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A Resourceful and Interactive Method to Teach Students about Cell Division

Cell division is a biological process that is covered in a multitude of science courses, from the introductory to the advanced levels. Classes often cover different aspects of cell division at multiple levels, including mitosis and meiosis. Despite continued exposure and repetition to the topic of cell division during students' academic careers, they continue to trivialize the process. Anecdotal observations indicate that a large proportion of undergraduate students find cell division a mundane, unimportant and obsolete topic. Perhaps students perceive cell division in a negative connotation because it continues to be a difficult concept to understand despite repetitive exposure to the topic. When discussing mitosis or meiosis with an undergraduate student, it is often quickly apparent that they are insecure about the mechanisms of the process. Rather than trying to improve their understanding by increasing the frequency of teaching mitosis and meiosis during their education, perhaps the way in which cell division is taught should be reevaluated.

Creating multiple ways in which students can connect with the material being presented increases the understanding and retention of the material. Howard Gardner (1993) identified the different intelligences that can be stimulated during learning to increase understanding. Having students recreate or demonstrate biological mechanisms through in-class guided performances or skits, targets the visual-spatial and bodily-kinesthetic intelligences.

Recreating complex processes using students and props during class can be used as a vehicle for learning in multiple instances in numerous courses. This teaching tip will explain how learning mitosis through active movements was implemented in an introductory animal science course in an effort to improve students' understanding of the basic mechanisms of mitosis. Students enrolled in the course are traditionally first semester freshman; however this method could be utilized in any course with minor modifications.

Procedure

Prior to the activity, 1.8 meter long polyethylene foam cylinders (swim or pool "noodles") of various colors are cut in half. Each cylinder represents a chromosome. Depending on the number of different colors you can find will determine the number of chromosomes that can be implemented. There must be four cylinders for each color. Name tags that are color coded and labeled as "maternal/paternal" or "dam/sire" are useful when teaching about or tracking ancestry and/or heredity. Finally, an assortment of different color elastic hair bands are used to represent different genes, which can be placed on the cylinders at specific locations to illustrate the concept of loci.

After first discussing DNA replication and cell division at a level the teacher believes necessary for the specific class, two cylinders of each color are randomly passed out to students. The class is then guided through the understanding that each cylinder is a specific chromosome and each pair of same colored cylinders is a maternal and paternal set, at which time the students receive their appropriate name tags. Based on time and course content, genes and loci could be introduced at this time by the placing of the elastic hair bands on the cylinders. In this specific introductory course, this is delayed until the genetics lecture. The student chromosomes are then encouraged to wander in front of the class until DNA replication takes place, at which point the additional pair of color-coded cylinders appear and are distributed to other students in the class. Finally, cell division can be demonstrated and the students can form two daughter cells or four germ cells. Depending on the time allotted for this method and topic, the process could be replicated again without the teacher's input which causes the class to teach themselves about cell division through common consensus.

Assessment

There was no empirical assessment conducted to evaluate if students increased their understanding and knowledge of cell division based on this interactive method in the classroom. Based on personal observation, the students appear more engaged during the lecture when using this method compared to previous semesters or upper level courses where I used handouts and traditional lecture

pedagogy. This should not be unexpected, since based on a scale where 1 = strongly disagree and 10 = strongly agree, undergraduate students enrolled in my classes (n=47) want (8.89 ± 1.44) and prefer (9.25 ± 0.79) classes to utilize active learning experiences.

Based on the feedback from students and colleagues, implementing active learning methods to illustrate and explain complex biological concepts improves students understanding of the concept and willingness to be an active participant in the learning process. Active learning methods can be a high-impact strategy that carries little risk to the teacher or student if planned and organized ahead of time.

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