

## 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 is a main difference between sensory and motor neurons?
2. What is the role of Bands of Büngner?
3. Autograft approach is the "gold standard" to treat PNI when the gap between the damaged nerves is too large for the nerves to be reattached. List one disadvantage of the autograft approach.
4. Define critical gap length.
5. What is the approximate critical gap length for humans?
6. Once a PN nerve guide is sutured into position, an important protein naturally builds up due to the microenvironment response to the implant. What protein is this bridge made of?
7. Name four important neurotrophic factors in nerve regeneration.
8. Compared to PN, there is one main obstacle for regenerating axons in the CNS following injury to the spinal cord. Please identify this process.
9. What is one approach that could be employed to address the spinal injury scar that forms after SCI?
10. Animals are used to model different degrees of SCI. List one model used for SCI.
11. What is one main advantage of using NPs to treat SCI?
12. NPs, matrices, and scaffolds may be functionalized with peptide sequences that aim to promote and direct neuronal growth. List one.
13. Name one advantage and one disadvantage of using cats as animal models for SCI.
14. Cell transplants have been proposed as a therapeutic approach to treat SCI. Name one cell type.
15. What is the difference between 3D and 4D biofabrication?
16. Name one 3D printing technique applied to the nervous system.
17. A proposed alternative to bypass the blood-brain barrier (BBB) is to deliver drugs intranasally. Name two advantages of the intranasal delivery route.
18. Describe one way in which the visual system is a useful model to study regenerative success or failure after nerve fiber damage in the mature CNS.
19. One main goal after optic nerve crush is to enhance the survival of retinal ganglion cells (RGCs). Neurotrophic factors have been proposed, but what is a more long-lasting alternative?
20. Age-related macular degeneration (ARMD) has been tackled by transplanting retinal pigment epithelium (RPE) cells to the subretinal space.
  - 20.1. What is one main challenge when suspended RPEs are injected into the subretinal space?
  - 20.2. What is a proposed alternative to overcome this challenge?

(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. Current approaches to treat PNI include the use of nerve guides. Some commercially available nerve conduits degrade shortly after being implanted in the body (as little as 3 months), whereas others are designed to not degrade. What are the advantages and disadvantages of degradable (both short and long term) versus nondegradable nerve guides?
2. Describe how you would design an experiment that incorporates a multifaceted approach to tackle PNI.
3. How would a therapeutic approach differ when addressing the peripheral versus the central nervous system? (PNS vs. CNS)
4. Even within the CNS, the physical properties of the nervous tissue vary greatly in physical/mechanical properties. How do you expect to tailor the mechanical properties of scaffolds or matrices that are to be implanted in the brain versus the spinal cord, for example?
5. Injury to the spinal cord caused by trauma creates a local primary response after impact, which then triggers a cascade of secondary inflammatory responses. Outline the existing tissue engineering approaches that aim to tackle the later stages of SCI.
6. What are the main considerations when designing a therapeutic strategy for degenerative diseases versus trauma-related injuries to the nervous system?
7. Wallerian degeneration is a degenerative process that occurs after injury to an axon. Sketch a figure that compares a healthy axon to one undergoing Wallerian degeneration.

8. If you reflect on the concepts presented in this chapter, how would you argue the importance of having a team of multidisciplinary researchers and clinicians to develop new therapeutic approaches for nerve regeneration?
9. In your opinion, what is still a major challenge in tissue engineering of the nervous system?
10. What do you expect will be a major advance in the field of tissue engineering of the nervous system in the next 5e10 years?