Proposed Guidelines for Microbiology in the Undergraduate Nursing Curriculum based on the ASM Recommended Curriculum Guidelines
Draft Guidelines for Microbiology in the Undergraduate Nursing Curriculum


**Part 1: Concepts & Statements**

*Impact of Microorganisms*

1. **The microbiome consists of diverse cellular and acellular microbes that impact human health; a dysbiosis in the microbiome that changes the level, location, or diversity of the normal microbiota may lead to disease.**

   *ASM Recommended Curriculum Guideline: 23*

   *NCLEX-RN Alignment: Basic Care & Comfort; Physiological Adaptation*

2. **Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.**
   a. Microorganisms have different characteristics that place them in different taxonomic groupings. An understanding of these taxonomic groupings informs infection management.

   *ASM Recommended Curriculum Guideline: 20*

   *NCLEX-RN Alignment: Pharmacological & Parenteral Therapies*

3. **Most bacteria in nature live in biofilm communities.**
   a. Biofilm production presents unique challenges to healthcare such as conferring resistance to antimicrobial agents and providing a continuously available pathogen source for renewed infections.

   *ASM Recommended Curriculum Guideline: 21*

   *NCLEX-RN Alignment: Pharmacological & Parenteral Therapies; Reduction of Risk Potential*
4. **Microbes interact with human hosts in beneficial, neutral, or detrimental ways.**
   a. Pathogens can be eukaryotic, prokaryotic, or acellular and primarily include bacteria, viruses, fungi, helminths, protozoa, and prions. A general understanding of these diverse groups is essential to inform healthcare practices and promote communication among professionals in such settings.
   b. To best protect themselves and care for their patients, nurses should understand the microbiological and epidemiological features of pathogenic agents (e.g. etiological agent, reservoir, transmission patterns, incubation period, risk factors, potential complications, treatments, etc.)
   c. Host factors, such as age and overall health and life habits, impact infectious disease development.

**ASM Recommended Curriculum Guideline: 23**
**NCLEX-RN Alignment:** Pharmacological & Parenteral Therapies; Safety & Infection Control; Health Promotion & Maintenance; Basic Care & Comfort; Physiological Adaptation

5. **Humans use microorganisms and their products to make food and pharmaceuticals.**

**ASM Recommended Curriculum Guideline:** 2
**NCLEX-RN Alignment:** Health Promotion & Maintenance

**Microbial Structure, Physiology, Genetics, and Pathogenicity**

6. **Microbes have unique features that serve as targets for antimicrobial drugs and immune responses.**
   a. Understanding structural and functional features of microbes allows us to develop new antimicrobial drugs and assess drug specificity mechanisms to limit adverse drug effects.

**ASM Recommended Curriculum Guidelines: 7, 8**
**NCLEX-RN Alignment:** Pharmacological & Parenteral Therapies; Health Promotion & Maintenance

7. **Pathogens have diverse offensive and defensive virulence factors (adhesion factors, enzymatic factors, toxins, endospores, evading immune responses, etc.) that influence their pathogenesis and impact treatment options and general clinical management.**
   a. Understanding endotoxins and exotoxins and the nature of toxigenic bacterial strains is central to developing effective patient care plans for toxemia and sepsis/septic shock.
   b. Understanding pathogenesis mechanisms allows healthcare workers to identify, properly treat, and reduce infectious disease transmission.
   c. Bacteriophages can impact bacterial pathogenicity. For example, lysogenic bacteriophages can perform specialized transduction, which can confer new genetic traits to bacteria while lytic bacteriophages serve as vehicles for generalized transduction of new genetic traits.

**ASM Recommended Curriculum Guidelines: 8, 9, 10, 23**
**NCLEX-RN Alignment:** Health Promotion & Maintenance; Safety & Infection Control

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8. Pathogens are continuously evolving and virulence is not a static property. Understanding mechanisms that impact pathogen evolution (i.e. vertical and horizontal genetic variation, mutations, recombination, etc.) is central to limiting pathogen evolution.
   a. Gene transfer events such as transduction, transformation, and conjugation help bacteria gain new virulence factors, including the ability to make toxins and acquire antimicrobial resistance.

ASM Recommended Curriculum Guidelines: 2, 3, 15
NCLEX-RN Alignment: Safety & Infection Control

Identifying and Managing Infectious Diseases

9. Koch’s postulates (and molecular Koch’s postulates) can be used to identify the etiological agent of certain infectious diseases.

ASM Recommended Curriculum Guideline: 23
NCLEX-RN Alignment: Management of Care

10. Infectious agents are identified through a variety of methods.
   a. Serology and other diverse molecular methods are used to definitively diagnose infections.
   b. Staining and biochemical test media are useful for identifying bacterial pathogens.

ASM Recommended Curriculum Guideline: 34
NCLEX-RN Alignment: Physiological Adaptation

11. Vaccines are safe and effective methods to prevent disease.
   a. Vaccines allow the host immune system to acquire memory against a particular pathogen.
   b. Vaccines are produced through a variety of methods, come in different formulations, and have different recommended schedules of administration that are designed to optimize immunization efficacy.
   c. Vaccines promote herd immunity and protect at risk populations that cannot be vaccinated. Understanding immune responses (especially the nature of immunological memory) helps nurses and other healthcare providers understand how vaccines work.

ASM Recommended Curriculum Guideline: 31
NCLEX-RN Alignment: Reduction of Risk Potential; Communication & Documentation; Physiological Adaptation

Healthcare Associated Infections & Epidemiology

12. Healthcare associated infections (HAIs, nosocomial) are costly and often have a poorer prognosis than community acquired infections.
   a. HAIs can be limited by standard/universal precautions, transmission precautions, surgical asepsis, and biosafety level precautions. These precautions are central to safely managing patients and safely collecting/analyzing patient samples.

ASM Recommended Curriculum Guidelines: 23, 37
NCLEX-RN Alignment: Safety & Infection Control; Health Promotion & Maintenance; Therapeutic Environment
13. Tracking and reducing the incidence of healthcare acquired infections is a collaborative effort that saves lives.
   a. Epidemiologists including those at state health departments, the Centers for Disease Control & Prevention (CDC), and the World Health Organization (WHO) use a variety of surveillance techniques to monitor certain infectious diseases. Being familiar with emerging and remerging infectious agents is essential if healthcare teams are to be prepared to manage potential outbreaks.
   
   **ASM Recommended Curriculum Guidelines: 23, 37**
   **NCLEX-RN Alignment:** Safety & Infection Control; Health Promotion & Maintenance; Therapeutic Environment

14. There are numerous strategies (i.e. quarantine, vector control, patient education) to break the epidemiological triangle and prevent disease transmission.
   
   **ASM Recommended Curriculum Guideline:** 23
   **NCLEX-RN Alignment:** Safety & Infection Control; Behavioral Intervention; Therapeutic Communication

**Controlling Microbial Growth to Limit Disease**

15. A microbe’s survival and growth in a given environment depends on its metabolic characteristics.
   a. Understanding a pathogen’s metabolic features (e.g. aerobic versus anaerobic metabolism or ability to break down certain nutrients) is essential for recognizing where they can thrive and their potential for introduction into humans.
   b. A pathogen’s metabolic requirements dictate its mechanisms of pathogenesis and its biofilm forming potential.
   
   **ASM Recommended Curriculum Guidelines: 11, 13**
   **NCLEX-RN Alignment:** Physiological Adaptation; Basic Care & Comfort

16. Microbial growth is controlled using physical, chemical, mechanical, and biological means.
   a. Physical and chemical methods are used to limit microbial growth in clinical settings. These are essential to reduce the incidence of healthcare associated infections (HAIs) and promote a safe and effective healthcare environment.
   b. Specific and nonspecific immunity are forms of biological control.
   
   **ASM Recommended Curriculum Guideline: 14**
   **NCLEX-RN Alignment:** Physiological Adaptation; Basic Care & Comfort

17. Antimicrobial compounds combat bacteria, fungi, helminths, protozoans, and viruses. The type of antimicrobial drug used to treat a particular pathogen depends on patient factors as well as microbial features.
   
   **ASM Recommended Curriculum Guidelines: 14, 15**
   **NCLEX-RN Alignment:** Safety & Infection Control
18. Proper stewardship of antimicrobial drugs (e.g. testing for resistance, tracking resistance, only prescribing antimicrobials when needed, and compliance with drug dosing regimens) is essential to limit antimicrobial resistance.

ASM Recommended Curriculum Guidelines: 14, 15
NCLEX-RN Alignment: Pharmacological & Parenteral Therapies; Safety & Infection Control; Psychosocial Integrity

Part 2: Competencies and Skills

Scientific Thinking & Critical Thinking Skills

19. Applying the process of science is relevant to nursing.
   a. Understanding the process of science (making observations, drawing conclusions, appreciating the roles of theories and laws in science) is central to science literacy and fundamental to nursing practices.
   b. Analyzing and interpreting results from a variety of microbiological tests applying analytical reasoning to solve problems are central to nursing practices.

ASM Recommended Curriculum Guideline: 28
NCLEX-RN Alignment: Nursing Process

20. Using quantitative reasoning ties into nursing practice.
   a. Nurses should be competent in drawing conclusions from charts and graphs related to patient medical history.
   b. Nurses should understand the metric system and scientific notation (i.e. milli \(10^{-3}\), micro \(10^{-6}\) and nano \(10^{-9}\) scales) as this terminology is used in patient medical history (e.g. lymphocyte counts) and is used in calculating dosage for medications.
   c. Nurses should appreciate that microbe levels impact disease development and prognosis (i.e. lethal dose-50 and infectious dose-50 as parameters that impact morbidity and mortality).

ASM Recommended Curriculum Guideline: 29
NCLEX-RN Alignment: Pharmaceutical & Parenteral Therapies; Reduction of Risk Potential

21. The ability to communicate and collaborate with other disciplines is important for a collaborative cross disciplinary healthcare team.
   a. Nurses should be able to effectively communicate fundamental concepts of microbiology in written and oral format.
   b. Nurses must work effectively as individuals and in groups.

ASM Recommended Curriculum Guideline: 30
NCLEX-RN Alignment: Communication & Documentation; Management of Care
22. **Understanding the relationship between science and society improves clinical practice and promotes the human aspect of medicine.**
   a. Nurses should be able to identify and discuss ethical issues in microbiology, especially with regard to vaccines.
   
   *ASM Recommended Curriculum Guideline: 31*
   *NCLEX-RN Alignment: Management of Care; Communication & Documentation; Psychosocial Integrity*

**Microbiology Laboratory Skills**

23. **Aseptic technique is central to collecting clinical samples and to protecting healthcare providers and patients.**
   a. Nurses should be competent in proper specimen collection methods.
   b. When applicable, specimen samples should be properly prepared for examination using microscopy (bright field and, if possible, phase contrast). Microscopy can lead to presumptive identification of certain pathogens (i.e. *Streptococcus* vs. *Staphylococcus*).
   
   *ASM Recommended Curriculum Guidelines: 32, 34*
   *NCLEX-RN Alignment: Management of Care, Safety & Infection Control; Health Promotion & Maintenance; Psychosocial Integrity; Basic Care and Comfort*

24. **Microbiological and molecular lab techniques are key to identifying pathogens and implementing effective treatment options.**
   a. To effectively explain how diagnostics work and their strengths and limitations, nurses will benefit from an exposure to lab equipment and methods.
   b. Clinical microbiology techniques include using appropriate methods to enrich for and isolate microorganisms from clinical samples. Nurses are the main healthcare providers who collect such samples for analysis and they should understand how their work at the patient level can impact the accuracy of clinical microbiology tests.
   c. Nurses should understand how microbes are identified (e.g. the use of selective/differential media, rapid test kits, and molecular and serological methods).
   d. General staining procedures as well as differential staining procedures like the Gram Stain and acid-fast stain are important in diagnosis. Nurses should understand the clinical implications that staining results have on diagnosis and treatment options.
   e. Understanding how pathogens are enumerated in a patient sample (for example, through direct count, viable plate count, and spectrophotometric methods) ties into how infections are treated and patient prognosis.
   
   *ASM Recommended Curriculum Guidelines: 33, 34, 35, 36*
   *NCLEX-RN Alignment: Management of Care*

25. **All healthcare providers must understand protective procedures for handling infectious materials to prevent the spread of disease.**
   a. Understanding biosafety levels and emergency procedures is central to safe nursing.
   
   *ASM Recommended Curriculum Guideline: 37*
   *NCLEX-RN Alignment: Safety & Infection Control; Physiological Adaptation; Reduction of Risk Potential; Basic Care & Comfort*
26. The ability to document and report on experimental protocols, results and conclusions is key to patient treatment.
   a. Nurses must accurately label specimens and keep records.
   b. In the microbiology lab nurses learn how to properly label specimens, correctly maintain records/complete paper work (which may be considered legal documentation), and use flow charts to solve a problem or direct their action.

ASM Recommended Curriculum Guideline: 38
NCLEX-RN Alignment: Communication & Documentation