

Assessment of your knowledge

(a) Answer the following questions to assess your command on terminology, facts, concepts, and theories learned in this chapter.

1. What are the phases of wound healing?
2. Name the five cell types that form the epidermis and their key function.
3. List the layers of the epidermis and how the shape of keratinocytes changes with differentiation throughout the layers.
4. What keratins are associated with keratinocyte differentiation, and which keratins would you expect to see upregulated in an inflammatory skin disease?
5. There are two distinct niches of dermal fibroblasts, where are they located in the skin and what is their key function?
6. Which cell colonies are best for expanding keratinocytes; holoclones, meroclones, or paraclones, briefly explain why?
7. List five key components of the dermoepidermal junction.
8. Briefly describe the culture method that triggered a breakthrough in keratinocyte monolayer culture.
9. What is the Hayflick limit and why is it important in cell culture?
10. List three types of dermal matrices used to create 3D skin cultures.
11. Outline the different approaches to managing a burn when a split-thickness skin graft is not appropriate.
12. What skin features are currently missing from cultured epidermal autografts?
13. What are the key cells that contribute to allograft keratinocyte transplant rejection? Briefly outline their main function.
14. List three naturally derived biomaterials currently used in engineered skin equivalents.
15. Define the term "dermal template" and briefly describe the clinical application.
16. Describe one limitation of cultured epidermal sheets overcome by keratinocyte spraying technologies.
17. What is the definition of a stem cell and where are the stem cells found in the skin?
18. Briefly describe the various types of models that have been proposed on how stem cells contribute to maintaining epidermal homeostasis.
19. What are the main benefits of using adult stem cells in skin tissue engineering?
20. What are some of the unresolved safety issues with the potential use of iPSCs for therapeutic application?

(b) Answer the following questions to assess your ability to apply the concepts and theories learned in this chapter in real life, clinical, and scientific situations.

1. Describe in detail the phases of wound healing and explain the differences between acute and chronic wound healing.
2. Describe the epidemiology, causes, types, and classifications of burn injuries.
3. Explain how keratinocytes are derived from epidermal stem cells and form the stratum corneum. What elements of this process are utilized in keratinocyte culture and why?
4. Describe the process that triggers transplant rejection of allogeneic skin and what methodologies are being used to overcome this reaction?
5. Illustrate how the basement membrane connects the epidermis to the dermis.
6. Describe in detail one example of a tissue-engineered skin equivalent and its specific application. Discuss the advantages and disadvantages of the engineered tissue of traditional grafting procedures.
7. Drawing upon basic concepts in tissue engineering and the current state-of-the-art in skin equivalent technology, propose a strategy to engineer skin constructs with functional sweat glands.
8. How could skin culture be improved for managing burns patients and why might these additional features be important?
9. Describe the main types of adult stem cells that can potentially be used in therapeutic application? Discuss the advantages and disadvantages of each.
10. Describe in detail the evolution of epidermal replacement starting from keratinocyte monolayer culture using different culture methods to the development of keratinocyte sheets used in the treatment of burn wounds. How have "take" rates of keratinocyte sheets improved over the years.