

**MIDDLE SCHOOL**

**Biotechnology**

**Medical Ethics**

**Teacher Background**:

There are so many factors that students may consider around ethical issues. Remember to stay non-biased and do your best to keep your non-verbal cues to a minimum so as not to influence student opinions.

**Goal**: Students will consider ethical issues and use data to support their opinions

**Objectives**: Students will…

* Evaluate veterinary medical issues
* Evaluate a medical ethics issue as it relates to humans and biotechnology
* Develop opinions
* Analyzing data to support both sides of the issue
* Weighting data to show a personal opinion

**Materials:**

* Overhead of “Medical Expenditure Log”
* White boards and markers
* Article
* Hanger for each student
* String
* Paper
* Popsicle sticks
* Washers
* Various art supplies for making mobiles
* Yellow and blue highlighters

**Time Required**: 60 minute class period

**Standards Met**:

* Science and Technology Standards: Understanding about science & technology
* Science In Personal And Social Perspectives: Science & technology in society

**Procedure**:

Day 1

* Have students get out their “Medical Expenditure Log”. Put the correct expense sheet on the overhead and review the tests Sparky has received.
* Ask students to review what they learned about Sparky’s kittens. List the genetic medical concerns on the board.
* Tell students that a family is interested in adopting Sparky and the kittens.
  + Ask the students if they would charge the family for all of the genetic tests. Why or why not?
  + If the students would not charge the family, who should pay?
  + Should the tests have been completed? Why or why not?
  + What if Sparky were a human?
* Give each student a white board and marker.
  + Read the first concern aloud.
  + Students should write “yes” or “no” if they would give the information to the adoptive family or not.
  + Students should also write considerations they used to make that decision.
  + Share and repeat the process for each genetic concern.
* Explain to students that these issues become more complicated when applied to humans. There are privacy acts, insurance considerations, and many factors to consider.
* Give each student a copy of The New York Time’s article, “Born to Run? Little Ones Get Test for Sports Gene” and read it aloud.
* On the article, students should highlight factors that support that testing for sports genes in yellow, and highlight factors that do not support it in blue.
* Tell students that their homework is to discuss the issue with adults and other students.
* For tomorrow, they should be prepared to share the pros and cons of this issue and be able to give factors to support both arguments.

Day 2

* Have students create a concept map outlining the arguments for and against testing for sports genes.
* They may use factors given by the article, people they interviewed, or their own.
* Explain that they will be making mobiles out of these concept maps. The arguments for will be on one side of the hanger, the arguments against will be on the other side of the hanger.
* Ask students is certain factors seem more important to them. Have a student share which factor is most important to him or her.
* Tell students that this is called weighting and to show which factor is the most important, they will literally weight that factor by applying a washer to the back of that factor.
* Allow students time to create their mobiles.

**Medical Ethics: Medical Expenditure Log**

Veterinary Assistants: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Fill out this chart daily

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date | Description  (item, test, situation) | Quantity | Cost per item | Total |
|  | **Diabetes Mellitus – Disease/Disorder Information Sheet** | 1 | 100.00 | 100.00 |
|  | **Regenerative Anemia – Disease/Disorder Information Sheet** | 1 | 100.00 | 100.00 |
|  | **Feline Acne – Disease/Disorder Information Sheet** | 1 | 100.00 | 100.00 |
|  | **Blood Test** | 1 | 200.00 | 200.00 |
|  | **Urine Test** | 1 | 200.00 | 200.00 |
|  | **Pregnancy Test** | 1 | 50.00 | 50.00 |
|  | **Gel Electrophoresis DNA Fingerprint** | 1 | 30.00 | 30.00 |
|  |  |  |  |  |
|  |  |  |  |  |
|  | TOTAL |  |  | $780.00 |

**Medical Ethics:** ***Born to Run? Little Ones Get Test for [New York Times](http://www.nytimes.com/)Sports Gene***



Kevin Moloney for The New York Times

DNA collected by swabbing the inside of a cheek can be used to determine whether a child is likely to excel at a particular sport.

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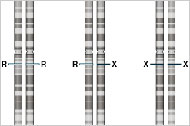
By [JULIET MACUR](http://topics.nytimes.com/top/reference/timestopics/people/m/juliet_macur/index.html?inline=nyt-per)

Published: November 29, 2008

BOULDER, Colo. — When Donna Campiglia learned recently that a genetic test might be able to determine which sports suit the talents of her 2 ½-year-old son, Noah, she instantly said, Where can I get it and how much does it cost?

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**Multimedia**

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“I could see how some people might think the test would pigeonhole your child into doing fewer sports or being exposed to fewer things, but I still think it’s good to match them with the right activity,” Ms. Campiglia, 36, said as she watched a toddler class at Boulder Indoor Soccer in which Noah struggled to take direction from the coach between juice and potty breaks.

“I think it would prevent a lot of parental frustration,” she said.

In health-conscious, sports-oriented Boulder, Atlas Sports [Genetics](http://health.nytimes.com/health/guides/specialtopic/genetics/overview.html?inline=nyt-classifier) is playing into the obsessions of parents by offering a $149 test that aims to predict a child’s natural athletic strengths. The process is simple. Swab inside the child’s cheek and along the gums to collect DNA and return it to a lab for analysis of ACTN3, one gene among more than 20,000 in the human genome.

The test’s goal is to determine whether a person would be best at speed and power sports like sprinting or football, or endurance sports like distance running, or a combination of the two. A 2003 study discovered the link between ACTN3 and those athletic abilities.

In this era of genetic testing, DNA is being analyzed to determine predispositions to disease, but experts raise serious questions about marketing it as a first step in finding a child’s sports niche, which some parents consider the road to a college scholarship or a career as a professional athlete.

Atlas executives acknowledge that their test has limitations but say that it could provide guidelines for placing youngsters in sports. The company is focused on testing children from infancy to about 8 years old because physical tests to gauge future sports performance at that age are, at best, unreliable.

Some experts say ACTN3 testing is in its infancy and virtually useless. Dr. Theodore Friedmann, the director of the University of California-San Diego Medical Center’s interdepartmental gene therapy program, called it “an opportunity to sell new versions of snake oil.”

“This may or may not be quite that venal, but I would like to see a lot more research done before it is offered to the general public,” he said. “I don’t deny that these genes have a role in athletic success, but it’s not that black and white.”

Dr. Stephen M. Roth, director of the functional genomics laboratory at the [University of Maryland](http://topics.nytimes.com/top/reference/timestopics/organizations/u/university_of_maryland/index.html?inline=nyt-org)’s School of Public Health who has studied ACTN3, said he thought the test would become popular. But he had reservations.

“The idea that it will be one or two genes that are contributing to the Michael Phelpses or the Usain Bolts of the world I think is shortsighted because it’s much more complex than that,” he said, adding that athletic performance has been found to be affected by at least 200 genes.

Dr. Roth called ACTN3 “one of the most exciting and eyebrow-raising genes out there in the sports-performance arena,” but he said that any test for the gene would be best used only on top athletes looking to tailor workouts to their body types.

“It seems to be important at very elite levels of competition,” Dr. Roth said. “But is it going to affect little Johnny when he participates in soccer, or Suzy’s ability to perform sixth grade track and field? There’s very little evidence to suggest that.”

The study that identified the connection between ACTN3 and elite athletic performance was published in 2003 by researchers primarily based in Australia.

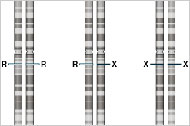
Those scientists looked at the gene’s combinations, one copy provided by each parent. The R variant of ACTN3 instructs the body to produce a protein, alpha-actinin-3, found specifically in fast-twitch muscles. Those muscles are capable of the forceful, quick contractions necessary in speed and power sports. The X variant prevents production of the protein.

The ACTN3 study looked at 429 elite white athletes, including 50 Olympians, and found that 50 percent of the 107 sprint athletes had two copies of the R variant. Even more telling, no female elite sprinter had two copies of the X variant. All male Olympians in power sports had at least one copy of the R variant.

Conversely, nearly 25 percent of the elite endurance athletes had two copies of the X variant — only slightly higher than the control group at 18 percent. That means people with two X copies are more likely to be suited for endurance sports.

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Still, some athletes prove science, and seemingly their genetics, wrong. Research on an Olympic long jumper from Spain showed that he had no copies of the R variant, indicating that athletic success is probably affected by a combination of genes as well as factors like environment, training, [nutrition](http://health.nytimes.com/health/guides/specialtopic/food-guide-pyramid/overview.html?inline=nyt-classifier) and luck.

“Just think if that Spanish kid’s parents had done the test and said, ‘No, your genes show that you are going to be a bad long jumper, so we are going to make you a golfer,’ ” said Carl Foster, a co-author of the study, who is the director of the human performance laboratory at the [University of Wisconsin](http://topics.nytimes.com/top/reference/timestopics/organizations/u/university_of_wisconsin/index.html?inline=nyt-org)-La Crosse. “Now look at him. He’s the springiest guy in Spain. He’s Tigger. We don’t yet understand what combination of genes creates that kind of explosiveness.”

Dr. Foster suggested another way to determine if a child will be good at sprint and power sports. “Just line them up with their classmates for a race and see which ones are the fastest,” he said.

Kevin Reilly, the president of Atlas Sports Genetics and a former weight-lifting coach, expected the test to be controversial. He said some people were concerned that it would cause “a rebirth of eugenics, similar to what [Hitler](http://topics.nytimes.com/top/reference/timestopics/people/h/adolf_hitler/index.html?inline=nyt-per) did in trying to create this race of perfect athletes.”

Mr. Reilly said he feared what he called misuse by parents who go overboard with the results and specialize their children too quickly and fervently.

“I’m nervous about people who get back results that don’t match their expectations,” he said. “What will they do if their son would not be good at football? How will they mentally and emotionally deal with that?”

Mr. Reilly insisted that the test is one tool of many that can help children realize their athletic potential. It may even keep an overzealous father from pushing his son to be a quarterback if his genes indicate otherwise, Mr. Reilly said.

If ACTN3 suggests a child may be a great athlete, he said, parents should take a step back and nurture that potential Olympian or [N.F.L.](http://topics.nytimes.com/top/reference/timestopics/organizations/n/national_football_league/index.html?inline=nyt-org) star with careful nutrition, coaching and planning. He also said they should hold off on placing a child in a competitive environment until about the age of 8 to avoid burnout.

“Based on the test of a 5-year-old or a newborn, you are not going to see if you have the next Michael Johnson; that’s just not going to happen,” Mr. Reilly said. “But if you wait until high school or college to find out if you have a good athlete on your hands, by then it will be too late. We need to identify these kids from 1 and up, so we can give the parents some guidelines on where to go from there.”

Boyd Epley, a former strength and conditioning coach at the [University of Nebraska](http://topics.nytimes.com/top/reference/timestopics/organizations/u/university_of_nebraska/index.html?inline=nyt-org), said the next step would be a physical test he devised. Atlas plans to direct children to Epic Athletic Performance, a talent identification company that uses Mr. Epley’s index. He founded the company; Mr. Reilly is its president.

China and Russia, Mr. Epley said, identify talent in the very young and whittle the pool of athletes until only the best remain for the national teams.

“This is how we could stay competitive with the rest of the world,” Mr. Epley said of genetic and physical testing. “It could, at the very least, provide you with realistic goals for you and your children.”

The ACTN3 test has been available through the Australian company Genetic Technologies since 2004. The company has marketed the test in Australia, Europe and Japan, but is now entering the United States through Atlas. The testing kit was scheduled to be available starting Monday through the Web site [atlasgene.com](http://www.atlasgene.com).

The analysis takes two to three weeks, and the results arrive in the form of a certificate announcing Your Genetic Advantage, whether it is in sprint, power and strength sports; endurance sports; or activity sports (for those with one copy of each variant, and perhaps a combination of strengths). A packet of educational information suggests sports that are most appropriate and what paths to follow so the child reaches his or her potential.

“I find it worrisome because I don’t think parents will be very clear-minded about this,” said William Morgan, an expert on the philosophy of ethics and sport and author of “Why Sports Morally Matter.” “This just contributes to the madness about sports because there are some parents who will just go nuts over the results.

“The problem here is that the kids are not old enough to make rational autonomous decisions about their own life,” he said.

Some parents will steer clear of the test for that reason.

Dr. Ray Howe, a general practitioner in Denver, said he would rather see his 2-year-old, Joseph, find his own way in life and discover what sports he likes the best. Dr. Howe, a former professional cyclist, likened ACTN3 testing to gene testing for [breast cancer](http://health.nytimes.com/health/guides/disease/breast-cancer/overview.html?inline=nyt-classifier) or other diseases.

“You might be able to find those things out, but do you really want to know?” he said.

Others, like Lori Lacy, 36, said genetic testing would be inevitable. Ms. Lacy, who lives in Broomfield, Colo., has three children ranging in age from 2 months to 5 years.

“Parents will start to say, ‘I know one mom who’s doing the test on her son, so maybe we should do the test too,’ ” she said.

“Peer pressure and curiosity would send people over the edge. What if my son could be a pro football player and I don’t know it?”

<http://www.nytimes.com/2008/11/30/sports/30genetics.html?pagewanted=1&_r=1&ref=us>