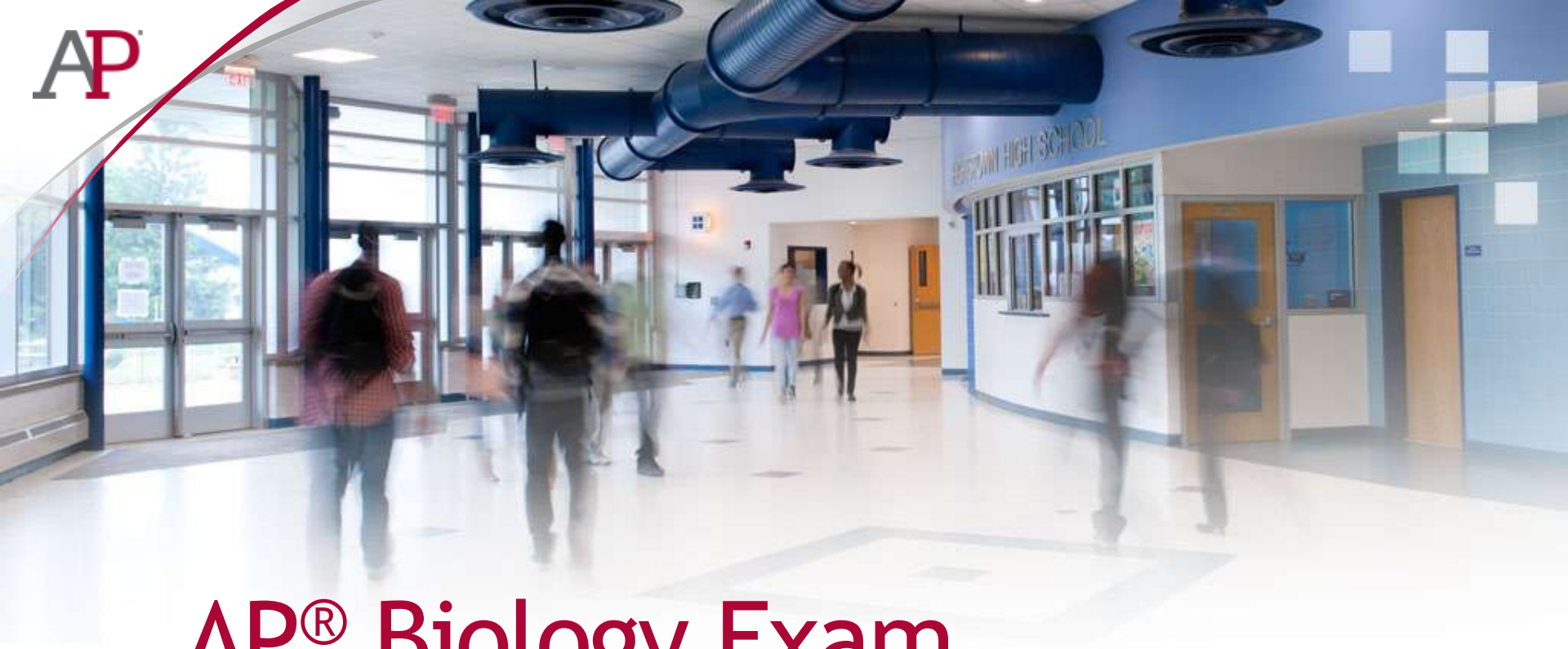

AP® Biology Exam

Rosemary Reshetar, The College Board

September 13, 2012

Large Scale Assessments Session

Workshop on Developing Assessments to Meet the Goals of the 2012 Framework for K-12 Science Education

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AP® Biology Intro

- Course and Exam
  - College level courses offered in high school
  - Revised course in effect fall 2012
  - AP Exams are given annually in May
- Revised course
  - Reduction in breadth of content
  - Increase in depth via application of science practices
- Exam
  - Standardized national assessment in support of students' application for higher ed credit and/or placement considerations
- More than190,000 test takers in 2012

The Exam Administration

- Secure proctored school-day administration
- Administered by high schools
- Designated date and time (May 13, 2013; 8 am)
- Paper and Pencil
- 3 hours
  - 90-minute multiple-choice section
    - 63 Multiple Choice
    - 6 Grid-in
  - 90-minute free-response section
    - 2 Long (e.g., 10 point)
    - 6 Short (e.g., 4 point)

Assessment of Content Knowledge and Science Practices

Evidence Centered Design applied for the course and exam review

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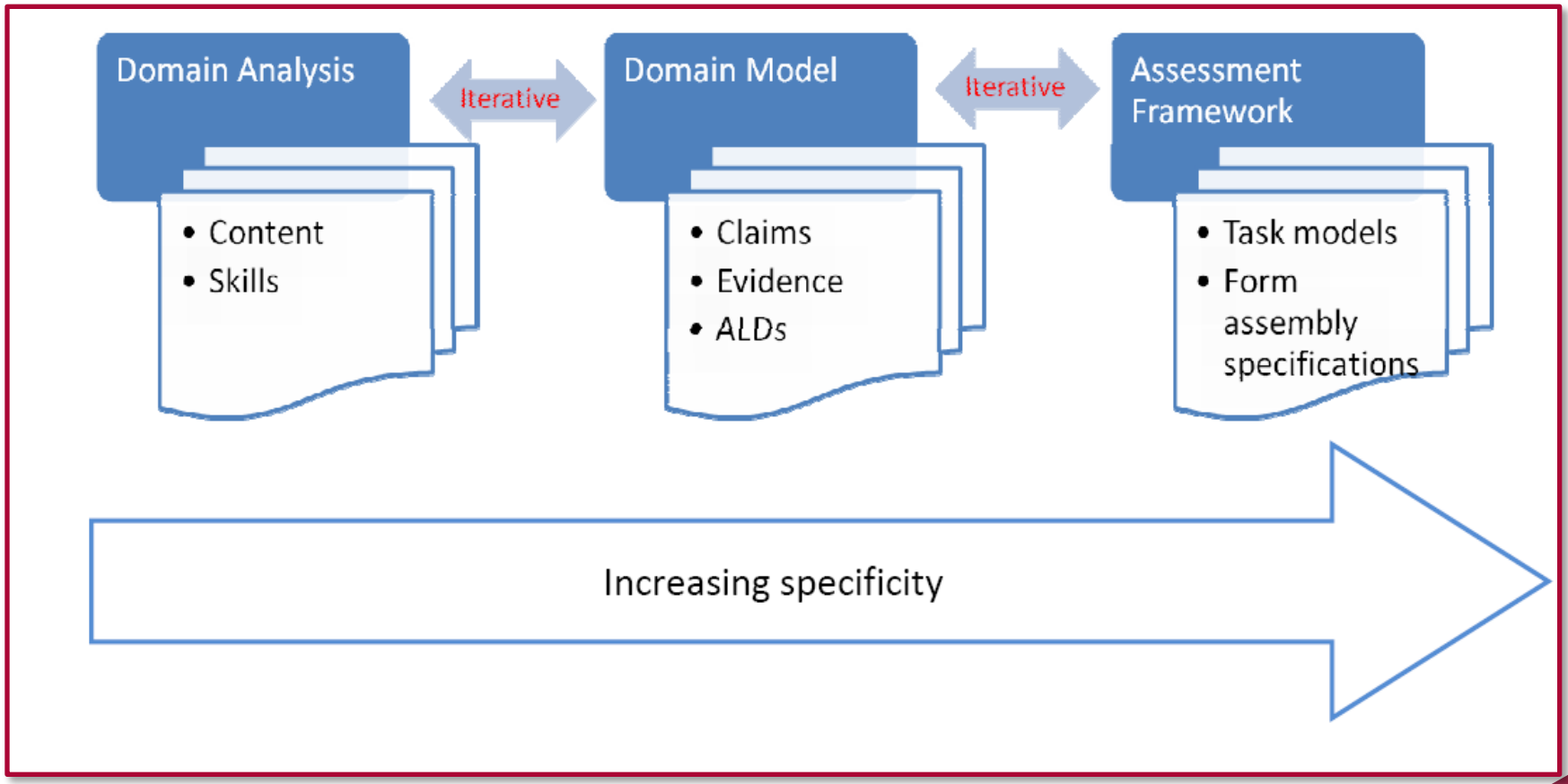
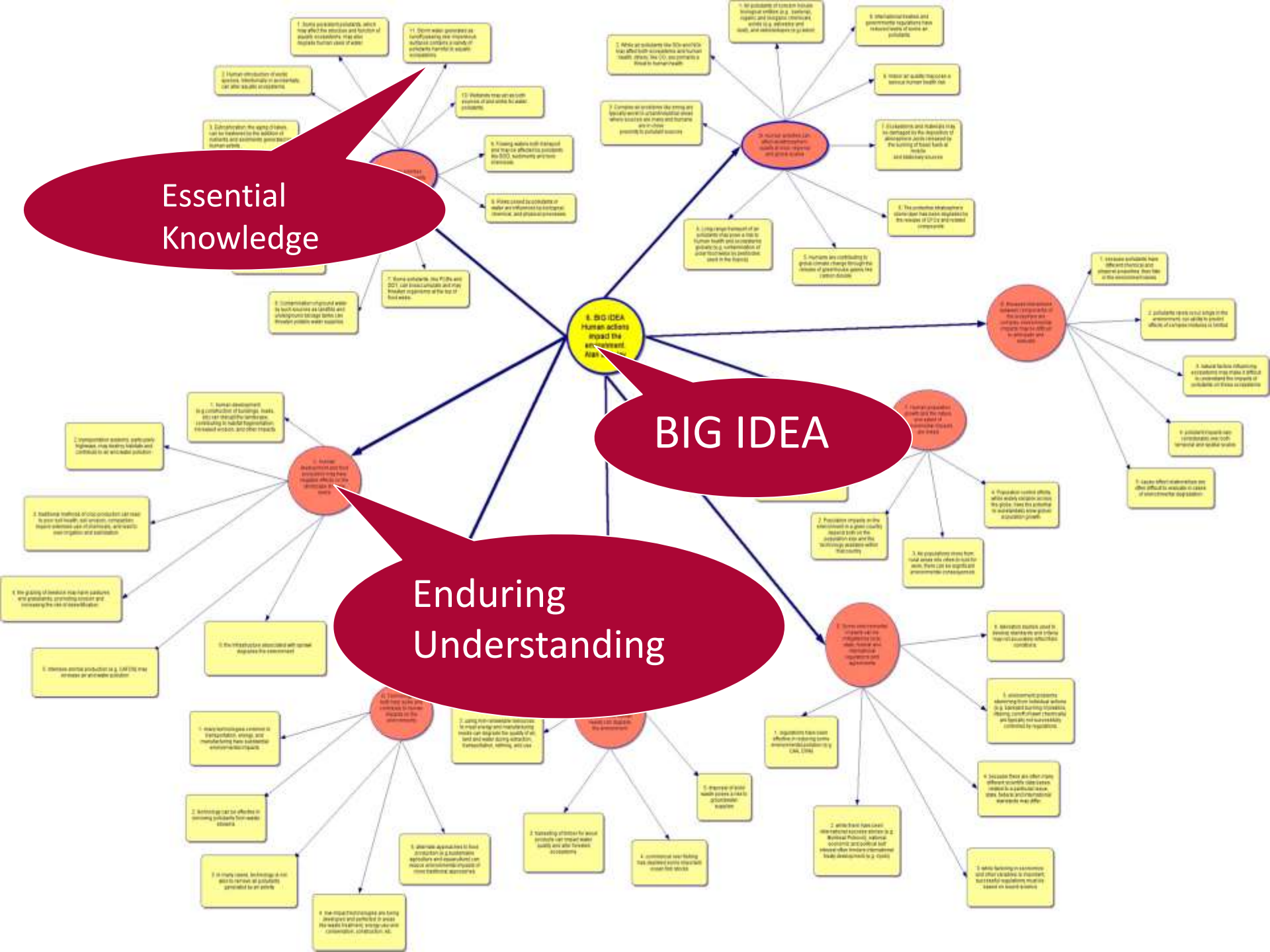
Three Critical ECD Phases (Course & Exam)



Assessment of Content Knowledge and Science Practices

- Experts with disciplinary content knowledge unpacked the domains, resulting in the content outline
  - Big Ideas (level 1)
  - Enduring Understandings(level 2)
  - Essential Knowledge (level 3)


Essential Knowledge
BIG IDEA
Enduring Understanding

Critical Design Element: Learning Objectives

Marriage of the 2nd level of science practices with the 3rd level of the content outline

Science claims and evidence

Biology Concept Outline	
1 - 4	Big Ideas
1A - 4C	Enduring Understandings
1A1 - 4C4	**Essential Knowledge**
1A1a - 4C4b	Additional detail

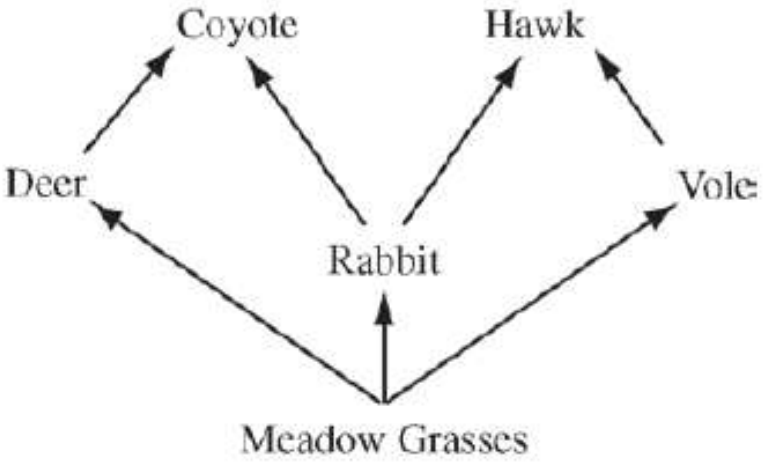
Science Practices
1 - 7
1.1 – 7.2
1.1.1 – 7.2.5

Learning Objective (Claim) = Essential Knowledge + Level 2 Science Practice

Example L.O.: (1C3 & 5.3): The student is able to evaluate given data sets that illustrate evolution as an on-going process.

Evidence is derived from fourth level of the Concept Outline and the Level 3 Science Practices

Food Web Example



- Big Idea 4
  - Biological systems interact, and these systems and their interactions possess complex properties

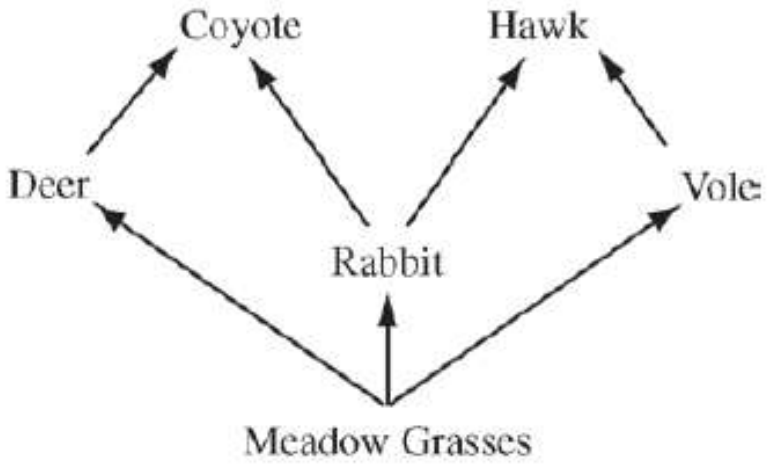
- Enduring Understanding 4.A
  - Interactions within biological systems lead to complex properties

The Learning Objective

Essential Knowledge	4.A.6: Interactions among living systems and with their environment result in the movement of matter and energy.
Science Practice	1.4: The student can use representations and models to analyze situations or solve problems qualitatively and quantitatively
Learning Objective	4.15: The student is able to use visual representations to analyze situations or solve problems qualitatively to illustrate how interactions among living systems and with their environment result in the movement of matter and energy.

Exam question

- The following is a food web for a meadow habitat that occupies 25.6 km2. The primary producers' biomass is uniformly distributed throughout the habitat and totals 1,500 kg/km2.



Developers have approved a project that will permanently reduce the primary producers' biomass by 50 percent and remove all rabbits and deer.

Which of the following is the most likely result at the completion of the project?

A) The biomass of coyotes will be 6 kg, and the biomass of hawks will be 0.5 kg.

B) The biomass of coyotes will be dramatically reduced.

C) The coyotes will switch prey preferences and outcompete the hawks.

D) There will be 50 percent fewer voles and 90 percent fewer hawks. The following is a food web for a meadow habitat that occupies 25.6 km2. The primary producers' biomass is uniformly distributed throughout the habitat and totals 1,500 kg/km2.

The Learning Objective

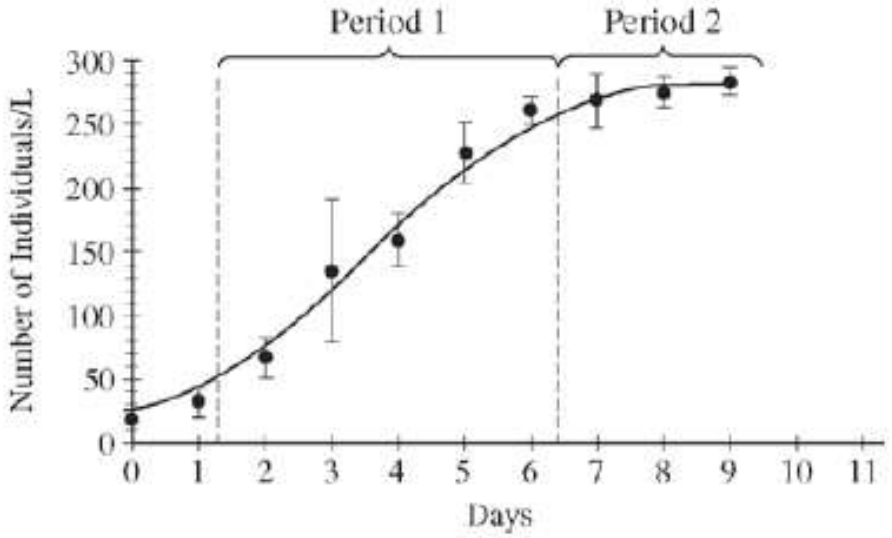
Essential Knowledge	4.A.6: Interactions among living systems and with their environment result in the movement of matter and energy.
Science Practice	1.4: The student can use representations and models to analyze situations or solve problems qualitatively and quantitatively
Learning Objective	4.15: The student is able to use visual representations to analyze situations or solve problems qualitatively to illustrate how interactions among living systems and with their environment result in the movement of matter and energy.

Exam Form Assembly Specifications

- Articulates standard distributions of Learning Objectives, thereby ensuring like distributions of both concepts/content and practices
- Items written to these specs
- Free response questions provide opportunity to cover application of science practices

Example Free Response Question

A population of microscopic eukaryotic organisms growing in a large flask had the growth pattern shown.



In one paragraph, **explain** the biological factors that determine the shape of the growth pattern shown above in both period 1 and period 2.

Example Free Response Question

Essential Knowledge	2.D.1: All biological systems from cells and organisms to populations, communities, and ecosystems are affected by complex biotic and abiotic interactions involving exchange of matter and free energy.
Science Practice	5.1: The student can analyze data to identify patterns or relationships.
Learning Objective	2.24: The student is able to analyze data to identify patterns and relationships between a biotic or abiotic factor and a biological system (cells, organisms, populations, communities, or ecosystems).

Example Free Response Question - Scoring

3 points maximum. 1 point for each correct explanation of the pattern or relationship between the environmental factor and the biological system.
Possible explanations include the following: • Recognition of exponential growth due to lack of limiting factors; reproductive/growth rate far exceeds death rate. • Slowing of reproductive/growth rate due to the influence of density-dependent limiting factors. • Death rate beginning to approach reproductive/growth rate in transition from period 1 to period 2. • Accumulation of toxic wastes increases death rate and decreases reproductive rate. • Population at carrying capacity stabilizes as the reproductive rate equals the death rate.

Score Reporting: Students

- Students receive a score of 1 through 5 which is reported to colleges and universities if desired

AP Score	Qualification
5	Extremely well qualified
4	Well qualified
3	Qualified
2	Possibly qualified
1	No recommendation

Scoring

- Multiple-Choice Section
  - Scanned, number correct
- Free-Response Section
  - Scored on-site at AP Reading in June
  - 7-days
  - Approx. 500 readers – higher ed faculty and AP teachers
  - Analytical rubrics, no. of points summed for section score
- Weighted composite = 50% MC + 50%FR
- Cut scores for 1 through 5 determined via standard setting

Score Reporting: AP Teachers

- **Instructional Planning Report** summarizes their students' performance relative to total test takers that year
  - Their group's mean and global mean
  - Number of students in their group in each quartile
- Multiple-Choice section subscores at Big Idea level
- Subscores for each Free Response Question
- For informational purposes only

Score comparability

- Scores on the 1-5 scale are comparable across administrations
- Score linking analyses rely on embedded common item anchor block in each form and equivalent group spiraling of forms
- Each year five forms are required:
  - Main, Alternate and Exception Domestic
  - Main and Alternate International

Practical Issues for Development & Maintenance

- Development timeline
  - Curriculum Framework completed Summer 2010
  - ~ 3 years until commencement of 1st exam, May 2013
  - Included special data collection studies such as think-alouds

- Challenges
  - Including broad spectrum of stakeholders in all phases of development process
  - Designing a secure, 3 hour max. exam that met desired content and psychometric requirements
  - Item Writing
    - A very tall order for item writers to craft items to the claims, writing items to the specs
    - Couldn't rely on traditional cadre of item writers

Summary: Innovations in Large-Scale Science Assessment

- Constructs:
  - Learning Objectives for AP Biology Course
- Observations
  - 3 Hour Multiple-Choice and Free-Response Format Exam
- Outcome Space/Interpretations
  - Degree of preparedness to place out of introductory college level Biology Course

Summary (cont.)

- Measurement models
  - One composite weighted raw score (MC + FR)
  - Cutscores based on standard setting and comparability study results
  - Classical Test Theory
    - NEAT linking design
    - Randomly equivalent groups design

- Demands and challenges
  - Significant challenge in training item writers to craft items in accordance with much more constrained specifications than is typically considered

College Board website links

- Collegeboard.com
- AP Central Website
  Apcentral.collegeboard.com
- AP Biology Course and Exam Description available electronically at the link below.

http://apcentral.collegeboard.com/apc/public/repository/AP_BiologyCED_Effective_Fall_2012_lkd.pdf