How-To-Do-It

Role-Playing Mitosis

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Biology instruction is effective when students are actively involved in the learning process (Igelsrud & Leonard 1988). Therefore, biology teachers need to reduce their reliance on the lecture mode of teaching and use strategies that encourage student inquiry/discovery, hands-on experience, and interactive group work in order to provide concrete learning situations (Costenson & Lawson 1986; Igelsrud & Leonard 1988, Lapp et al. 1989). For example, in using sweat socks to illustrate nuclear division, Oakley (1994) demonstrates a teacher’s commitment to actively involving students in the process of learning. She says, “The more I teach, the more I realize the importance of having a student be ‘physical’ in the learning process . . . The more senses involved in learning, the easier it is for the student to learn the material.”

Role-playing is a useful method for getting students involved in their own learning. Some teachers apply the role-play method to help students understand abstract biological concepts. For example, Stencel and Barkoff (1993) teach protein synthesis through student role-play. In their role-play, Stencel and Barkoff choreograph protein synthesis to accompaniment with Tchaikovsky’s “Dance of the Sugar Plum Fairy.”

Other teachers employ role-playing to engage students in problem-solving situations that integrate science and society. Cherif and Somervill (1995) use role-playing in their classrooms to maximize learning in a setting where students simulate competing community and industrial interests. Students portray city council members, community representatives and industrial delegates debating whether or not to build a biotechnology company in their community. In another classroom, debate about nuclear power occurs as students role-play Senate Energy Committee Hearings on a proposal to build a nuclear power plant in a community (Arce 1992).

In an effort to involve our students actively in learning biology, we designed a role-play for mitosis. The role-play was easy to conduct, did not require extravagant materials, and got students involved physically in the learning process. We tailored the activity to fit various objectives. By varying the amount of material introduced, we altered the activity to meet different intellectual levels with particular groups of students. For example, with a middle school class the objective was to have the students describe in writing and with pictures the process of genetic material duplication and cellular division after the role-play. In high school and college freshmen biology classes, students showed mastery in understanding mitosis by making correct drawings (in structure and in sequence) while using correct terms to describe and label the processes of mitosis.

Setting the Stage

To introduce role-playing mitosis, at least one same-sex pair of students (two girls or two boys) in the class are given identically colored athletic jerseys—the number of students selected to wear jerseys can be adjusted depending on the class size and the number of different pairs of jerseys available. If dealing with more than one pair of students, it is important to obtain as many pairs of different colored jerseys as possible, so that many students can be involved in the “moving” part of the procedure. We recommend starting with four students, two female and two male, each person in a pair wearing a jersey color similar to each other but different from the other pair of students (Figure 1). For example, red and yellow jerseys may be used. Overhead bib-type, tie-on jerseys can be borrowed from the athletic or physical education department of the school. Alternatively, a teacher may choose to purchase some pullover jerseys for permanent addition to the biology classroom. Students could bring their favorite Women’s National Basketball Association jerseys to class and a teacher might use the jerseys to make necessary paired-combinations from the student contributions.

Students without jerseys form a large ring (a circle of 10 to 20 students depending on class size, minus students with colored jerseys). The student pair(s) wearing the athletic jerseys enter the ring. The instructor explains that the students forming the circle are the boundary of a cell, the cell membrane. The students wearing the jerseys carry information that controls activities in the cell; those students represent chromosomes containing genes. Together all the students represent a normal mature cell, a parent cell (Figure 2).

Continuing the Role-play Activity

The instructor poses a problem for the parent cell: produce another cell like yourself, that although smaller in size, could control the same activities that you control—this is the key question of the activity (Figure 3). After some discussion and trial and error at regrouping, the class makes two circles of students (two new cell membranes are represented). But there is half the number of students wearing jerseys inside each circle compared to the number in the parent cell (initial single circle). Here the teacher guides the class toward proposing that the students with jerseys need to be doubled. The teacher should make sure that students suggest that the doubling could occur in the parent cell circle before the two new cell circles form (Figure 1). Additionally, students might suggest that the doubling of...