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Developing Critical Thinking
in Medical Lab Program



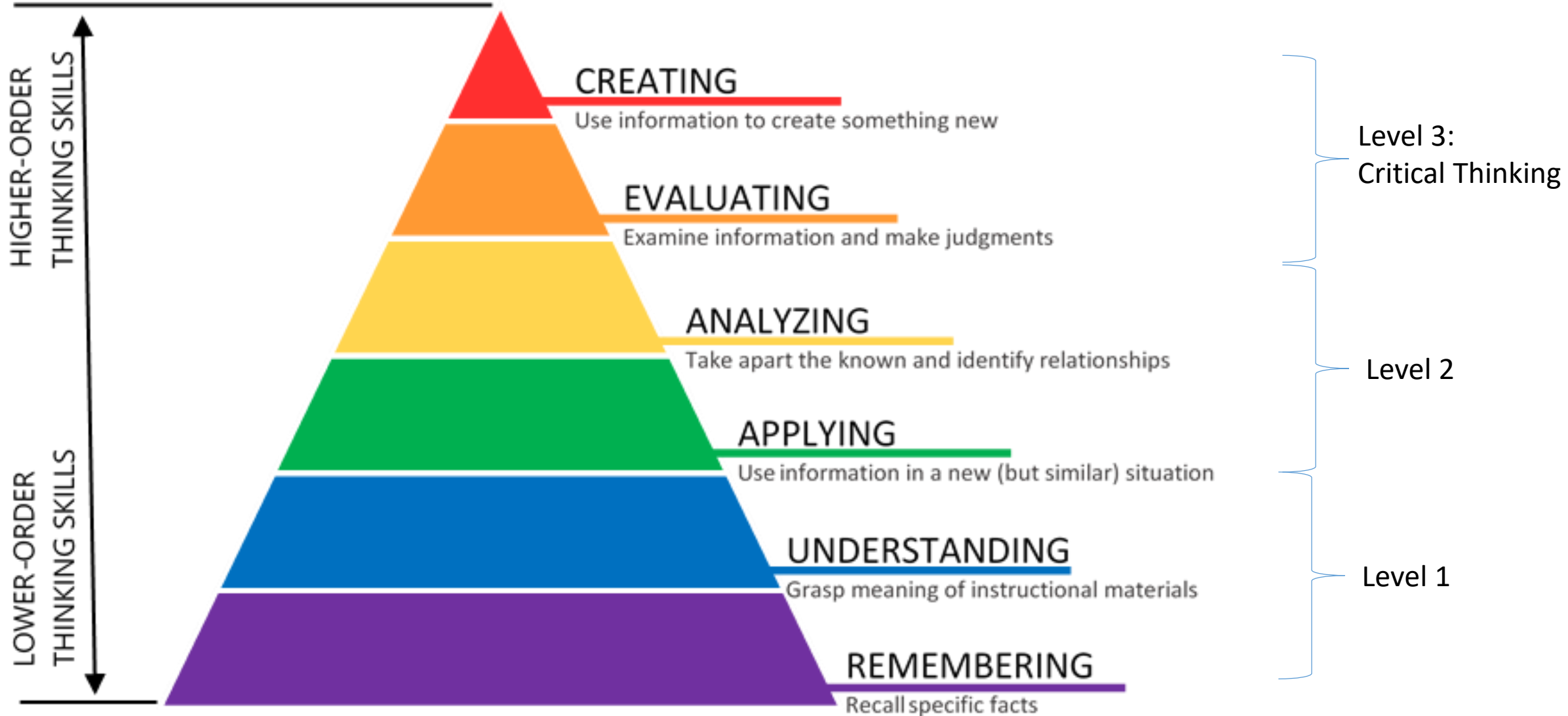
Outline/Objectives

- Discuss the framework of an MLS curriculum and how it develops critical thinking skills for MLS students
 - Blooms Taxonomy
 - Course Sequencing
 - Examples of Microbiology Lab(s)
- Discuss *proposed* course curricular changes in an educational setting to improve critical thinking of graduates

Accredited MLS Programs

- **Goal:** To develop competent entry-level Medical Laboratory Scientists
- **Description of entry-level (summarized from NAACLS)**
 - Ability to perform a full range of laboratory testing in all clinical areas
 - Role in development and evaluation of test systems and interpretive algorithms
 - Diverse responsibilities in analysis, QA/QC, and compliance
 - Be professional, ability to communicate with others
 - ***Problem solve, troubleshooting techniques***
- **How do we get students entry-level?**

BLOOM'S TAXONOMY – COGNITIVE DOMAIN (2001)



Mixture of objectives

Cognitive

- Emphasizes intellectual learning outcomes

Psychomotor

- Involves activities requiring neuromuscular coordination

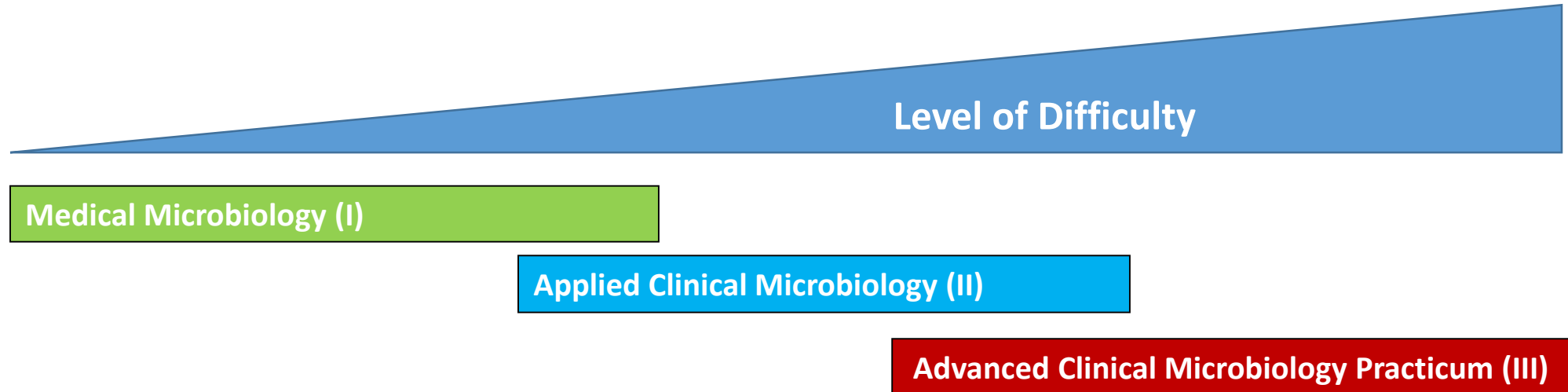
Affective

- Involves values, attitudes and interests

Objectives Properly Sequenced (L1 → L3)

Classification	Level 1	Level 2	Level 3
Cognitive	<i>Recall</i>	<i>Application</i>	<i>Problem Solving</i>
Psychomotor	<i>Readiness</i>	<i>Proficiency</i>	<i>Adaptation</i>
Affective	<i>Awareness</i>	<i>Value</i>	<i>Commitment</i>

Sequencing – Microbiology Curriculum Example



Typically 2-3 total semesters (courses) to get students to critically think

Objectives Example

- **Clinical Microbiology (Clinical Micro I)**

- Identify medically significant bacteria through recognition of macroscopic & cellular morphology, growth patterns & requirements, & specific tests as they are performed in laboratory
- Discuss the principles of biochemical & other definitive diagnostic tests performed on organisms studied in the laboratory.

- **Advanced Clinical Microbiology (Clinical Micro II)**

- Distinguish normal flora from potential pathogens and list commensal organisms that one could expect to isolate from various clinical sites.
- Compare and contrast what pathogens cause the most common diseases in various organ systems.

- **Advanced Clinical Microbiology Practicum (Clinical Micro III)**

- Organize the daily workload and complete testing in an accurate, efficient, and timely manner.
- Correlate test results on patient samples to obtain a clinical diagnosis.

Medical micro lab example (Micro I)

Lab 1: Student Procedures: please share broth but work individually

1. Gram stain mixed broth. Record the Gram stain results.
 1. Label the slides
 2. Mix the broth, flick the bottom (the caps are vented, **do not invert tube**)
 3. Circle the area you wish to apply the organism, about 2 cm wide (1cm = width of small fingernail)
 - a. Use etching pen & circle the bottom of the slide
 4. Apply one loop of organism, spread into a thin layer, slightly smaller than the width of the circle
 5. Label the edge of the slide with the organism (use etching pen)
 6. Place on the slide warmer (attached to top of incinerator) to dry fast or leave on bench to dry while you set up other procedures (go to part 2 on following page)
 7. Fix the slides by holding in flat on the front of the incinerator for 20 seconds. *Slide warmer does NOT fix the organisms to the slides.*
 8. Proceed with *Clinical* Gram Stain procedure (see box below)
 9. Record the Gram reaction and cell morphology on the results table (page 7 in manual)
 10. Store your "Gram Stains" in your slide box for later reference. Label your slide box with your name & section using labeling tape.

Applied Clinical Lab (Micro II) – Lab Example

Part I: Set up Blood Culture

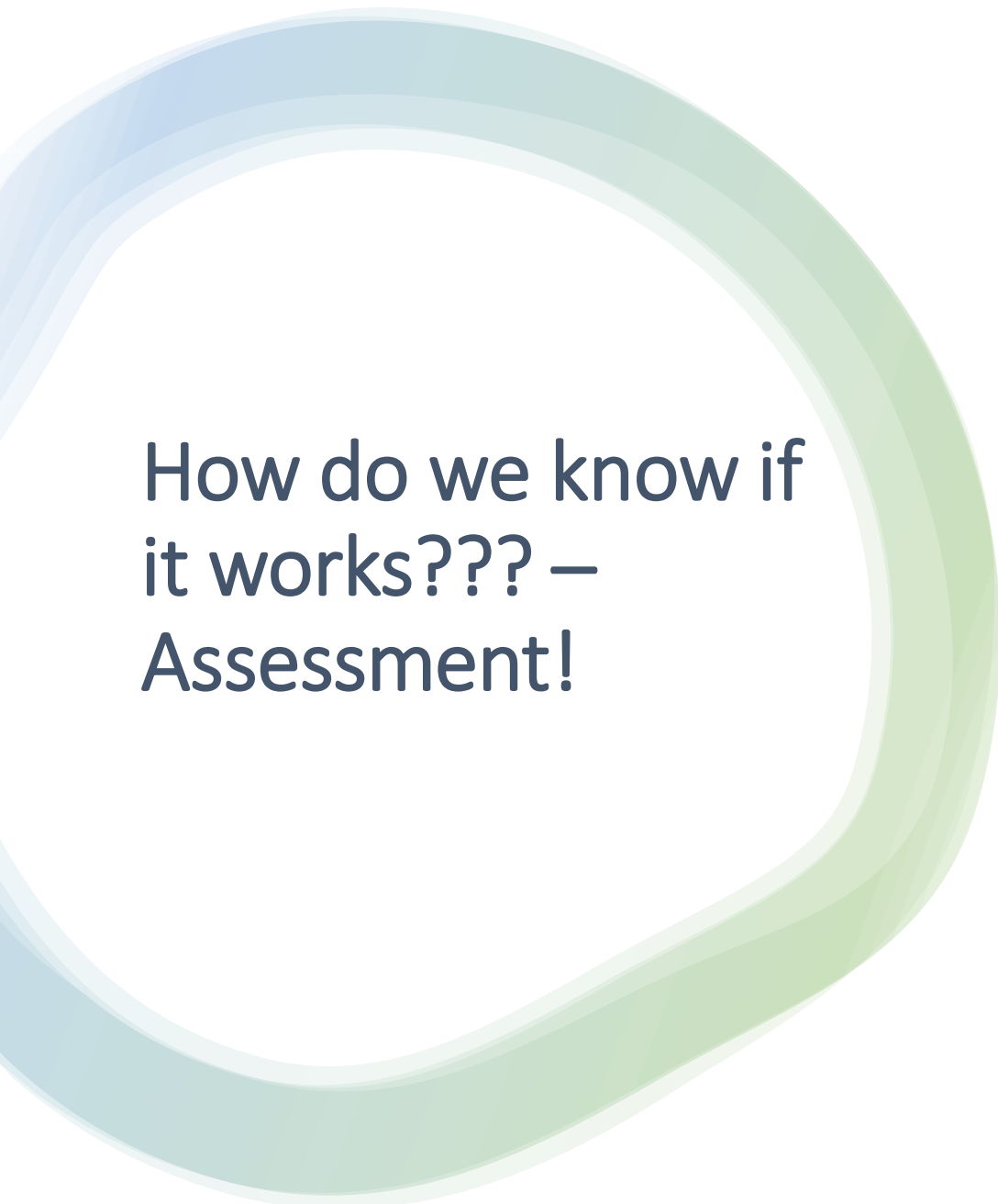
- Select blood culture bottle (patient specimen) labeled with your bench #
- Record patient information on the Micro Lab Report form.
- Specimen observation: record results on Micro Lab Report form:
(clear, cloudy, hemolyzed, etc.)
- Plate and streak for isolation: SBA, Choc, Mac, and a slide for gram stain.
- Gram Stain: observe & record results on Micro Lab report form
- Incubate in proper incubators

CSF specimen Work up

- Review gram stain result; repeat if required from plates.
 - Observe plates (SBA, Choc, Mac, BHI broth); record observations on Micro Lab Report form.
 - Pathogen ID / Susceptibility (refer to p. 10):
 - Perform appropriate presumptive (rapid) test(s): catalase or oxidase on suspect pathogen.
 - Set up confirmatory test(s) & susceptibility testing (if required).
 - Re-incubate plates with growth.
- SAVE ALL PLATES, TUBES, TESTS, & SLIDES until report is graded & returned.**

Applied Clinical Lab (Micro II): Plate Reading Quizzes

1. In a normal individual, should this specimen be sterile or contain normal flora?
2. How many pathogens/organisms do you suspect, after observing the plates?
3. Describe the growth pattern and the colony morphology of the suspected pathogen(s) (example: Medium tan colonies, growth on Chocolate and BAP, no growth on Mac)?
4. Based on growth, can we determine if organism is Gram Positive, Negative or Fastidious?
5. What is the most likely Gram stain result (organism only)?
6. What is the most likely pathogen present?
7. Indicate a presumptive or confirmatory test that you would perform to aid in confirming identification



How do we know if
it works??? –
Assessment!

- **NAACLS (Accreditation) Benchmarks/Outcomes**
 - Graduation Rates, Job Placement Rates, ***Board of Certification Rates***
- **Advisory Committee**
- Surveys
 - Graduate, Program Exit, Employer
 - **Most critical feedback in 2022 – preparing graduates to manage workload within laboratory**

Ideas to Improve Critical Thinking

- **Writing**
 - Informal or formal
 - Formulating own opinion
- **Research**
 - Unanswered questions
 - Coming up with own hypotheses and tests
- **Open Resource Exams**
 - Questions that don't have a write/wrong answer
 - Can go into higher level quicker
- **Questions we are trying to avoid from students**
 - *What I need to know* for this objective?
 - *Do I just need to memorize* everything on the slides for the exam?



Questions?