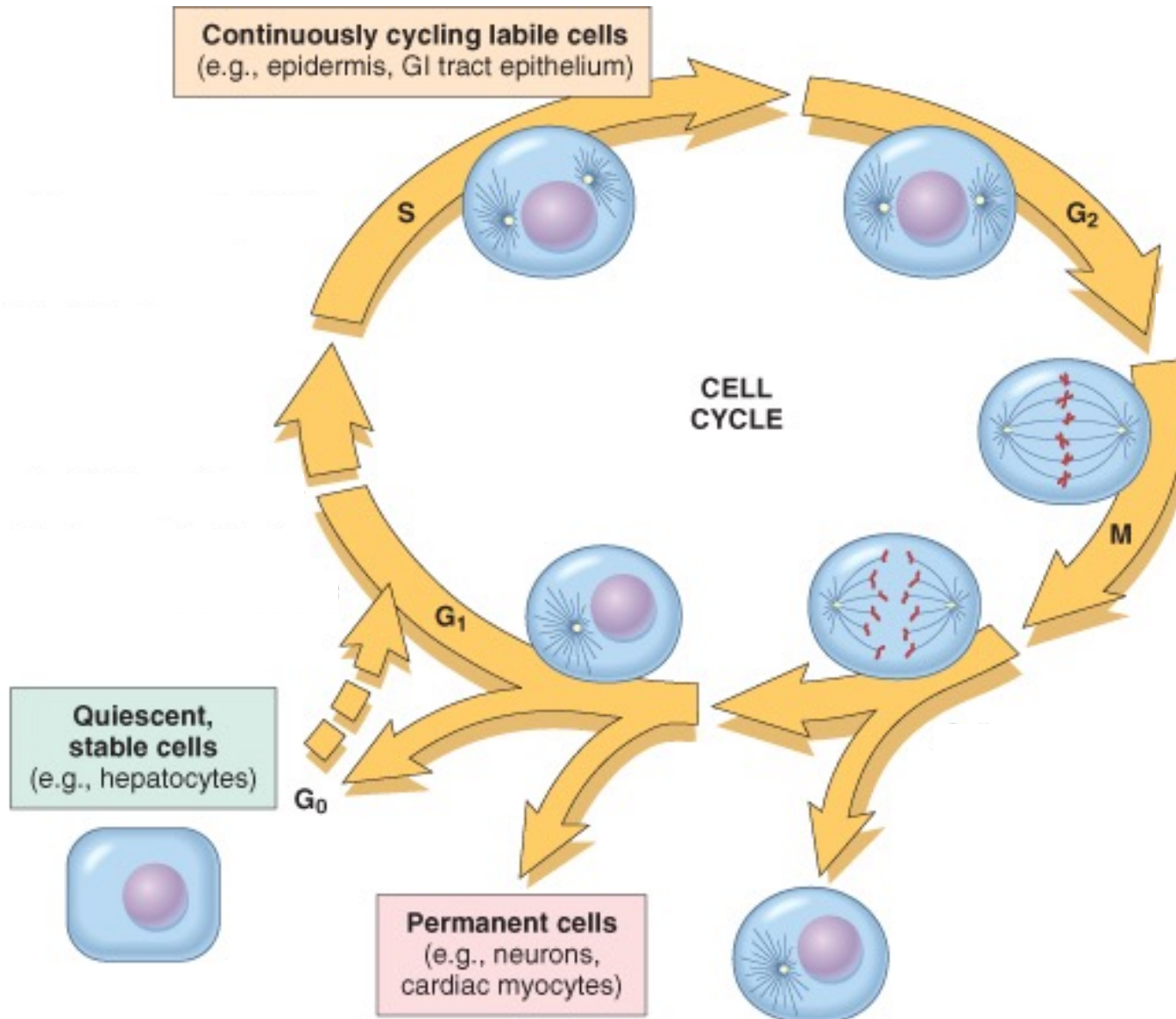
Labile tissues

Stable tissues

Permanent tissues

- Composed of cells that cannot proliferate
- Cannot regenerate in response to injury
- Injury always results in scarring
- Examples: brain, heart

Three types of tissues in relation to cell cycle



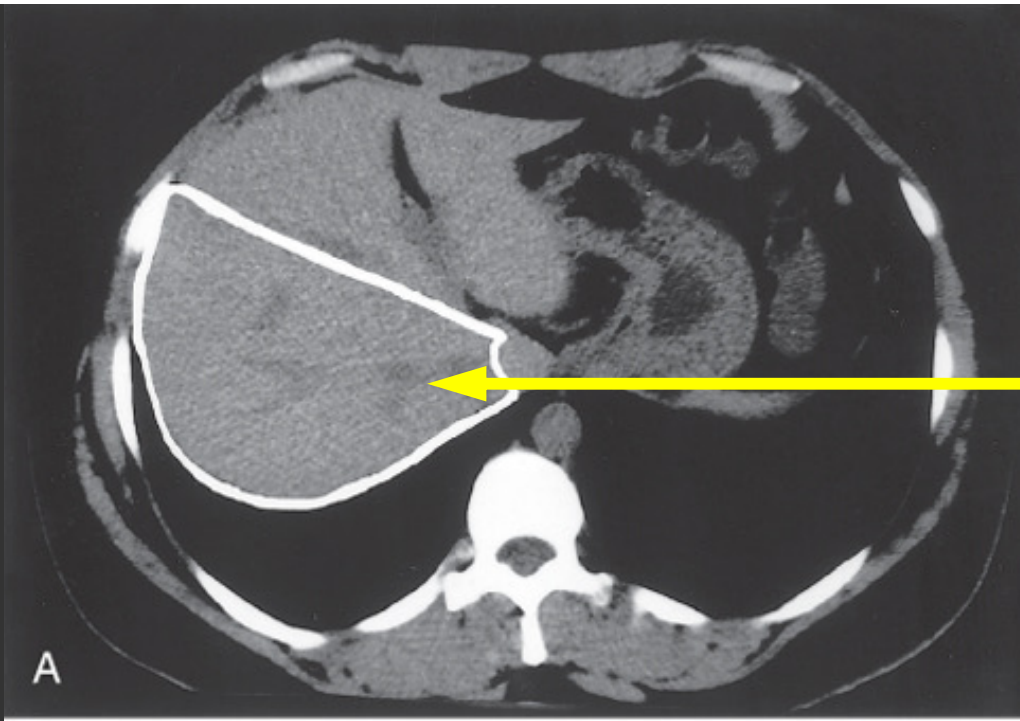
Tissue Repair Lecture Outline

- Introduction and definitions
- Three types of tissues
- **Repair by regeneration**

Regeneration

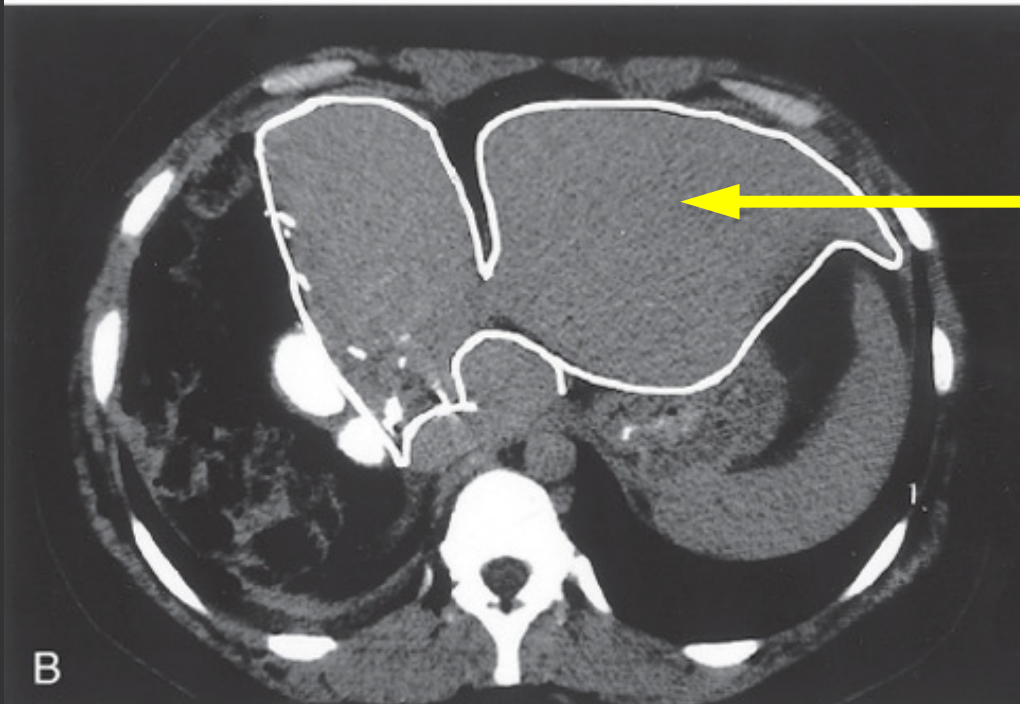
- Occurs all the time in labile tissues!
- Can occur, sometimes, in stable tissues.
- Doesn't occur at all in permanent tissues.

Liver
before
resection



right lobe
to be
resected

Liver
1 week
after
resection



left lobe
now
enlarged

Tissue Repair Lecture Outline

- Introduction and definitions
- Three types of tissues
- Repair by regeneration
- **Repair by scarring**

Scarring

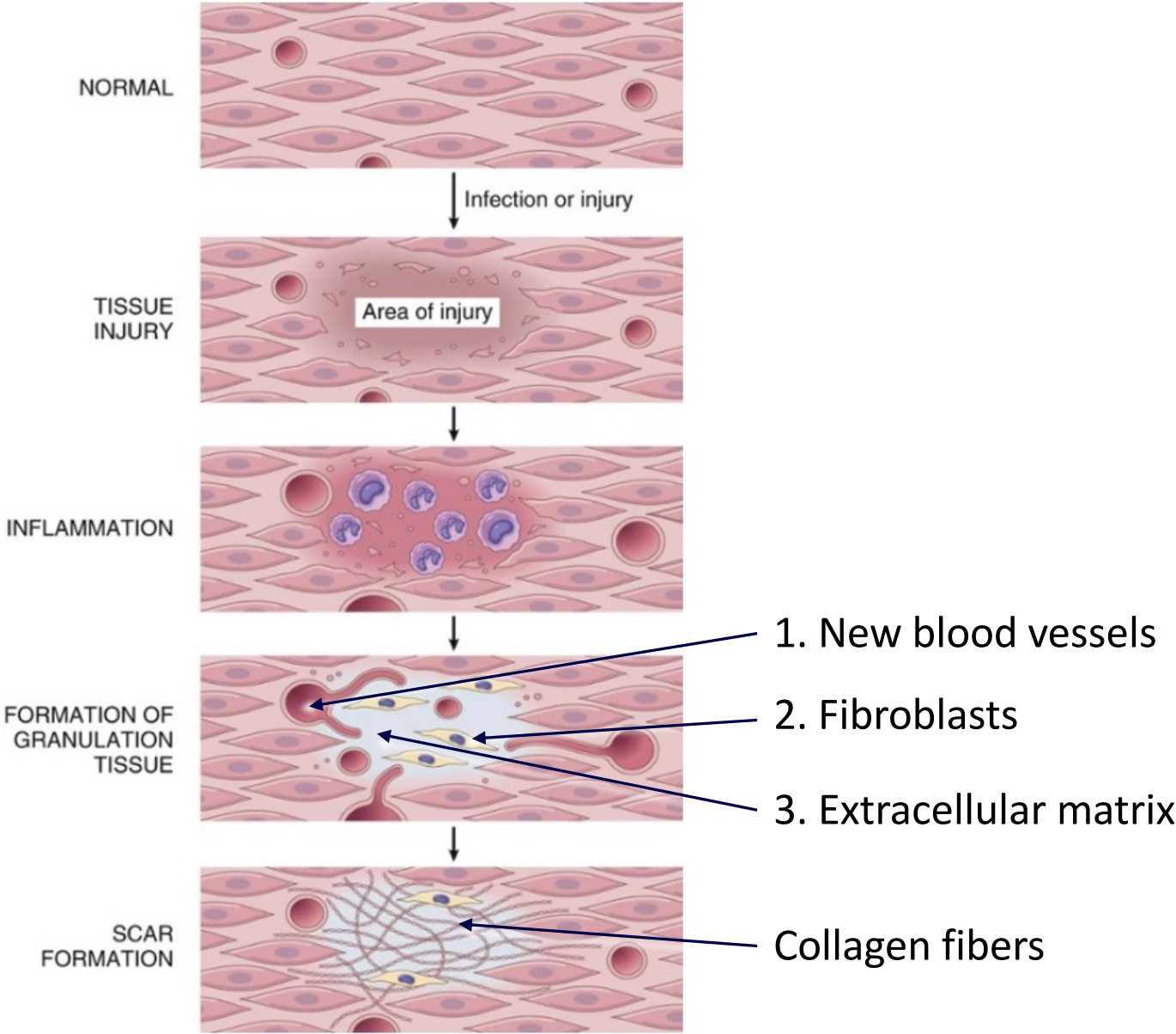
- If full regeneration isn't possible, then you need to make a scar.
- What determines whether regeneration is possible?
 - Type of tissue (labile, stable, or permanent)
 - Extent of extracellular matrix damage
- Scarring involves creating new blood vessels (angiogenesis), laying down collagen (which is made by fibroblasts), and eventually remodeling the collagen so the scar is just right.

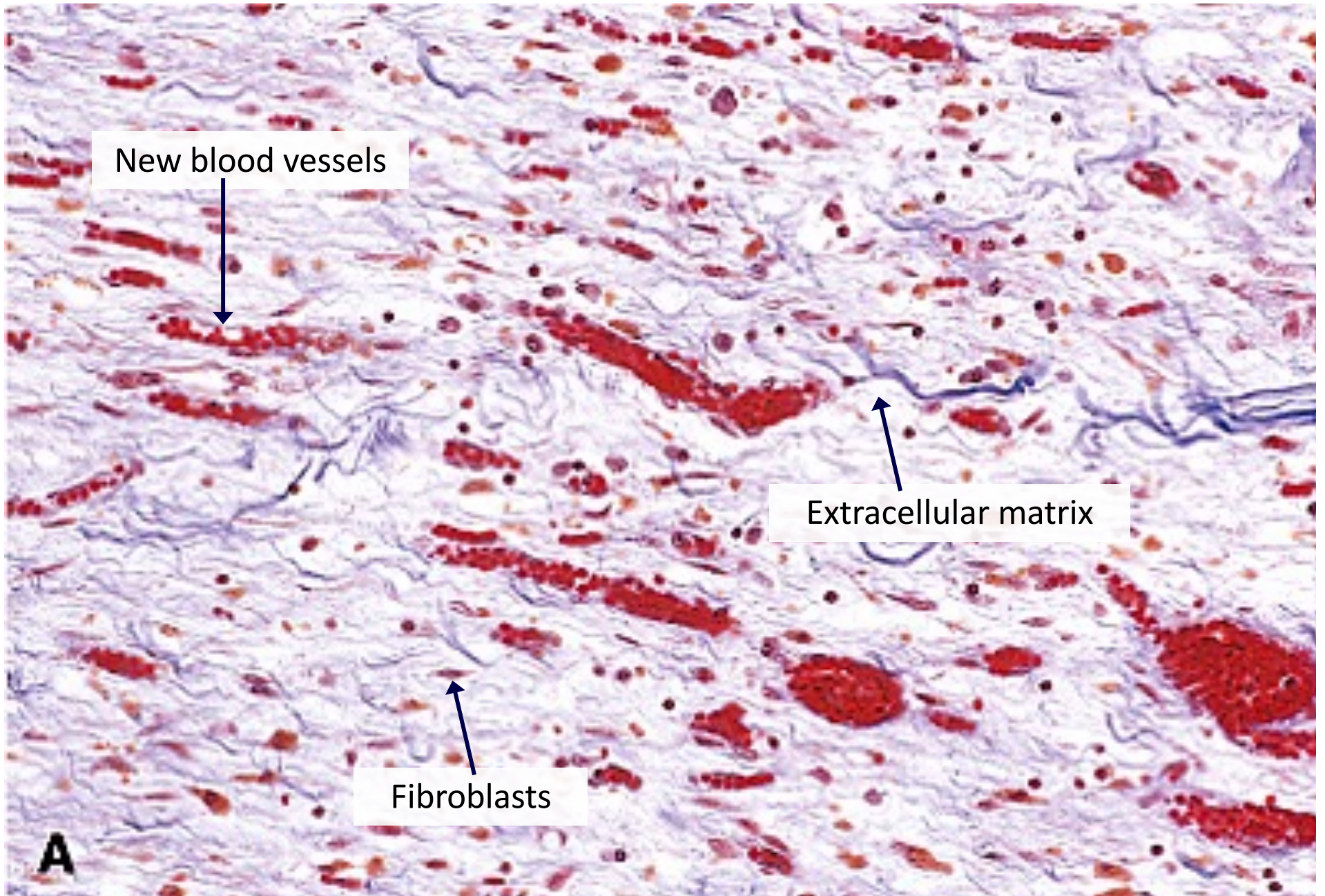
Scarring

Summary:

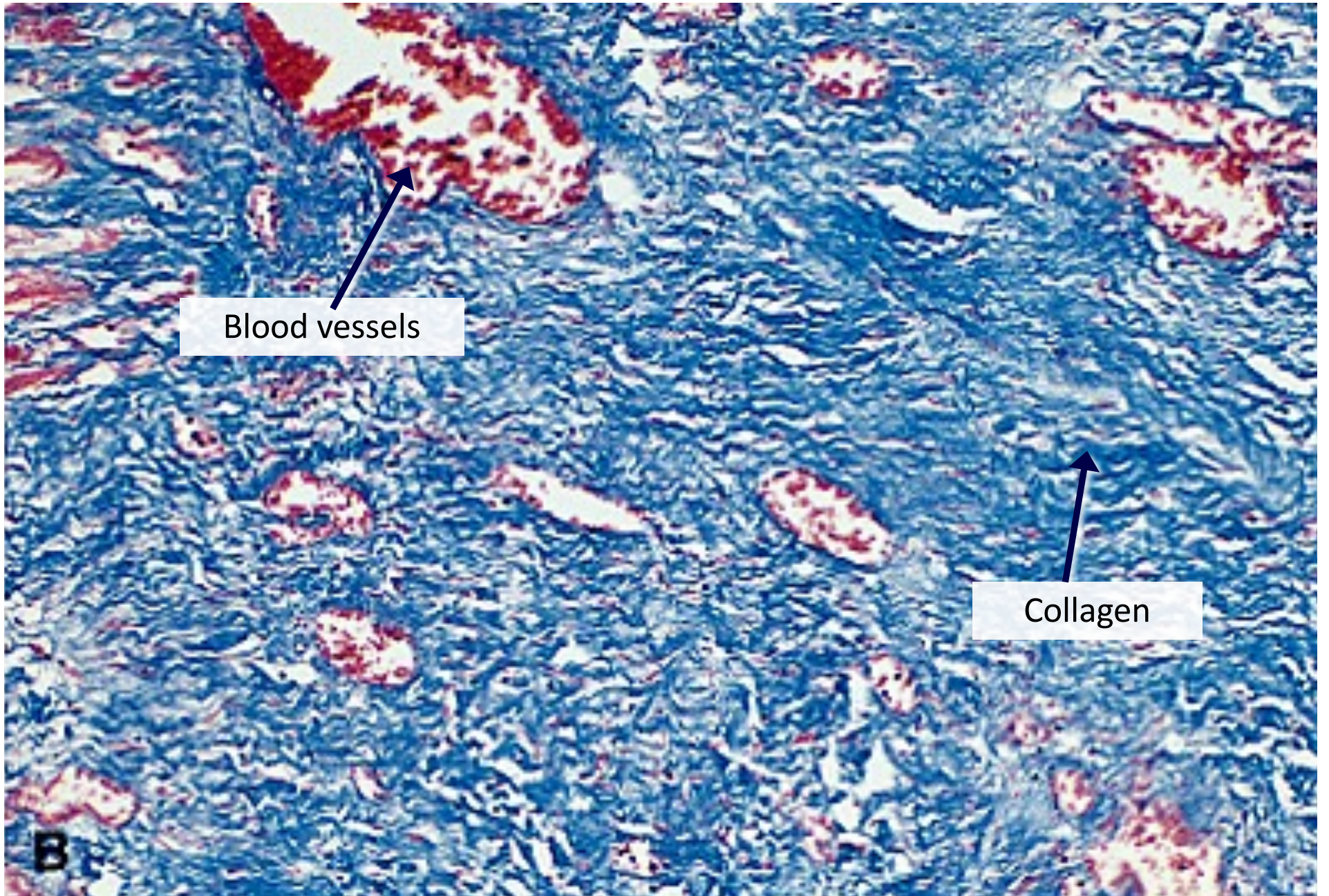
1. Make granulation tissue
2. Turn it into a chunk of collagen

Overall process of injury, inflammation, and scar formation





Granulation tissue: 3 components



Blood vessels

Collagen

Scar

Tissue Repair Lecture Outline

- Introduction and definitions
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- Repair by scarring
- **A couple things about skin wounds**

Skin Wounds: Two Types of Healing



First intention healing



Second intention healing

First Intention Healing

Small wounds that close easily

Regeneration > scarring

Healing is fast

Minimal inflammation and scarring

Examples:

- Paper cuts
- Well-approximated surgical incisions
- Replaced periodontal flaps

Second Intention Healing

Large open wounds

Scarring > regeneration

Healing is slower

More inflammation and scarring,
greater risk of infection

Examples:

- Burns
- External-bevel gingivectomies
- Extraction sockets

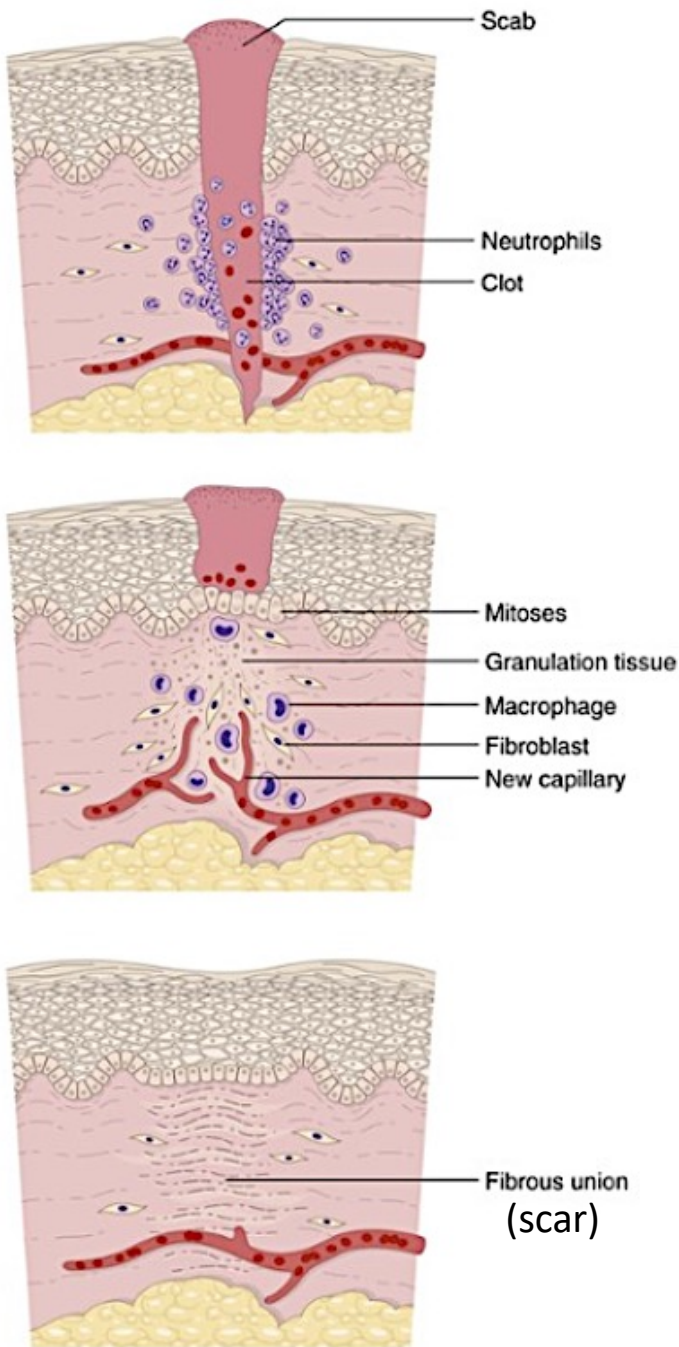
Rough timeline for first intention healing of small wounds

24 hours

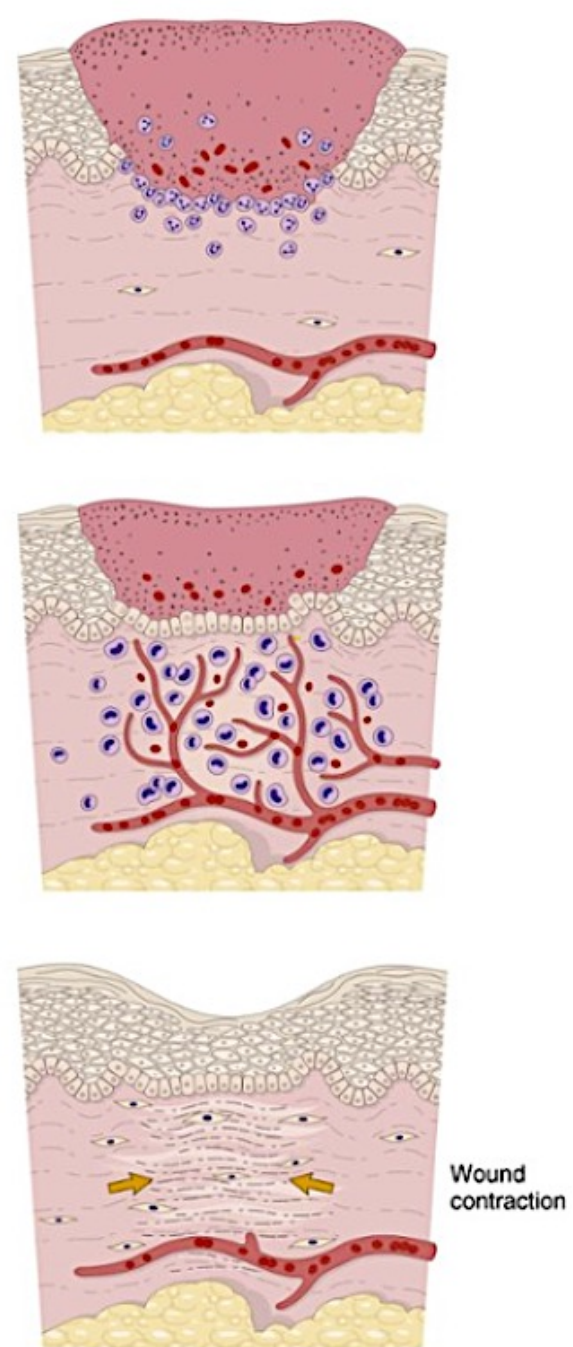
3 to 7 days

Weeks

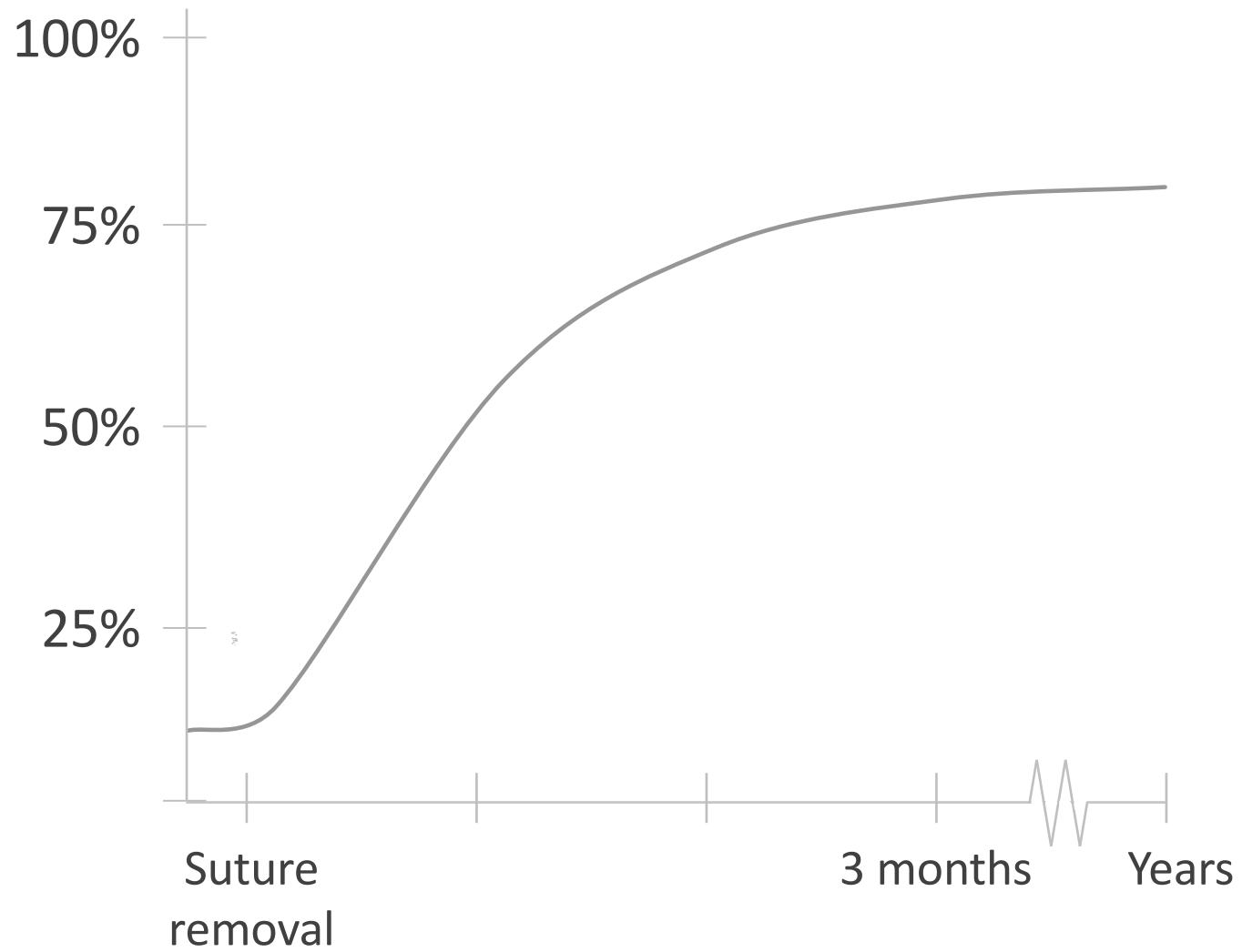
HEALING BY FIRST INTENTION



HEALING BY SECOND INTENTION



Skin Wound Strength



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- **Abnormalities in tissue repair**

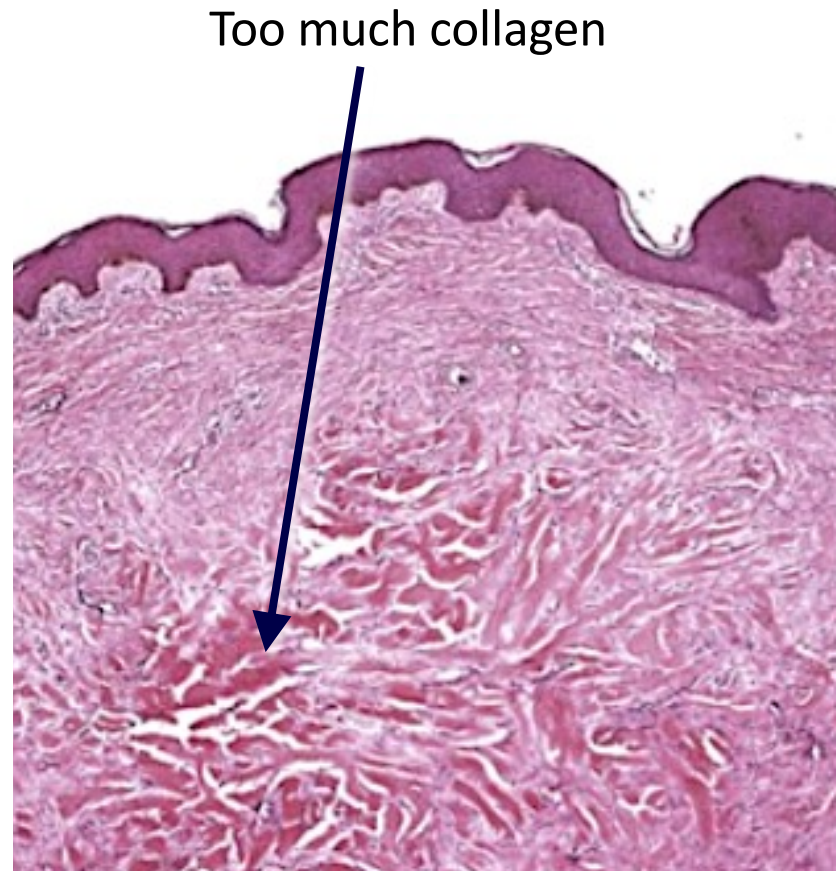
Abnormalities in Tissue Repair

- Inadequate repair (can be due to many things: steroids, infection, diabetes)
- Overzealous repair (keloid scar, proud flesh)

Keloid Scar



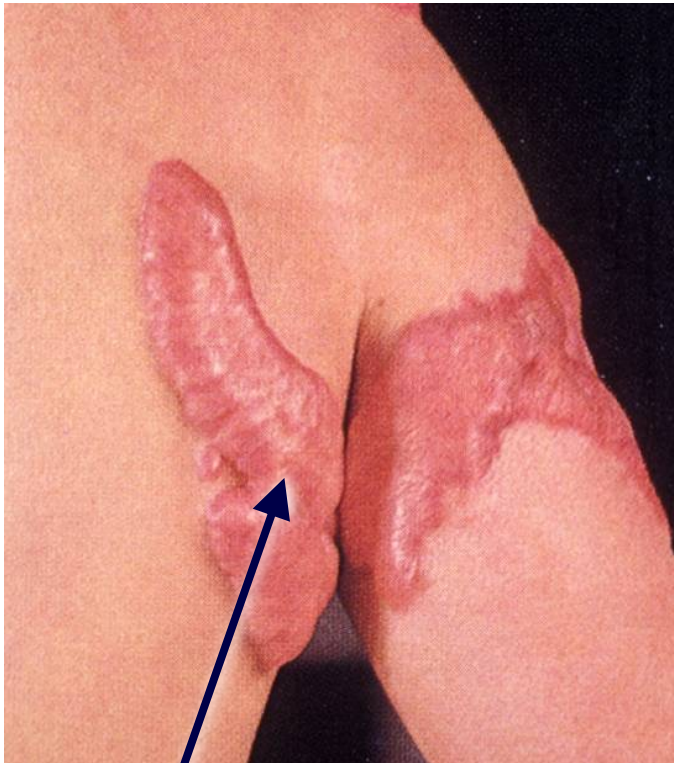
Keloid scar: gross appearance



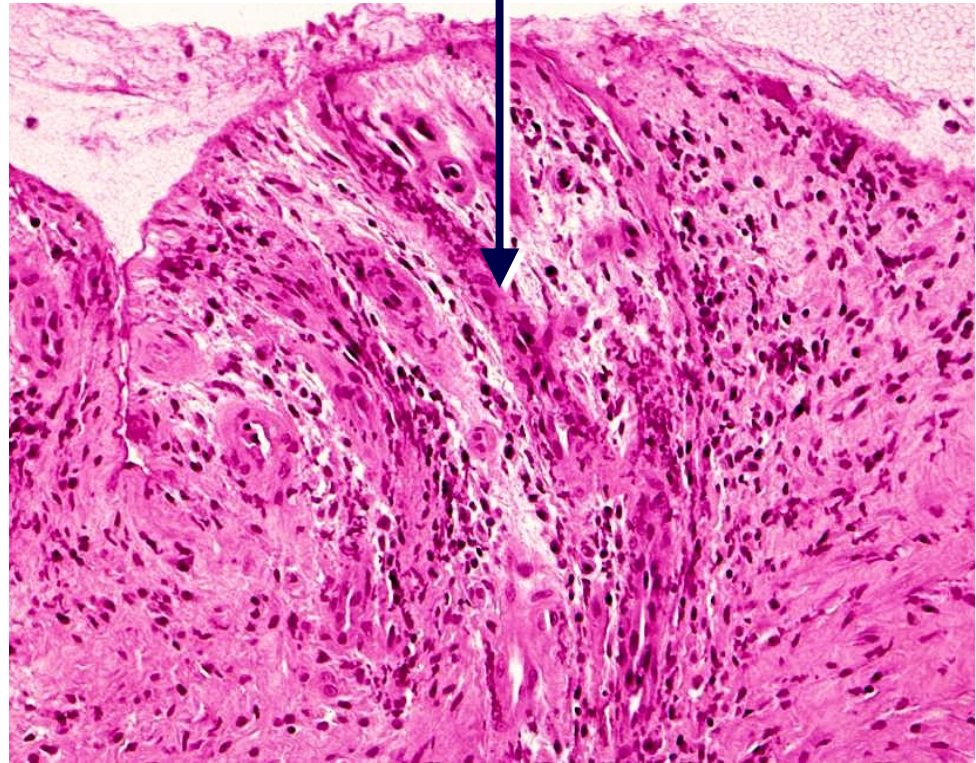
Keloid scar: histologic appearance

Proud Flesh

Too much granulation tissue



Proud flesh: gross appearance



Proud flesh: histologic appearance