After this webinar, you should be able to:

- Explain how the new ASM Curriculum Guidelines (CG) support recommendations from Vision & Change and other national reports
- Describe the steps involved in the process of backward design, and how it relates to the ASM CGs
- Identify and write appropriate learning outcomes (LO)
- Align assessments with LOs

**ASM Curriculum Guidelines**

**Core Concepts with Fundamental Statements**

<table>
<thead>
<tr>
<th>Evolution</th>
<th>FUNDAMENTAL STATEMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Cells, including (e.g., prokaryotic and eukaryotic) and all major metabolically important</td>
<td>- The structures and functions of microorganisms have been revealed by the use of microscopy techniques in the study of the structure and function of cells, replication, and genetic transformation.</td>
</tr>
<tr>
<td>- Metabolic pathways and the interactions among organisms</td>
<td>- Microbes and microorganisms have specialized structure (e.g., flagella, virus, and plasmids) and cell metabolism characteristics.</td>
</tr>
<tr>
<td>- Life is energy dependent</td>
<td>- Microorganisms are able to obtain energy from other sources different from their environment (e.g., photosynthesis, oxidative stress, and non-oxidative stress).</td>
</tr>
<tr>
<td>- Impact of microbes</td>
<td>- The evolutionary nature of microorganisms is reflected in their genetic makeup.</td>
</tr>
</tbody>
</table>

**Polling Question**

Are you familiar with “Understanding by Design” often called “Backward Design”? 

A. I know what it is and I have used it. 
B. I have some idea of what it is, but I haven't used it. 
C. I have heard of it, but I don't really know what it is. 
D. I have never heard of it.
Understanding by Design

“Backward Design”

Understanding by Design is a process that guides curriculum development, assessment, and instruction.

Key ideas based on:
1) prioritizing outcomes and setting goals.
2) assessing students for understanding and achieving goals.
3) designing the curriculum “backward” from those goals.

1) LEARNING OUTCOMES: Identify desired results

2) ASSESSMENT: decide acceptable evidence

3) INSTRUCTION: Plan learning experiences

FUNDAMENTAL STATEMENTS

Enduring Understanding

Important to know and do

Worth being familiar with

Are you familiar with learning outcomes?

A. I know what they are and I have used them.
B. I have some idea of what they are, but I haven't used them.
C. I have heard of them, but I don't really know what they are.
D. I have never heard of them.
A student learning outcome is:
"a specific statement that describes the knowledge, skills/abilities, or attitudes that students are expected to learn upon successful completion of a course or activity."

Anatomy of a learning outcome:
1) State the condition
2) Describe a performance
3) Give the criteria
4) Measure student success!

After this activity, students will be able to design an antibiotic that would affect Gram (+) cells, but not Gram (-) cells.

Student-centered
Measurable
Action-oriented
Results-driven
Tailored to specific goals
Learning Outcomes

Fundamental Statement (FS): Bacteria and Archaea have specialized structures that often confer critical capabilities.

Which of the following do you think is the BEST learning outcome related to this FS?

After this activity, students will be able to:

A. label a diagram of a bacterial flagellum.
B. understand the function of pili and fimbriae.
C. appreciate that endospores can survive extreme conditions.
D. How do specialized structures enable a bacterium to survive in a given environment?

Learning Outcomes

Which learning outcome is an improvement over:

After this activity, students will be able to:

A. tell all about endospores and surviving pasteurization.
B. understand how endospores help cells survive.
C. describe 2 features of endospores that allow them to survive extreme conditions.
D. What makes endospores so resilient?

Bloom’s Taxonomy

Higher-order activities and assessments develop critical thinking skills.

LOW-ORDER THINKING VERBS:
Define, Draw, Identify, Label, List, Locate, Match, Name, Recall, Recite, Recognize, State, Underline

Construct, Convert, Describe, Develop, Discuss, Draw, Estimate, Explain, Give examples, Group, Identify, Locate, Rearrange, Report, Review, Summarize

BLOOM’S TAXONOMY
CREATING EVALUATING ANALYZING

HIGHER-ORDER THINKING VERBS:
Assess, Arrange, Assemble, Compare, Conclude, Contrast, Critique, Categorize, Combine, Compile, Compose, Construct, Create, Design, Develop, Debate, Defend a position, Estimate, Evaluate, Formulate, Generate, Hypothesize, Improve upon, Invent, Investigate, Judge, Justify, Modify, Organize, Plan, Propose, Predict, Rank, Review, Revise, Rewrite, Synthesize….
**Fundamental Statement:**
“Replication cycles differ among viruses and are determined by their unique structures and genomes.”

**Select the Learning Outcome that addresses HIGHER-order thinking according to Bloom’s Taxonomy:**

A. Label the key parts of the virus.
B. Arrange the steps of a viral infection in the correct order.
C. Compare and contrast the physiological consequences for a cell infected by bacteriophages T₄ and lambda.
D. State the difference between an enveloped and non-enveloped virus.

**ASM Curriculum Guidelines**
(Learning Outcomes and Bloom’s Taxonomy)

Higher-order activities and assessments develop critical thinking skills.

**Cell Structure and Function**
- **FS:** Bacteria and Archaea have specialized structures (e.g., flagella, endospores, and peptidoglycan) that offer their unique evolutionary advantages.
- **Higher-order thinking**
  - **LO1:** Describe, explain, compare, and contrast the structure of cell membranes and cell walls in Bacteria and Archaea.
    - **Bloom’s Taxonomy:** Understand how specialized structures (e.g., peptidoglycan, lipopolysaccharides, capsules, or flagellum) enable a microorganism to survive in a given environment.
    - **Bloom’s Taxonomy:** Predict how the ability to make a specialized structure (e.g., peptidoglycan, lipopolysaccharide, capsule, or flagellum) might affect survival.
    - **Bloom’s Taxonomy:** Compare and contrast different bacterial transport processes (e.g., facilitated diffusion, osmotic transport, ABC transporters, group translocation, etc.) with regard to the proteins involved and the energy source used.

**Assessment**

“Backward Design”

Based on:
1. prioritizing outcomes and setting goals.
2. assessing students for understanding and achieving goals.
3. designing the curriculum “backward” from those goals.

1) **LEARNING OUTCOMES:** Identify desired results
2) **ASSESSMENT:** Decide acceptable evidence
3) **INSTRUCTION:** Plan learning experiences

**Pre-assessment (BEFORE: finding out)**
- Pre-test checklist
- Peer evaluation
- Oral questions
- Concept inventory (another ASM project)

**Formative Assessment (DURING: checking in)**
- Observation
- Self-evaluations
- Classroom discussion
- Journal entries
- Concept inventory (another ASM project)

**Summative Assessment (AFTER: making sure)**
- Tests
- Peer evaluation
- Performance tasks
- Demonstrations
- Portfolios
- Concept inventory (another ASM project)

**Assessments should align with your Learning Outcomes**

**QUESTION:** Compare and contrast the structure of cell envelopes in Bacteria and Archaea.

A. Predict how β-lactam antibiotics would affect Bacterial and Archaeal cells and explain why.
B. Which structures are found in Gram (+) bacteria only, Gram (-) bacteria only, or both?
C. Describe 2 functions of the peptidoglycan cell wall.
D. Explain how vancomycin inhibits the growth of bacterial cells.
**Assessment**

Assessments should align with your Learning Outcomes

**QUESTION:** Which assessment aligns with the LO: *Describe the features of endospores that allow them to survive extreme conditions.*

A. Describe how membranes in thermophiles are different from membranes in mesophiles.
B. How do endospores protect their DNA in extreme conditions over long periods of time?
C. What features allow *Deinococcus* to withstand high radiation?
D. Design an experiment that would allow you to isolate a *Bacillus* auxotroph.

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**ASM Curriculum Guidelines**

**Core Concepts from V&C (2012)**
- each with a number of

**Fundamental Statements (2013)**
- each with a number of

**Learning Outcomes (ASMCUE 2013)**
- each with a number of

**Assessments (ASMCUE 2014)**

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**SLAMD**

STUDENT LEARNING ASSESSMENTS IN MICROBIOLOGY DATABASE

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**Resources**

3. SLAMD: [http://www.microbelibrary.org/about](http://www.microbelibrary.org/about)
6. Biology in Bloom: Implementing Bloom's Taxonomy to Enhance Student Learning in Biology: [http://www.lifescied.org/content/7/4/368.full](http://www.lifescied.org/content/7/4/368.full)

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**QUESTIONS?**