



**Figure 3-32** Keloid. **A**, Excess collagen deposition in the skin forming a raised scar known as *keloid*. **B**, Note the thick connective tissue deposition in the dermis. (**A**, From Murphy GF, Herzberg AJ: Atlas of Dermatopathology. Philadelphia, WB Saunders, 1996, p 219; **B**, Courtesy Z. Argenyi, MD, University of Washington, Seattle, Wash.)

continuity of the epithelium. Fortunately rarely, incisional scars or traumatic injuries may be followed by exuberant proliferation of fibroblasts and other connective tissue elements that may, in fact, recur after excision. Called *desmoids*, or *aggressive fibromatoses*, these neoplasms lie in the interface between benign and malignant (though low-grade) tumors.

- **Contraction** in the size of a wound is an important part of the normal healing process. An exaggeration of this process gives rise to contracture and results in deformities of the wound and the surrounding tissues. Contractures are particularly prone to develop on the palms, the soles, and the anterior aspect of the thorax. Contractures are commonly seen after serious burns and can compromise the movement of joints.

## KEY CONCEPTS

### Cutaneous Wound Healing and Pathologic Aspects of Repair

- The main phases of cutaneous wound healing are inflammation, formation of granulation tissue, and ECM remodeling.
- Cutaneous wounds can heal by primary union (first intention) or secondary union (secondary intention); secondary healing involves more extensive scarring and wound contraction.
- Wound healing can be altered by many conditions, particularly infection and diabetes; the type, volume, and location of the injury are important factors that influence the healing process.
- Excessive production of ECM can cause keloids in the skin.
- Persistent stimulation of collagen synthesis in chronic inflammatory diseases leads to fibrosis of the tissue, often with extensive loss of the tissue and functional impairment.

## SUGGESTED READINGS

### General Mechanisms of Inflammation

- Okin D, Medzhitov R: Evolution of inflammatory diseases. *Curr Biol* 22:R733–40, 2012. [An interesting conceptual discussion of the balance between the high potential cost and benefit of the inflammatory response and how this balance may be disturbed by environmental changes, accounting for the association between inflammation and many of the diseases of the modern world.]
- Rock KL, Latz E, Ontiveros F, et al: The sterile inflammatory response. *Annu Rev Immunol* 28:321–42, 2010. [An excellent discussion of how the immune system recognizes necrotic cells and other noninfectious harmful agents.]
- Takeuchi O, Akira S: Pattern recognition receptors and inflammation. *Cell* 140:805, 2010. [An excellent overview of Toll-like receptors and other pattern recognition receptor families, and their roles in host defense and inflammation.]

### Acute Inflammation: Vascular Reactions

- Alitalo K: The lymphatic vasculature in disease. *Nat Med* 17:1371–80, 2011. [An excellent review of the cell biology of lymphatic vessels, their functions in immune and inflammatory reactions, and their roles in inflammatory, neoplastic and other diseases.]
- Vestweber D: Relevance of endothelial junctions in leukocyte extravasation and vascular permeability. *Ann N Y Acad Sci* 1257:184–92, 2012. [A good review of the basic processes of vascular permeability and how interendothelial junctions are regulated.]

### Acute Inflammation: Role of Leukocytes

- Amulic B, Cazalet C, Hayes GL, et al: Neutrophil Function: From Mechanisms to Disease. *Annu Rev Immunol* 30:459–89, 2012. [An excellent review on neutrophils – their recruitment, activation, functions in microbe elimination, and interactions with other cells of the immune system.]
- Flannagan RS, Jaumouillé V, Grinstein S: The Cell Biology of Phagocytosis. *Annu Rev Pathol* 7:61–98, 2012. [A modern discussion of the receptors involved in phagocytosis, the molecular control of the process, and the biology and functions of phagosomes.]
- Kolaczowska E, Kuberski P: Neutrophil recruitment and function in health and inflammation. *Nat Rev Immunol* 13:159–75, 2013. [An excellent review of neutrophil generation, recruitment, functions and fates, and their roles in different types of inflammatory reactions.]
- Muller WA: Mechanisms of leukocyte transendothelial migration. *Annu Rev Pathol* 6:323, 2011. [A thoughtful review of the mechanisms by which leukocytes traverse the endothelium.]
- Papayannopoulos V, Zychlinsky A: NETs: a new strategy for using old weapons. *Trends Immunol* 30:513, 2009. [A review of a newly discovered mechanism by which neutrophils destroy microbes.]