Biology Olympics

Some Ideas From Students

Alan J. McCormack
Department Editor

Since we have not run Biology Olympics in *ABT* for several issues, a quick refresher as to the intent of this department may be in order. The Biology Olympics department is intended to assist high school and college teachers in involving their students in creative thinking and scientific problem-solving. Here is how it works:

1) Approximately every other issue, several scientific challenges to students will be posed. Challenges are "bet-you-can't-do-it" brainteasers meant to grab the interest of biology students and send them to their school laboratory or home workshop to seek a solution.

2) Teachers are encouraged to use the challenges as a regular part of their biology courses, as optional extra-credit assignments, as enrichment for highly motivated students, or as stimuli for science fair projects.

3) Students who invent solutions to challenges are invited to send written and pictorial descriptions to *ABT* for possible publication.

4) Ideas for novel challenges are sought from both teachers and students. Send any challenge ideas to our editorial office. (Credit will be given, of course, to originators of all ideas published.)

Four issues of *ABT* published during the 1981-82 school year posed 19 different challenges to students. As you might guess, this effort has produced considerable correspondence to *ABT* from capable and enthused students who have completed challenges. Response to the "Olympics" has been favorable from teachers also, sometimes revealing unexpected applications of the idea: Teacher Lori Mundhenke, for instance, wrote: "The Biology Olympics have been fun for my classes. Oddly enough it has been the 'slow' or unmotivated students that have been eating it up! I'll do anything to keep their interest and, in some cases, this really works. Thanks for the help!"

This installment of Biology Olympics represents a small landmark in that it is the first to be totally based on students' ideas. Following are a few samples of student solutions to challenges and some of their suggestions for new challenges.

> The Biology Olympics department presents challenges and puzzles for biology students. Teachers are encouraged to blend these challenges into their biology courses and to submit outstanding student solutions to *ABT* for possible publication. Descriptions of student solutions should be typewritten, double-spaced on white bond paper, and submitted in duplicate. Black-and-white photographs or black ink line drawings of solutions are encouraged. Send to Alan J. McCormack, Editor, "Biology Olympics," *ABT*, **1757 N. 15th, Laramie, WY 82070.**

Challenge Solutions

The most popular challenge so far has been "Create-a-Creature" posed in this department in February 1982. Students were asked to pretend that they were biologists employed by NASA and were given data about habitats on planets in distant planetary systems. Of data provided for several imaginary planets, that for "Planet Sneila" encouraged the most idea production by students. Here is the description of Sneila provided to students:

> Planet Sneila: Most of Sneila is a barren desert covered by dust many meters thick. Daily temperatures fluctuate tremendously, from a high of 92 C to a low of -30 C. The atmosphere of the planet is 80% helium, 19.8% oxygen, contains negligible water vapor, and typically is in a state of high turbulence. Water is found in only small quantities in pockets deep under Sneila's surface. Some evidence of cactus-like plant life and lichen-like 'crusty' organisms has been discovered in NASA's photographs of Sneila.

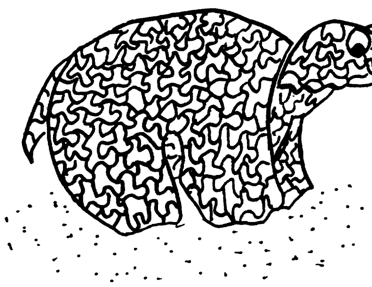
Biology teacher Edward F. Schroth, of Quaker Valley High School, Leetsdale, Pennsylvania, encouraged all students in his biology class to solve "Create-a-Creature" with some fascinating results. Some samples appear on the following pages.

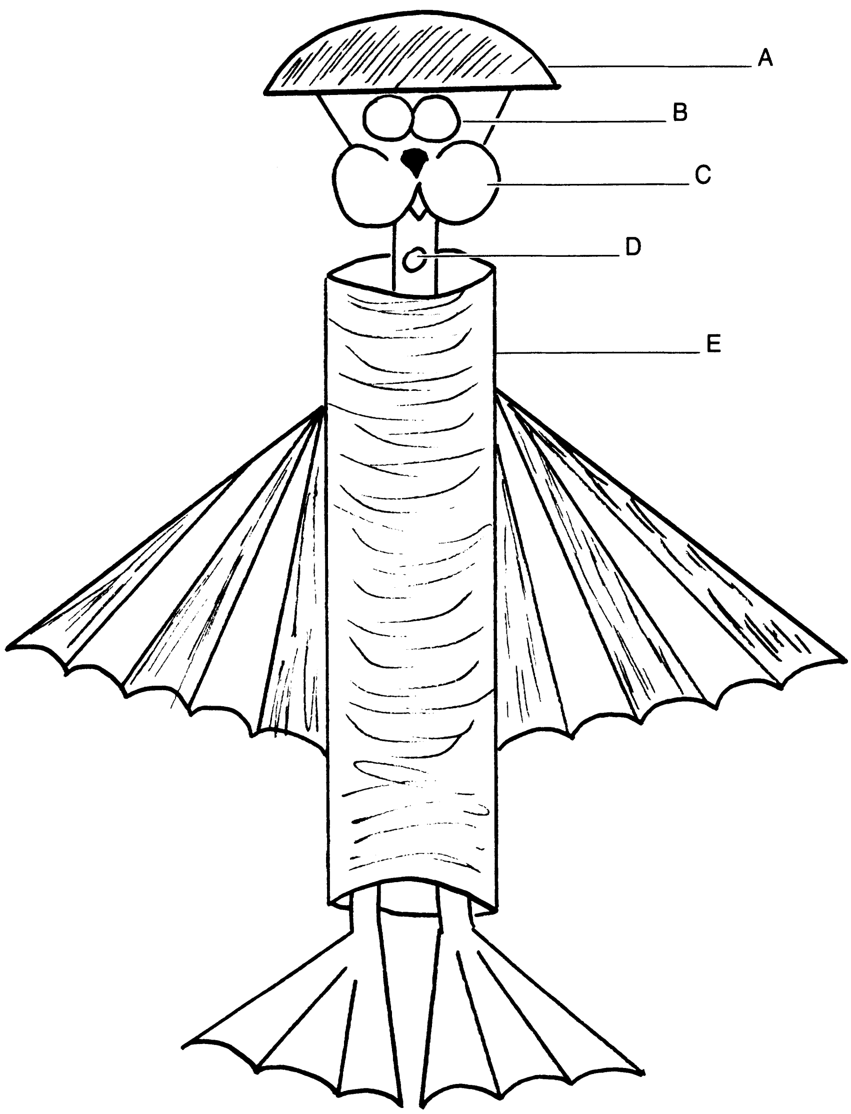
Scrob by Becky Smith (Grade 10)

A small, rocky-looking creature covered by a thick leathery skin encased with hard, reflective scales used during the day that change to a dark, dull color at night, Scrob is active during the morning and evening hours when the temperature is not so extreme. The rest of the time it curls up in a ball with its soft underside protected. The eyeballs are stationary and are not affected by the turbulent conditions because they have exterior lenses made of an almost totally unscratchable glassy substance.

Blood is oxygenated by pore-like holes located all over the body below the scales. They're covered by a thin filter substance to keep out the dust. Air enters the hole and is transferred by diffusion to small capillaries, thus no heart or lungs are needed. Metabolic waste products are eliminated the same way (diffusion).

Scrob eats by thrusting its tongue out of a little hole located beneath its eyes. It has prickly, little teeth covering the end of its tongue that scrape plant life off rocks, etc. to eat. Then it coils the food up and brings it back into its mouth where it's digested by long coils of thin intestines. Solid waste is eliminated through a small opening located below its tail. It hardly ever urinates and tries to keep all moisture in its thick skin that insulates its innards.



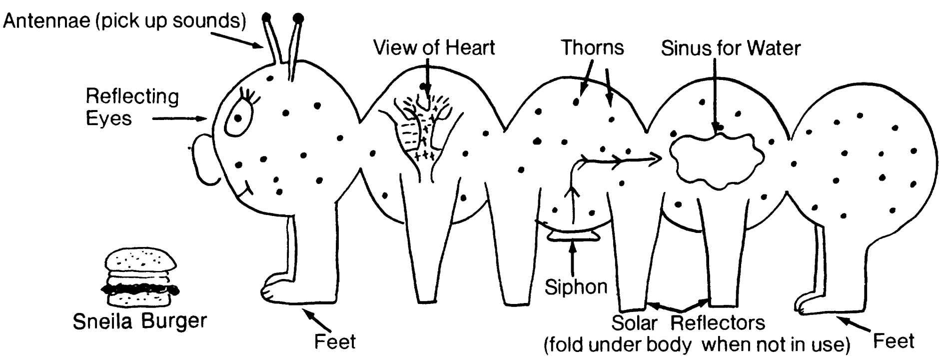


Chitty-Chitty Trashbag by Shannon McQuone (Grade 10)

Chitty-Chitty Trashbag is a compactible inhabitant of the desert planet Sneila. Quite suited for the dusty helium atmosphere, Trashbag's hollow body, fins on sides and feet, tubular eye protectors, and storage bag cheeks are very advantageous. These animals are very rare, and practically extinct because of their peculiar habit of burying their young, thus killing them at birth. Possibly they feel they are protecting them from the dangers of Sneila life.

Adaptive features: A. This crusty head cap protects the eye tubes just below. Underneath the cap is a very thin membranous skin, which holds moisture for the animal. B. The tubes here are not actually the eyes, but tubes which constantly take excess air from the throat and body and blow the air into the atmosphere to keep dust away from the extremely sensitive eyes. C. The two sac-like cheeks in the face store food. Since food is not very abundant and the water supply is also low, the sacs keep excess food that is not eaten at the time. The digestive tract enters the mouth, travels along the walls of the throat, and enters the body walls which contain enzymes to break down the food. D. The hole in the tubular throat allows helium to pass into the entirely hollow body. The body structure serves as the lungs of this animal, and is made up of the right and left muscle tissue and a cartilage membrane wrapping them into a circle. E. This is the 1-inch-thick layer of muscle that supports the entire circulatory system. The system contains no blood, only a yellowish fluid which circulates throughout the body and keeps the main postanterial muscle (called this because it is the only muscle which runs posterially and anterially and serves as the pump). This is an open circulatory system because there are no veins or blood vessels. F. The wing and foot flippers are compactible into the tube body. They serve the dual purpose of blocking the wind in high turbulence and supplying leverage.

Snalipus by Jennifer Wargats (Grade 10)



During the cold spells of Sneila, this creature hibernates under its thick, shell-like covering that is excreted through its thorns. This is also a means of self defense. The creature conserves heat by using its eight solar reflector legs. (When not in use they fold up under the body.) For support on Sneila's thick bed of dust, the creature has four foot-like projections. The eight solar reflector legs also assist. The foot-like projections are also used as means of movement. The creature's protruding eyes contain aluminum which reflects the sun's rays. On top of the Snalipus' head there are two antennae which pick up sounds. To locate the scant H_2O pockets under the surface, there are suction cup-like siphons which absorb H_2O, which is then stored in an internal sinus. To survive, the creature needs only H_2O, fairly warm weather, and oxygen. Because of a mutation that occurred long ago, the Snalipus has the ability to combine the lichen-like crusty organisms, a small amount of H_2O, and an abundance of helium to produce Sneila Burgers.

The Snalipus has a three-chambered heart and an open circulatory system. The Snalipus species reproduces sexually. Snalipus' red nose helps it to see during Sneila's dust storms.

New Challenges From Students

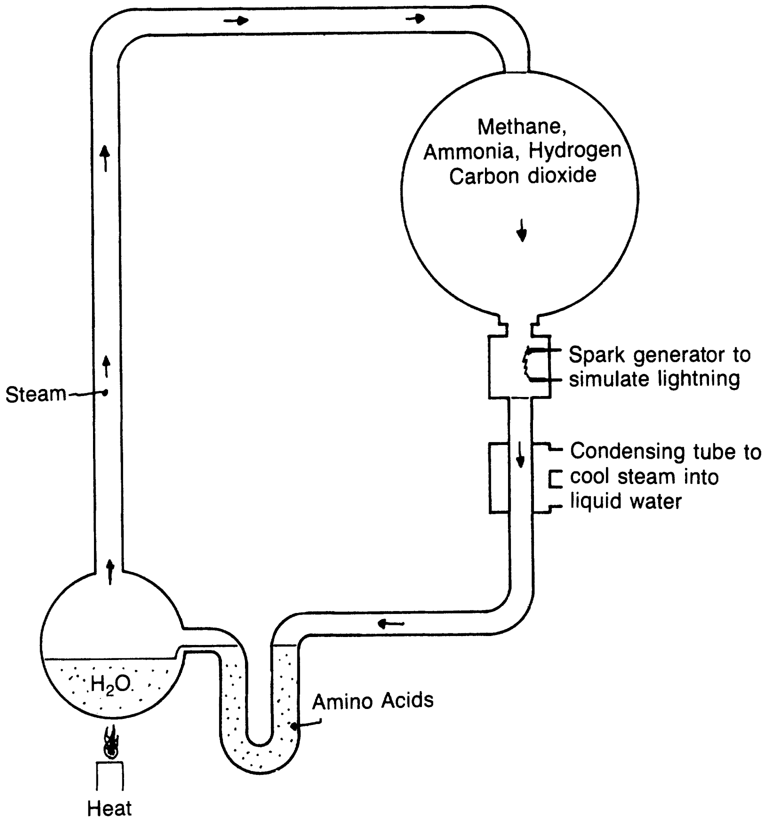
Professor Jane Kahle, of Purdue University, encouraged university students enrolled in a "Methods of Teaching Secondary Science" course to invent some new challenges for our Olympics. Following are some of their intriguing suggestions:

Origin of Life Challenge (Bob Wurster)

We all know that plants and animals are made up of many small units that have been named cells. Remarkably, these cells are composed mostly of six basic elements. They are carbon, hydrogen, oxygen, phosphorous, sulfur, and nitrogen. Together these elements form the building blocks of the cells: fats, carbohydrates, proteins, and nucleic acids.

Proteins form the structural components of the cells and they are made up of individual units known as amino acids. There are 20 known natural amino acids and they form the structures of all cells. Where did the first amino acids come from? In 1953 S.L. Miller attempted to answer this question as it would provide a clue to the origin of life on Earth.

Miller prepared an apparatus that would supposedly be representative of the Earth's ancient atmosphere. He figured that if he could supply the basic elements of proteins (C,H, O,N) in the form of carbon dioxide, methane, water vapor, ammonia, and hydrogen, he could conceivably make amino acids if an external energy source was provided (Miller used an electrical spark to simulate lightning.) Miller performed his experiment and to his surprise he found that amino acids were formed! Miller's experimental apparatus looked like this:



CHALLENGE 1—TRY TO DUPLICATE MILLER'S EXPERIMENTAL SETUP AND REPLICATE HIS CLASSIC DISCOVERY.

CHALLENGE 2—AFTER RUNNING THIS EXPERIMENT FOR ONE MONTH, DEVISE A WAY TO IDENTIFY ANY AMINO ACIDS THAT MAY HAVE BEEN FORMED. (NOTE: ONLY STANDARD HIGH SCHOOL LABORATORY EQUIPMENT SHOULD BE USED.)

Oxygen Used in Human Respiration (Gregg Beck)

We all know that our bodies need oxygen. When we exercise we need more oxygen than when we are at rest. How much oxygen does your body take out of the air when you are at rest? How much when you are exercising? Some questions you might want to consider are: What proportion of air is oxygen? What proportion of exhaled air is oxygen? Is this proportion different during exercise?

CHALLENGE 3—DEVISE A METHOD TO MEASURE THE PROPORTION OF OXYGEN IN A BREATH OF AIR EXHALED FROM HUMAN LUNGS.

Design an Imaginary Journey (Perry M. Kirkham)

Generally speaking, science fiction is based on solid, existing scientific principles or on reasonable projections of today's science into the future. A good way to help some students develop their understanding of science concepts is to encourage them to develop science fiction-style fantasy stories based on the scientific ideas they have learned. For example:

CHALLENGE 4—WRITE A STORY ABOUT THE LIFE AND TRAVELS OF A BLOOD CELL THROUGH THE HUMAN CIRCULATORY SYSTEM.

CHALLENGE 5—WRITE A STORY ABOUT THE TRAVELS OF A WATER MOLECULE THAT HAS BEEN ABSORBED INTO THE ROOT OF A PLANT.

A Fire-Breathing Cow (Anthony T. Gonczarow)

No doubt you have heard myths about fire-breathing dragons, but did you know that fire-breathing cows actually exist? Cows don't breathe fire very often (or for very long), but instances of cows with their breath on fire have been reported by reliable (and sober) observers.

CHALLENGE 6—DEVISE A REASONABLE EXPLANATION TO ACCOUNT FOR OBSERVATIONS OF "FIRE-BREATHING" COWS.

That's it for this installment of the Olympics. Have your students send challenge solutions (illustrated by India ink line drawings or black-and-white photos) directly to me. Ideas for new challenges from teachers and students are also sought. Send all materials to: Alan J. McCormack, *ABT*, 1757 N. 15th, Laramie, WY 82070.