OLAAF: OnLine Assessment and Feedback

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Sheffield Hallam University.

OLAAF Aims

- **Develop and disseminate resources to support authors in design, delivery and evaluation of Computer-Based Assessment with Feedback (CBAF)**
  - **contributions from HE community**
  - **give evidence-informed advice, where possible**
  - **address gaps in existing resources**
- **CBAF Authoring Environments:**
  - **Consortium is TRIADS-focused**
  - **Interest Group is diverse (QM Perception, WebCT, Blackboard)**

CBAF Construction

- **Aligned CBA: map items to learning outcomes**
  - **use CBAF where appropriate**
  - **design to promote learning**
  - **staged CBAF delivery: meet needs of students when they are ready to benefit**
- **Appropriate item mix…**
  - **…with respect to cognitive levels**
  - **…taking account of needs of the student at the time the CBAF is presented**
- **Principled feedback design**
  - **more than “right” vs. “wrong”**

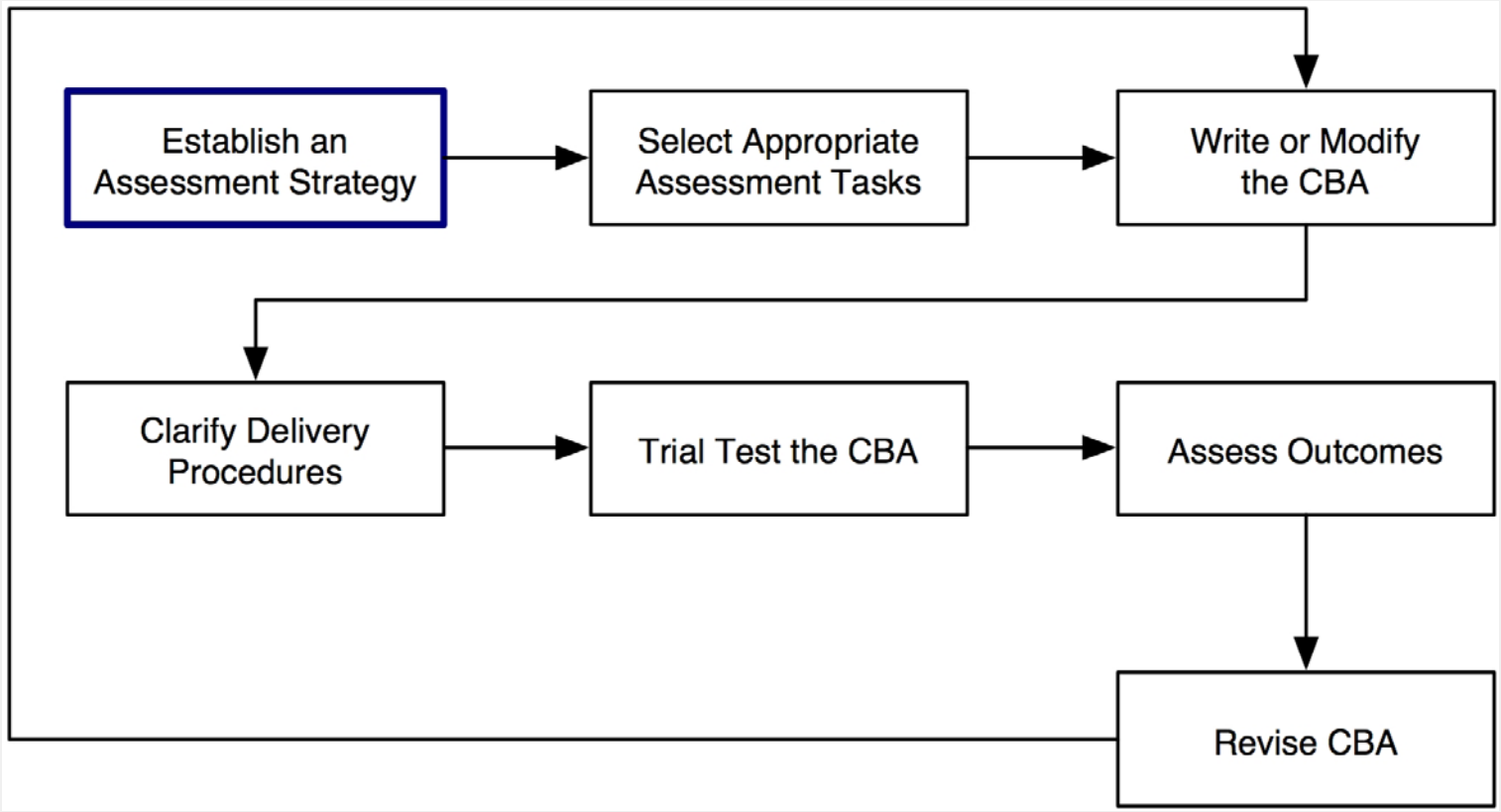
Evaluation Strategy

- **Focus on "assessment experience"**
  - **evaluate all assessments (CBA or other) similarly, to disguise 'novelty effect'**
  - **use, wherever possible, common, neutral questions about assessments**
  - **use, wherever possible, validated evaluation instruments**

Assessment Construction Resources

- **OLAAF Briefings**
  - on specific aspects of CBAF construction
  - literature reviews, annotated bibliographies
- **Toolkit for CBAF Authors**
  - proformas, checklists to assist authors approach development systematically
- **Compilation of Survey Instruments**
  - evaluation of outcomes

Assessment Development Model



Assessment Development Model

- **Choice Point**
  - **You are considering CBA(F) as an assessment in your module**
  - **What factors would influence your choice as to whether to use CBA(F)?**
    - **What would persuade you to use it?**
    - **What would dissuade you from using it?**

1st December, Loughborough

- **Assessment in Science Teaching: Technological Solutions?**
  - 10 am to 4:15 pm, Burleigh Court
  - Co-hosted by OLAAF, FAST, PPLATO and LTSN Physical Sciences

- **Learning to Learn: using technology for formative/diagnostic assessment**
- **Making Progress: using technology to engage and develop science learners**
- **Reaching Higher: using technology to promote and assess higher order learning**

- See www.physsci.ltsn.ac.uk

Contact

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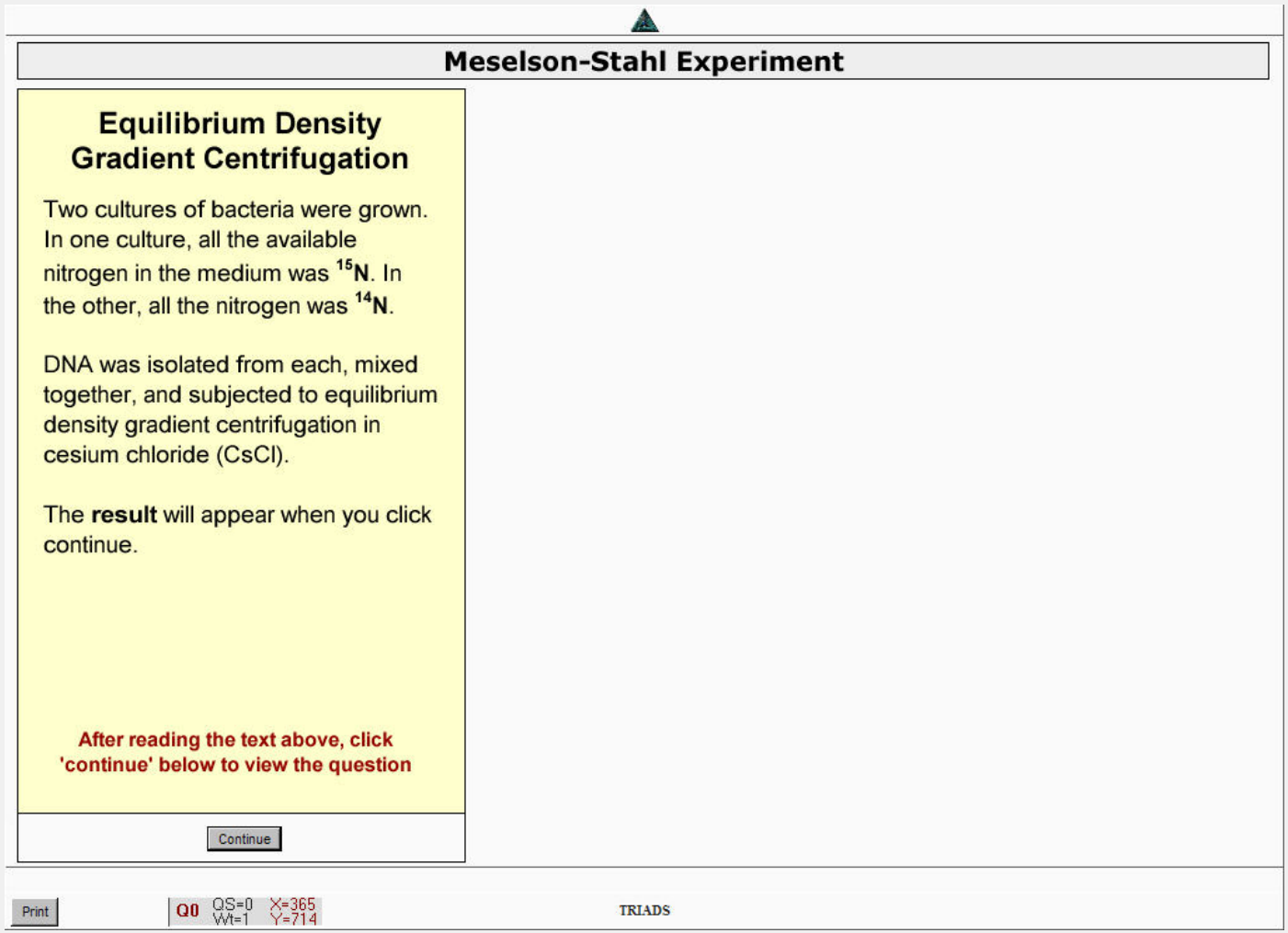
- **OLAAF web site:**
  - **http://www.bbk.ac.uk/olaaf/**

M-S 1.1


Meselson-Stahl Experiment
Equilibrium Density Gradient Centrifugation
Two cultures of bacteria were grown. In one culture, all the available nitrogen in the medium was ^{15}N. In the other, all the nitrogen was ^{14}N.
DNA was isolated from each, mixed together, and subjected to equilibrium density gradient centrifugation in cesium chloride (CsCl).
The result will appear when you click continue.
After reading the text above, click 'continue' below to view the question
Continue
Print
Q0 QS=0 Wt=1 X=365 Y=714
TRIADS

M-S 1.2

Meselson-Stahl Experiment

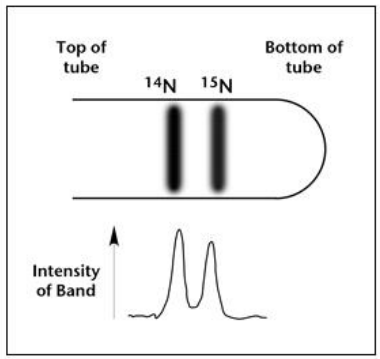
Equilibrium Density Gradient Centrifugation

Two cultures of bacteria were grown. In one culture, all the available nitrogen in the medium was ^{15}**N**. In the other, all the nitrogen was ^{14}**N**.

DNA was isolated from each, mixed together, and subjected to equilibrium density gradient centrifugation in cesium chloride (CsCl).

The **result** will appear when you click continue.

Which of the conclusions are supported by the results shown in the figure?
Select all correct answers.



- 15-N-labeled DNA is more dense than 14-N DNA
- 15-N-labeled DNA is less dense than RNA
- the amounts of DNA in the two samples are approximately equal
- 15-N-labeled DNA takes longer to reach its position in the gradient than 14-N DNA
- 15-N-labeled DNA can be separated from 14-N DNA by this method

Select answer(s) with mouse, click again to deselect. Select 'Submit' to finish.

Print | Q1 QS=0 Wt=1 X=294 Y=691 | TRIADS | Tutor Help

M-S 1.3

Meselson-Stahl Experiment

Equilibrium Density Gradient Centrifugation

Two cultures of bacteria were grown. In one culture, all the available nitrogen in the medium was ^{15}N. In the other, all the nitrogen was ^{14}N.

DNA was isolated from each, mixed together, and subjected to equilibrium density gradient centrifugation in cesium chloride (CsCl).

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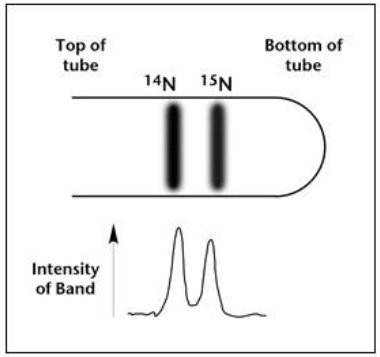

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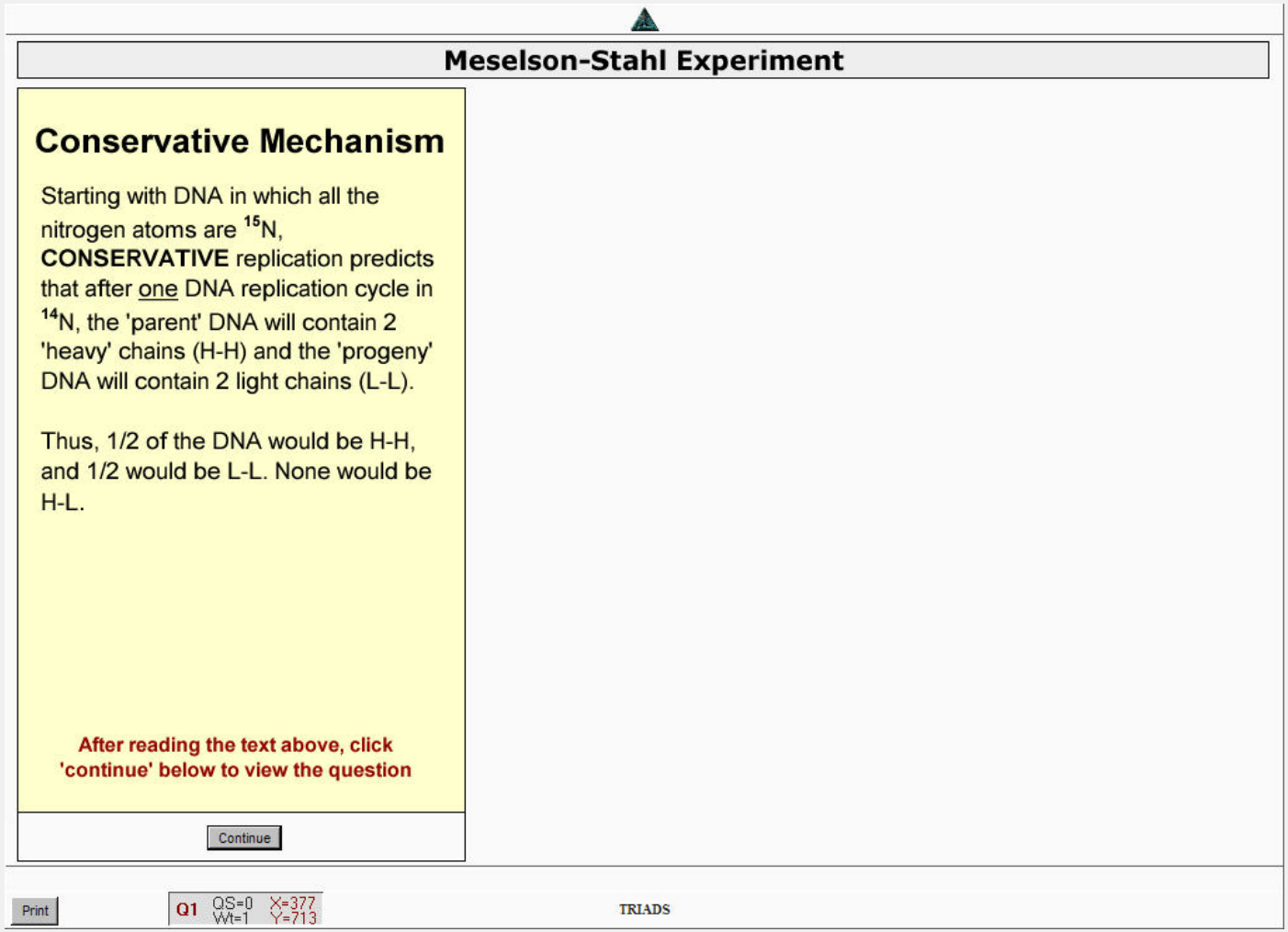
Select answer(s) with mouse, click again to deselect. Select 'Submit' to finish.

Print | Q1 QS=66 Wt=1 X=571 Y=718 | TRIADS | Tutor Help | Submit

M-S 2.1


Meselson-Stahl Experiment
Conservative Mechanism
Starting with DNA in which all the nitrogen atoms are ^{15}N, **CONSERVATIVE** replication predicts that after one DNA replication cycle in ^{14}N, the 'parent' DNA will contain 2 'heavy' chains (H-H) and the 'progeny' DNA will contain 2 light chains (L-L).
Thus, 1/2 of the DNA would be H-H, and 1/2 would be L-L. None would be H-L.
After reading the text above, click 'continue' below to view the question
Continue
Print
Q1 QS=0 Wt=1 X=377 Y=713
TRIADS

M-S 2.2

Meselson-Stahl Experiment

Conservative Mechanism

Starting with DNA in which all the nitrogen atoms are ^{15}N, **CONSERVATIVE** replication predicts that after one DNA replication cycle in ^{14}N, the 'parent' DNA will contain 2 'heavy' chains (H-H) and the 'progeny' DNA will contain 2 light chains (L-L).

Thus, 1/2 of the DNA would be H-H, and 1/2 would be L-L. None would be H-L.

Assuming CONSERVATIVE replication, what would be the proportions (as fractions) of H-H, H-L, and L-L DNA after 2 and 6 replication cycles?

A fraction is part of a whole number.
To write one-half as a fraction, we write 1/2
Fill in the gaps below using fractions where appropriate.

	H - H	H - L	L - L
EXAMPLE 1 cycle	1/2	0	1/2
2 cycles		0	
6 cycles			

Click on entry box - Type answer then press 'Enter' - click on 'Submit' to finish..

Print | Q2 QS=0 Wt=1 X=384 Y=739 | TRIADS | Tutor Help | Delete

M-S 2.3

Meselson-Stahl Experiment

Conservative Mechanism

Starting with DNA in which all the nitrogen atoms are ^{15}N, **CONSERVATIVE** replication predicts that after one DNA replication cycle in ^{14}N, the 'parent' DNA will contain 2 'heavy' chains (H-H) and the 'progeny' DNA will contain 2 light chains (L-L).

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A fraction is part of a whole number.
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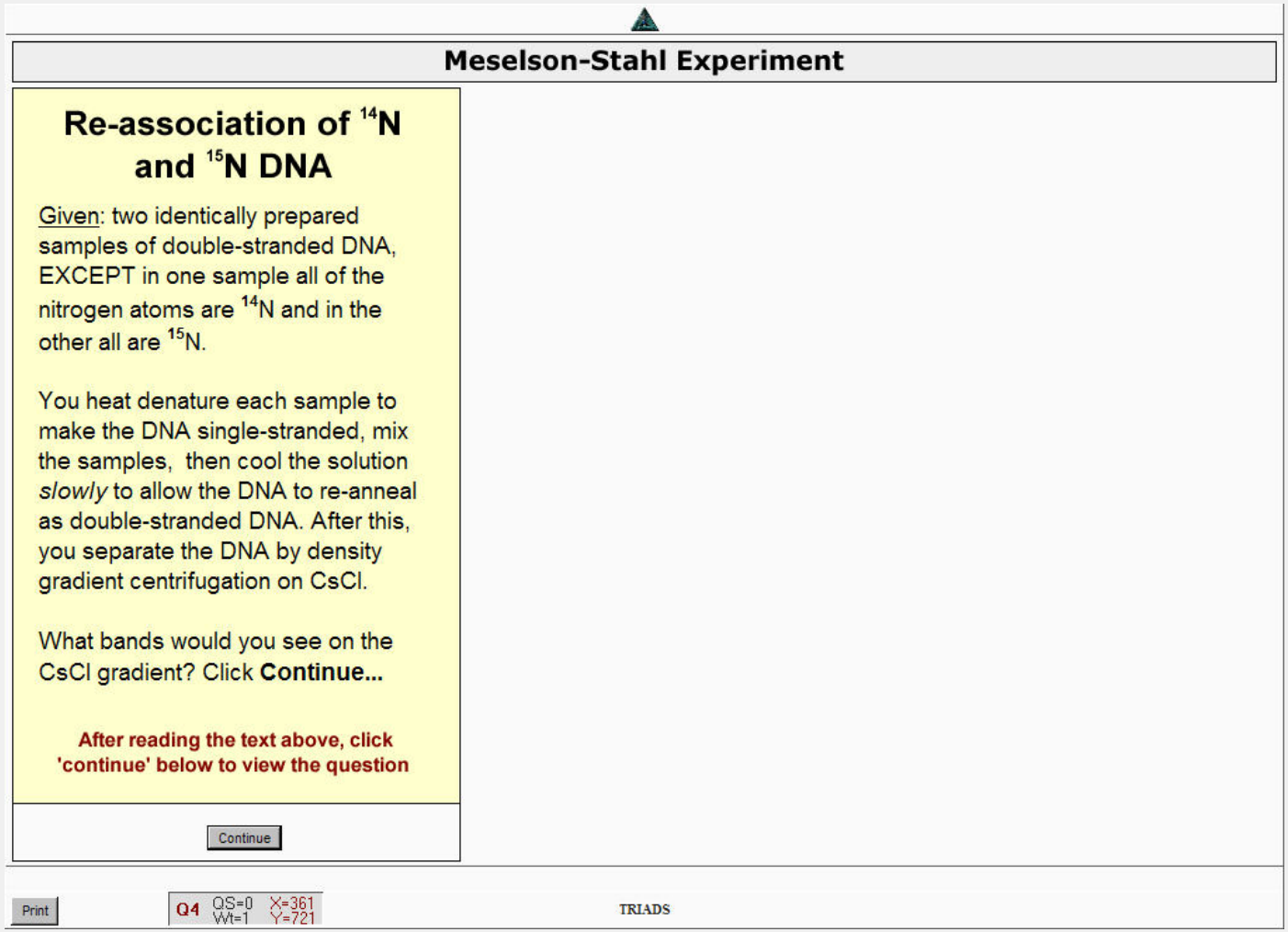
Fill in the gaps below using fractions where appropriate.

	H - H	H - L	L - L
EXAMPLE 1 cycle	1/2	0	1/2
2 cycles	1/4	0	3/4
6 cycles	1/64		63/64

Click on entry box - Type answer then press 'Enter' - click on 'Submit' to finish..

Print | Q2 QS=80 X=96 Wt=1 Y=724 | TRIADS | Tutor Help | Delete | Submit

M-S 5.1


Meselson-Stahl Experiment
Re-association of ^{14}N and ^{15}N DNA
Given: two identically prepared samples of double-stranded DNA, EXCEPT in one sample all of the nitrogen atoms are ^{14}N and in the other all are ^{15}N.
You heat denature each sample to make the DNA single-stranded, mix the samples, then cool the solution *slowly* to allow the DNA to re-anneal as double-stranded DNA. After this, you separate the DNA by density gradient centrifugation on CsCl.
What bands would you see on the CsCl gradient? Click **Continue...**
After reading the text above, click 'continue' below to view the question
Continue
Print
Q4 QS=0 Wt=1 X=361 Y=721
TRIADS

M-S 5.2

Meselson-Stahl Experiment

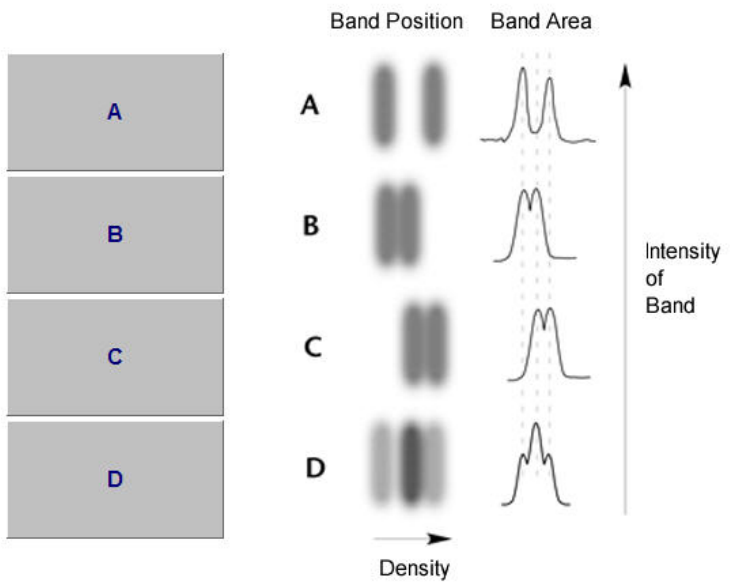
Re-association of ^{14}N and ^{15}N DNA

Given: two identically prepared samples of double-stranded DNA, EXCEPT in one sample all of the nitrogen atoms are ^{14}N and in the other all are ^{15}N.

You heat denature each sample to make the DNA single-stranded, mix the samples, then cool the solution *slowly* to allow the DNA to re-anneal as double-stranded DNA. After this, you separate the DNA by density gradient centrifugation on CsCl.

What bands would you see on the CsCl gradient? Click **Continue...**

The figure below shows results of DNA separations on CsCl gradients. Which diagram shows the result expected for the experiment described?



Select answer with mouse.

Print | Q5 QS=0 Wt=1 X=280 Y=666 | TRIADS | Tutor Help

M-S 5.3

Meselson-Stahl Experiment

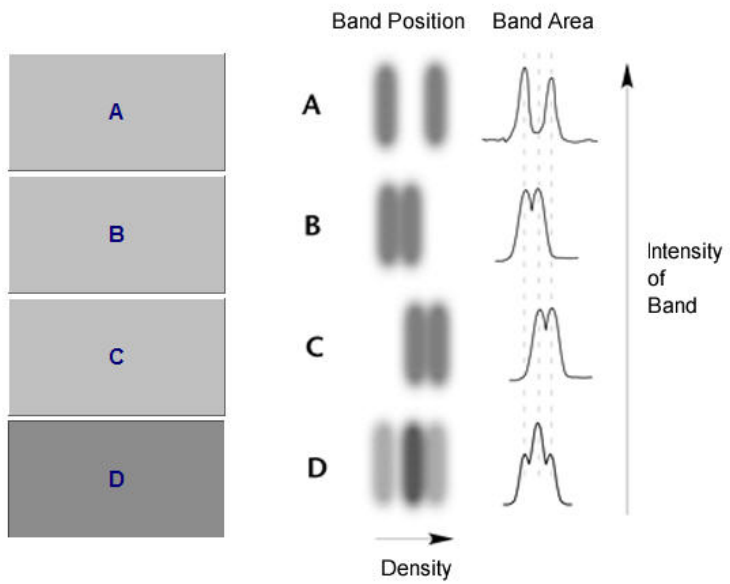
Re-association of ^{14}N and ^{15}N DNA

Given: two identically prepared samples of double-stranded DNA, EXCEPT in one sample all of the nitrogen atoms are ^{14}N and in the other all are ^{15}N.

You heat denature each sample to make the DNA single-stranded, mix the samples, then cool the solution *slowly* to allow the DNA to re-anneal as double-stranded DNA. After this, you separate the DNA by density gradient centrifugation on CsCl.

What bands would you see on the CsCl gradient? Click **Continue...**

The figure below shows results of DNA separations on CsCl gradients. Which diagram shows the result expected for the experiment described?



Do you want to submit this answer?

Print | Q5 QS=100 X=313 Wt=1 Y=728 | Yes | TRIADS | No

Cognitive type inventory

- **ReCAP***
  - **Recall**
  - **Comprehension**
  - **Application**
  - **Problem solving**

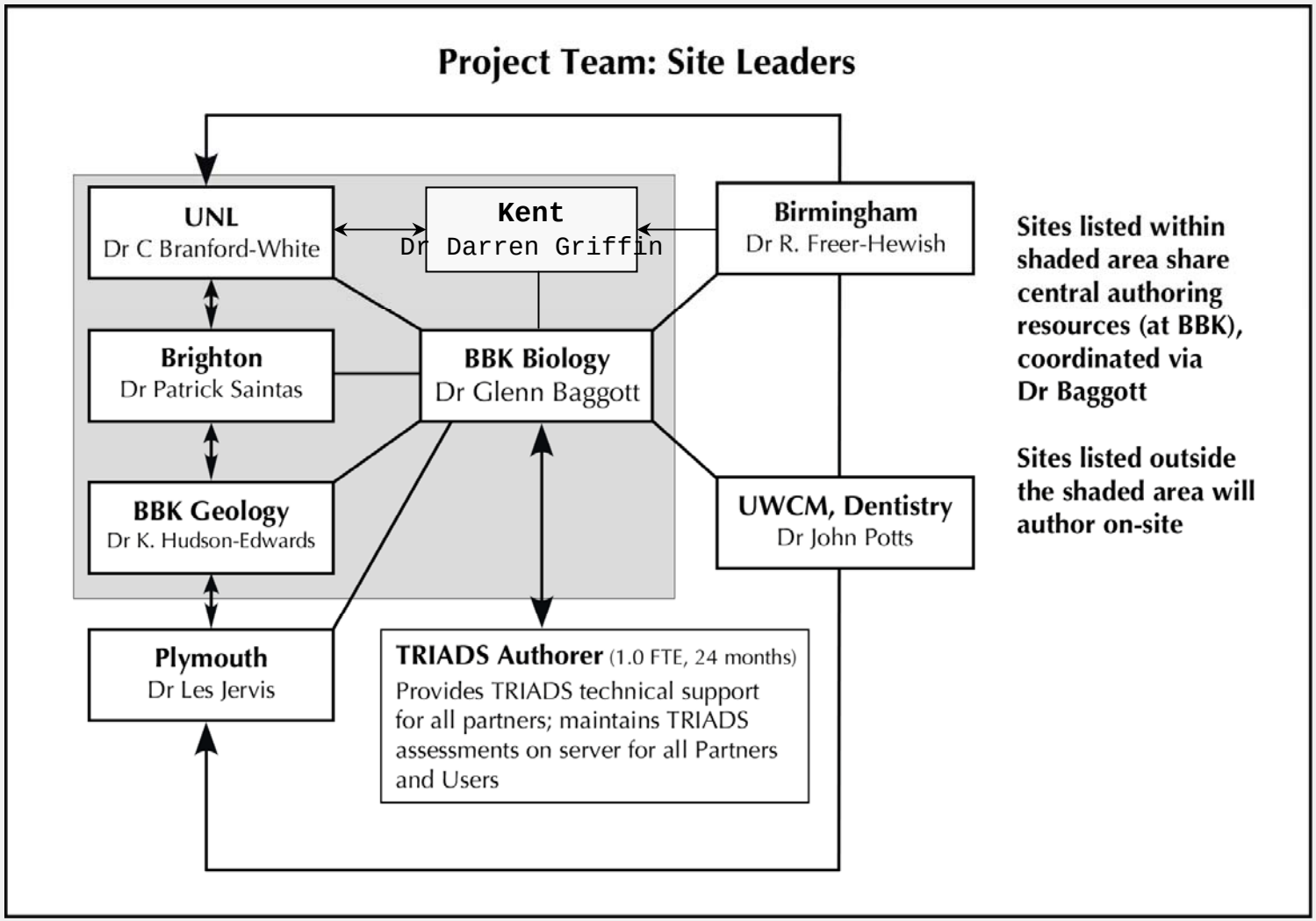
    (= analysis + synthesis + evaluation)

* Imrie (1995) *Assessment & Evaluation in Higher Education* 20 (2): 175-189.

Cognitive type inventory

Problem Solving	Evaluation
	Synthesis
	Analysis
Application	Application
Comprehension	Comprehension
Recall	Knowledge

OLAAF Network



Main Project Aim

"to **develop** and **disseminate** resources to support authors in the design, delivery and evaluation of Computer-Based Assessment with Feedback (CBAF)"

Field Biology (year 2, BSc)

- **Semi-distance learning**
  - 5 weeks: lecture block at Birkbeck (evenings)
  - 5 weeks: self-directed learning
  - 1 week: residential field course
  - 4 weeks later…computer-based exam at Birkbeck
- **Staged formative CBAF ('e-tutorials') support student learning**
  - one CD given at start of module (Group 1 tutorials)
  - second CD given at field course (Group 2 tutorials)
- **Assessed work (summative)**
  - four pieces of written work (field reports; 80%)
  - end of module computer-based exam (20%)

Assessed work mapped to learning outcomes

		Learning Outcomes					
Assessment tasks	**Mode**	**1**	**2**	**3**	**4**	**5**	**6**
Pre-trip lecture course	***Formative***	×	×		×		
CBA Tutorials 1	***Formative***	×					×
CBA Tutorials 2	***Formative***		×				×
Field Investigation 1	***F/S***		×	×			×
Field Investigation 2	***F/S***		×	×			×
Field Investigation 3	***F/S***		×	×			×
Mini project	***F/S***					×	×
End of unit CBA exam 16 questions	***Summative***	×	×				×

Feedback design

Tutorial CBAF were designed to ensure that students had to 'work at' them…

Feedback styles:

1. **diagnosis of response with no solution given (*return to tutorial material*)**
2. **diagnosis of response with partial solution given (*partial tutorial material presented at completion of question*)**
3. **diagnosis of response with complete solution given**

Criteria for classifying items by cognitive type (ReCAP)

Recall

Answers are information previously encountered in course materials. Text or images exactly as in source; stem may be same also.

Comprehension

Form of answers, text or images, will not have been seen in the course materials. Selection of the correct answers depends on an understanding of the question and use of the concepts to deduce the correct selection.

Application

Student must apply the concepts appropriate to the question posed. Answers, text or images, will not have been seen in the course materials. Differs from comprehension in that the student is expected to use understanding to produce a defined outcome.

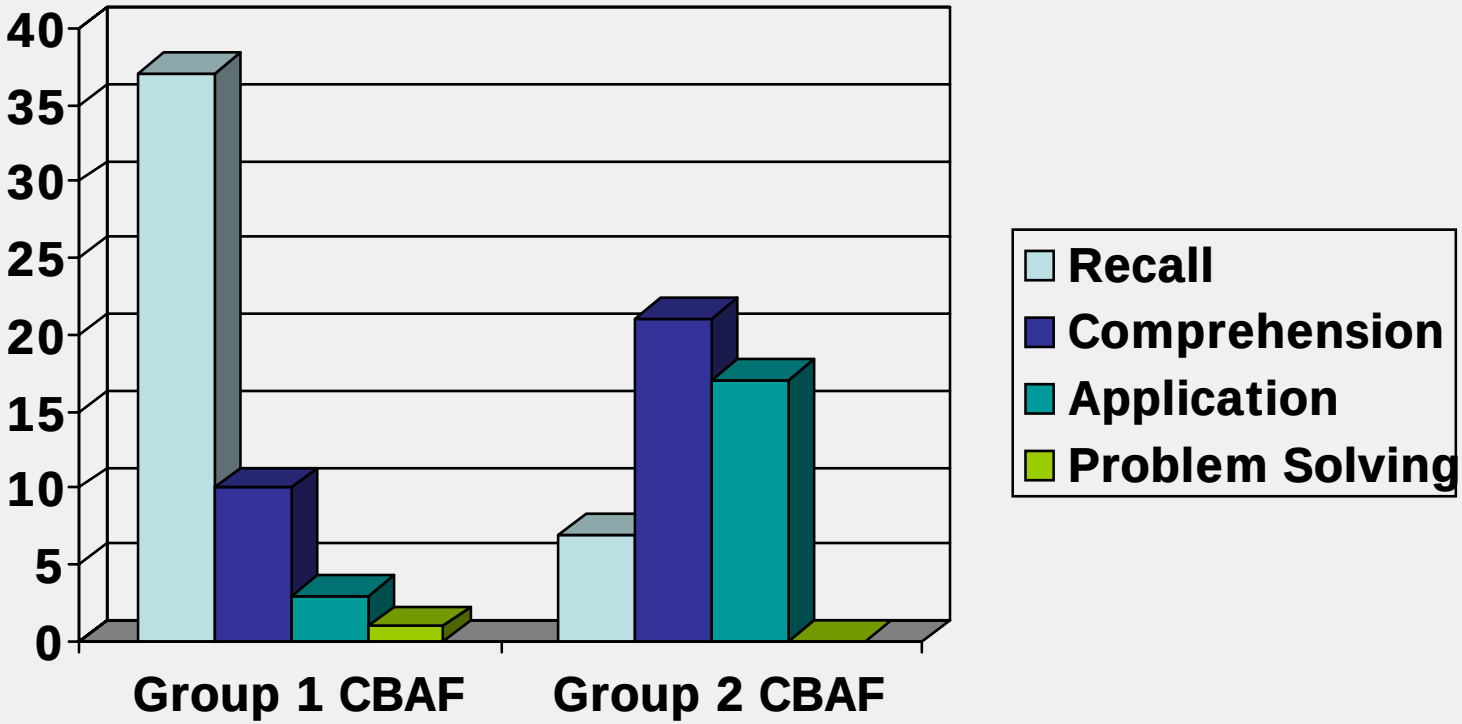
Problem solving (Analysis/Synthesis)

Analysis: must process the question into its component parts.

Synthesis: must bring together (synthesise) an outcome from novel (unseen) and non-novel (seen) sources to determine the correct outcome.

CBAF Cognitive Inventory

84 items in total



Tutorial CBAF on CD

- **Group 1 tutorials: provided in pre-field trip week of lectures and practicals**
  - **to support learning of ecology content and practise essential skills**
    - **tutorial mode with diagnostic feedback *and***
    - **self-test mode— some web-delivered—return only score, no feedback**
  - **mainly recall and some comprehension to establish students' understanding**
- **Group 2 tutorials: provided for the field-trip week; to support the fieldwork and report writing**
  - **built on the knowledge acquired in pre-field trip lectures and Group 1 tutorials**
  - **tested mainly comprehension and application of concepts and skills**

Feedback on summative work

- **Two summative elements**
  - **computer-based exam: answers revealed plus grade**
  - **written reports: returned with annotation and written feedback sheet and guide**
- **Summative assessment outcomes**
  - **2002: mean 56.6% (range 16.8 to 81.8)**
  - **2003: mean 64% (range 51.8 to 71.8)**
    - **Fewer low achievers?**

Evaluation Questions

- **Did the assessment promote learning? (4 items)**
  - doing the **exam/reports** brought things together for me
  - I learnt new things whilst preparing for the **exam/reports**
  - I understand things better as a result of the **exam/reports**
  - in **exam/reports** you can get away with not understanding
- **Nature, quality utility of feedback (5 items)**
  - I read the **TRIADS/reports** feedback carefully and try to understand what it is saying
  - The **TRIADS/reports** feedback prompted me to go back over material
  - The **TRIADS/reports** feedback helped me to understand things better
  - I don't understand some of the **TRIADS/reports** feedback
  - I can seldom see from the **TRIADS/reports** feedback what I need to do to improve
- **Utility of all learning resources (6 items)**
  - CD useful in preparing for the **exam/reports**
  - booklet useful in preparing for the **exam/reports**
  - website and self-tests useful in preparing for the **exam/reports**
  - library useful in preparing for the **exam/reports**
  - [availability] electronic tutorials/self-tests on CD useful to me…for the **exam/reports**
  - [availability] electronic tutorials/self-tests on web useful to me…for the **exam/reports**

Outcome of evaluation

- **Student opinion in two clear camps**
  - ***Formative assessment helped develop understanding by…***
    - **providing opportunities for practice**
    - **reinforcing key concepts**
    - **structuring student study/learning**
    - **prompting further learning**
  - ***Formative assessment was exclusively useful for passing CBA exam by…***
    - **providing practice questions**
    - **providing correct answers for memorization**
    - **helping predict content of the computer-based exam**

Good news…

- No evidence in responses or free comments of ‘novelty effect’
- Questionnaires thus surveyed ‘assessment experience’
  - …not “do you like having CDs…”
- Need to evaluate student motives; examine if tactics can shift behaviour productively

Acknowledgements

- **Funding:**
  - Birkbeck College Development Fund
  - Higher Education Funding Council of England (HEFCE) through FDTL4
- **People at Birkbeck:**
  - Authorware Programmers: Dijana Maric, Ellen McCarthy, Caroline Pellet-Many
- **People elsewhere:**
  - Don Mackenzie and his team at the Centre for Interactive Assessment Development, University of Derby

Map overall scheme of all assessment methods for module against learning outcomes to identify where CBAF might be appropriate

Some issues are:

- formative vs. summative
- computer-based vs. written word
- which assessment for which LO's?

Decide what cognitive levels are appropriate to be assessed and when to schedule assessments

Some issues are:

- role of feedback, type and timing
- progressive assessment?
- relationship of summative vs. formative assessments

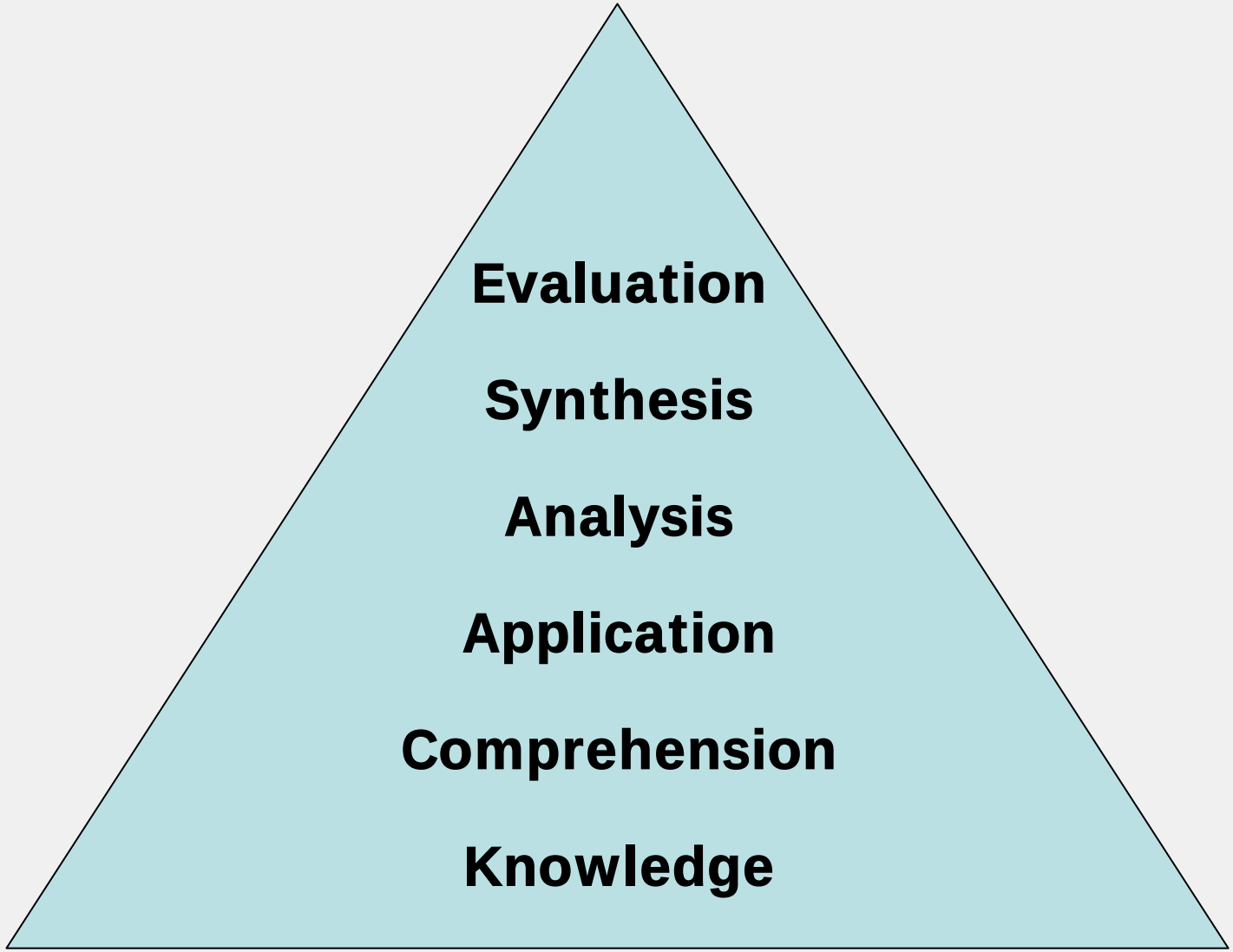
Decide which learning outcomes and subject topic areas are to be tested for each individual CBA

Some issues are:

- best use of formative assessment
- integration with cognitive levels
- technical limitations of computer based assessment

Cognitive Taxonomies

Bloom's



OLAAF: Aligned CBA

Examples of Two Contrasting Strategies in Use of CBAF (1 of 2)

Molecular Cell Biology (Year 1 B.Sc.)

- staged open book and unseen summative assessments delivered over network
- some summative CBA recycled as formative assessments
- one piece of written work (lab report)

OLAAF: Aligned CBA

Examples of Two Contrasting Strategies in Use of CBAF (2 of 2)

Field Biology (Year 2 B.Sc.)

- semi-distance learning
- staged formative assessments ('tutorials') and an unseen summative assessment
- CBAF delivered by CD
- four pieces of written work (field report)