RCN-UBE Biochemistry and Molecular Biology Workshop Sessions

University of Michigan - Dearborn
16 June 2012

American Society for Biochemistry & Molecular Biology
Supported by NSF
Goals of This Today’s Workshop

1. Rewrite BMB Core Concepts into sentences

2. Transform BMB Core Concepts into $\geq 5$ Specific Performance Expectations.

3. Identify underlying concepts from chemistry, physics, biology and math that support one Performance Expectations.
Biochemistry Working Core Concepts

From workshops across the nation, and from small working groups last year, three (3) core concepts and a set of skills have emerged. These core concepts and skills will occupy us in various ways for the rest of the day.

First we need to create working groups of about four people each. You will stay with this group for the workshop activities.
Problem-solving is what you do when you don’t know what to do, otherwise it is not a problem.

Wheatley (1984)
Forming Groups
Homogeneous vs. Heterogeneous

Your Class

Student Selected

"Homogeneous" Groups

Instructor Selected

"Heterogeneous" Groups
What Aspects of Heterogeneity are Important for this Workshop?

Skills?  Age?  Discipline?
Gender?  Learning Style?  Personality Type?
Institution Type?  Class size taught?  Ethnicity?
If you know you want to form heterogeneous groups, but don’t know critical information about your audience, what can you do?

Let the sthem help you.
### Forming Heterogeneous Groups Without Prior Information

When you have calculated “Your Number”, line up in numerical order.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>If you are Male, add 400</td>
<td>400</td>
</tr>
<tr>
<td>If you are Female, add 200</td>
<td>-</td>
</tr>
<tr>
<td>If you consider yourself a Molecular Biologist – add 200</td>
<td>-</td>
</tr>
<tr>
<td>If you consider yourself a Biochemist – add 100</td>
<td>100</td>
</tr>
<tr>
<td>If you are employed by a PUI – add 100</td>
<td>-</td>
</tr>
<tr>
<td>If you are employed by a University – add 50</td>
<td>50</td>
</tr>
<tr>
<td>Sum the last 2 digits of your Phone Number</td>
<td>8</td>
</tr>
<tr>
<td><strong>GRAND TOTAL (Your Number)</strong></td>
<td>558</td>
</tr>
</tbody>
</table>
Four Working Core Concepts

1. Energy: Fundamental Nature, Utilization and Flow (Groups 1 & 5)

2. Core Concepts in Biochemistry and Molecular Biology are Based on Certain Skills: (Groups 2 & 6)
   a. Objective Measurement
   b. Quantitative Analysis
   c. Critical Interpretation

3. Macromolecular Structure, Function, Regulation, and Storage (Groups 3 & 7)

4. Transformation and Transfer of Information (Groups 4 & 8)
Session I: Input and Feedback from Biochemistry Educators on Working Core Concepts

Each group transform your assigned core concept into a complete sentence (or two) that would succinctly capture its meaning.

Elect a group recorder who has the responsibility of capturing your group’s responses and communicating them to me.
Session II: Unpackaging Core Concepts

Working in your groups, write at least five performance outcomes for your assigned core concept. These would be the ≥5 most important learning objectives for this core concept or skill set.

These performance outcomes should embrace the breadth of that core concept.

Use Bloom’s Taxonomy (in binder) to choose appropriate verbs for the cognitive levels of the objectives.
Bloom’s Taxonomy

Knowledge
- Memorizing verbatim information. Being able to remember, but not necessarily fully understanding the material.

Comprehension
- Using information to solve problems; transferring abstract or theoretical ideas to practical situations. Identifying connections and relationships and how they apply.

Application
- Identifying components; determining arrangement, logic, and semantics.

Analysis
- Making decisions and supporting views; requires understanding of values.

Synthesis
- Combining information to form a unique product; requires creativity and originality.

Evaluation
- Restating in your own words; paraphrasing, summarizing, translating.

Graduate School

Undergraduate

High School
## Bloom’s Taxonomy for Thinking

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Comprehension</th>
<th>Application</th>
<th>Analysis</th>
<th>Synthesis</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recall</td>
<td>Understanding</td>
<td>Using knowledge in new situations</td>
<td>Breaking things down Critical thinking</td>
<td>Putting things together Creative thinking</td>
<td>Judgement</td>
</tr>
<tr>
<td>Knowledge Retention</td>
<td>Knowledge Retention</td>
<td>Knowledge Retention</td>
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<tr>
<td>Foundation for higher order thinking</td>
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</table>

**Evaluation**
- Appraise, Argue, Assess, Choose, Conclude, Critic, Decide, Evaluate, **Judge**, Justify, Predict, Prioritize, Prove, Rank, Rate, Select,

**Synthesis**
- Compose, Construct, **Create**, Design, Develop, Integrate, Invent, Make, Organize, Perform, Plan, Produce, Propose, Rewrite

**Analysis**
- Analyze, Characterize, Classify, Compare, Contrast, Debate, Deduce, Diagram, Differentiate, Discriminate, Distinguish, Examine, Outline, Relate, Research, **Separate**

**Application**
- Apply, Change, Choose, Compute, Dramatize, Interview, Prepare, Produce, Role-play, Select, Show, Transfer, **Use**

**Comprehension**
- Conclude, Demonstrate, Discuss, Explain, Generalize, **Identify**, Illustrate, Interpret, Paraphrase, Predict, Report, Restate, Review, Summarize, Tell

**Knowledge**
- Count, Define, Describe, Draw, Find, Identify, Label, List, Match, Name, Quote, **Recall**, Recite, Sequence, Tell, Write

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Promoting Concept Driven Teaching Strategies in BMB through Concept Assessments
Session III: Identify foundational concepts from Chemistry, Physics, Biology, and Math

Working in your group, consider your core concept and relate it to foundational concepts from chemistry, physics, and math.

Select the appropriate ones for the learning objectives that you developed.

If there are additional foundational concepts, please identify them.

i. e. What do students need to know and use from prerequisite courses to understand your core BMB concepts?
What Do Our Students Need to Know?

Biochemistry
- Provides the relevance

Molecular Biology
- Provides the methods and molecular perspective
- Provides the means to evaluate and predict

Chemistry

Mathematics

Physics
- Provides physical models
Future Direction of the Project

Change and refine wording of core concepts in biochemistry and molecular biology based on nation-wide workshops such as this one.

Compile learning outcomes developed at these workshops for each core concept.

Identify foundational concepts from chemistry, physics, biology, and math.
Thank you

Thank you for your time and effort in developing these national biochemistry and molecular biology core concepts and learning objectives!