Recommended Curriculum Guidelines for Undergraduate Microbiology Education

2024

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In 2008-2009, two seminal reports, *Vision and Change in Undergraduate Biology*

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PART I. FUNDAMENTAL STATEMENTS

Important note: For purposes of the ASM Curriculum Guidelines for Undergraduate Microbiology, we consider the term "microbe" to encompass both cellular organisms (such as bacteria, protists, or fungi) and non-cellular infectious agents (such as viruses, prions, or viroids) that are not visible to the unaided eye.

Evolution

1. All cells, eukaryotic organelles (e.g., mitochondria and chloroplasts), and major metabolic pathways evolved from early progenitor cells.
2. The diversity of microbes has arisen because of processes that include horizontal gene transfer, mutation, reassortment, recombination, and natural selection in varying ecological niches favor the growth and survival of certain variants.
3. The evolution of microbes is impacted by their interactions with the environment and a variety

Metabolic Pathways

12. Bacteria and Archaea exhibit extensive metabolic diversity, including nitrogen fixation, methane production, and anoxygenic photosynthesis, many of which are unique to these two domains.
13. Intrinsic factors, such as genotype, metabolism, and cell structures, impact the survival and growth of microbes.
14. Extrinsic factors, such as abiotic and biotic interactions in the environment, can impact survival and growth of microbes.
15. Most microbial life is currently unculturable and therefore both cultivation-dependent and cultivation-independent techniques are used to identify microbial populations and their potential metabolic pathways.

Information Flow and Genetics

16. Genetic variation can influence microbial structures and their functions.
17. Although the flow of information from DNA to RNA to protein is universal in all cells, aspects of the processes of replication, transcription, and translation differ between Bacteria, Archaea, and Eukarya.
18. The regulation of gene expression is influenced by external and internal molecular cues and signals.
19. Non-cellular infectious agents, such as viruses, prions, viroids, and satellites, are dependent on host cell processes in order to replicate.

Microbial Ecology

20. Microbes are ubiquitous, found in diverse and dynamic ecosystems, where they use available resources and often form complex communities.
21. Microbes and the environment interact with and affect each other.
22. Most microbes interact with hosts in beneficial or neutral ways, with a minority having a detrimental impact on their host.
23. The health of the environment and all organisms (microbes, plants, humans, other animals) are closely linked and interdependent, as described by the One Health paradigm.

Impact of Microbes

24. Microbes and their communities are essential for supporting all life as we know it.
25. Microbes are used as models that provide fundamental knowledge about life processes.

26. Humans leverage microbes and their products to address problems and improve quality of life