Activity 4

LE SAUT quantique
CENTRE D'INNOVATION PÉDAGOGIQUE
EN SCIENCES AU COLLÉGIAL

The Synthesis of Macromolecules… as Easy as a Card Game!

Activity developed at Cégep de Lévis-Lauzon
By **PATRICE BABEUX**

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Author's Name

Patrice Babeux

Originating Cegep

Cégep de Lévis-Lauzon

Author's E-Mail Address

patrice.babeux@clevislauzon.qc.ca

Scientific Discipline

Biology

Average Age of Students

17-18 years old

Course Title and Number

Evolution and Diversity of Life (101-NYA-05)

Duration of Activity

3 hours

NOTE

In this document, the masculine is used without discrimination and solely to make the text easier to read.

Appendices are available in PDF and Word format on the CD provided with this document.

In addition, an instructional analysis of the activity is available in the pedagogical treasures section (*Trésors pédagogiques*) on the Saut Quantique Web site at: **http://www.apsq.org/sautquantique**.

LE SAUT QUANTIQUE
CENTRE D'INNOVATION PÉDAGOGIQUE EN SCIENCES AU COLLÉGIAL

The Synthesis of Macromolecules… as Easy as a Card Game!

Description of Activity

OVERVIEW

This activity consists in building various macromolecules (polysaccharide, polypeptide, phosphoglycerolipid, triacylglycerol, RNA and DNA polynucleotide) using playing cards. The cards represent the various monomers that make up the macromolecules, energetic molecules and catalysts required for the formation of bonds.

RELEVANCE AND ORIGINALITY OF ACTIVITY

This activity allows students to consolidate their learnings about the basic structure of the major macromolecules that make up living things, and the importance of catalysts and energy supply when these macromolecules are synthesized by a cell.

The activity's originality lies in the format of the educational material used, i.e. a card game. As students are required to develop various strategies and interact with their opponents, they learn while having fun.

Objectives and Relation to the Program

PEDAGOGICAL OBJECTIVES OR TARGETED COMPETENCIES

This activity allows students to consolidate their learnings about:

- The basic structure of the various classes of macromolecules that make up living things;
- How enzymes work and the importance of catalysts in the metabolism;
- The native conformation of enzymatic proteins and denaturing factors;
- The energy molecules of the cell (ATP and ADP).

LINK BETWEEN THE ACTIVITY AND THE PROGRAM

General Program Goals Targeted

This activity aims at acquiring three abilities targeted by the *Science* program:

- To take a systematic approach to problem solving (synthesize various types of macromolecules);
- To work as members of a team (since the various players assist each other in their respective missions);
- To apply what they have learned to new situations (when the activity serves to integrate and reinforce what has been learned in previous theoretical sessions).

Link with Course

The activity allows the teacher and students to address the overall concepts of the course subject describing the chemical bases of life (macromolecules, metabolism, enzymes).

Link with Other Course

The activity reinforces the basic concepts of cellular metabolism, thereby providing a direct link to the second biology course in the *Health*

Science profile, since this course often discusses photosynthesis, cellular respiration, chemical control, as well as several vegetable and animal systems. The activity is also directly related to the various chemistry courses offered as part of the program.

Number of Students and Educational Support

APPROXIMATE NUMBER OF STUDENTS IN CLASS

16-20 students (laboratory subgroups)

NUMBER OF STUDENTS PER TEAM

From 4 to 6 people. Ideally 6.

EDUCATIONAL SUPPORT

Initially, the teacher explains how to play the game. He makes sure that the teams understand the rules. He circulates among players, asking theoretical questions to check if students understand the concepts discussed (the game boards include a few sample questions). Finally, he reviews the concepts learned and objectives targeted as part of the activity.

Conducting the Activity

CONDUCTING THE ACTIVITY AND TIME REQUIRED TO COMPLETE EACH STEP

Before

The activity could be conducted after a theoretical session on macromolecules and cellular metabolism. In this case, the teacher simply asks students to read the presentation document (Appendix S.1) before the next class.

If the activity is to be conducted as an introduction to the topic or before a theoretical session, the teacher also asks students to read certain sections of the reference manual (see the list of recommended readings in Appendix T.5).

During

Step 1: Setting up the game (approximately 30 minutes)

During this step, the teacher goes over targeted objectives and major points in playing the game, including rules, with the students. He can draw the various macromolecules to be synthesized on the blackboard, and insist on the bonds to create. Also during this preparatory step, the teacher can complete the summary table of the synthesis of various macromolecules (see Appendices S.2 and T.4) with the students. He can also ask students to complete it on their own, either during or after the game.

Step 2: Playing the game (90 to 120 minutes)

The game is explained in detail in Appendix T.3.

After

The teacher reviews the learning objectives of the activity. He asks questions on:

- The basic composition of the various macromolecules;
- The source of energy required for their synthesis;
- The required catalyst, its exact role and function.

Evaluation and Required Material

SUGGESTED EVALUATIONS

The evaluation can be conducted in different ways:

- A flash quiz immediately after the game;
- An oral question per student during the game;
- Correcting the summary table of missions submitted at the end of the session.

The evaluation can also be done at a later date, as part of the next summative test.

REQUIRED MATERIAL

A sufficient number of card games to allow all students to play, i.e. one game per 6 students (Appendix T.1)

Game boards (Appendix T.2)

The document describing how to play the game, and rules (Appendix S.1)

A table of elements required to synthesize each of the macromolecules (Appendix S.2)

A list of preparatory readings (Appendix T.5)

Prizes for winners! (optional)

APPENDICES

Teachers

Appendix T.1 : Cards

Appendix T.2 : Game Boards

Appendix T.3 : Teacher's Guide

Appendix T.4 : Corrected Table of Elements Required to Complete the Missions

Appendix T.5 : List of Preparatory Readings

Students

Appendix S.1: Playing the game

Appendix S.2: Table of Elements Required to Complete the Missions

Note:

Appendices are available in PDF and Word format on the CD provided with this document.

Other Ideas to Explore

As mentioned previously, the activity can be conducted during a theoretical or laboratory session. The second option is preferable as students are fewer in number (if the laboratory is divided into two groups), making supervision and assistance much easier.

The game could be upgraded by adding elements of cellular morphology (organelles, compartments, types of cells, etc.) or general chemistry (atoms, types of bonds). The activity could then be spread over a longer period and include several stages.

MEDIA DIRECTORY

CAMPBELL, Neil. A. and Jane B. REECE (2004). *Biologie*, 2nd Edition, French adapted by Richard MATHIEU, Montreal, ERPI, 1364 p. (reference manual for preparatory readings)

DE ROSNAY, Joël (1988). *L'aventure du vivant*. Éditions du Seuil, Collection Points Sciences no. S73, 281 p.

REEVES, Hubert, Joël DE ROSNAY, Yves COPPENS and Dominique SIMONNET (1996). *La plus belle histoire du monde*. Éditions du Seuil, Collection Points Sciences no. P897, 187 p.