Genetic Science Learning Center

Teaching Tips & Classroom Resources

from the Genetic Science Learning Center

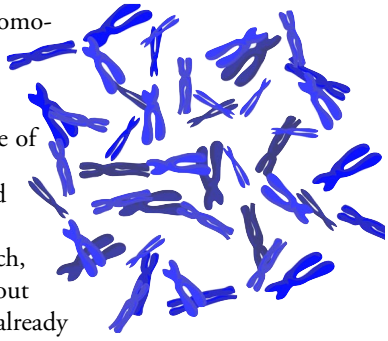
http://gslc.genetics.utah.edu

Newsletter available online at http://gslc.genetics.utah.edu/workshops/newsletters.html

Teaching Activities

Animated basic genetics tour

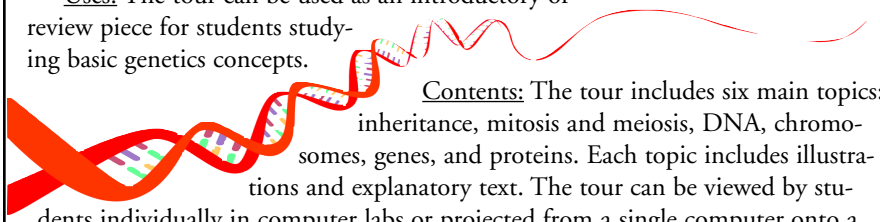
http://gslc.genetics.utah.edu/basic/index.html



What are genes made of? What are chromosomes made of? Is that the same thing? Can I see DNA? What do I get from my parents besides lectures? How do genes make me who I am? Are all people made of the same genes?

If you or your students are a little confused about all the talk about genes, use our "Basic Genetics Tour" for a refresher. This visually-rich, animated tour encourages viewers to think about genetics concepts in context with things they already know. For example, to show where DNA is found in the body and its size relative to other body parts, the tour starts outside a human ear and zooms in through organs, tissues and cells until it gets to DNA. Proteins are explained by showing how they transmit pain signals felt when a person drops a bowling ball on his foot.

Uses: The tour can be used as an introductory or review piece for students studying basic genetics concepts.



Contents: The tour includes six main topics: inheritance, mitosis and meiosis, DNA, chromosomes, genes, and proteins. Each topic includes illustrations and explanatory text. The tour can be viewed by students individually in computer labs or projected from a single computer onto a screen. For off-line viewing, the files can be downloaded from our teachers' page (http://gslc.genetics.utah.edu/teachers.html) and saved to a disk or hard drive.

Technical requirements: Internet browsers with the Flash/Shockwave plugin installed can view the tour. If you don't have the Flash plugin, it is available for free at http://www.macromedia.com/downloads/.

Science fair and research project ideas

"How to Extract DNA From Anything Living"
http://gslc.genetics.utah.edu/basic/howto/index.html
Compare the amount of DNA extracted from several organisms or tissues using this protocol.

"How Do Proteins Work?"
http://gslc.genetics.utah.edu/basic/protein/index.html
Use gelatin as an assay tool to determine whether protein-degrading enzymes are present in different fruits, fruits processed in different ways, or different household products containing enzymes.

"The Effect of the Environment on Our DNA"
http://gslc.genetics.utah.edu/disorders/units/environment/index.html
Compare the effectiveness of different sun-blocking agents such as different SPFs of sunscreen, sunglasses with and without UV protection, clothing, different thicknesses of glass or Plexiglas.

Ideas from the Classroom

Students at Weber High School in Pleasant View, Utah can't wait to get to their science class. They even try to coax the teacher into giving them additional time in the lab before other students arrive for class. When the students finally get to class they break off into small groups and quietly discuss the strategy for the day.

Students examine "evidence" for a classroom forensics activity in Darlene Bell's class.

What has gotten into these students, you ask? They have become forensic detectives, applying their lab skills to examine the evidence of a mock crime. Their teacher, Darlene Bell, has created a forensic science unit that has changed the traditional student into the forensic lab detective -- ready to solve any crime that comes their way.

With the help of local police officers, the Utah State Crime Lab and classes such as "Genetics & Forensics" and "Exploring Gel Electrophoresis" offered by the Genetic Science Learning Center, Darlene has created a complete unit for her students to study the careers involved in forensic science and to perform crime scene investigations in their own classroom. Students are divided into forensic detective groups that strive to identify the "would-be" guilty suspect.

The forensic unit starts by Darlene reading the crime scenario. Students are given a list of five suspects that includes identification information and prior police records. The students are briefed on the importance of keeping accurate records in case they have to testify on their lab findings. Each group is then given a box of evidence which includes: two hairs, a piece of glass with a stain on it, a fiber found at the point of entry, a white powder collected from the victim's house, and an anonymous letter left at the scene.

At that point the students are released to discuss their plan of attack. They have a certain amount of time and budget to complete all the tests necessary to narrow the suspects down to two individuals on whom they will run a DNA fingerprint.

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Current Events in Genetics

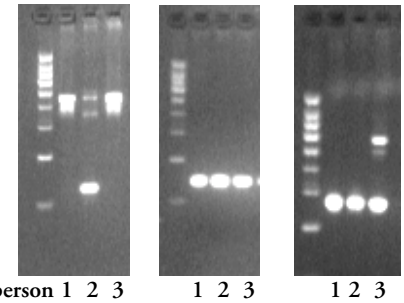
Tracking early humans across the globe might seem like a hard task, since we're talking about events that occurred 10,000 years ago. However, genetic analysis techniques allow scientists to peer into history by studying the DNA of living humans. Drs. Mike Bamshad and Lynn Jorde, geneticists at the University of Utah, used these genetic techniques to study the ancestry of people from India.

"The dispersal and growth of Indian populations during the Neolithic age is one of the most important events to have shaped the history of South Asia," Bamshad says. Their studies showed that Indian peoples of the upper social group, or caste, are genetically more closely related to Europeans than are people of the lower social classes. They also found that Indian women are genetically more similar to Asians than are Indian men. This information suggests that when people from western Europe migrated into India long ago, most of them were probably men. These Eurasian men probably then had children with Indian women and the children were usually members of the upper social class.

Previous studies by other scientists analyzing either Y-chromosome or mitochondrial genetic data of Indian populations have often produced conflicting results, suggesting stronger similarity to either Europeans or Asians. The new study analyzed both types of data in more than 1000 people and showed that ancestors of Indian men and women came from different parts of the world. The differences likely account for the different genetic relationships shown by looking at the gender-specific Y-chromosome and mitochondrial genetic data.

Bamshad's study showed that each caste's mitochondrial DNA, which derives from the mother only, has a greater similarity to Asians than to Europeans, but the upper castes show less similarity than do the lower castes. Conversely, Y-chromosome data, derived from the father only, show each caste more similar to Europeans, with the upper castes being most similar, probably because more Eurasian males migrated to India than did Eurasian females.

Scientific Article: Bamshad M, et. al. "Genetic Evidence on the Origins of Indian Caste Populations." *Genome Research.* June 2001.



The DNA of 3 different individuals in Bamshad's study is examined for similarities and differences at 3 different genetic markers. Notice in gel "A" that persons 1 and 3 have similar DNA, but person 2 is different. For gel "B," all 3 persons have the same DNA. In gel "C," person 3 has a DNA sequence that varies from persons 1 and 2. The left lane in each gel is a DNA measurement ladder.

Ideas from the Classroom (continued from page 1)

Once released to do their lab work, Darlene's role as teacher becomes one of facilitator and observer; she directs students during lab, but they are responsible for their findings and, in essence, the task of making sure they don't send an innocent man to jail.

Submitted by Darlene Bell
Weber High School
Pleasant View, Utah

Careers Focus: genetic counseling

Genetic Counseling is a relatively new career, but one that is growing fast with the advances in genetic research. The Genetic Science Learning Center spoke with Karin Dent, M.S., a genetic counselor with the University of Utah Health Sciences Center, to learn more about this career.

What is your job description?

Genetic counselors work as members of a healthcare team to support families affected by genetic disorders. We identify families at risk for genetic conditions, investigate the genetic or medical problem present in the family, interpret information about the disorder, analyze inheritance patterns and risks of recurrence, and review available options with the family. We also provide supportive counseling to families, serve as patient advocates and refer individuals and families to community or state support services.

What is the salary range for careers in genetic counseling?

The average salary for genetic counselors in the U.S. Mountain States region is $43,800 and varies by years of experience.

What do you think are the most important skills needed to do your job?

I think that listening and communication skills in addition to up-to-date knowledge and on-going interest in the science of genetics are important skills needed in genetic counseling. The ability to facilitate decision-making and communicate complex information in less complex, medicalized terms is also important.

Why did you choose this career?

I chose this career because of my interest in science, particularly genetics, and my desire to work with families and individuals with genetic conditions. Genetic counseling is an excellent way to combine the science, which you really have to understand and be comfortable handling, with the human element of counseling and helping families through difficult time periods.

I have wanted to do this since I was a teenager and have spent time working with special needs individuals, many who had genetic conditions. It is important for both the child's family and child to have as much knowledge about their condition as possible and I want to be a person who can help share and interpret that information for them.

What do you like best about genetic counseling? What do you like least?

There are many aspects of genetic counseling that I truly enjoy, particularly working with children and their families. I find it very rewarding to be able to make a difference in somebody's life by empowering them with information about genetics and how it pertains to them personally. I also enjoy being a part of a constantly expanding field about which I learn something new every day.

My least favorite aspect of genetic counseling is dealing with insurance companies. Most insurance companies do not cover genetic counseling or testing and do not seem to understand the importance of our services.

How do you think genetic counseling will change in the next 5-10 years?

The demand for genetic services is expected to increase significantly as the Human Genome Project and other research yields scientific advances with clinical applications. I think that the need for competent genetic counselors will greatly expand in the next several years, as more genetic testing becomes available and accessible, specifically in the primary care setting. It will be increasingly important for knowledgeable individuals trained in medical genetics to interpret the information accurately.

Do you have any advice for students who are thinking about genetic counseling?

As a first step I would suggest that an interested person explore the career information pages of the National Society of Genetic Counselors website (www.nsgc.org). Here one can learn about Genetic Counseling training programs, undergraduate course requirements, career opportunities, etc. I would also suggest they talk with and observe a genetic counselor in practice. We are always happy to speak with interested students.