Aesthetics in the Biology Course

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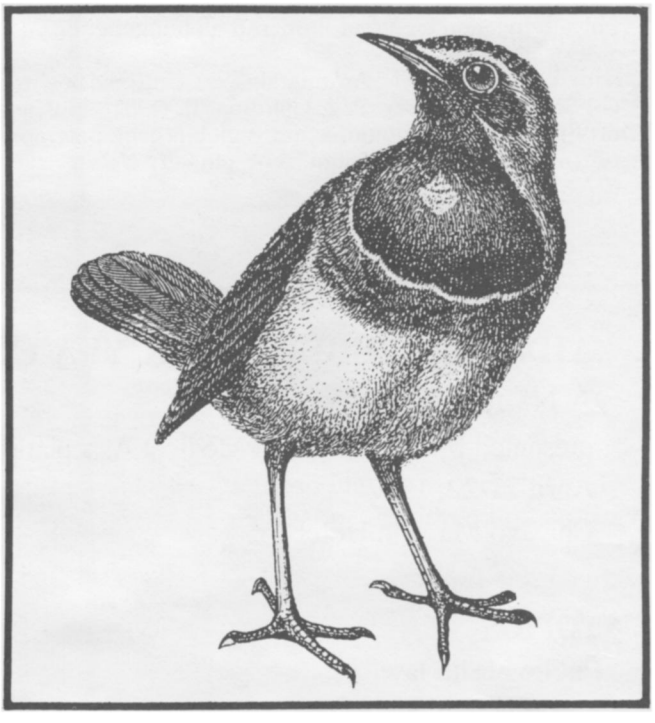
All of us, during unexpected moments in our lives, experience the wondrous beauty of the biological world. The biology teacher moreover, through past training in the anatomy, physiology and interactions of organisms, has the distinct advantage of a deep understanding of the underlying natural principles that result in this beauty. The teacher's challenge is to impart this understanding and sometimes awesome appreciation of the aesthetic qualities of nature to the students, for once enlivened, a perceptive attitude will influence their observations throughout their lives.

The precise manner in which this may be accomplished is difficult to outline, and, in fact, methods will vary among individual teachers, because they must emerge from each teacher's assimilation of background and values as a unique composite. There are, however, definite aesthetic characteristics that are possessed by living things, either individually or as a community, which the teacher may wish to identify.

Color

Nothing is more eyecatching than color, and nowhere is color more noticeable than in nature. Sometimes the hues are breathtaking, as they are during autumn in the New England countryside. We have all marveled at the flamboyant tones of the scarlet tanager, indigo bunting or a cardinal at a feeder in the snow. A field of goldenrod or a purple patch of heather in a meadow seldom goes unnoticed. At other times, color is more subtle and requires closer observation, as it does on a fallen log where fruticose lichens extend their tiny scarlet heads or at the edge of a pond where damselflies and pickerel weeds combine shades of blues and purples among the green and brown reeds. The delicate yellows and greens of finches blend in harmony with the sunlit treetop foliage where the birds dwell.

It is sometimes almost unbelievable to the student that combinations of bright shades can act as camouflage for a specific animal; that is, until the teacher explains the total effect of these colors when the animal is in its most frequented habitat. Orange and black in the tiger's striped pelage resemble grasses



and their shadows, the white v-shaped patch on the head of a bufflehead interrupts the familiar silhouette of a duck, and the iridescence of the elytra of beetles or the wings of butterflies miraculously hide them in the glimmering sunlight. There is opportunity for the biology teacher to point out the resulting effect of the overlapping of pigment containers in the skin as students examine a frog, and to concentrate on the nature of chromatophores in other types of vertebrates.

One informative and easily assembled classroom demonstration or student laboratory exercise which focuses on the masking effect of colors involves the sequential removal of pigments from a bicolored leaf, such as that of *Coleus*. By boiling the leaf in water, the anthocyanins may be removed, since these are soluble in water. The student may now observe green leaf areas which were previously hidden. If the leaf is then carefully rolled and inserted into a test tube containing alcohol and suspended in a hot water bath (no open flame), the chlorophylls will be extracted. Furthermore, if the colorless leaf is then saturated with an iodine solution, to test for starch,

only the previously green areas will darken, providing evidence that chlorophyll is instrumental in the photosynthetic action. This experiment is one which allows the teacher to point out the overlapping of aesthetics and plant functioning.

Patterns and Textures

The picturesque overview of nature from a hilltop is actually a blending of the individual growth patterns and textures of numerous plant species cooperating and competing with each other in the valleys below. Variations in growth habits and branching patterns in shrubs and trees, such as tall, pointed evergreen excurrents interspersed among wide deciduous deliquescents result in interesting contrasts that tend to accent each other. At this time, the teacher might explain the structure of buds, their contents and their role in the growth habits of trees. Apical dominance and auxin activity in plant growth may be interjected here, also. Student experiments based upon auxin application to plant parts and the removal of apical buds to see growth alterations compared to controls may now be performed in the laboratory or greenhouse. Close examination of vegetation reveals curves and asymmetry in individual plant members which result from the influences of dominant species on subordinates as well as from weather and terrain. A sunset behind a tall tree stand or falling on a shrub planting will accentuate individual growth traits.

There are, nevertheless, similarities among members of a family that substantiate the influence of genetics on the final product. The fine texture of pine needles or fern fronds contrast strikingly with the coarse nature of the leathery foliage of rhododendron or the broad expanse of oak and maple leaves. Students can collect leaves of various types and take them back to the laboratory to study their anatomy and physiology. The wilting tendency, for example, is linked to the location and number of stomates as well as the thickness of the cuticle. Cross sectional specimens or lower epidermal temporary slide mounts will help the student to understand water loss from the leaf. The rough outer trunk of the shagbark hickory, interspersed with its own shadows, contrasts artistically with the smooth gray bark of the beech or amelanchier. In winter, as snow clings to branches, needles and bark, growth patterns become even more defined. Animals, too, form patterns as they flock or follow each other in line; migrating geese, for example, form variations of a v-shaped design.

Motion

While observing growth patterns, symmetry and design, the students may be further directed to appreciate movements in nature. Many motions are gentle, sleek and subtle. The willow in a wind and a grain field during a gentle breeze exemplify harmonious swaying that equals the graceful movements of a ballet. The constant circular action of a whirligig beetle or a single leaf of the trembling poplar on a seemingly still day in summer is fascinating. Sometimes the motion is slow and gentle, as is true of the soaring hawk or the seagull as it rides a coastal wind. At other times movements are abrupt and swift as the hawk dives toward a rodent or a member of a cat family suddenly pounces on its unsuspecting prey. The establishment of a feeding station for birds gives the students ample opportunity to study the flight patterns as well as the feeding habits of birds. This type of project calls for long-term observations, perhaps spanning an entire winter, to record new arrivals as they discover the food source. The data may be carefully recorded and graphs, charts and summaries may be assembled.

Probably the most convenient opportunity to study the aesthetic attributes of the biological world presents itself during a field trip to a meadow, woods, park or pond. Most students are naturally attracted to the outdoors, but they will better appreciate its beauty if the teacher carefully designs the field experience by incorporating exercises during which time the class pauses to examine the intricacies of color and pattern and to listen to subtle sounds while attempting to identify them. A prepared form on which the student records and describes observations is convenient and promotes attention to minute details. During classroom discussions the teacher also has an opportunity to incorporate aesthetics. Not only should the structure and function of an organism be considered, but also the total individual, including its unique life habits, relationships to others and its appearance, especially concerning its contribution to the artistry of nature. The laboratory is an excellent resource area for the study of forms, composition and color. The student using the microscope may be directed to observe design in organisms such as diatoms, protozoans and leaf stomates, colors in algae and flower parts, and the variety of movements in volvox, planaria and hydra. The living world abounds in beauty, and, by strategic planning, the biology teacher can permanently open young minds to its appreciation.

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