Master 1.7 Answer Key for Oscar Pistorius's Case

Four Key Questions and Statement of Position and Justification

Name of Case: *Oscar Pistorius*

Part 1. The Four Key Questions

What is the ethical question?

- *Should Oscar Pistorius be allowed to compete in the Olympics?*

A broader, overarching ethical question is:

- *Which changes to the human body create an unfair advantage?*

What are the relevant facts?

- *Oscar Pistorius was born missing both fibulas.*
- *His parents chose to have both his legs amputated below the knees when he was less than one year old so that he could learn to walk with prosthetic legs and feet.*
- *Pistorius would have been wheelchair bound without the amputation and prosthetics.*
- *Pistorius is an excellent track athlete.*
- *He trains to maintain and improve his running ability.*
- *He was fitted with prosthetics to help him walk.*
- *He wears artificial limbs named Cheetahs made of carbon fiber.*
- *An alternative athletic competition exists for people with differently abled bodies called the Paralympics.*
- *Pistorius excels in competition. He has competed in the Paralympics and set world records in track events.*
- *Pistorius now requests the opportunity to compete in the Olympics.*
- *It is unclear whether the Cheetah prosthetics make athletes run faster than athletes with flesh-and-blood legs.*

Who or what could be affected by how the question is resolved?

- *Oscar Pistorius*
- *All athletes, whether they are differently abled or not*
- *Sports competition in general*
- *Coaches*
- *Referees*
- *Young children (and others) with different abilities who are thinking about their future opportunities*

What are the relevant ethical considerations?

- **Respect for Persons**

In Favor of Allowing Pistorius to Compete in the Olympics

Pistorius is an athlete, pure and simple; he ought to be able to follow his dream of competing in the Olympic Games if he qualifies based on time trials or other qualifying rules.

Against Allowing Pistorius to Compete in the Olympics

Pistorius is respected as an athlete and a person who has been able to follow his dream of competing at the highest levels of athletics within the Paralympics Organization.

- **Harms and Benefits**

In Favor of Allowing Pistorius to Compete in the Olympics

- *Pistorius will benefit by having the chance to test himself against the best in the world.*
- *Other athletes will benefit by being challenged by his presence in the race and, perhaps, compete at a higher level.*
- *Pistorius's presence may help erase lines between people with physical disabilities and those without. It may bring more attention and respect to the achievements of those with different physical forms, which is a benefit to them.*
- *Pistorius's race in the Olympics might be very inspirational to many people.*

Against Allowing Pistorius to Compete in the Olympics

- *If Pistorius qualifies to compete, he might take a spot away from another athlete who has trained for years in hopes of competing in the Olympics and, so, harm that person.*
- *By wanting to compete in the Olympics even though he is a top athlete in the Paralympics, Pistorius is saying indirectly that the Paralympics aren't good enough—that they are inferior to the Olympics. This subtle attitude could reflect negatively on other physically disabled athletes and on the reputation of the Paralympics, and thus harm those athletes and that institution.*
- *In an effort to keep up with Pistorius's carbon-fiber blades, other athletes might be inspired to take additional training risks that could be harmful, including using performance-enhancing drugs.*
- *Mixing in an athlete who uses technological enhancements or additions to his body with athletes who do not may forever change the nature of sport. It could become more of a competition about engineering and technology than physical achievement and effort, and thus harm the spirit of the sport.*

- **Fairness**

In Favor of Allowing Pistorius to Compete in the Olympics

- *Engineers disagree over whether the carbon-fiber blades that Pistorius wears make him run faster than people with flesh-and-blood legs. Even if they did give him some small advantage with respect to speed, this is not different from the advantage gained by highly engineered track shoes. So, he does not have an unfair advantage*
- *It is unfair to discriminate against Pistorius because the obstacle to athletic victory that he had to overcome is a congenital physical malformation, correctable by surgery and prostheses.*
- *It is unfair to disqualify him from racing because he still has to train and prepare for athletic competition, just like able-bodied athletes.*
- *Fairness requires that people are not discriminated against based on irrelevant characteristics. In this context, for example, national origin and sexual orientation are irrelevant to fair play. Pistorius's prosthetic legs are also an irrelevant consideration; his athletic ability should be the focus.*

Against Allowing Pistorius to Compete in the Olympics

- *Engineers disagree over whether the carbon-fiber blades that Pistorius wears give him an advantage with respect to speed over people with flesh-and-blood legs. If he is allowed to compete, he might have an unfair advantage.*
- *The fact that Pistorius's physical disability means he cannot compete in the Olympic Games is unfortunate, but it is not unfair. The International Paralympics Games are a world-renowned athletic competition with top-caliber athletes who compete with a range of disabilities. It was established to provide a fair and world-class venue in which athletes with disabilities could compete.*
- *Pistorius's participation in the Olympics is unfair to the other athletes. If he qualifies, he removes a spot for an athlete without artificial limbs who has spent years training in hopes of making the Olympic Squad. The Olympics are the highest level of competition for able-bodied world-class athletes.*
- *Pistorius's ability to run in both the Paralympics and, perhaps, the Olympics is unfair because able-bodied athletes do not have the corresponding freedom to participate in the Paralympics.*

- **Others? (Fill in other ethical considerations you think are relevant to this case.)**
  Value, Authenticity, Spirit of Sport (particularly the Olympics)

In Favor of Allowing Pistorius to Compete in the Olympics

- *The Olympic motto is "*citius, altius, fortius*" or "faster, higher, stronger"; nothing about using carbon-fiber blades goes against that motto or the spirit of the Games.*
- *Every aspect of Pistorius's life story and his dedication to sport fulfill the best and most positive aspects of athletic integrity, character, and spirit.*
- *Sport functions to inspire and entertain, and Pistorius's participation in the Olympics will do both for people with able bodies and those with differently abled bodies.*
- *The notion of striving for excellence in sports will be supported because able-bodied competitors and other differently abled competitors will be challenged to improve to the highest degree by Pistorius's participation.*

Against Allowing Pistorius to Compete in the Olympics

- *Tradition and expectation surrounding the Olympic Games mean that competing athletes are challenging their own and fellow competitors' physical abilities. Refining and nurturing those talents through training and discipline are within the norms of the Games, but technological enhancements of the human body itself are outside the norms of the Games.*
- *The spirit of sport demands that the athlete stands before the challenge without artificial enhancements of his or her physical gifts. It will totally change the central notion or nature of sports—challenging oneself to excellence based on one's natural gifts and efforts—to include technologically enhanced athletes in sports competition against athletes with bodies that have not been technologically enhanced.*
- *Other athletes might take additional risks to compete against Pistorius. His presence might induce them to use drugs or other substances to go beyond their natural talents, which is against the spirit of the sport.*

Part 2. Position and Justification

What do you recommend be done and why?

NOTE: These justifications are provided in depth as background for teachers. Most students will not provide such well-developed justifications.

Assessing Student Justifications, a table in the Introduction on pages 10 and 11, may be useful for assessing student work.

Oscar Pistorius should not be allowed to compete in the Olympic Games

Oscar Pistorius should not be allowed in the Olympic Games despite the fact that he clearly is a gifted athlete. The justification for this position is that the athletic competition at the Olympic Games is a competition that pits people against one another to see who is the strongest and fastest, has the most stamina, etc., based on each person's genetic makeup, natural physical abilities, training and nutrition, psychological strength, and strategy. These characteristics are a mixture of gift, effort, and luck. His carbon-fiber legs create an unfair advantage when Mr. Pistorius competes against athletes with legs of flesh and blood.

At its core, sport functions allow human beings to compete against one another to see how fast or how far the human body can go—to achieve the excellence of the human body in certain categories and measured by certain criteria established through mutual consent. This competition tests the human body as it is made by nature, although clearly genetic and physical variations exist. Artificial or technological additions can't be allowed because then, the test becomes a test of the technology or artificial body addition and not simply a test of the athletic skill or gifts of the athlete, although that skill and those gifts are usually still required.

All athletes, whatever their physical or mental abilities, have athletic drive and benefit from competition. The different advantages conferred by technology (wheelchairs and prosthetics) and the disadvantages related to physical disability require another playing field for differently abled athletes to compete in, namely, the Paralympics.

Typically, an enhancement is a technology, artificial addition, or intervention that does more than make physical or mental abilities equal to those of the person before an accident or injury. An enhancement increases a person's abilities or capacities beyond those that are normal for a human being. (Clearly, it is difficult to define the normal level of functioning for a human being, but a range certainly exists.) An enhancement goes beyond these benchmark levels to something that provides an advantage.

The prosthetics give clear advantages to Pistorius. Because his lower legs and feet are made of carbon steel, Mr. Pistorius does not suffer from tired muscles or fatigue in that part of his body. He also has aerodynamic advantages from the blades.

Mr. Pistorius does have a venue for his athletic abilities and is very successful there. He should continue to pursue records in the Paralympic Games. Within the Paralympics world, developing and refining prosthetic legs for the purposes of winning athletic competitions is the accepted norm. Oscar Pistorius's efforts to develop top-performing running Cheetahs are matched by the efforts of other Paralympians to refine their prosthetic devices for similar improvements in form and function. Refined prosthetic legs are acceptable enhancements and are the norm among competitors in the Paralympics. Mr. Pistorius will not be getting an unfair advantage compared with his fellow competitors. Efforts should be made to bring the Paralympics to a place that is as prestigious as Olympics locations. Paralympic athletes ought to enjoy endorsements and name recognition, too; if they did, perhaps the desire to compete across the divide of the two games would be reduced.

Oscar Pistorius should be allowed to compete in the Olympic Games.

Oscar Pistorius ought to be allowed to compete in the Olympic Games because athletic competition is about trying to overcome obstacles to do the physical best that one can as measured by agreed-upon criteria. In the races that Mr. Pistorius runs, best is measured in terms of speed. Sometimes the obstacles to reaching one's physical best are emotional, such as the death of a parent at a young age, but other times the obstacles are physical, as in Mr. Pistorius's case.

Human beings have become faster, stronger, and taller over time with better nutrition and vitamins. What is "normal" for a human being changes. Whether the change comes from advances in training or diet or our abilities to replace human function with technology should not make a difference. Mr. Pistorius must be an exceptional athlete to be able to perform at the levels he does using his carbon-fiber running blades. Using the blades demands a certain degree of athleticism and may demand more of an individual than does running on legs of flesh.

The prosthetics do not provide advantages to Pistorius. His thighs, knees, and the rest of his body are subject to the same conditions of fatigue as are those of athletes without lower-leg prosthetics. At the same time, it is true that Mr. Pistorius is unable to take advantage of natural sensors for balance because he has no feeling in his feet. According to Mr. Pistorius, he must work harder to overcome difficult weather conditions such as wind and rain because his carbon blades perform less well under those circumstances. He also must use several meters at the beginning of a race to establish his stride because the blades take some time to control; athletes with legs of flesh can get into their stride more quickly.

Oscar Pistorius is a double amputee instead of a single amputee. He may be able to achieve greater success in running because of that fact, since his forward motion is smoother, but he might also have to work much harder to maintain balance, stability, and control because he does not have lower-leg muscles in either leg to provide that experience. Finally, the muscles that control his stride and create the power for forward movement are almost entirely located in his hips, making his stride less efficient than those of able-bodied athletes.

Another criterion for judging whether an added technology or artificial addition to the body is acceptable is whether it returns the body to the level of achievement it had before the addition or surpasses it. In this case, it is not possible to compare Mr. Pistorius's running times with prostheses with his speed without them because he has lived his whole mobile life with prosthetics. Perhaps the traditional criterion for determining what an ethically acceptable enhancement is might be more useful. That criterion deems that an artificial or technological addition to the body is acceptable if it permits the user or wearer to function at the level that a person without such an artificial or technological addition functions. Certainly, a range exists, and Mr. Pistorius performs at a level beyond that achieved by most human beings—able-bodied or not—but he is still within the normal range for what human beings can achieve.

Mr. Pistorius, like other athletes, must train and prepare physically and mentally for competition. He must also think about strategy as he runs in high-speed sprints. His prosthetic legs have not removed these requirements. As long as Pistorius's legs are of the appropriate size for his body, the fact that he has legs created by technology should be acceptable for competition.

If Oscar Pistorius is permitted to compete in the Olympics, he should be required to give up participation in Paralympics events. If that requirement is not enforced, Pistorius has two arenas in which to compete, an option not open to athletes without a disability or other condition. He should commit and cast his lot in only one of these arenas.

Master 1.7 Answer Key for Carl's Case

Four Key Questions and Statement of Position and Justification

Name of Case: *Carl's Case*

Part 1. The Four Key Questions

What is the ethical question?

What should Carl do? Should he take the steroids?

What are the relevant facts?

Examples may include

- *the health risks of steroids;*
- *the fact that they only work to build muscle and strength if the athlete continues to train while taking them; and*
- *that they are currently illegal in the United States if used in ways not prescribed by a doctor.*

There are also facts pertinent to Carl's specific situation—such as the facts that

- *others on the team might be using steroids;*
- *he will only use them for a short period, while he is recovering from an injury; and*
- *he might get a college scholarship if he performs well this season.*

Who or what could be affected by how the question is resolved?

- *Carl*
- *Carl's family*
- *Carl's teammates (both present and future)*
- *competitors (individuals and teams competing against Carl)*
- *other students at his school*
- *the school's reputation*
- *athletic organizations and related organizations that regulate sports*
- *individuals distributing steroids*

What are the relevant ethical considerations?

- **Respect for Persons**

In favor of Carl taking the steroids:

Society should respect Carl's choices about his body, even if the use of steroids harms him, as long as no one else is physically harmed by his actions. He should have the liberty to make those decisions for himself.

Against Carl taking the steroids:
Society should respect Carl's choices to a certain degree but should not allow him to make choices that can cause physical harm.

- **Harms and Benefits**

In favor of Carl taking the steroids:
– *The opportunity for Carl to have a scholarship will have important benefits for his future.*
– *Carl may help the school win sports victories.*

Against Carl taking the steroids:
– *Carl may be physically harmed by taking the steroids.*
– *Carl's use of steroids may hurt the school's reputation and may jeopardize its athletic standings. The school's eligibility to participate in athletic events may be revoked.*

- **Fairness**

In favor of Carl taking the steroids:
It is fair for Carl to use the steroids, because others on his team (or on other teams in the league) are using them and he is using them to compensate for an injury.

Against Carl taking the steroids:
– *It isn't fair for Carl to use the steroids, because fairness in sports requires using your natural abilities, and taking steroids alters you in a significant way.*
– *Competitors who have not taken steroids may lose their own opportunities for advancement or scholarships.*

- **Authenticity**

In favor of Carl taking the steroids:
Carl will still be his authentic self if he takes steroids. He would be using a naturally occurring substance and just using more of it until his body gets back to its normal levels after he recovers from the injury. Using steroids is no different from using other types of enhancements.

Against Carl taking the steroids:
– *Carl will not be his authentic self when he takes steroids since he is altering his physical condition with something that creates a dramatic effect. Any achievements reached through such efforts are not really valid because sports rely on fair play.*

- **Others?**

Students may also mention integrity of the sport, which is undermined when competitors take steroids.

Part 2. Position and Justification

What would you recommend be done and why?

Carl shouldn't take the steroids.

- *He is not remaining true to his authentic self. He will fundamentally alter his physical abilities by taking them. Even though he has had an injury, he should recuperate naturally rather than try to use steroids to alter his condition.*
- *A related reason is that taking the steroids would undermine what people most value about sports, which has to do with people challenging themselves to their maximum natural capacities and achieving their best as they naturally are. Sports rely on a shared understanding that all competitors will bring their authentic selves into the competition.*
- *Carl will also have to lie and sneak around to use steroids because they aren't publicly acceptable to use in sports; this dishonesty will further damage Carl's authenticity for himself and others, and lying is disrespectful to others.*
- *Another important reason why Carl shouldn't take steroids is that they can harm him. There is scientific evidence that steroids are physically damaging.*
- *Carl's use of steroids would damage the ideals of fair competition and sport.*
- *While it is important to respect people's desires to have control over their own bodies, if the changes are harmful to themselves or to others (for example, other competitors or the sport itself), they should not be carried out.*
- *If steroid use became legal for sports enhancement, then all athletes might begin to feel pressure to take steroids, even if they personally would not have wanted to. This would create a new bar for human performance, dependent on the drug. It would also expose more people to the physical harms associated with steroids.*

Carl should take the steroids.

- *People should be respected for what they want to do to their own bodies, even if there may be physical risks to themselves. For example, people are allowed to make the choice to smoke and ride motorcycles, which are also potentially harmful.*
- *Carl is recuperating from an injury and plans to use the steroids only until he is up to his normal level. He doesn't intend to make himself better than he was. The injury hurt his chances at a well-deserved scholarship—the temporary use of steroids would help him get back to the condition he was in before the injury. The steroids do not give him an advantage over others but, rather, equalize the playing field, since they bring him up to his normal level of operation.*
- *Taking steroids doesn't mean that Carl can be lazy. He will still have to work out and train hard.*
- *In addition, Carl has strong obligations to his team and to his school. He needs to be the best he can be for the sake of his teammates.*

Caffeine and Modafinil

A group of college students is staying up late together to study for exams. Several of them have been drinking coffee all day and are wide awake, although feeling jittery. One of the students, Lisa, mentions that she has recently started taking a prescription medication that helps her stay awake because of a medical condition. Lisa had previously been a heavy coffee drinker, consuming four or more cups of coffee a day in her struggle to stay awake. Since starting on the new medication, she is able to stay awake easily for a day or longer and is not experiencing any negative side effects. "It's better than coffee," she tells her friends, "but it is a lot more expensive."

Should Lisa give her friends her medication? Should her friends take the medicine?

Background

The central nervous system (CNS—the spinal cord and brain) directs the functions of the body. The peripheral nervous system (PNS) takes sensory inputs and relays them to the brain, which evaluates them. The CNS then transmits messages to the appropriate organ or tissue. Drugs that act on the CNS usually do so by interacting with this messaging system, often by stimulating or inhibiting the release of neurotransmitters (the chemical messengers that travel between nerve cells).

Caffeine

Many drugs act on the CNS to enhance alertness. The most popular behavior-altering drug is the stimulant caffeine. An estimated 9 out of 10 Americans consume some type of caffeine regularly. Caffeine is well known for its ability to briefly relieve fatigue and drowsiness.

Caffeine is found naturally in more than 60 plants. It is in coffee, tea, soft drinks, and, to a lesser extent, chocolate, and it's sometimes added to medicines. Caffeine is absorbed quickly and travels to the brain. Excreted several hours after it's been consumed, it does not build up in the blood and is not stored in the body.

Although some people are highly sensitive to the effects of caffeine, most are not harmed by the amount of caffeine in two to three cups of coffee per day (200–300 milligrams total). More than 500–600 milligrams per day of caffeine (as much as in four to seven cups of coffee) can result in sleeplessness, headaches, irritability, anxiousness, and changes in heart rhythm. Caffeine is addictive, and individuals who consume large quantities of it exhibit withdrawal symptoms if they suddenly stop using it.

Modafinil

The chemical compound modafinil (moe-DAH-fih-nill) is another CNS stimulant. It is used to treat sleepiness, especially sleepiness from disorders such as narcolepsy (which causes people to fall asleep during the day, especially when excited), shift-work sleep disorder (which can occur as a result of working nights or on rotating shifts), and sleep apnea (when someone's breathing is disrupted during sleep).

Modafinil helps people stay awake during the day and does not interfere with their ability to sleep at night or have many of the side effects of other CNS stimulants. Although the exact way modafinil works is unknown, it probably changes the amounts of neurotransmitters in the part of the brain involved in controlling sleep and wakefulness. Although it may be habit forming, its potential for abuse is considered lower than that of other CNS-stimulant drugs, such as amphetamines. It is frequently prescribed for off-label use (that is, for conditions other than those originally approved by the U.S. Food and Drug Administration). The estimated cost is over $200/month.

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Myostatin (based on an actual case)

Doctors in Germany noted the birth of an extraordinary boy. While not heavy at birth (his weight was in the 75th percentile), he was unusually muscular. Muscles in his thighs and upper arms were very pronounced. Except for the fact that he had strong reflexes, his physical examination was normal. His levels of testosterone and growth factors were also normal. By age four, the boy could hold two 3-kg (6.6-lb.) dumbbells out at his side with arms extended.

His mother had been a professional athlete. She was healthy and had a normal pregnancy. Several other family members were also reputed to be very strong. Researchers analyzed the DNA of both mother and son and found a mutation in the myostatin gene, resulting in an abnormal myostatin protein. Myostatin normally inhibits muscle growth. When the protein is not functioning, that inhibition is lifted and muscles grow as a result. Myostatin inactivators might help people with muscular dystrophy and other muscle-wasting diseases or with sports injuries. However, the possibility also exists that healthy athletes would use such inactivators for enhancement purposes.

Imagine that a top athlete has that myostatin-gene mutation. A competitor is taking myostatin inactivators. Is there a difference in how these two athletes should be treated? Should they both be allowed to compete? Why or why not?

Background

Myostatin (my-oh-stat-in) is a protein that puts the brakes on muscle growth. When myostatin is somehow itself inhibited, muscles grow—although the precise mechanism by which they do so is not yet understood. A mutated form of the gene for myostatin has been found in types of cattle that are also abnormally muscular (Belgian Blue and Piedmontese) and have very little fat. Mice that have been genetically engineered to lack myostatin grow into "mighty mice"—from the increase in size and number of muscle fibers.

Scientists have come up with several approaches to blocking myostatin. One uses antibodies against myostatin to bind and block it. Another uses a smaller, incomplete version of myostatin. The incomplete version binds to many of the places in the cells surrounding the muscles that normal myostatin would otherwise bind to (competitive inhibition), thus blocking and preventing some of the normal myostatin from carrying out its normal function.

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Erythropoietin (EPO) (based on an actual case)

The Tour de France is considered by many people the ultimate bicycle race. It's between 3,000 and 4,000 km (1,800 and 2,500 miles) long, on a grueling course across France and over many mountain passes. Various techniques and drugs to enhance performance have become widespread among the racers. Particularly common has been the use of "blood doping." This is when athletes increase the number of red blood cells in circulation, either through blood transfusions or by stimulating the production of more blood cells. An increase in red blood cells allows more oxygen to be carried to the tissues, which enhances aerobic performance.

One of the most frequently used blood-doping substances is erythropoietin (EPO). In 1998, an entire team was banned from the race when their use of EPO was discovered. Bjarne Riis of Denmark, who won the Tour in 1996, also publicly admitted his use of EPO. Erik Zabel, a German cyclist, noted in his public admission of EPO use, "My generation will probably be remembered as generation EPO."

Some people have argued that allowing athletes to use EPO and other enhancements violates the spirit of sport. Others, such as Julian Savelscu and his colleagues, disagree: "Far from being against the spirit of sport, biological manipulation embodies the human spirit—the capacity to improve ourselves on the basis of reason and judgment.... The result will be that the winner is not the person who was born with the best genetic potential to be strongest. Sport would be less of a genetic lottery. The winner will be the person with a combination of the genetic potential, training, psychology, and judgment.... We should not think that allowing cyclists to take EPO would turn the Tour de France into some kind of 'drug race,' any more than the various training methods available turn it into a 'training race' or a 'money race.' Athletes train in different, creative ways, but ultimately they still ride similar bikes, on the same course. The skill of negotiating the steep winding descent will always be there" (Savulescu, Foddy, and Clayton, 2004).

Do you agree or disagree with Savulescu, Foddy, and Clayton? Should athletes be allowed to use EPO? Why or why not?

Should there be separate sports events for people who are taking drugs for enhancement and those who are not?

Background

Erythropoietin (e-rith-roh-POY-e-tin) (EPO) is a hormone naturally made by the kidneys. It is produced in response to a variety of conditions, such as living at a high altitude, pregnancy, or a lower-than-normal number of blood cells (anemia) or loss of large quantities of blood. EPO travels through the blood stream to the bone marrow, where it stimulates production of red blood cells. Human EPO was isolated and purified in the 1970s. Because of a strong interest in developing EPO for clinical uses, by the mid 1980s, several biotechnology companies had developed techniques to produce genetically engineered (recombinant) EPO.

Recombinant EPO is used to treat anemia (low levels of red blood cells) resulting from a host of conditions, primarily kidney failure and cancer chemotherapy. However, EPO has also been used in sports to enhance performance. One side effect of overuse of EPO is that the athlete's blood can thicken and clog in the heart or brain, causing heart attacks and strokes. EPO was officially banned in 1985. Until recently, accurate testing was not possible because of the similarities between laboratory-made and natural EPO.

In the future, it may be possible to manipulate the genes that manufacture EPO naturally. Experiments involving the transfer of genes to increase EPO production have been conducted in monkeys. Although the animals' red blood cell counts increased dramatically, their blood also thickened to such an extent that it had to be diluted regularly to prevent heart failure. If such gene-transfer or gene-manipulation techniques are developed, detection of EPO enhancement will become even more challenging.

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Growth Hormone

Ryan knew he was shorter than other boys, and he was beginning to feel uncomfortable about it. His father had taken him to the doctor, who assured them that Ryan was within the normal range for height, even though he was on the lower end of that range. His sisters were small for their age, too, although they weren't getting teased like Ryan was. His doctor had Ryan's blood tested, and all the results came back normal—he had adequate amounts of growth hormone.

One night, Ryan's parents asked him if he wanted to try to increase his height with additional growth hormone. They had read about the treatment for individuals with short stature and wanted to bring it up at his next doctor's appointment. Even though his hormone levels were normal, they reasoned that additional growth hormone would make him taller. Ryan's parents had heard on TV that taller men were more likely to have successful careers. Even though they weren't sure whether they could trust the TV report, they were concerned that Ryan might have fewer opportunities later in life if he was shorter than average as an adult.

Should Ryan take the growth hormone? Why or why not? What if Ryan doesn't want to but his parents want him to?

Background

When people have normal body proportions but are unusually short, they may be deficient in growth hormone. This condition, which can either be present at birth or develop later in life, is often noticed when a child's growth curve (a graph of change in height over time) indicates little or no growth. Short stature is associated with a height that is below the fifth percentile on a standardized chart. The condition can continue throughout childhood and is often associated with reduced levels of other hormones.

Growth hormone is involved in the metabolism of glucose and fat, as well as in the production of protein in growing cells. It also causes bones to grow from the growth plates at the ends of bones. The pituitary gland, which is about the size of a pea and is located at the base of the brain, ordinarily produces growth hormone. Mutations in genes that code for growth hormone can lead to a decrease in the amount of the hormone in the body. Injury to the brain and lack of a pituitary gland can also decrease the amount of growth hormone being produced. In most cases, however, the cause of the growth hormone deficiency is unclear.

Diagnosis of growth hormone deficiency is made using blood tests. Treatment involves giving people recombinant growth hormone that has been created by genetic engineering. The treatment is generally safe and has few side effects, although it has been associated with tumors. If someone gets the hormone treatment before puberty, additional growth can occur before the growth plates fuse.

The U.S. Food and Drug Administration first approved growth hormone treatment for idiopathic short stature (short stature with unknown cause) in 2003. An NIH study had followed 68 children who had the treatments because they were simply short (and not because of any growth hormone deficiency). The children, who were given injections three times a week over an average of 4.4 years, gained an average of 1.5 inches as adults.

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Beta-Blockers

Juanita is an excellent violin player. Music is her passion in life, and she can't see herself doing anything professionally other than playing the violin. The biggest problem she has is that when it comes time for an important performance, her hands start to shake and she starts to feel anxious and panicky. She is embarrassed to admit that she has this problem. Recently, though, the situation has gotten so bad that she told the conductor of her orchestra about it. He recommended she see the doctor to get a medication to "calm her down" so that she can continue to perform. Juanita feels uncomfortable about taking a drug for her tremors, but she also knows that she can't continue to feel the way she does when she is on stage and the audience is looking at her.

Beta-blockers are sometimes used by musicians to minimize the outward effects of nervousness, but they are banned from some competitive sports such as archery. Is taking beta-blockers for performance anxiety fundamentally different from taking substances to enhance sports performance? Explain your position.

Background

Drugs called beta-blockers (such as propranolol) affect the response of the body to particular nerve signals. They are commonly used to treat heart conditions and high blood pressure. Because they relax blood vessels and lower blood pressure, the heart does not have to work as hard. Beta-blockers can also be used to prevent symptoms associated with anxiety.

Beta receptors, which bind the nerve-stimulating hormones such as epinephrine and norepinephrine, occur in the heart, blood vessels, kidneys, and lungs. Beta-blockers compete with the nerve-stimulating hormones to bind to the beta receptors, thereby blocking the physical basis of the flight-or-fight response.

Beta-blockers may be prescribed for social phobias or other situations when an individual has physical anxiety, such as stage fright. They are also used to treat tremors. The most common type of tremor, essential benign tremor, is often treated with beta-blockers. Beta-blockers are on the list of the World Anti-Doping Agency's prohibited substances for certain sports (such as archery) because of their ability to reduce anxiety and muscle tremors.

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Activity 6 Prompts: Understanding the Ethical Considerations

Respect for Persons: When you show respect to someone, what do you do? What are examples of disrespectful actions?

Harms and Benefits: What are examples of harms? What are examples of benefits? Can you think of actions or policies that minimize harmful consequences? What are some examples of actions or policies that maximize beneficial consequences?

Fairness: What are examples of fair actions or policies? Can you think of examples of unfair ones?

Authenticity: What do people value about a performance in any domain (sports, music, academics)? In particular, what makes a sports performance authentic (that is, valuable and true to its essential nature)? What might make it inauthentic?

Activity 7 Questions:
Applying the Ethical Considerations to Carl's Case

Respect for Persons

- Should society respect a person's choice to use an enhancement technology even when doing so will negatively affect the person's health?

Harms and Benefits

- Are enhancements harmful or beneficial to individuals who use them?
- Are enhancements harmful or beneficial to society when individuals use them?

Fairness

- Is it fair for an individual to use an enhancement?
- Does fairness require that everyone in society have equal access to enhancements?

Authenticity

- Does using enhancements in sports performance violate what people most value about sports?

Facilitating a Good Ethical Discussion of Carl's Case: Sample Student-Teacher Dialogue

The sample dialogue below shows how a teacher might push a student to develop a more reasoned stance about Carl and steroid use. Notice that the teacher does not provide reasons for the student; instead, the teacher asks open-ended and probing questions and periodically summarizes the student's reasoning. Thus, the teacher facilitates and guides the student's thought process but does not provide ideas or reasons. Also, although this sample dialogue focuses on an exchange between the teacher and one particular student, this could instead be a class-wide discussion, with multiple students participating.

In the sample dialogue below, major statements and key turning points are in bold font.
The italics represent thoughts about the student-teacher interaction.

TEACHER: **So, do you think Carl should use steroids?**
STUDENT: **Athletes have the right to do whatever they want to improve their performance.**
TEACHER: Why do you think so?
STUDENT: Your body is your body. No one can tell you what you can or can't do with your body.

This student is implicitly invoking the ethical consideration of respect for persons (respect for personal autonomy) and likely believes it would be disrespectful for another person to get in the way of the athlete's decision. The teacher asks an open-ended question to help the student articulate the ethical consideration behind the student's statement.

TEACHER: Tell me more about that. You seem to be saying that it would be disrespectful not to let athletes do what they want with their own bodies.
STUDENT: Right. In fact, everyone should have that right.

The teacher becomes concerned by the student's rigid extension of the student's original thought.

TEACHER: **Everyone? All the time?**
STUDENT: Yes.

The teacher is worried that the student is stuck thinking in very rigid terms and sees no exceptions to the belief about respect for persons. So, the teacher asks a probing question.

TEACHER: **Can you think of any exceptions?**
STUDENT: Not really.

The teacher decides to follow up with an open-ended question.

TEACHER: Can you give me some other examples of actions that athletes take to better their performance?
STUDENT: I don't know … maybe weightlifting and working out. Or eating energy bars.
TEACHER: Good, can you think of a few more?
STUDENT: No.

The teacher sees that the student is again stuck. The teacher resists the temptation to provide more examples for the student. Instead, the teacher frames the question slightly differently, and in a more accessible way, in hopes that the student can continue.

TEACHER: Well, then, what do everyday people do to maximize their own personal health?
STUDENT: Well, taking vitamins, getting doctor check-ups, eating healthy foods, getting enough sleep.

The teacher records the examples as the student speaks. The list can then serve as a visual reference for the student.

TEACHER: Good. I've made a list of these as you've been talking. **Is there any difference between taking steroids and doing any of these other actions?**
STUDENT: Well, the others are pretty common, and most of them don't require much money, assuming you have health insurance.
TEACHER: Yes, I agree. Are there any other differences?
STUDENT: Well, steroids can be harmful to your body, while the others don't have many risks associated with them.
TEACHER: **Okay, so should safety risks, cost, or accessibility be determining factors for whether athletes should take steroids?**
STUDENT: In terms of risk, I think that it's still the person's choice. The athlete needs to be informed of the risks, and maybe be at least a certain age. But we allow other risky behaviors: smoking, drinking, driving motorcycles.

The teacher decides to verbally summarize what the student has said so far.

TEACHER: So you're saying that we allow other risky behaviors and that it would be disrespectful of one adult to tell another adult how much risk he or she should take?
STUDENT: Yes, as long as the person is an adult who is aware of the risks.

By asking a probing question, the teacher then encourages the student to think about exceptions.

TEACHER: Do you think any limits should be put on that?
STUDENT: Well, like I said—maybe age. Little kids shouldn't decide stuff like that themselves.
TEACHER: Any other exceptions?
STUDENT: Well, maybe if the risks are extreme. Like people who drive motorcycles need licenses and may need to wear a helmet to keep the risk from being extreme. And certain drugs are illegal. Maybe I should learn more about the health effects of steroids...but they probably aren't riskier than alcohol.
TEACHER: Okay, so you're saying that the level of risk—how safe or dangerous something is—might count?
STUDENT: Right.
TEACHER: So we need to make sure that we know more about the science of steroids, and their medical risks, in order to weigh them against other types of risks that our society permits?

The teacher wants to affirm the value the student places on respect for personal choices, but the teacher also wants to help the student see that there may be other ethical considerations to take into account. In the sequence below, first, the teacher affirms the student's emphasis on the importance of respecting personal decisions when confronted with risks, but then immediately introduces another ethical consideration: fairness.

TEACHER: **Okay, you've said that in general we should allow adults to make decisions for themselves, even if there's risk involved, but you might want to place limits on their choices if the risks are extreme. So we'll do more research on the science, and come back to this question.** But I want to go back to another point that you mentioned when you were brainstorming this list of actions that people take to improve their personal health or performance.

The teacher again points to the list the student generated.

TEACHER: You mentioned that using steroids differs from these other actions (sleeping, taking vitamins, exercising, etc.) in terms of their accessibility. **What do you think about this issue of accessibility?** Vitamins and sleep are relatively accessible, but steroids aren't. **Is it fair for some athletes to take steroids, since steroids aren't available to all athletes?**

STUDENT: That's where I'm getting confused. If steroids aren't easy to get, some people will have access and some won't. **Maybe the need for fairness matters, too, meaning that people can no longer do whatever they want, even though they are doing it to their own bodies.** If a few students gain access to steroids and then break a school record, that wouldn't be fair. I'll have to keep thinking about that one.

The teacher notices that this student began thinking about Carl's Case in a rather rigid way—thinking only about one of several important ethical considerations—for example, only about respect for persons or autonomy. Through carefully structured questions and positive give and take, the teacher helped introduce concerns about safety (minimizing harms when risks are high) and about fairness, another ethical consideration relevant to the case. The teacher wraps up this part of the conversation to help make sure the student is aware of what has happened.

TEACHER: You've done a nice job thinking about multiple ethical considerations: showing respect for persons by allowing them great latitude in making choices about their own behaviors, minimizing harms if risks are high, and fairness. **You began with the blanket statement that "athletes have the right to do whatever they want to improve their performance" and moved to a more complex thought, that there could be instances when a loss of freedom is necessary to reducing potential harms or ensuring fairness.** Tomorrow, when we have more scientific facts about the safety issues and we've had a chance to think a little more about the fairness issues, we will talk about this case again.

Point-Counterpoint: Should Performance-Enhancing Drugs Be Banned in Sport?

Drugs, Sport, and Ethics

By Thomas H. Murray

When the Olympic Games return to Greece this summer, the results at the drug testing laboratory may get as much attention as what happens at the Olympic stadium. The history of drugs, and drug control, at the Olympics is discouraging—a farrago of ill-informed rules, outright state-sponsored cheating, and half-hearted and erratic attempts at enforcement.

A new model has recently revived hope for effective drug control by moving testing and enforcement from the direct control of the International Olympic Committee and the national governing bodies to the World Anti-Doping Agency and similar organizations at the national level. The U.S. Anti-Doping Agency, for example, played a central role in uncovering a new synthetic steroid known as THG linked to a California firm catering to Olympic and professional athletes.

But the renewed hope will be frustrated unless we can respond effectively to the ethical challenge. No amount of interdiction will suffice if we do not explain clearly what, precisely, is wrong with using performance-enhancing drugs in sport.

There are three compelling reasons to ban such drugs: assuring all athletes that the competition is fair; preserving the integrity of the athlete; and safeguarding what gives sport its meaning and value.

Young Olympians devote their lives to their sport for the opportunity to match themselves against the world's most gifted and dedicated athletes. The difference between gold medalist and also-ran may be measured in fractions of seconds or inches. A tiny advantage can make all the difference. What if that advantage comes from using a performance-enhancing drug?

For athletes who want to compete clean, the threat that they may be beaten by a competitor who is not faster, stronger, or more dedicated, but who takes a drug to gain the edge, is profoundly personal. When drugs are prohibited but some athletes use them anyway, the playing field tilts in favor of the cheater. If we prohibit drugs in the Olympic Games, we owe it to the athletes to deter, detect, and punish those who cheat.

Integrity seems like an old-fashioned idea, but it is at the heart of who we are and how we live. Performance-enhancing drugs affect the individual athlete's integrity in two ways. First, if drugs are banned, then choosing not to use them is a test of one's character. A person of integrity does not behave dishonestly. A person of integrity does not seek to prevail over his competitors by methods that give him an illegitimate advantage.

Second, the concept of integrity implies wholeness, being unbroken, moral soundness, and freedom from corruption. When an athlete wins by using a performance-enhancing drug, what does that mean for the athlete's own understanding of what happened? Am I the world's best? Or was my supposed victory hopelessly tainted by the drug's effects? The meaning of a drug-aided victory is ambiguous and elusive even for the athlete. It is the result of corruption and brokenness, the very opposite of authentic victory.

What makes a victory authentic? What gives sport its meaning and value? We expect the winning athlete to combine extraordinary natural talents with exemplary effort, training, and technique. These are all forms of human excellence. Some we are born with—or not. As much as I loved playing basketball, I was destined never quite to reach six feet in height. An accurate jump shot and the willingness to take punishment never made up for my size and mediocre leaping ability.

Whatever natural abilities we have must be perfected. We achieve this—or not—through a combination of virtues such as fortitude in the face of relentless training, physical courage as we persevere through pain, and cleverness when we outsmart our opponents, along with other factors such as helpful coaching, optimized equipment, and sound nutrition.

Natural talents should be respected for what they are: the occasionally awesome luck of the biological draw. Courage, fortitude, competitive savvy, and other virtues rightfully command our moral admiration. The other factors—equipment, coaching, and nutrition—contribute to an athlete's success but don't evoke the same awe

or esteem. When we watch a sprinter set a new Olympic record in the hundred meter dash, it's not the shoes he or she wears that command our admiration. Nor is it the coaching received or the energy bar consumed just before the event.

All of these contribute to the record, just like a good camera was necessary for Ansel Adams' unforgettable photos of the American West, or good marble and sharp chisels for Michelangelo's sculpture of David. But what we care about most, what gives that achievement its meaning and value, is the ineffable combination of remarkable natural talents and extraordinary dedication.

Performance-enhancing drugs disguise natural abilities and substitute for the dedication and focus that we admire. Performance-enhancing drugs cheapen sport, making winners out of also-rans, and depriving virtuous and superior athletes of the victories that should be theirs.

Getting performance-enhancing drugs out of sport will not be easy, and success is not assured. But the effort is worthwhile as long as we care enough about fairness, integrity, and the meaning and value of sport.

Thomas H. Murray is the president of the Hastings Center.

Source: Murray, T.H. 2004, Drugs, sports, and ethics. Retrieved February 16, 2009, from *http://www.project-syndicate.org/commentary/murray1*. Reproduced with permission from the BMJ Publishing Group.

Performance enhancing drugs

Why we should allow performance enhancing drugs in sport

J Savulescu, B Foddy, M Clayton

The legalisation of drugs in sport may be fairer and safer

In 490 BC, the Persian Army landed on the plain of Marathon, 25 miles from Athens. The Athenians sent a messenger named Feidipides to Sparta to ask for help. He ran the 150 miles in two days. The Spartans were late. The Athenians attacked and, although outnumbered five to one, were victorious. Feidipides was sent to run back to Athens to report victory. On arrival, he screamed "We won" and dropped dead from exhaustion.

The marathon was run in the first modern Olympics in 1896, and in many ways the athletic ideal of modern athletes is inspired by the myth of the marathon. Their ideal is superhuman performance, at any cost.

DRUGS IN SPORT

The use of performance enhancing drugs in the modern Olympics is on record as early as the games of the third Olympiad, when Thomas Hicks won the marathon after receiving an injection of strychnine in the middle of the race.[1] The first official ban on "stimulating substances" by a sporting organisation was introduced by the International Amateur Athletic Federation in 1928.[2]

Using drugs to cheat in sport is not new, but it is becoming more effective. In 1976, the East German swimming team won 11 out of 13 Olympic events, and later sued the government for giving them anabolic steroids.[3] Yet despite the health risks, and despite the regulating bodies' attempts to eliminate drugs from sport, the use of illegal substances is widely known to be rife. It hardly raises an eyebrow now when some famous athlete fails a dope test.

In 1992, Vicky Rabinowicz interviewed small groups of athletes. She found that Olympic athletes, in general, believed that most successful athletes were using banned substances.[4]

Much of the writing on the use of drugs in sport is focused on this kind of anecdotal evidence. There is very little rigorous, objective evidence because the athletes are doing something that is taboo, illegal, and sometimes highly dangerous. The anecdotal picture tells us that our attempts to eliminate drugs from sport have failed. In the absence of good evidence, we need an analytical argument to determine what we should do.

CONDEMNED TO CHEATING?

We are far from the days of amateur sporting competition. Elite athletes can earn tens of millions of dollars every year in prize money alone, and millions more in sponsorships and endorsements. The lure of success is great. But the penalties for cheating are small. A six month or one year ban from competition is a small penalty to pay for further years of multimillion dollar success.

Drugs are much more effective today than they were in the days of strychnine and sheep's testicles. Studies involving the anabolic steroid androgen showed that, even in doses much lower than those used by athletes, muscular strength could be improved by 5–20%.[5] Most athletes are also relatively unlikely to ever undergo testing. The International Amateur Athletic Federation estimates that only 10–15% of participating athletes are tested in each major competition.[6]

The enormous rewards for the winner, the effectiveness of the drugs, and the low rate of testing all combine to create a cheating "game" that is irresistible to athletes. Kjetil Haugen[7] investigated the suggestion that athletes face a kind of prisoner's dilemma regarding drugs. His game theoretic model shows that, unless the likelihood of athletes being caught doping was raised to unrealistically high levels, or the payoffs for winning were reduced to unrealistically low levels, athletes could all be predicted to cheat. The current situation for athletes ensures that this is likely, even though they are worse off as a whole if everyone takes drugs, than if nobody takes drugs.

Drugs such as erythropoietin (EPO) and growth hormone are natural chemicals in the body. As technology advances, drugs have become harder to detect because they mimic natural processes. In a few years, there will be many undetectable drugs. Haugen's analysis predicts the obvious: that when the risk of being caught is zero, athletes will all choose to cheat.

The recent Olympic games in Athens were the first to follow the introduction of a global anti-doping code. From the lead up to the games to the end of competition, 3000 drug tests were carried out: 2600 urine tests and 400 blood tests for the endurance enhancing drug EPO.[8] From these, 23 athletes were found to have taken a banned substance—the most ever in an Olympic games.[9] Ten of the men's weightlifting competitors were excluded.

The goal of "cleaning" up the sport is unattainable. Further down the track the spectre of genetic enhancement looms dark and large.

THE SPIRIT OF SPORT

So is cheating here to stay? Drugs are against the rules. But we define the rules of sport. If we made drugs legal and freely available, there would be no cheating.

The World Anti-Doping Agency code declares a drug illegal if it is performance enhancing, if it is a health risk, or if it violates the "spirit of sport".[10] They define this spirit as follows.[11] The spirit of sport is the celebration of the human spirit, body, and mind, and is characterised by the following values:

- ethics, fair play and honesty
- health
- excellence in performance
- character and education
- fun and joy
- teamwork
- dedication and commitment
- respect for rules and laws
- respect for self and other participants
- courage
- community and solidarity

Would legal and freely available drugs violate this "spirit"? Would such a permissive rule be good for sport?

Human sport is different from sports involving other animals, such as horse or dog racing. The goal of a horse race is to find the fastest horse. Horses are lined up and flogged. The winner is the one with the best combination of biology, training, and rider. Basically, this is a test of biological potential. This was the old naturalistic Athenian vision of sport: find the strongest, fastest, or most skilled man.

Training aims to bring out this potential. Drugs that improve our natural potential are against the spirit of this model of sport. But this is not the only view of sport. Humans are not horses or dogs. We make choices and exercise our own judgment. We choose what kind of

training to use and how to run our race. We can display courage, determination, and wisdom. We are not flogged by a jockey on our back but drive ourselves. It is this judgment that competitors exercise when they choose diet, training, and whether to take drugs. We can choose what kind of competitor to be, not just through training, but through biological manipulation. Human sport is different from animal sport because it is creative. Far from being against the spirit of sport, biological manipulation embodies the human spirit—the capacity to improve ourselves on the basis of reason and judgment. When we exercise our reason, we do what only humans do.

The result will be that the winner is not the person who was born with the best genetic potential to be strongest. Sport would be less of a genetic lottery. The winner will be the person with a combination of the genetic potential, training, psychology, and judgment. Olympic performance would be the result of human creativity and choice, not a very expensive horse race.

Classical musicians commonly use β blockers to control their stage fright. These drugs lower heart rate and blood pressure, reducing the physical effects of stress, and it has been shown that the quality of a musical performance is improved if the musician takes these drugs.[12] Although elite classical music is arguably as competitive as elite sport, and the rewards are similar, there is no stigma attached to the use of these drugs. We do not think less of the violinist or pianist who uses them. If the audience judges the performance to be improved with drugs, then the drugs are enabling the musician to express him or herself more effectively. The competition between elite musicians has rules—you cannot mime the violin to a backing CD. But there is no rule against the use of chemical enhancements.

Is classical music a good metaphor for elite sport? Sachin Tendulkar is known as the "Maestro from Mumbai". The Associated Press called Maria Sharapova's 2004 Wimbledon final a "virtuoso performance".[13] Jim Murray[14] wrote the following about Michael Jordan in 1996:

> "You go to see Michael Jordan play for the same reason you went to see Astaire dance, Olivier act or the sun set over Canada. It's art. It should be painted, not photographed.
> It's not a game, it's a recital. He's not just a player, he's a virtuoso. Heifetz with a violin. Horowitz at the piano."

Indeed, it seems reasonable to suggest that the reasons we appreciate sport at its elite level have something to do with competition, but also a great deal to do with the appreciation of an extraordinary performance.

Clearly the application of this kind of creativity is limited by the rules of the sport. Riding a motorbike would not be a "creative" solution to winning the Tour de France, and there are good reasons for proscribing this in the rules. If motorbikes were allowed, it would still be a good sport, but it would no longer be a bicycle race.

We should not think that allowing cyclists to take EPO would turn the Tour de France into some kind of "drug race", any more than the various training methods available turn it into a "training race" or a "money race". Athletes train in different, creative ways, but ultimately they still ride similar bikes, on the same course. The skill of negotiating the steep winding descent will always be there.

UNFAIR?

People do well at sport as a result of the genetic lottery that happened to deal them a winning hand. Genetic tests are available to identify those with the greatest potential. If you have one version of the ACE gene, you will be better at long distance events. If you have another, you will be better at short distance events. Black Africans do better at short distance events because of biologically superior muscle type and bone structure. Sport discriminates against the genetically unfit. Sport is the province of the genetic elite (or freak).

The starkest example is the Finnish skier Eero Maentyranta. In 1964, he won three gold medals. Subsequently it was found he had a genetic mutation that meant that he "naturally" had 40–50% more red blood cells than average.[15] Was it fair that he had significant advantage given to him by chance?

The ability to perform well in sporting events is determined by the ability to deliver oxygen to muscles. Oxygen is carried by red blood cells. The more red blood cells, the more oxygen you can carry. This in turn controls an athlete's performance in aerobic exercise. EPO is a natural hormone that stimulates red blood cell production, raising the packed cell volume (PCV)—the percentage of the blood comprised of red blood cells. EPO is produced in response to anaemia, haemorrhage, pregnancy, or living at altitude. Athletes began injecting recombinant human EPO in the 1970s, and it was officially banned in 1985.[16]

At sea level, the average person has a PCV of 0.4–0.5. It naturally varies; 5% of people have a packed cell volume above 0.5,[17] and that of elite athletes is more likely to exceed 0.5, either because their high packed cell volume has led them to success in sport or because of their training.[18]

Raising the PCV too high can cause health problems. The risk of harm rapidly rises as PCV gets above 50%. One study showed that in men whose PCV was 0.51 or more, risk of stroke was significantly raised (relative risk = 2.5), after adjustment for other causes of stroke.[19] At these levels, raised PCV combined with hypertension would cause a ninefold increase in stroke risk. In endurance sports, dehydration causes an athlete's blood to thicken, further raising blood viscosity and pressure.[20] What begins as a relatively low risk of stroke or heart attack can rise acutely during exercise.

In the early 1990s, after EPO doping gained popularity but before tests for its presence were available, several Dutch cyclists died in their sleep due to inexplicable cardiac arrest. This has been attributed to high levels of EPO doping.[21] The risks from raising an athlete's PCV too high are real and serious.

Use of EPO is endemic in cycling and many other sports. In 1998, the Festina team was expelled from the Tour de France after trainer Willy Voet was caught with 400 vials of performance enhancing drugs.[22] The following year, the World Anti-Doping Agency was established as a result of the scandal. However, EPO is extremely hard to detect and its use has continued. Italy's Olympic anti-doping director observed in 2003 that the amount of EPO sold in Italy outweighed the amount needed for sick people by a factor of six.[23]

In addition to trying to detect EPO directly, the International Cycling Union requires athletes to have a PCV no higher than 0.5. But 5% of people naturally have a PCV higher than 0.5. Athletes with a naturally high PCV cannot race unless doctors do a number of tests to show that their PCV is natural. Charles Wegelius was a British rider who was banned and then cleared in 2003. He had had his spleen removed in 1998 after an accident, and as the spleen removes red blood cells, its absence resulted in an increased PCV.[24]

There are other ways to increase the number of red blood cells that are legal. Altitude training can push the PCV to dangerous, even fatal, levels. More recently, hypoxic air machines have been used to simulate altitude training. The body responds by releasing natural EPO and growing more blood cells, so that it can absorb more oxygen with

every breath. The Hypoxico promotional material quotes Tim Seaman, a US athlete, who claims that the hypoxic air tent has "given my blood the legal 'boost' that it needs to be competitive at the world level."[25]

There is one way to boost an athlete's number of red blood cells that is completely undetectable:[26] autologous blood doping. In this process, athletes remove some blood, and reinject it after their body has made new blood to replace it. This method was popular before recombinant human EPO became available.

> "By allowing everyone to take performance enhancing drugs, we level the playing field."

There is no difference between elevating your blood count by altitude training, by using a hypoxic air machine, or by taking EPO. But the last is illegal. Some competitors have high PCVs and an advantage by luck. Some can afford hypoxic air machines. Is this fair? Nature is not fair. Ian Thorpe has enormous feet which give him an advantage that no other swimmer can get, no matter how much they exercise. Some gymnasts are more flexible, and some basketball players are seven feet tall. By allowing everyone to take performance enhancing drugs, we level the playing field. We remove the effects of genetic inequality. Far from being unfair, allowing performance enhancement promotes equality.

JUST FOR THE RICH?

Would this turn sport into a competition of expensive technology? Forget the romantic ancient Greek ideal. The Olympics is a business. In the four years before the Athens Olympics, Australia spent $547 million on sport funding,[27] with $13.8 million just to send the Olympic team to Athens.[28] With its highest ever funding, the Australian team brought home 17 gold medals, also its highest. On these figures, a gold medal costs about $32 million. Australia came 4th in the medal tally in Athens despite having the 52nd largest population. Neither the Australian multicultural genetic heritage nor the flat landscape and desert could have endowed Australians with any special advantage. They won because they spent more. Money buys success. They have already embraced strategies and technologies that are inaccessible to the poor.

Paradoxically, permitting drugs in sport could reduce economic discrimination. The cost of a hypoxic air machine and tent is about US$7000.[29] Sending an athlete to a high altitude training location for months may be even more expensive. This arguably puts legal methods for raising an athlete's PCV beyond the reach of poorer athletes. It is the illegal forms that level the playing field in this regard.

One popular form of recombinant human EPO is called Epogen. At the time of writing, the American chain Walgreens offers Epogen for US$86 for 6000 international units (IU). The maintenance dose of EPO is typically 20 IU per kg body weight, once a week.[30] An athlete who weighs 100 kg therefore needs 2000 IU a week, or 8600 IU a month. Epogen costs the athlete about US$122 a month. Even if the Epogen treatment begins four years before an event, it is still cheaper than the hypoxic air machine. There are limits on how much haemoglobin an athlete can produce, however much EPO they inject, so there is a natural cap on the amount of money they can spend on this method.

Meanwhile, in 2000, the cost of an in competition recombinant EPO test was about US$130 per sample.[31] This test is significantly more complex than a simple PCV test, which would not distinguish exogenous or endogenous EPO. If monetary inequalities are a real concern in sport, then the enormous sums required to test every athlete could instead be spent on grants to provide EPO to poorer athletes, and PCV tests to ensure that athletes have not thickened their blood to unsafe levels.

UNSAFE?

Should there be any limits to drugs in sport?

There is one limit: safety. We do not want an Olympics in which people die before, during, or after competition. What matters is health and fitness to compete. Rather than testing for drugs, we should focus more on health and fitness to compete. Forget testing for EPO, monitor the PCV. We need to set a safe level of PCV. In the cycling world, that is 0.5. Anyone with a PCV above that level, whether through the use of drugs, training, or natural mutation, should be prevented from participating on safety grounds. If someone naturally has a PCV of 0.6 and is allowed to compete, then that risk is reasonable and everyone should be allowed to increase their PCV to 0.6. What matters is what is a safe concentration of growth hormone—not whether it is natural or artificial.

We need to take safety more seriously. In the 1960s, East German athletes underwent systematic government sanctioned prescription of anabolic steroids, and were awarded millions of dollars in compensation in 2002. Some of the female athletes had been compelled to change their sex because of the large quantities of testosterone they had been given.[32]

We should permit drugs that are safe, and continue to ban and monitor drugs that are unsafe. There is another argument for this policy based on fairness: provided that a drug is safe, it is unfair to the honest athletes that they have to miss out on an advantage that the cheaters enjoy.

Taking EPO up to the safe level, say 0.5, is not a problem. This allows athletes to correct for natural inequality. There are of course some drugs that are harmful in themselves —for example, anabolic steroids. We should focus on detecting these because they are harmful not because they enhance performance.

Far from harming athletes, paradoxically, such a proposal may protect our athletes. There would be more rigorous and regular evaluation of an athlete's health and fitness to perform. Moreover, the current incentive is to develop undetectable drugs, with little concern for safety. If safe performance enhancement drugs were permitted, there would be greater pressure to develop safe drugs. Drugs would tend to become safer.

This is perhaps best illustrated by the case of American sailor Kevin Hall. Hall lost his testicles to cancer, meaning that he required testosterone injections to remain healthy. As testosterone is an anabolic steroid, he had to prove to four separate governing bodies that he was not using the substance to gain an advantage.[33] Any tests that we do should be sensitive to the health of the athlete; to focus on the substances themselves is dogmatic.

Not only this, but health testing can help to mitigate the dangers inherent in sport.

For many athletes, sport is not safe enough without drugs. If they suffer from asthma, high blood pressure, or cardiac arrhythmia, sport places their bodies under unique stresses, which raise the likelihood of a chronic or catastrophic harm. For example, between 1985 and 1995, at least 121 US athletes collapsed and died directly after or during a training session or competition—most often because they had hypertrophic cardiomyopathy or heart malformations.[34] The relatively high incidence of sudden cardiac death in young athletes has prompted the American Heart Association to recommend that all athletes undergo cardiac screening before being allowed to train or compete.[35]

Sometimes, the treatments for these conditions will raise the performance of an athlete beyond that which they could

attain naturally. But safety should come first. If an archer requires β blockers to treat heart disease, we should not be concerned that this will give him or her an advantage over other archers. Or if an anaemic cyclist wants to take EPO, we should be most concerned with the treatment of the anaemia.

If we are serious about safety in sport, we should also be prepared to discuss changes to the rules and equipment involved in sports which are themselves inherently dangerous. Formula One motor racing, once the most deadly of sports, has not seen a driver death in over six years, largely because of radical changes in the safety engineering of the tracks and the cars. Meanwhile, professional boxing remains inherently dangerous; David Rickman died during a bout in March 2004, even though he passed a physical examination the day before.[36]

CHILDREN

Linford Christie, who served a two year drug ban from athletics competition, said that athletics "is so corrupt now I wouldn't want my child doing it".[37] But apart from the moral harms to children in competing in a corrupt sport, should we withhold them from professional sport for medical reasons?

The case where the athletes are too young to be fully autonomous is different for two important reasons. Firstly, children are much less capable of rejecting training methods and treatments that their coach wishes to use. Secondly, we think it is worth protecting the range of future options open to a child.

There is a serious ethical problem with allowing children to make any kind of choice that substantially closes off their options for future lifestyles and career choices. If we do not consider children competent for the purposes of allowing them to make choices that cause them harm, then we should not allow them to decide to direct all of their time to professional gymnastics at age 10. The modifications such a choice can make to a child's upbringing are as serious, and potentially as harmful, as many of the available performance enhancing drugs. Children who enter elite sport miss large parts of the education and socialisation that their peers receive, and are submitted to intense psychological pressure at an age when they are ill equipped to deal with it.

We argue that it is clear that children, who are not empowered to refuse harmful drugs, should not be given them by their coaches or parents. But the same principles that make this point obvious should also make it obvious that these children should not be involved in elite competitive sport in the first place. However, if children are allowed to train as professional athletes, then they should be allowed to take the same drugs, provided that they are no more dangerous than their training is.

Haugen's model showed that one of the biggest problems in fighting drug use was that the size of the rewards for winning could never be overshadowed by the penalties for being caught. With this in mind, we can begin to protect children by banning them from professional sport.

CLIMATE OF CHEATING

If we compare the medical harms of the entire worldwide doping problem, they would have to be much less than the worldwide harms stemming from civilian illicit drug use. And yet, per drug user, the amount of money spent on combating drugs in sport outweighs the amount spent on combating civilian drug use by orders of magnitude.

We can fairly assume that if medical harms and adherence to law were the only reasons we felt compelled to eradicate doping, then the monetary value we placed on cleaning up sport should be the same, per drug user, as the monetary value we place on eradicating recreational drug use. And yet it is not.

Because of this, it should be obvious that it is not medical harms that we think are primarily at stake, but harm to sport as a whole, a purported violation of its spirit. It is a problem for the credibility of elite sport, if everyone is cheating.

If it is this climate of cheating that is our primary concern, then we should aim to draft sporting rules to which athletes are willing to adhere.

PROHIBITION

It is one thing to argue that banning performance enhancing drugs has not been successful, or even that it will never be successful. But it should also be noted that the prohibition of a substance that is already in demand carries its own intrinsic harms.

The Prohibition of Alcohol in America during the 1920s led to a change in drinking habits that actually increased consumption. Driven from public bars, people began to drink at home, where the alcohol was more readily available, and the incidence of deaths due to alcoholism rose or remained stable, while they dropped widely around the world in countries without prohibition.[38] Furthermore, as the quality of the alcohol was unregulated, the incidence of death from poisoned alcohol rose fourfold in five years.[39]

Even when prohibition leads to a decrease in consumption, it often leads to the creation of a black market to supply the continuing demand, as it did in the Greenland study of alcohol rationing.[40] Black markets supply a product that is by definition unregulated, meaning that the use is unregulated and the safety of the product is questionable.

The direct risks from prohibiting performance enhancing drugs in sport are similar, but probably much more pronounced. Athletes currently administer performance enhancing substances in doses that are commensurate with the amount of performance gain they wish to attain, rather than the dose that can be considered "safe". The athletic elite have near unlimited funds and the goal of near unlimited performance, a framework that results in the use of extremely unsafe doses. If athletes are excluded when their bodies are unsafe for competition, this kind of direct consequence from prohibition would be reduced.

THE PROBLEM OF STRICT LIABILITY

Lord Coe, a dual Olympic champion, has defended the doctrine of "strict liability", as it is currently applied to athletes who use a banned substance:[41]

> "...The rule of strict liability—under which athletes have to be solely and legally responsible for what they consume—must remain supreme. We cannot, without blinding reason and cause, move one millimetre from strict liability—if we do, the battle to save sport is lost."

The best reason for adhering to this rule is that, if coaches were made responsible for drugs that they had given to their athletes, then the coach would be banned or fined, and the athlete could still win the event. In this situation, other athletes would still be forced to take drugs in order to be competitive, even though the "cheat" had been caught.

But the doctrine of strict liability makes victims of athletes such as those of the East German swim team, who are competing in good faith but have been forced to take drugs. It also seems dogmatically punitive for athletes like British skier Alain Baxter, who accidentally inhaled a banned stimulant when he used the American version of a Vicks decongestant inhaler, without realising that it differed from the British model.[42]

It seems that strict liability is unfair to athletes, but its absence is equally unfair. Our proposal solves this paradox—when

we exclude athletes only on the basis of whether they are healthy enough to compete, the question of responsibility and liability becomes irrelevant. Accidental or unwitting consumption of a risky drug is still risky; the issue of good faith is irrelevant.

ALTERNATIVE STRATEGIES

Michael Ashenden[43] proposes that we keep progressive logs of each athlete's PCV and hormone concentrations. Significant deviations from the expected value would require follow up testing. The Italian Cycling Federation decided in 2000 that all juniors would be tested to provide a baseline PCV and given a "Hematologic Passport".

Although this strategy is in many ways preferable to the prohibition of doping, it does nothing to correct the dangers facing an athlete who has an unsafe baseline PCV or testosterone concentration.

TEST FOR HEALTH, NOT DRUGS

The welfare of the athlete must be our primary concern. If a drug does not expose an athlete to excessive risk, we should allow it even if it enhances performance. We have two choices: to vainly try to turn the clock back, or to rethink who we are and what sport is, and to make a new 21st century Olympics. Not a super-Olympics but a more human Olympics. Our crusade against drugs in sport has failed. Rather than fearing drugs in sport, we should embrace them.

In 1998, the president of the International Olympic Committee, Juan-Antonio Samaranch, suggested that athletes be allowed to use non-harmful performance enhancing drugs.[44] This view makes sense only if, by not using drugs, we are assured that athletes are not being harmed.

Performance enhancement is not against the spirit of sport; it is the spirit of sport. To choose to be better is to be human. Athletes should be the given this choice. Their welfare should be paramount. But taking drugs is not necessarily cheating. The legalisation of drugs in sport may be fairer and safer.

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Authors' affiliations
J Savulescu, Uehiro Chair of Practical Ethics, University of Oxford, Oxford, UK
B Foddy, M Clayton, Murdoch Childrens Research Institute, Melbourne, Victoria, Australia

Correspondence to: Professor Savulescu, Flat 2, 3 Bradmore Road, Oxford OX2 6QW, UK; julian.savulescu@philosophy.ox.ac.uk

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Sample Completed Point-Counterpoint Summary

Should performance-enhancing drugs be banned in sports?

Ethical Argument	Yes	No
Fairness: to assure all athletes that the competition is fair	• Athletes who do not want to use drugs will not be put at an unfair advantage by those who do use drugs.	• Such drugs even out the unfair advantage in sports that some people get through their genes (that is, they reduce the effects of the genetic lottery), permitting more fair competition. • Money now used to test and detect the use of illegal substances could instead be used to underwrite enhancement costs for poorer athletes who might otherwise not be able to afford them, thereby creating fair access. • Regulated and monitored use of safe and legal drugs means that all athletes can use the drugs without fear of detection or safety.
Athletic integrity: to preserve the integrity of the athlete	• Choosing not to use banned, but effective, drugs is a test of character because people with integrity do not behave dishonestly. • Using drugs undermines the "wholeness," "unbrokenness," "moral soundness," and "freedom from corruption" of an athlete relying only on his or her own skills and training.	• Human sport is more than mere biological determinism; it involves reason, choice, judgment, and creativity about how to train and how to compete—including whether or not to use drugs to improve or enhance human biology. • Unlike sports involving other animals, humans make choices and use judgment in their training and decisions about how to run a race; more than genetic potential is required for success—athletic success is the result of creativity, determination, and skill.
Nature of sport: to safeguard what gives a sport its meaning and value	• Athletes ought to win because of their natural talents, their training, and their skill—not because of the effect of a drug. • People value athletic victory based on the combination of "extraordinary natural talent with exemplary effort, training, and technique" and because of virtues such as courage, fortitude, andcompetitive savvy.	• To choose to be better is to be human and is in the spirit of sport. • Athletes can still display virtues of courage, determination, and wisdom even while choosing to manipulate their biology using drugs. • Nothing about performance-enhancing drugs in themselves goes against any of the qualities of sport defined by the World Anti-Doping Agency code.

Continued

Ethical Argument	Yes	No
Additional information	• Efforts to control drugs at the Olympics have been undermined by poor rules, state-sponsored cheating, and weak and erratic enforcement of bans on certain substances. • New national and international agencies offer promise that drugs may be effectively identified and discouraged in sport. • It won't be easy to eliminate performance-enhancing drugs, and success is not guaranteed. However, it is important to try to eliminate such drugs from sports to maintain fairness, integrity, and the meaning and value of sport. • Murray notes the hope that drugs can be effectively controlled in sports because testing and enforcement has been moved to the World Anti-Doping Agency (a new agency) and similar national-level anti-doping agencies (2004). • "Performance-enhancing drugs disguise natural abilities and substitute for the dedication and focus that we admire. Performance-enhancing drugs cheapen sport, making winners out of also-rans, and depriving virtuous and superior athletes of the victories that should be theirs." (Page 2.)	• Using the illustration of the marathon story from Ancient Greece, Savulescu et al. argue that the idea of sport has always meant "superhuman performance, at any cost" (2004). • Drugs have been part of sports for a long time; athletes have always sought out legal and illegal ways to improve their performance, including drug use. • Efforts to eliminate drugs from sports have failed. People need to decide what to do in light of that reality. • In sports, the financial and popular rewards of success are great. That fact, in combination with the facts that drugs are more effective and the chance of being caught cheating is small because of the low rate of testing and the difficulty of detecting some substances, means that using performance-enhancing drugs is very attractive. • Savulescu et al. (2004) argue that performance-enhancing drugs that are safe should be legalized so that all athletes may use them and their use and effects can be monitored. • Children should not be involved in elite competitive sports or given harmful drugs because they are not able to reject methods for training and treatment suggested by their coaches and because children's future options for life should be kept open to the extent possible. However, if they are allowed to be professional athletes in training, they should be allowed to take drugs as long as they are not harmful.

Continued

Ethical Argument	Yes	No
		• "If a drug does not expose an athlete to excessive risk, we should allow it even if it enhances performance.... Performance enhancement is not against the spirit of sport; it is the spirit of sport. To choose to be better is to be human. Athletes should be given this choice. Their welfare should be paramount. But taking drugs is not necessarily cheating. The legislation of drugs in sport may be fairer and safer." (Savulescu et al. 2004, page 670.)

Sources for the Yes Side: Murray, T.H. 2004. Drugs, sports, and ethics. *Project Syndicate* (online). Retrieved October 30, 2008, from *http://www.project-syndicate.org/commentary/murray1*. Levine, C., ed. 2006. *Taking Sides: Clashing Views on Controversial Bioethical Issues, 11th ed*. Dubuque, Iowa: McGraw-Hill/Dushkin. (Pages 305–306.) Also, Murray, T.H. 1987. The ethics of drugs in sport. In *Drugs and Performance in Sports*. Philadelphia, PA: W.B. Saunders. (Pages 11–21.)

Sources for the No Side: Savulescu, J., Foddy, B., and Clayton, M. 2004. Why we should allow performance-enhancing drugs in sport. *British Journal of Sports Medicine, 38*: 666–670. Levine 2006, pages 301–311.

Notes

- Murray's three arguments against permitting performance-enhancing drugs in sports are made in terms of fairness, athletic integrity, and the meaning and value of sport (which is similar to the ethical consideration of maintaining authenticity in a sport's performance).
- Savulescu et al. use some of the same or similar terms to characterize their arguments in favor of permitting performance-enhancing drugs in sports, such as fairness, the spirit of sport, and safety.
- The argument headers are from Murray's 2004 article.

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Carole Levine, editor of the *Taking Sides: Clashing Views on Controversial Bioethical Issues* series, originally identified and paired the Murray commentary and the Savulescu et al. (2004) article in the 11th edition of the series. She placed the articles one after the other in a section titled "Issue 18: Should performance-enhancing drugs be banned from sports?" that ran on pages 303–312 with her issue summary and postscript. See the full citation for the 11th edition of *Taking Sides* above.

Master 2.2 Answer Key

Gathering the Facts—Vaccines

Station 1—Vaccine-Preventable Diseases

Directions: Write Low, Medium, or High in each column.

What was the **risk of getting the disease** before the vaccine was available? What is the **magnitude of harm** caused by the disease, if contracted? What is the **risk of suffering harm** from the disease, if contracted?

Disease	Risk of getting the disease (before vaccine was available or if most people are not vaccinated)*	Magnitude of harm caused by the disease, if contracted	Risk of suffering that harm
Chickenpox	*High (4 million cases per year)*	*Low (Usually mild.)*	*Low (4 million cases resulted in 11,000 hospitalizations (0.3%) and 100 to 150 deaths)*
Hepatitis B	*Medium (70,000 acute cases per year estimated)*	*Medium (Chronic infection can lead to increased risk of liver-related complications.)*	*Medium (5,000 deaths per year from complications)*
Measles	*High (500,000 cases per year)*	*Medium (Most commonly characterized by body rash. Pneumonia is a serious complication.)*	*Medium (20% need hospitalization, 0.3% die)*
Mumps	*Medium to High (150,000 cases per year)*	*Low (Relatively mild viral disease causing swelling in the jaw and cheeks.)*	*Low (0.005% become deaf, 1 out of 150,000 die)*
Polio	*Low (13,000–20,000 cases per year)*	*Medium (Most infected people don't have symptoms, however some become permanently paralyzed or die.)*	*Low (1% become paralyzed; of those, 15–30% of adults die)*
Smallpox	*Medium (50,000 cases per year)*	*High (Smallpox is often fatal.)*	*High (30% of people who contract the most common form die)*

* "Risk of getting the disease" is defined here as the approximate number of cases per year in the United States before the vaccine was available.

Notes: Students' notes will vary, but they should reflect the facts listed on Master 2.3.

Station 2—Vaccine Risks

Directions: Add Low, Medium, or High to each column.

What is the **magnitude of harm** caused by the vaccine? What is the **risk of suffering that harm**?

Vaccine	Harm caused by the vaccine	Risk of suffering that harm
Chickenpox	*Low (Soreness and swelling are most common.)*	*Low (Seizure caused by fever is found in fewer than 1 in 1,000; pneumonia is also rare.)*
Hepatitis B	*Low (Soreness and swelling are most common.)*	*Low (Mild to moderate fever in 1 out of 14 children, including adolescents, and 1 out of 100 adults; serious allergic reaction is also rare.)*
Measles, Mumps, and Rubella (MMR)	*Low (Fever and mild rash are most common, as are temporary pain and stiffness in the joints.)*	*Low (Seizure due to fever in 1 out of 3,000 doses, risk of bleeding disorder in 1 out of 30,000 doses, and serious allergic reaction in fewer than 1 out of 1 million doses.)*
Polio	*Low (for Inactivated form of vaccine) (Soreness is most common.)*	*Low (The Inactivated form has never been known to cause serious harm.)*
Smallpox	*High (For every 1 million vaccinated, 1 to 2 will die from the vaccine and between 14 and 52 will have a serious, life-threatening reaction.)*	*Medium (Even though risks are greater than from other vaccines, they are still low compared with those of the disease itself.)*

Notes: Students' notes will vary, but they should reflect the facts on Master 2.4.

Station 3—The Measles Graph

1. What are **two**things that the Measles Graph shows? Refer to specific years and number of measles cases in your answer.
   Answers may include
   - *During the period 1950–2004, the number of measles cases was highest in 1958, at almost 800,000.*
   - *The vaccine was licensed in 1964, when the number of measles cases was approximately 450,000.*
   - *Within 5 years after licensure (by 1969), the number of measles cases had dropped by 400,000, to approximately 50,000.*
   - *The graph also shows that smaller fluctuations in the number of cases per year have occurred since licensure. For example, the number of cases increased from under 5,000 in 1987 to almost 30,000 three years later, in 1990.*

2. Why might outbreaks of vaccine-preventable diseases still occur? List below as many reasons as you can for why people might not be vaccinated.
   Answers can vary and may include
   - *No access to vaccines (lack of health insurance, no health clinic nearby).*
   - *Religious or cultural objections.*
   - *Concern about vaccine safety and side effects.*
   - *Thinking that the disease no longer exists.*
   - *Too young to be vaccinated.*
   - *Medical reasons (for example, allergic reactions to vaccine components).*
   - *Sometimes, even vaccinated individuals are not fully protected because they haven't developed an appropriate immune response ("vaccine failures").*

3. Which members of the community might be most susceptible (vulnerable) to infectious disease?
   Answers can vary and may include very young, very old, poor, or individuals with immune deficiencies or getting cancer treatments.

Station 4—Exemptions

1. List the different types of exemptions and provide an example of each.
   Medical: *This can be used when a child is allergic to some vaccine components or has a weakened immune system, such as occurs during cancer treatment.*
   Religious: *This is used by individuals belonging to a particular religion with written views against vaccination.*
   Philosophical (personal belief): *This is a very broad category. Parents who are concerned about risks of vaccines can sometimes use this category to opt out of vaccination programs.*

2. How many states allow medical exemptions?
   All 50 states allow medical exemptions.

3. How many states allow only medical exemptions? Which states are these? (These are the states with the most restrictive policies.)
   Two states allow only medical exemptions: Mississippi and West Virginia.

4. How many states allow medical, religious, and philosophical exemptions? (These are the states with the least restrictive policies.)
   Twenty states allow these exemptions. See Master 2.6, page 2, for a list of the types of exemption allowed by each state as of fall 2008.

5. What types of exemption are allowed in your state?
   See Master 2.6, page 2, for a list of the types of exemption allowed by each state as of fall 2008.

Master 2.7 Answer Key

Key Questions

What is the **ethical question**?

Under what circumstances, if any, should a state (or our state) grant exemptions to its school vaccination policy?

What are the **relevant facts**?

- *The risk of contracting a disease varies.*
- *The magnitude of harm caused by the disease also varies, as does the risk of suffering those harms.*
- *Childhood diseases were once common in the United States, but they are largely unknown today because of widespread vaccination.*
- *The risk of harm from a vaccine is much lower than the risk of harm associated with getting a disease.*
- *Vaccines are very safe and effective, but there are some risks associated with them. Sometimes, if there is a high risk of great harm from the disease, individuals might be willing to incur a lesser but still high risk of significant harm from the vaccine. The smallpox vaccine is an example of a vaccine that has a high risk of great harm relative to other vaccines, but because the disease itself has an even higher risk of great harm, the vaccine may be worth getting.*
- *Vaccines are largely responsible for reducing the number of people who get childhood diseases such as measles.*
- *Sometimes outbreaks occur because vaccinated individuals haven't developed an appropriate immune response ("vaccine failure") or because people have not been vaccinated for a variety of reasons.*
- *All states allow at least one of the following types of exemption: medical, religious, or philosophical (personal belief).*

Who are the **stakeholders**? (Who or what could be affected by the way the question gets resolved?)

- *the school*
- *parents*
- *students*
- *teachers*
- *the medical community*
- *the larger civic community*
- *the school board*
- *the state public health department*

What are the **ethical considerations?**

- Respect for Persons

  Under what circumstances and to what extent should we respect an individual's choice not to be vaccinated? How much of a role should the state play in deciding whether people should be vaccinated? How coercive or forceful should the state be in implementing a vaccination policy?

- Fairness

  If an individual chooses not to be vaccinated for a readily transmissible childhood disease, the individual benefits from the actions of others yet assumes few risks (individuals who are not vaccinated still run the risk of getting the disease, though the risk is much lower when community immunity is achieved). A whole community may be put at risk if community immunity is not achieved.

- Other Considerations

  What responsibilities do individuals have to their communities?

Master 2.10 Answer Key

Community Immunity Reflection

1. What, in your own words, is community immunity?

   Answers should reflect this basic concept:

   When a critical percentage of a population is immune to a particular transmissible disease (in this case, through vaccination), the disease can no longer circulate in the community.

2. Explain how the class data from Master 2.8: Community Immunity Data Sheet relate to the concept of community immunity. Compare what happened in each round, noting the relationship between the percentage of the population vaccinated and the total number infected. Use actual numbers from the simulation in your description.

   Answers will vary depending on how the simulation progressed in your classroom. Students should note that as the number of vaccinated people increases, the total number infected decreases.

   When community immunity is achieved, the chances that an unvaccinated person gets a disease are greatly diminished. There are vastly fewer people from whom an unvaccinated person can contract a virus. Although an unvaccinated person's chances of contracting a disease are greatly diminished, the risk is not entirely eliminated. If an unvaccinated child happens to come in contact with a virus, he or she is vulnerable to the disease. This means that parents who opt out of vaccinating their children reduce overall community immunity and may place their own children at risk of contracting an illness.

3. Is it fair for someone to benefit from the protective effect of community immunity if he or she has chosen not to assume any risks of vaccination? Why or why not?

   Some susceptible people were protected in Round 2 by high levels of vaccination in the community even though they took no risks of vaccination themselves, which can be considered unfair.

Autism and the MMR Vaccine

Information about the possible relationship between autism and vaccines is not directly addressed in the module, but it's provided here in case questions arise in class.

Does the measles-mumps-rubella (MMR) vaccine cause autism?

- In 1998, a study of autistic children raised the question of a connection between the MMR vaccine and autism. The study was very small, involving only 12 children—too few cases to make any generalizations about the causes of autism. In addition, the researchers suggested that the MMR vaccination caused bowel problems in the children, which then led to autism. However, in some of the children studied, symptoms of autism appeared *before* symptoms of bowel disease. In 2004, 10 of the 13 authors of the 1998 study retracted the study's interpretation. The authors stated that the data were not able to establish a causal link between the MMR vaccine and autism.
- Other larger studies have found no relationship between the MMR vaccine and autism. For example, a study of 498 children with autism in the United Kingdom found that the percentage of children with autism who received the MMR vaccine was the same as the percentage of unaffected children in the region who received the vaccine. The study also found that there was no difference in the age of diagnosis of autism in vaccinated and unvaccinated children.
- Much speculation has surrounded the use of a mercury-containing preservative, thimerosal, in vaccines. However, since the preservative was removed from all but a few vaccines in 2001, the number of cases of autism has continued to rise, indicating that the preservative is not the cause of autism. In 2004, a report by the Institute of Medicine concluded that there is no association between autism and the MMR vaccine or any vaccines that contain thimerosal as a preservative.
- It is possible, however, that certain individuals with *pre-existing conditions* may have negative reactions to vaccines such as the MMR. In 2008, the government compensated the parents of a child with a rare mitochondrial disorder who developed autism after vaccination. Most children with autism do not have mitochondrial disorders, making this a rare event. The director of the Centers for Disease Control and Prevention clarified that "the government has made absolutely no statement about indicating that vaccines are the cause of autism, as this would be a complete mischaracterization of any of the science that we have at our disposal today" (CDC 2008b).

Sources

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Wakefield, A.J., Murch, S.H., Linnell, A.A.J., Casson, D.M., Malik, M., Berelowitz, M. et al. 1998. Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children. *Lancet, 351*: 637–41.

Disease Occurrence Before and After Vaccine Development

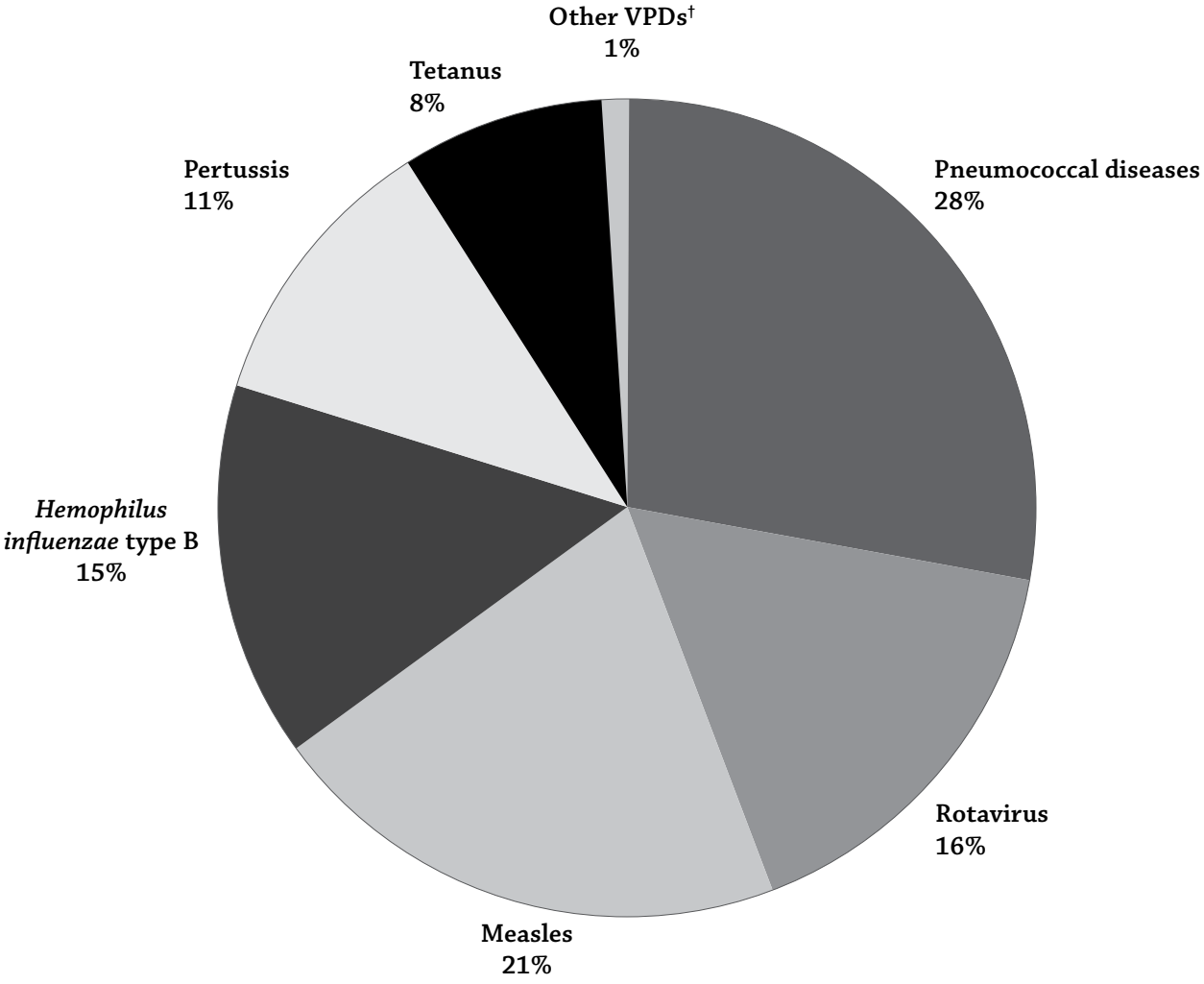
Occurrence of Diseases (Morbidity) in the United States in the Years Just Before the Vaccine Was Licensed and in 2000

Disease	20th-Century Annual Morbidity*	2000†	Percentage Decrease
Smallpox	48,164	0	100
Diphtheria	175,885	4	99.99
Measles	503,282	81	99.98
Mumps	152,209	323	99.80
Pertussis	147,271	6,755	95.40
Polio (paralytic)	16,316	0	100
Rubella	47,745	152	99.70
Congenital rubella syndrome	823	7	99.10
Tetanus	1,314	26	98.00
Haemophilus influenzae type b and unknown (<5 years)	20,000	167	99.10

Source: Malone, K.M., and Hinman, A.R. 2003. Vaccination mandates: The public health imperative and individual rights. In *Law in Public Health Practice* (pp. 262–84). New York: Oxford University Press. Retrieved August 12, 2008, from *http://www.cdc.gov/vaccines/vac-gen/policies/downloads/vacc_mandates_chptr13.pdf*.

*20th-Century Annual Morbitiy is the annual average of the incidence of the disease in the three years before the vaccine was licensed.
†Data from the year 2000 is provisional.

Deaths from Vaccine-Preventable Diseases



Percentage of 2.5 million deaths from vaccine-preventable diseases among children aged less than 5 years (worldwide), 2002. (**Source:** Centers for Disease Control and Prevention. 2006. Vaccine Preventable Deaths and the Global Immunization Vision and Strategy, 2006–2015. Retrieved September 3, 2008, from *http://www.cdc.gov/mmwr.*)

* About 2.5 million of the 10.5 million deaths worldwide per year in this age group are caused by diseases for which vaccines are available.

† Other vaccine-preventable diseases: diphtheria, hepatitis B, Japanese encephalitis, meningococcal disease, polio, and yellow fever.

For Further Reflection

1. Which three diseases in the chart result in the greatest number of deaths in children under age five years? What percentage of total deaths does each of those diseases cause?

   Pneumococcal Diseases: 28%
   Measles: 21%
   Rotavirus: 16%

2. The World Health Organization recommends the following vaccines universally: polio, diphtheria, yellow fever, tetanus, pertussis, *Hemophilus influenzae* type B (also called Hib), and measles. Which one of these diseases causes the largest percentage of deaths?

   Measles

3. If 2.5 million deaths are caused annually in children less than five years of age by diseases for which vaccines are available, approximately how many deaths are due to the measles?

   0.21 x 2.5 million = 525,000 deaths

4. Access to vaccines is limited for many young children globally. What kind of ethical issues does this fact raise?

   Limited access to vaccines for some young children raises issues of fairness. The benefits resulting from vaccines are available only to some children and not others. Also, children in some areas of the world suffer more harm from contracting vaccine-preventable diseases than children in other areas.

U.S. Vaccination Rates for Selected Vaccines, by Poverty Level

U.S. Vaccination Rates (%) for Selected Vaccines, by Poverty Level, in Children Aged 19–36 Months*

Number of doses and vaccine received	Recommended Number of Doses †	U.S. National	At or Above Poverty	Below Poverty	Unknown Poverty
Three or more doses of DTP (any diphtheria, tetanus, and pertussis vaccines or closely related vaccines)	5	95.8	96.7	93.4	96.3
Four or more doses of DTP	5	85.3	87.1	80.7	84.3
Three or more doses of Poliovirus	4	92.5	93.2	90.5	93.0
One or more doses of MMR (measles, mumps, rubella)	2	91.6	92.5	89.6	89.1
Three or more doses of Hib (*Haemophilus influenzae* type b)	4	93.7	94.6	91.1	93.4
Three or more doses of HepB (hepatitis B)	3	93.0	93.7	91.5	90.9
More than one dose of Chickenpox (varicella vaccine, at or after child's first birthday, not adjusted for history of varicella illness)	2	88.5	89.2	87.4	85.2
Four or more doses **DTP**, three or more doses **poliovirus**, one or more dose of **MMR**	5 DTP, 4 polio, 2 MMR	82.9	84.8	78.4	79.8

Source: Centers for Disease Control and Prevention. 2005–2006. Estimated vaccination coverage with individual vaccines and selected vaccination series among children 19–35 months of age by poverty level and race/ethnicity. U.S. National Immunization Survey, Q3/2005-Q2/2006. Retrieved September 3, 2008, from *http://www2a.cdc.gov/nip/coverage/nis/nis_iap.asp?fmt=r&rpt=tab32_pov_race&qtr=Q3/2005-Q2/2006*.

* Children in the National Immunization Survey were born between July 2002 and January 2005.

† Number of doses recommended from birth to 6 years old.

For Further Reflection

1. What trend or trends do you see in immunization levels and poverty levels? Support your claims with specific numbers and examples.

   Answers may vary. Here's one example: For every vaccine in the chart, the immunization levels for "below poverty" are lower than the national average. For example, for polio, the national average is 92.5% immunized, while for those below poverty, 90.5% are immunized. Similarly, for every vaccine in the chart, the immunization levels for "at or above poverty" are above the national average. For polio, the figure for immunization level at or above poverty is 93.2%.

2. For which common vaccine or vaccine series is the gap between those vaccinated at or above poverty level and below poverty level largest? Support your claim with specific numbers and examples.

   In both the ≥4 (5) DTP series and the 4:3:1 DTP:poliovirus:MMR series, the difference between immunization levels at or above poverty and below poverty is 6.4%.

Vaccine	***At or Above Poverty, %***	***Below Poverty, %***	***Difference, %***
Four or more doses of DTP	*87.1*	*80.7*	*6.4*
Four or more doses DTP, three or more doses poliovirus, one or more dose of MMR	*84.8*	*78.4*	*6.4*

3. Which common vaccine or vaccine series has the highest coverage at the U.S. national level? Which has the lowest? Include the name of the vaccine or vaccine series along with the percent coverage.

Coverage Nationally	***Vaccine or Vaccine Series***	***Coverage, %***
Highest	*Three or more doses of DTP (any diphtheria, tetanus, and pertussis vaccines or closely related vaccines)*	*95.8*
Lowest	*Four or more doses DTP, three or more doses poliovirus, one or more dose of MMR*	*82.9*

4. What specific challenges might people living below the poverty level face in getting access to vaccines, even if they are provided for free?

   Individuals may have difficulty locating and traveling to a healthcare facility, for example.

U.S. Vaccination Rates for Selected Vaccines, by State

Estimated Vaccination Coverage (%)with Individual Vaccines and Selected Vaccination Series Among Children 19–35 Months of Age by State and Immunization Action Plan Area, U.S. National Immunization Survey, 2005–2006

Region	4+DTP Four or more doses of any diphtheria and tetanus and pertussis vaccines or closely related vaccines.	3+Polio Three or more doses of any poliovirus vaccine.	1+MMR One or more doses of measles-mumps-rubella vaccine.	1+Var (Chickenpox) One or more doses of varicella at or after child's first birthday.
U.S. National	85.3	92.5	91.6	88.5
Alabama	91.0	94.8	92.8	94.7
Alaska	85.7	91.2	91.8	83.6
Arizona	83.2	90.0	89.7	83.3
Arkansas	73.7	89.4	87.8	86.7
California	84.1	93.0	90.5	90.6
Colorado	86.3	92.9	91.6	85.8
Connecticut	90.6	95.0	95.8	92.5
Delaware	89.7	93.4	94.9	92.7
District of Columbia	85.3	92.2	92.4	90.2
Florida	85.3	91.5	92.2	92.5
Georgia	88.0	93.4	91.4	91.2
Hawaii	84.9	91.3	90.7	89.0
Idaho	80.6	91.0	86.1	76.6
Illinois	89.5	91.0	92.2	86.6
Indiana	83.2	92.3	89.1	86.6
Iowa	85.3	94.8	87.8	84.4
Kansas	88.1	91.5	92.0	81.8
Kentucky	90.1	97.0	94.3	88.1
Louisiana	79.8	92.7	91.3	90.1
Maine	89.2	91.3	93.2	89.4
Maryland	90.5	94.1	96.1	94.4
Massachusetts	93.9	96.7	96.4	93.6
Michigan	85.0	92.6	92.2	90.0
Minnesota	83.8	92.7	89.6	82.4
Mississippi	81.9	95.5	87.0	88.4

Continued

U.S. Vaccination Rates for Selected Vaccines, by State
CONTINUED

Region	4+DTP Four or more doses of any diphtheria and tetanus and pertussis vaccines or closely related vaccines.	3+Polio Three or more doses of any poliovirus vaccine.	1+MMR One or more doses of measles-mumps-rubella vaccine.	1+Var (Chickenpox) One or more doses of varicella at or after child's first birthday.
Missouri	84.4	94.0	90.9	90.0
Montana	77.4	90.6	88.3	74.4
Nebraska	89.3	94.6	93.3	88.3
Nevada	75.8	87.9	86.2	84.2
New Hampshire	86.9	91.9	88.3	85.4
New Jersey	88.4	90.3	90.8	91.9
New Mexico	80.0	89.6	90.0	83.4
New York	87.8	93.0	94.8	88.2
North Carolina	87.9	94.8	96.1	92.5
North Dakota	86.4	94.0	91.7	87.2
Ohio	87.0	92.1	93.1	86.6
Oklahoma	80.9	92.6	91.4	88.4
Oregon	79.9	86.7	86.8	79.7
Pennsylvania	85.3	92.8	92.4	90.1
Rhode Island	84.1	94.9	96.3	93.3
South Carolina	87.7	93.6	92.1	91.3
South Dakota	88.6	96.3	93.5	83.1
Tennessee	86.3	94.9	92.7	88.5
Texas	80.7	91.2	89.6	88.6
Utah	83.4	89.3	89.5	83.8
Vermont	87.0	94.7	95.1	74.8
Virginia	84.1	90.5	91.0	85.8
Washington	84.8	90.2	88.9	74.9
West Virginia	83.8	93.0	89.0	81.9
Wisconsin	87.9	95.0	91.5	86.9
Wyoming	79.5	88.5	88.0	78.0

Source: Centers for Disease Control and Prevention. 2005–2006. Estimated vaccination coverage with individual vaccines and selected vaccination series among children 19–35 months of age by state and immunization action plan area. U.S. National Immunization Survey, Q3/2005-Q2/2006. Retrieved September 3, 2008, from *http://www2a.cdc.gov/nip/coverage/nis/nis_iap.asp?fmt=v&rpt=tab03_antigen_state&qtr=Q3/2005-Q2/2006*.

For Further Reflection

1. Which two to three states have particularly high immunization rates? Support your claims with specific numbers and examples.

State	*4+DTP*	*3+Polio*	*1+MMR*	*1+Var (Chickenpox)*
Alabama	*91.0*	*94.8*	*92.8*	*94.7*
Connecticut	*90.6*	*95.0*	*95.8*	*92.5*
Maryland	*90.5*	*94.1*	*96.1*	*94.4*
Massachusetts	*93.9*	*96.7*	*96.4*	*93.6*

These four states have 90% or greater immunization levels for each of the vaccines or vaccine series. Other ways of analyzing the data are also possible (for example, students may average immunization rates across vaccines).

2. Which two to three states have particularly low immunization rates compared with other states? Support your claims with specific numbers and examples.

State	*4+DTP*	*3+Polio*	*1+MMR*	*1+Var (Chickenpox)*
Montana	*77.4*	*90.6*	*88.3*	*74.4*
Oregon	*79.9*	*86.7*	*86.8*	*79.7*
Wyoming	*79.5*	*88.5*	*88.0*	*78.0*

Each of these three states has immunization rates of below 80% for more than one vaccine or vaccine series. Other ways of analyzing the data are also possible (for example, students may average immunization levels across vaccines).

3. Provide two or more hypotheses about why vaccination rates might vary by state.

   States with more restrictive exemption policies may have higher vaccination rates.

   States with a larger number of people below the poverty level may have lower immunization rates.

   Other hypotheses are possible.

4. What kind of evidence would help you support or refute your hypotheses? In other words, what other kinds of information would help you determine whether your ideas are on the right track? If that information is available, determine whether your hypotheses are supported or not.

   The following would help determine whether the hypotheses above are supported or not:

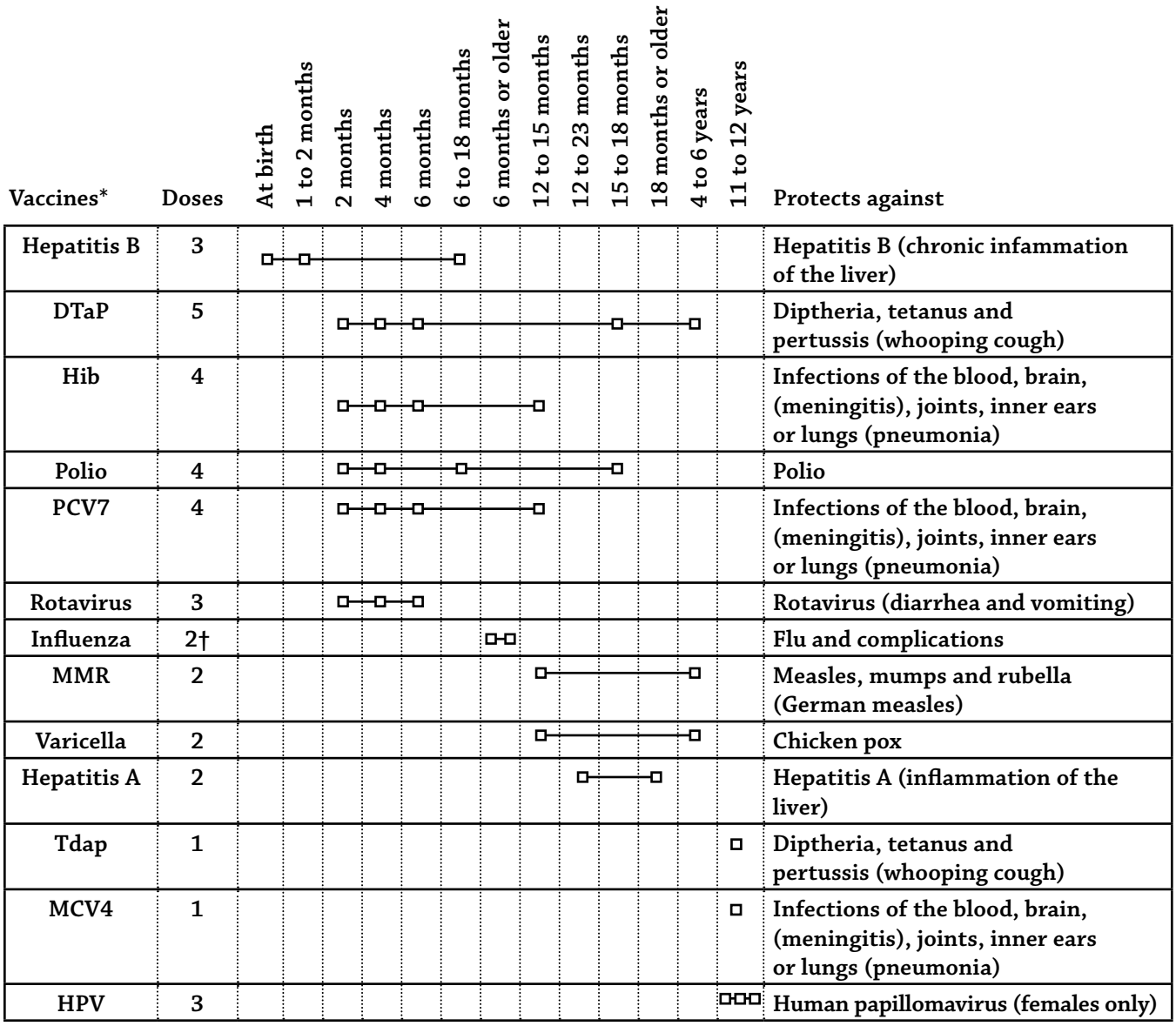
   Exemption policies for each state

   Vaccination rates for each state

   Poverty level information for each state

   Other answers are possible.

Recommended Childhood Immunization Schedule



Vaccines*	Doses	Protects against
Hepatitis B	3	Hepatitis B (chronic infammation of the liver)
DTaP	5	Diptheria, tetanus and pertussis (whooping cough)
Hib	4	Infections of the blood, brain, (meningitis), joints, inner ears or lungs (pneumonia)
Polio	4	Polio
PCV7	4	Infections of the blood, brain, (meningitis), joints, inner ears or lungs (pneumonia)
Rotavirus	3	Rotavirus (diarrhea and vomiting)
Influenza	2†	Flu and complications
MMR	2	Measles, mumps and rubella (German measles)
Varicella	2	Chicken pox
Hepatitis A	2	Hepatitis A (inflammation of the liver)
Tdap	1	Diptheria, tetanus and pertussis (whooping cough)
MCV4	1	Infections of the blood, brain, (meningitis), joints, inner ears or lungs (pneumonia)
HPV	3	Human papillomavirus (females only)

Source: Centers for Disease Control and Prevention.

*DTaP, diphtheria, tetanus, and acellular pertussis (whooping cough); Hib, *Haemophilus influenzae* type b; PCV7, pneumococcal conjugate; MCV4, tetravalent meningococcal conjugate; Tdap, combined tetanus, diphtheria, pertussis.
†One dose yearly thereafter.

Vaccination Policy Assignment Rubric

Clearly States Position

Exemplary	Proficient	Partially Proficient	Developing	Not Present
Student makes specific recommendations about whether or not the state should require mandatory vaccination. If student advocates for compulsory vaccination, the circumstances under which vaccination should occur are described in depth. Student thoughtfully addresses how vaccination policy should be enforced.	Student makes specific recommendations about whether or not the state should require mandatory vaccination. If student advocates for mandatory vaccination, the circumstances under which vaccination should occur are clearly, but not deeply, described. Student mentions ideas for how vaccination policy should be enforced, but not in detail.	Student makes recommendations about whether or not his or her state should require mandatory vaccination, but these may lack specificity. If student advocates for mandatory vaccination, the circumstances under which vaccination should occur are described, but may lack clarity or depth. Student description of how vaccination policy should be enforced is incomplete or not developed.	Student makes partial or incomplete recommendations about whether or not the state should require mandatory vaccination. If student advocates for mandatory vaccination, the circumstances under which vaccination should occur may be lacking. Student description of how vaccination policy should be enforced may be missing.	Student recommendations about the state policy are absent.

Recognizes and Understands Different Perspectives

Exemplary	Proficient	Partially Proficient	Developing	Not Present
Student is able to clearly articulate different perspectives and insightfully relate them to the policy suggested. Student explores who may be affected by the policy and their interests. Student describes all the main arguments people might make about vaccination policies.	Student demonstrates recognition and understanding of multiple perspectives. Student identifies who may be affected by the policy and their interests. Student describes most of the main arguments people might make about vaccination policies.	Student recognizes and understands some alternative perspectives. Student identifies some of the people who may be affected by the policy and their interests. Student describes some arguments people might make about vaccination policies.	Student struggles to reflect and paraphrase alternative perspectives accurately. Student misses some people who may be affected by the policy and their interests. Student may not describe arguments people might make about vaccination policies, or the description may be incomplete.	Student does not recognize the existence of different perspectives.

Demonstrates Understanding and Application of Facts and Science Content

Exemplary	Proficient	Partially Proficient	Developing	Not Present
Student describes the factual background relevant to his or her position in detail. The facts are accurate, complete, and provide thorough support for the position. Student demonstrates a thorough understanding of the concept of community immunity and specifically applies it to his or her recommendation. Student uses scientific vocabulary appropriately. Scientific statements are factual and thorough. Student is able to apply scientific concepts and make connections between ideas.	Student describes the factual background relevant to his or her position. The facts are accurate, complete, and provide support for the position. Student demonstrates a good understanding of the concept of community immunity and specifically applies it to his or her recommendation. Student uses scientific vocabulary appropriately. Scientific statements are factual and thorough. Student is able to apply scientific concepts.	Student describes the factual background relevant to his or her position but may miss some key points. Student demonstrates an understanding of the concept of community immunity and specifically applies it to his or her recommendation. Student mostly uses vocabulary appropriately. Some facts may be incorrect. Student shows some ability to apply scientific concepts.	Student describes a limited amount of factual background. The background may not be relevant to his or her position or may include misconceptions. Student may demonstrate some misunderstandings of the concept of community immunity or may not apply it to his or her recommendation. Student may use terms inappropriately. Facts are often incorrect. Student struggles to apply scientific concepts.	Student's science content about the disease and vaccine is lacking, as is accurate reference to community immunity.

Demostrates Understanding and Application of Ethical Considerations

Exemplary	Proficient	Partially Proficient	Developing	Not Present
Student clearly identifies the relevant ethical considerations (respect for persons, fairness, public health needs, etc.). Student makes insightful connections between ideas.	Student clearly identifies relevant ethical considerations.	Student identifies some of the relevant ethical considerations.	Student's understanding of the ethical considerations is incorrect or incomplete.	Student does not discuss ethical considerations.

Provides a Strong Justification for the Position

Exemplary	Proficient	Partially Proficient	Developing	Not Present
Student makes a compelling case for his or her position that is orderly and easy to follow. The justification is relevant to the ethical question and makes reference to the potential effects of the position on others. The reasoning incorporates elements of the scientific background and ethical considerations.	Student makes a clear case for his or her position. The justification provided is relevant to the ethical question and refers to the potential effects of the position on others. The reasoning incorporates elements of the scientific background and ethical considerations.	Student makes an argument for his or her position, but it may be unclear or incompletely justified.	Student's argument and justification is only barely developed.	Student does not make an argument or provide justification for the position.

Extension (Optional)

Responsibility Prompts and Scenarios

Tell students that they will now consider the question, What responsibilities do individuals have to their community regarding vaccination and medical care?

Ask students, "Mary chooses not to be vaccinated against measles because it is inconvenient, and then she gets the disease. Who should be financially responsible for her medical care? Why?"

- Some students will say Mary, since it is her "fault" that she got the disease.
- Some students will say the community because everyone has a right to medical care or because compassion and charity require the community to respond to those in need.
- Students may come up with other answers.

Ask students, "Andre gets the measles vaccine, and then gets the disease anyway. Who should be financially responsible for his medical care? Why?"

- Some students will say Andre should be responsible because he accepted the risk of getting the disease when he agreed to get the vaccine.
- Other students will say the community because it is not Andre's fault that he got the disease.
- Some students might say that Andre suffered a burden for the sake of the community, and so the community should now suffer a (financial) burden for the sake of Andre. They may also say that everyone has a right to medical care or compassion, and charity requires the community to respond to those in need.
- Students may come up with other answers.

Ask students, "Ingrid gets the measles vaccine, and then suffers harms from the vaccine. Who should be financially responsible for Ingrid's medical care? Why?"

- Students will probably offer reasons similar to those above.

Ask students, "Gopal wants to get the measles vaccine, but he will have a hard time affording it. Who should be financially responsible for paying for this vaccine? Why?"

- Some students will say the individual, since the individual is likely to benefit from the vaccine.
- Some students will say the community for reasons similar to those above.

Extension (Optional)

Responsibility Prompts and Scenarios

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- Some students will say the community for reasons similar to those above.

Extension (Optional)

Responsibility Prompts and Scenarios

Tell students that they will now consider the question, What responsibilities do individuals have to their community regarding vaccination and medical care?

Ask students, "Mary chooses not to be vaccinated against measles because it is inconvenient, and then she gets the disease. Who should be financially responsible for her medical care? Why?"

- Some students will say Mary, since it is her "fault" that she got the disease.
- Some students will say the community because everyone has a right to medical care or because compassion and charity require the community to respond to those in need.
- Students may come up with other answers.

Ask students, "Andre gets the measles vaccine, and then gets the disease anyway. Who should be financially responsible for his medical care? Why?"

- Some students will say Andre should be responsible because he accepted the risk of getting the disease when he agreed to get the vaccine.
- Other students will say the community because it is not Andre's fault that he got the disease.
- Some students might say that Andre suffered a burden for the sake of the community, and so the community should now suffer a (financial) burden for the sake of Andre. They may also say that everyone has a right to medical care or compassion, and charity requires the community to respond to those in need.
- Students may come up with other answers.

Ask students, "Ingrid gets the measles vaccine, and then suffers harms from the vaccine. Who should be financially responsible for Ingrid's medical care? Why?"

- Students will probably offer reasons similar to those above.

Ask students, "Gopal wants to get the measles vaccine, but he will have a hard time affording it. Who should be financially responsible for paying for this vaccine? Why?"

- Some students will say the individual, since the individual is likely to benefit from the vaccine.
- Some students will say the community for reasons similar to those above.

Master 3.6 Answer Key (Sample)

The Liver and Liver Transplants: Checking for Understanding

Check Facts

1. What does your liver do? List at least four different functions.
   Stores vitamins, sugar, and iron to help give the body energy.
   Controls the removal and production of cholesterol.
   Clears the blood of waste products, drugs, and other toxins.
   Makes clotting factors to stop bleeding after cuts or injuries.
   Releases bile that helps digest food and absorb important nutrients.

2. Describe two causes of liver failure in adults.
   Liver failure can be caused by cirrhosis, which can be caused by viruses, alcohol, buildup of fat in the liver, and inherited disease; cancer; benign tumors; and inherited disease.

3. Identify an action that you can take to help keep your liver healthy.
   Stay away from excessive alcohol intake.

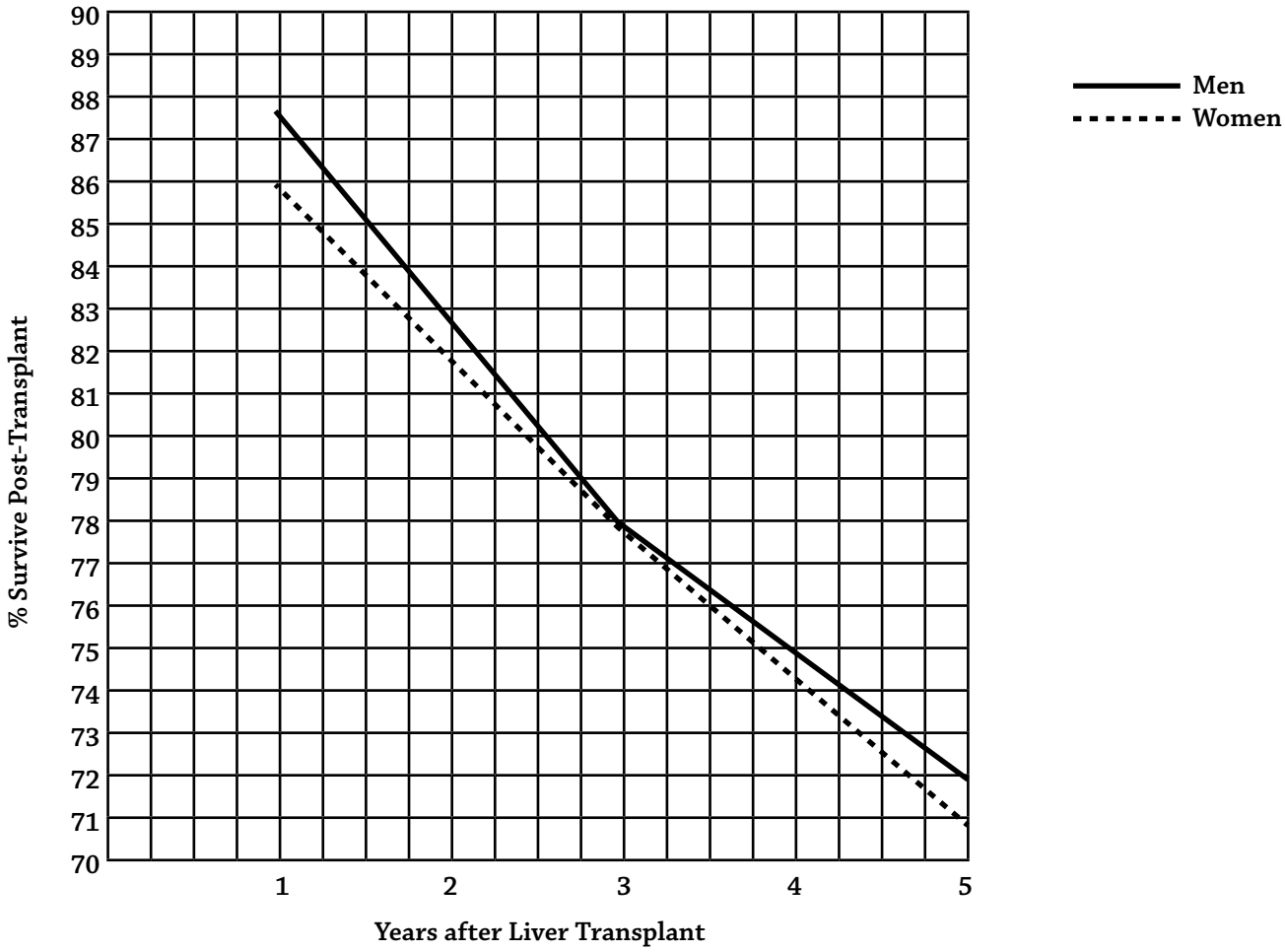
4. After a transplant, a patient must take medication.
   a) What are some of the side effects of the medications one must take after a liver transplant?
      Immune suppression, risk of infections.
   b) Why are these medications necessary, despite the side effects?
      You must partially suppress the patient's immune system so it doesn't reject the organ.

Apply Your New Knowledge

5. Why is geography important to consider? In other words, why might a hospital give a liver to a patient closer to the hospital, even if this patient has been waiting for less time or is not as sick as another patient who lives farther away?
   A liver has the best chance of success when there is very little time between removing the organ from the deceased donor and transplanting the liver into the recipient. Usually, no more than 12 hours can pass.

6. Out of all of the people waiting for a liver in 2005, what percentage died while waiting for a liver transplant?
   (2,000/17,000) x 100 = about 12%

7. Suppose that you are giving a presentation to compare percentage survival in males vs. females one year, three years, and five years after a liver transplant from a deceased donor. Using the area below, prepare a line graph in which you show the relevant data.
   a) Consider which variable (number of years or percentage survival) you will place on the X (independent) axis and which variable you will place on the Y (dependent) axis. Label each axis, and decide on an appropriate scale.
   b) Make two lines, one for females and one for males. Color-code your lines (or make one dashed and one solid).
   c) Provide a descriptive title.



8. On the basis of your graph above, do you think that the patient's sex (male vs. female) makes a small, medium, or large difference in terms of percentage survival over five years?
   Small difference

Master 3.9 Answer Key (Sample)

Identifying Allocation Criteria and the Relevant Facts

Your teacher will ask you to fill in the top row of this chart with the criteria your class came up with—one criterion in each shaded box. In the column on the left are different facts that may or may not be relevant to the criteria. With your teacher, you will fill out the first column by placing check marks in the boxes next to the facts you would need to know to evaluate whether someone met the first criterion. Then, as homework, you will fill out the rest of the chart by looking at each criterion in the top row and checking off the facts that you think are relevant to that criterion. Be prepared to share your completed chart during class.

Note to teachers: *The criteria in the table below are just examples; the actual criteria will vary from class to class. Students should write the criteria their class came up with—the ones you recorded during the Activity 5 discussion—in the empty top row of Master 3.9.*

	Criteria relevant to allocating livers						
Potentially Relevant Facts	Will likely live the longest post-transplant	Is the sickest	Is the youngest	Is most valuable or socially useful to society	Is the least responsible for the liver disease	Wins a random lottery*	Waited the longest for a liver
Patient's age	✓		✓		✓		
Patient's sex	✓†						
Cause of liver failure					✓		
Patient's other medical conditions	✓	✓					
Cold ischemic time	✓						
Compliance with medical requirements after the transplant	✓						
Access to health care	✓						
When the patient will die without a transplant		✓					
Patient's career				✓			
Patient's impact on dependents				✓			
Patient's support system at home	✓						
Time on the waiting list							✓

*To win the lottery, the only relevant facts are whether the person's name was placed in the lottery and whether his or her name was selected.

† Patient's sex has a small impact on their post-transplant life expectancy.

Reflection Question: Which of these criteria (listed in the top row in the shaded cells) do you think are the most important? Explain your answer on the back of this page.
Students' answers will vary. The most important part of this activity is that students have supported their answers well.

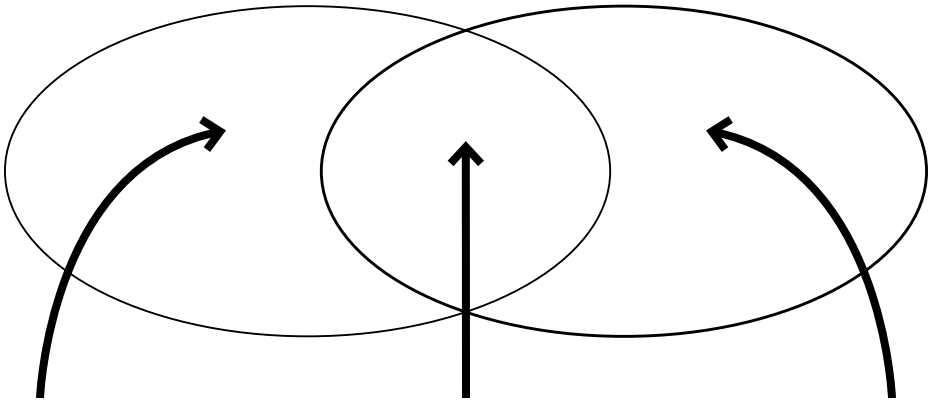
Master 3.11 Answer Key (Sample)

Comparing the Past and Current Unos Policies

Compare the past and current UNOS policies by completing each of the three areas in the Venn diagram below. Include information about what is included in the policies, as well as what is not included. For example, you could write a phrase such as "prioritizes whoever is sickest" as well as a phrase like "doesn't mention worth to society." Characteristics unique to the past policy belong in the far left region; characteristics unique to the current policy belong in the far right region; and characteristics shared by both policies belong in the middle region.

Note to teachers: *The completed diagram below provides one example of how a student might communicate his or her understanding of the past and current UNOS liver allocation policies. Students' responses will vary, but look for the basic concepts shown below in their completed diagrams.*

Before 1998 (past policy) **Both** **Since 1998 (current policy)**



- *Used four medical-urgency-status categories to prioritize patients*
- *Prioritized patients within each local OPO area, even if they weren't sickest*
- *Prioritized those who were on waiting lists longest, even if they weren't sickest*
- *Patients' doctors' subjective opinions were used*
- *Healthier patients could get livers before very sick patients*

- *Severity of patients' illness important*
- *Waiting list used*
- *No mention of worth to society*
- *No use of a lottery system*
- *Youngest patients not prioritized*
- *Those who will likely live longest not prioritized*
- *First-come, first-served not used*
- *Those responsible for disease not penalized*

- *Prioritizes Status 1 patients that will die within a week without a new liver*
- *Prioritizes all others using a MELD score—based on objective blood tests—that predicts their risk of death over the next three months*
- *Patients with the highest scores (highest risk of dying) receive next highest priority*
- *Ensures that sickest patients—Status 1 and those with highest MELD scores—receive livers first, whether or not they live in a local OPO area or region*
- *Objective medical data and medical tests—not doctors' opinions—guide decision making*

Pros and Cons of Prioritizing a Single Criterion

Criterion Being Prioritized	Pro	Con
Likely to live the longest after the transplant	• Maximizes the number of years when valuable projects, plans, and relationships are pursued. • Ensures the greatest number of extra years of life across the total population.	• It is impossible to be 100% certain how long a person will live after a transplant. • Ignores other relevant considerations.
The sickest	• Aids those who are suffering right now.	• Ignores needs of those who will become sick. • Leads to people receiving interventions only after their health deteriorates. • Likely to lead to fewer extra years of life across the total population. • Ignores other relevant considerations.
The youngest	• Benefits those who otherwise would have had the shortest life.	• Favors infants over adolescents, yet adolescents already have life plans and projects, as well as developed relationships, all of which will be lost without a transplant. • Ignores other relevant considerations.
Considered the most valuable or socially useful	• Maximizes the overall benefit—the benefit not only to the recipient of the resource but to all the people the recipient will in turn help or benefit.	• Fails to treat people as moral equals. • May result in systematic but unconscious discrimination or bias toward unpopular or vulnerable groups. • Ignores other relevant considerations.
Not personally responsible for their disease	• Ensures that those who are sick through no fault of their own do not die as a result of bad luck.	• Creates the opportunity for people to possibly misjudge—and penalize—those who are responsible for their disease. May attribute more responsibility for the disease to the person than he or she really had, given the available resources, family experiences, and educational opportunities. • Ignores other relevant considerations.
Wins a random lottery	• Hard to "game" or corrupt the system and so gain an unfair chance at getting the scarce resource. • Requires little information about recipients, so it is easy to implement.	• Ignores other relevant considerations.
Waited the longest for a liver	• Requires little information about recipients, so it is easy to implement.	• Ignores other relevant considerations.
Other: First-come, first-served system	• Protects existing doctor-patient relationships. • Requires little information about recipients, so it is easy to implement.	• Favors wealthy, powerful, and well-connected people since they are more likely to "get there first." • Ignores other relevant considerations.

Note: For a more detailed discussion of the pros and cons of these criteria, as well as pros and cons of policies that have a mixture of some of these criteria, please see Persad, G., Wertheimer, A., and Emanuel, E.J. 2009. Principles for allocation of scarce medical interventions. *Lancet 373*: 423–31. Retrieved February 2, 2009, from *http://bioethics.nih.gov/departmentpubs/Persad 2009 - Lancet.pdf*.

Master 4.3 Answer Key

Max's Case: Thyroid Cancer, Men II, and Genetic Testing

Question	Answer
1. Who had thyroid cancer, and when were they diagnosed with it?	*James, Harriet, and Nick all had thyroid cancer; all were diagnosed with it in their teens, 20s, or 30s.*
2. Who died of thyroid cancer?	*James, Harriet, and Nick died of thyroid cancer.*
3. Of those who had thyroid cancer, who is known to have had MEN II?	*At this point, no one (even those who had thyroid cancer) is known to have had MEN II.*
4. Who died of reasons not related to thyroid cancer?	*Susie, when she was 32 years old.*
5. Who has elevated levels of thyroxine, which could be a warning sign of future thyroid cancer?	*Diane.*
6. If someone had MEN II, what would his or her genotype be?	*The MEN II gene is dominant. The genotype could be homozygous dominant (TT) or heterozygous (Tt). Since the dominant allele is rare, assume that a person with MEN II is heterozygous.*
7. If someone did *not* have MEN II (even if he or she did have thyroid cancer), what would his or her genotype be?	*Homozygous recessive (tt).*

Master 4.6 Answer Key

Thyroid Cancer, Men II, and Genetic Testing: Checking for Understanding

1. What is MEN II? Although many kinds of cancer are linked with MEN II, 100 percent of people with the gene for MEN II will get cancer of what organ?

   MEN II is multiple endocrine neoplasia 2. People with this disease almost always develop a certain type of thyroid cancer and may also develop other kinds, such as adrenal gland, brain, and bone cancer.

2. The Alzheimer's disease genetic test doesn't predict Alzheimer's disease with certainty; a person who tests positive for *E4* has only a 13-to-57-percent lifetime risk of Alzheimer's disease. If a person tests positive for the mutation that causes MEN II, what is the chance that the person will get thyroid cancer?

   100 percent.

3. There is no followup medical procedure that will prevent onset of Alzheimer's disease. What followup medical options are there for a person who has tested positive for the mutation that causes MEN II?

   The thyroid can be removed before any sign of cancer. Therefore, the person will never get thyroid cancer. Because the person doesn't have a thyroid gland anymore, they need to take a daily medication.

4. As noted, this type of thyroid cancer is caused by an autosomal dominant mutation. What does this mean? (What does *autosomal* mean? What does *dominant* mean?)

   An autosomal gene is a gene that is not on the X or Y chromosome. If one inherits the dominant version of the gene from one or both biological parents, he or she will develop the disease.

5. Other than the predictive value of the test and the options for followup medical care, what is another difference between Alzheimer's disease and the type of thyroid cancer associated with MEN II?

   The most typical type of Alzheimer's arises at older ages (age 65 or older); the type of thyroid cancer associated with MEN II arises by a person's 30s. Alzheimer's involves brain degeneration; MEN II leads to an aggressive cancer if left untreated.

6. If Max were to test positive for the mutation, would he know anything more about anyone else in his family? Explain, and be as specific as possible.

   If Max tests positive, that means that others in his family could also have inherited the same mutation. For example, his aunt and uncle could both have inherited this mutation, along with his cousins. This means that others in the family may want to follow up with their own genetic tests for the MEN II mutation.

Master 4.7 Answer Key

What Impact Would Max's Newly Discovered Mutation Have on Him and Others?

Name	Age	1. If Max had the mutation, what is the chance that the person below also inherited the mutation? 2. What is the chance that the person would develop thyroid cancer?
Max	*15*	1. 100% 2. 100%
Pierre	*39*	*No additional info; married into family; assume he's homozygous recesive* (tt).
Sally	*9*	1. *50% chance of being heterozygous* (Tt)*;* *50% chance of being homozygous recessive* (tt). 2. *50%*
Diane	*31*	1. *50% chance of being heterozygous* (Tt)*;* *50% chance of being homozygous recessive* (tt). 2. *50%*
Lindsey	*5*	1. *25% chance of being heterozygous* (Tt)*;* *75% chance of being homozygous recessive* (tt). 2. *25%*
Eula	*80*	1. *50% chance of being heterozygous* (Tt)*;* *50% chance of being homozygous recessive* (tt). 2. *50%, but she is 80 years old and free of thyroid cancer, so she must be homozygous recessive* (tt).

Master 4.8 Answer Key

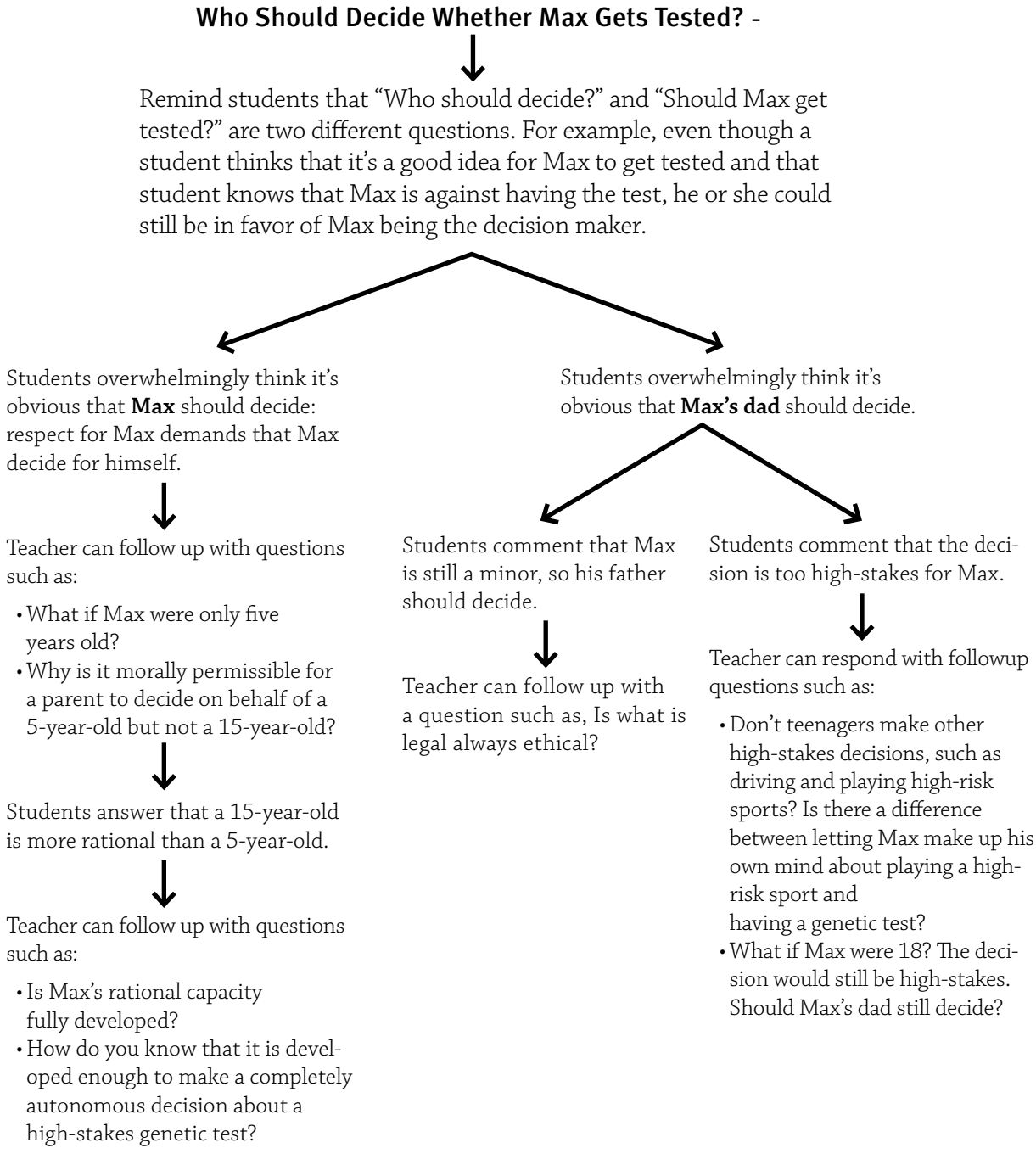
Thyroid Cancer and Genetic Testing: Harms and Benefits

Complete the chart below by applying relevant scientific facts about genetic testing and followup medical care for this type of thyroid cancer.

Type of Harm or Benefit	Harms	Benefits
Physical	• *If Max tested positive and received preventative surgery, he would need to recover from the surgery. This would likely be a very temporary harm. However, there is always a small chance of more major complications from surgery.* • *There are many types of thyroid cancer, and Max is being tested for the mutation that causes just one type. If he tests negative, he might falsely interpret this to mean that he has zero lifetime risk of thyroid cancer and might not be as careful about getting thyroid checkups and screenings, which could save his life were he to develop thyroid cancer.*	• *If Max tested positive, he could have followup surgery that would eliminate his chance of thyroid cancer.* • *Even if Max didn't have the preventive surgery, a positive test result would lead to more screenings and the cancer would be detected earlier.*
Psychological (Emotional)	• *If Max tested positive, he might be upset at first, especially if the testing happens against his will.* • *Max might feel angry about inheriting this mutation.* • *Max might feel guilty about not inheriting this mutation, knowing that others in his family may have inherited it.*	• *If Max tested negative, he would feel relieved and would benefit emotionally.* • *If Max tested positive, he would be able to take concrete medical action, and by taking this kind of control over his own life, he might experience an emotional benefit.*
Social	• *If Max tested positive and got the followup surgery, he would have a thin scar that might be embarrassing.* • *If Max tested positive, others might stigmatize him for having a mutation that will lead to cancer.*	• *Max's friends and family members would greatly benefit from Max's staying alive, in terms of social and family relationships.*
Economic	• *The test is expensive and puts a financial drain on whoever pays for it.*	• *Preventive surgery would probably cost less than cancer medications and treatments (which would probably include surgery).* • *Max would probably miss less school or work if he had the preventive surgery rather than cancer treatment later on.*

Who Should Decide Whether Max Gets Tested?

(Day 3, Activity 7)



Additionally, the teacher can pose other hypothetical scenarios for the class to consider, including these:

- Who should get to decide whether Max should have the genetic test if the genetic test were not 100-percent predictive of a future disease or condition? What if a positive result indicated only a 70-percent chance of thyroid cancer developing?
- Who should get to decide if the medication had very prolonged and negative side effects?
- Who should get to decide if the age of onset were in the patient's 50s, 60s, or 70s?
- Who should get to decide if no followup medical care were available for a positive test result?

Teachers should also make sure that students keep the core ethical question—Who should decide?—at the forefront of the discussion. This discussion is *not* about whether Max should have the test or whether it would be best for Max to have the test.

Who Should Have Access to the Results?

(Day 3, Activity 8)

Who Should Have Access to the Results? -

Make sure that students understand what Max's positive test result means for others in the family.

1. Does it mean that others in the family have also inherited the mutation? (No)
2. Would a negative test result from Max mean that others in the family are free of the mutation? (No)

Students overwhelmingly think it's obvious that Max's father **should** share the information. Students think that everyone should know because "they are part of the family."

Teacher reminds students that family members can only learn this information by getting themselves tested. Max's results will not tell them anything definitive about themselves.

Teacher asks whether the father could share information that Max has had a genetic test and that there has been concern of a particular inherited mutation in the family. Then, each affected family member could decide about getting genetically tested.

Students can compare the following phrasings: Which is preferable and why?

1. "Max has had a genetic test for an inherited mutation related to thyroid cancer. He asked me not to share his test results, but you can get yourself tested if you choose, and I can give you more information about the test itself."
2. "Max has had a genetic test for an inherited mutation related to thyroid cancer. Since his results may have a bearing on your own health, I can tell you the results if you want to know."
3. "Max has tested positive for a mutation related to thyroid cancer. This means you have a ____ percent chance of also having inherited the mutation.

Students overwhelmingly think it's obvious that Max's father **should not** share the information.

Teacher asks students to brainstorm scenarios in which a person has an obligation to share information with others. For example, these scenarios could include

1. diagnosis of a very contagious disease and
2. patient tells therapist that he or she intends to kill or hurt someone.

Teacher asks whether there is a difference between scenarios above vs. sharing results of Max's test. If so, what are the differences? If not, why are they similar?

Supplementary Information on Alzheimer's Disease and MEN II*

Disease Characteristics	Alzheimer's Disease	MEN II
Brief overview	Different types of Alzheimer's disease exist. This module focuses on the more typical kind of Alzheimer's disease, which arises past the age of 65. Early-onset Alzheimer's disease, on the other hand, can arise in a person's 30s. Alzheimer's disease affects memory, problem-solving ability, and even personality. Eventually, it is fatal.	This inherited disorder almost always leads to a type of thyroid cancer called medullary thyroid carcinoma. MEN II is defined by the overactivity of the thyroid, adrenal, and parathyroid glands. Tumors can appear in any of these glands, but they do not necessarily appear at the same time. If the cancer spreads, it may spread to places such as bones and the brain.
Prevalence (total number of current cases) in the United States	Over 5 million people.	Approximately 10,000 people.
Symptoms	Problems with memory, thinking, and concentration that extend beyond the normal aging process.	Severe headache, rapid heart rate, sweating, irritability, loss of weight, high blood pressure, and enlarged lymph nodes.
Brief description of mutation from biochemical perspective	The version of the *ApoE* gene (on chromosome 19) inherited from each parent plays a role in the development of the more typical (not early-onset) form of Alzheimer's. The gene comes in three versions: *E2*, *E3*, and *E4*. The *E4* version elevates a person's chance of getting Alzheimer's, whereas the *E2* version may actually lessen the chance. The *E3* version does not seem to affect a person's chance of getting Alzheimer's.	Mutation in a proto-oncogene named *RET* (on chromosome 10), which leads to unregulated cell growth.
Predictive ability of genetic test	Partial: positive test result means 13–57% lifetime chance of getting Alzheimer's.	Full: positive test result means nearly 100% chance of thyroid cancer.
Medical Response to a Positive Test Result	There is no medical action to prevent Alzheimer's disease. However, the disease does seem to have an association with diseased arteries and type 2 diabetes. Therefore, eating well and promoting good cardiovascular health may serve to lessen one's chance of getting Alzheimer's disease.	Preventive removal of the thyroid gland (often by age 10) and thyroid hormones then taken orally. This followup medical treatment eliminates the chance of thyroid cancer.
Age of Onset	Age 65 or later.	Teens, 20s, 30s.

*MEN II, multiple endocrine neoplasia type 2.

Supplementary Information on HNPCC*

"Microsatellite instability" (also known as MSI) is very often associated with HNPCC. Microsatellites are stretches of the genome with repetitive sequences such as "AAAAA" or "CGCGCGCG." These stretches are especially prone to developing errors, when a mismatch-repair gene is mutated. (However, 15 to 20 percent of sporadic, or noninherited, colon cancers also display MSI.) Because MSI is associated with 90 percent of colon cancers caused by HNPCC, the presence of MSI usually means the person has HNPCC.

Most commonly, the mutated gene is either *MLH1* or *MSH2*, both of which are part of chromosome 2. Both the MLH1 and MSH2 proteins are responsible for DNA repair. The mutations leading to HNPCC are autosomal dominant mutations and include insertions, nonsense mutations, and mutations at splicing sites. The normal MLH1 protein contains 746 amino acids, coded for by 19 exons. When the corresponding gene is mutated, an abnormal MLH1 protein is formed, and it is more difficult for the cell to properly correct DNA damage. However, on its own, this abnormal protein isn't enough to cause cancer; other mutations must also arise over the person's lifetime. Therefore, these other mutations are somatic. If these somatic mutations occur in a person's colon cells, for example, the person will get colon cancer. If these somatic mutations occur in a person's ovary, ovarian cancer would instead develop. Thus, each of these cancers (when associated with the *MLH1* or *MLH2* mutation) displays a polygenic inheritance pattern.

Cancer Risks in the General Population Compared with Individuals with HNPCC

Cancer	General Population Risk	HNPCC Risk	HNPCC Mean Age of Onset
Colon	5.5%	80%	44 years
Endometrium	2.7%	20–60%	46 years
Stomach	less than 1%	11–19%	56 years
Ovary	1.6%	9–12%	42.5 years
Urinary tract	less than 1%	4–5%	approximately 55 years
Brain, central nervous system	less than 1%	1–3%	approximately 50 years

Source: *http://www.genetests.org/*. Copyright University of Washington and Children's Health System, Seattle. Reprinted with permission.

* Hereditary nonpolyposis colorectal cancer.

Comparison of Alzheimer's Disease, MEN II, and HNPCC*

Disease Characteristics	Alzheimer's Disease	MEN II	HNPCC
Part of body (most) affected	Brain	Thyroid gland	Large intestine, colon
Examples of other parts of the body that could also be affected	—	Adrenal glands, parathyroid glands, bones, brain	Stomach, uterus, ovaries
Cancer?	No	Yes	Yes
Age of onset	65 or older	Teens, 20s, 30s	Mid 40s, on average; onset before age 20 is very rare.
Positive test result indicates what lifetime percentage chance of disease?	13–57%	Nearly 100%	80% by age 75
Medical followup available?	No medical intervention is known to lower one's chance of developing Alzheimer's disease. General wellness should be stressed, as it should be for any patient.	Yes, full removal of thyroid followed by daily medication. This eliminates any chance of thyroid cancer.	Yes, more regular colonoscopies (usually beginning at age 20 to 25) in hopes of early detection of any colon irregularities. Also, dietary changes and medication might be recommended. Surgery is also possible (to remove colon, ovaries, etc.), but frequent screenings are thought to offer the same medical benefit in terms of lifespan.
Mutation inheritable by future generations?	Yes	Yes	Yes
Mutation type	Autosomal, incomplete dominance	Autosomal, dominant	Autosomal, dominant

*MEN II, multiple endocrine neoplasia type 2; HNPCC, hereditary nonpolyposis colorectal cancer.

Evaluative Criteria for the Final Assessment

Who should decide?

Level of Achievement	General Characteristics of Response	Actual Student Response	Analysis of Response
Exemplary	Student provides **three reasons** and clearly understands how to **apply both the ethical considerations and the relevant scientific facts**; student elaborates and shows **original thinking**; student goes beyond class discussions.	*"Camilla should get to decide whether she gets tested because she has the greatest understanding of how the results will psychologically affect her, and she will have to deal most directly with the results of the test. Also, not taking the test now does not preclude her chances of taking the test in the future so she can wait until she feels emotionally prepared. The parent may exert influence over her decision, but because [Camilla] will have to make the medical decisions in the future, she should be able to make this decision now."* *"Camilla should be the one to decide whether she will take this test.... She could get regular colonoscopies [even if she didn't take] the test. This will help catch the cancer if she is predisposed, but keeps her from taking the test...."* (Note that this response could be exemplary or proficient, depending upon the nature of the class discussions. If this response essentially rephrases a class discussion, then it would be proficient. If, however, it extends reasonably far beyond class discussions, it would be exemplary.)	**Ethical Considerations** *minimizing harms and maximizing benefits* Delaying testing could simultaneously • pave the way for minimizing emotional harm and • maximize physical benefit. **Scientific Facts** • Regular colonoscopies are most critical in terms of diagnosis. • Colonoscopies can occur in absence of genetic tests.
Proficient	Student provides **three reasons** and clearly understands how to **apply both the ethical considerations and the relevant scientific facts**; although the explanation is organized and logical, it **repeats much of what was already discussed in class**.	See sample response above. If this response essentially rephrases a class discussion, it would be proficient.	**Same as analysis above**

Continued

Level of Achievement	General Characteristics of Response	Actual Student Response	Analysis of Response
Developing	Student provides **one or two reasons** or is **unable to fully apply both the ethical considerations and the relevant scientific facts.**	*"By getting her tested, [her mother] can give her a longer life by giving her better access to colonoscopies and medication. It has been proven that when colon cancer is detected in its early stages, … 90 percent of patients will live at least five years after diagnosis…."*	**Ethical Considerations** *minimizing harms and maximizing benefits* Attention to physical benefits but not to potential harms. (To fully examine this consideration, the student would need to weigh out more harms and benefits than just physical benefit.) **Scientific Facts** • Early detection predicts greater longevity.
Unacceptable	Student provides **one or two reasons** but is **unable to apply the ethical considerations and the relevant scientific facts.**	*"[Camilla's] family should decide… because they are responsible for [Camilla] and they want to make sure that [she is not going] to get the cancer."* Or *"It is important for Camilla to have the test so that her parents can test themselves and their other children."*	Student provides a reason (parental responsibility) but applies **no** ethical considerations and has the scientific facts wrong. (Student seems to think that the test results can prevent or cure the cancer.) Student doesn't understand that family members can get tested independently of Camilla and that her results—whether positive or negative—offer no definitive information.

If Camilla were to have the genetic test, who else (if anyone) should learn the results (other than Camilla, her doctor, and her mother)?

Level of Achievement	General Characteristics of Response	Actual Student Response*	Analysis of Response
Exemplary	Student provides **two reasons** and clearly understands how to **apply both the ethical considerations and the relevant scientific facts**; student elaborates, and shows **original thinking**; student goes beyond class discussions.	*"If Camilla were to take the test, she should not have to tell her family. It is her medical result, and she should be able to keep [it] confidential. Secondly, the other members of the family already knew they were at risk, because Felicia had colon cancer. The other family members could take the test as well. They could then tell the results to whichever family members they want. Not only would this solution allow Camilla to keep her confidentiality, but the results would also be much more helpful to the person taking the test than just knowing Camilla's results. Because it is her information, Camilla should control her course of action, and what is happening. "[Finally,] unlike something like HIV, the gene is not transmissible or except to her offspring…."* *"Camilla's mother should share information about the HNPCC test availability with the family while keeping Camilla's personal genetic testing results confidential. The testing does pave the way for significant medical intervention and benefit, so it would be a good idea to make sure that all family members know about the availability of the test. Each family member could then make up their own mind for testing. Camilla's results don't definitively predict other family members' results, anyway. Even if Camilla is negative, her sisters could still have the mutation."*	**Ethical Consideration** • *Confidentiality* • *Minimizing harms, maximizing benefits* **Scientific Facts** • Mendelian genetics and specific inheritance patterns apply to this situation. • Infectious and inherited diseases are significantly different. • The nature of the genetic test

Continued

*Note that this response could be exemplary or proficient, depending upon the nature of the class discussions. If it extends reasonably far beyond class discussions, it would be exemplary.

Level of Achievement	General Characteristics of Response	Actual Student Response	Analysis of Response
Proficient	Student provides **two reasons** and clearly understands how to **apply both the ethical considerations and the relevant scientific facts**; although the explanation is organized and logical, it **repeats much of what was already discussed in class**.	See sample response above. If this response essentially rephrases a class discussion, it would be proficient.	**Same as analysis above**
Developing	Student provides **one reason**, or is **unable to fully apply both the ethical considerations and the relevant scientific facts**.	*"The only other people that should learn the results of Camilla's genetic test are the ones [who themselves could have the mutation]. Both of Camilla's sisters, Erlinda and Ella, could have inherited the [mutation], meaning that they, too, are at risk of being diagnosed with or developing colon cancer in the future. As the mutation is autosomal and dominant, if it is present only once in either or both of her sisters, they will also have a [high chance of] colon cancer and will need to know this before making any decisions [regarding followup care]. Her paternal grandfather, Ronald, [could] also be affected [as he] could still feasibly develop colon cancer, even though he is past the average age of 44. Felicia should not learn the results because she specifically asked not to be informed."*	**Ethical Considerations** *confidentiality and physical benefit of followup medical care* **Scientific Facts** • Colon cancer typically arises in someone's mid 40s, and Mendelian genetics applies to this situation. • However, the student doesn't make it clear that Camilla's result won't give any definitive information regarding the sisters. (Student has successfully applied some of the scientific facts [age of colon cancer onset, for example], but doesn't make it clear that Camilla's result won't give any definitive information regarding the sisters.) To bring this response to the next level, the student could write something such as, *"Learning that a close relative has an inherited mutation is different from learning that an inherited form of colon cancer may run in the family. Therefore, it's important that the sisters learn of Camilla's test result, especially if she turns out to be positive. This will more likely encourage them to take the test themselves, and receive early followup care if necessary."*
Unacceptable	Student provides one reason with very little or no application of the ethical considerations and the relevant scientific facts.	*"Nobody [else] should get to see the result. If people are in constant fear that others will learn their medical information, they will be disinclined to ever get tested."*	**Ethical Consideration** *beginning of confidentiality* **Scientific Facts** none

Extension (Optional)

Should Employers Have Access to Genetic Test Results?

Estimated Time: 45 minutes

If you have another class period to devote to this work, you might want to explore this ethical question: Should employers be able to require and gain access to genetic testing results that could affect a person's ability to do his or her job? Master 4.11: About Retinitis Pigmentosa will guide you and your students through an exploration of a degenerative eye condition. This case focuses on the following question:

Should airline companies be able to screen prospective pilots for associated genetic mutations?

Procedure

1. **Give each student a copy of Master 4.11.**
2. **Read the scenario aloud and pose the following ethical question: Should an airline company be able to require perspective employees to have a genetic test for retinitis pigmentosa?**
3. **Remind students that the next step is to consider all relevant information. A great deal of information is available in Master 4.11.**
4. **Ask students, "Who or what will be affected by the decision?"**
5. **Ask students to identify the relevant ethical considerations.**
   Students will likely identify ethical considerations such as minimizing harms and maximizing benefits, fairness, and respect for persons.
6. **Now that students have identified the ethical considerations, help them elaborate on their initial ideas by asking questions such as these:**

   a. **What are the associated harms and benefits for airline companies that require retinitis pigmentosa genetic screening for perspective employees?**
      Students will likely bring up economic benefits as part of this discussion.

   b. **What are the associated harms and benefits for prospective employees who receive retinitis pigmentosa genetic screening from airline companies?**
      Students may bring up

      - economic harms if these employees are not hired as a result of a positive test,
      - emotional harms if the prospective employee must now explain to family and friends why he or she was not hired, and
      - economic or emotional benefit if the prospective pilot can now choose a different career that he or she can do for a longer period of time.

c. **How do the harms and benefits compare? Which outweighs the other? Why?**

d. **Should a company be able to require this kind of information from prospective employees? Why or why not?**

   Note: By bringing up coercion, you can connect this to the ethical consideration of respect for persons.

e. **If airlines refuse to hire someone with retinitis pigmentosa, is this unfair discrimination? Why or why not?**

   Note: This links back to the ethical consideration of fairness.

f. **Compare and contrast the current case with the following:**

   Should an airline company be able to require prospective employees to have a routine vision test (including peripheral vision)? If prospective employees do not pass this test, the company plans to not hire them. Additionally, the company will conduct annual vision tests of all employees. Failure to pass means that the person's contract will not be renewed.

   Note: In this case, the motivation is more about safety than economic benefit for the airline company.

g. **Should an airline company be able to require prospective employees to have a drug test for a substance such as marijuana? If the test comes back positive, the company plans not to hire or train the prospective pilot.**

Master 5.5 Answer Key

Willowbrook—Key Questions

(Fill out individually as homework.)

What is the **ethical question?**

Was the Willowbrook Study conducted ethically?

What are the **relevant facts?**

- *Willowbrook State School was designed to house and care for mentally disabled children.*
- *Hepatitis A is a relatively mild disease affecting the liver.*
- *Hepatitis usually spreads from person to person when someone puts something in his or her mouth that is contaminated with the feces of an infected person.*
- *Krugman thought that if a child was infected with hepatitis after he or she had been injected with protective antibodies, a mild case of hepatitis would result, and the child would have long-lasting protection against future, potentially more serious, infections. He wanted to find the best ways to protect children from hepatitis.*
- *First studies: children in the experimental group were injected with protective antibodies and those in the control group were not; the degree of immunity to hepatitis was then observed. These studies used children already at the institution.*
- *Later studies: newly admitted children were isolated from the rest of the children in the facility, put in a special care unit, and given the protective antibodies. The children in the experimental group were then deliberately infected with hepatitis virus (isolated from sick children). The children who had received protective antibodies but were not deliberately infected served as the controls.*
- *The researchers noted that many children would become infected during their stay at Willowbrook, anyway. Krugman initially believed almost all new patients would contract hepatitis within their first year at Willowbrook (more recent estimates put the risk at 30 to 50 percent).*
- *Children who got hepatitis from other children had worse symptoms than those who got it from the study.*
- *The researchers obtained consent from the parents of each child involved in the study. Early on, information was provided to parents orally and in writing. Later in the process, parents were given the opportunity to meet the research staff, tour the facility, discuss the program with the staff and other parents, and speak with parents' private physicians. Then, after several weeks, researchers asked for the parents' consent.*

Who or what could be affected by the way the question gets resolved?

- *Children in the facility (with hepatitis and without)*
- *Incoming children*
- *Parents*
- *Adults at Willowbrook, including caregivers*
- *Other individuals with hepatitis*
- *Researchers*
- *Medical and regulatory communities*

(Fill out with your partner.)

What are the **relevant ethical considerations?**

NOTE: Please see the case study and Master 5.4 for details and other possible answers.

Pro: The benefits outweighed the potential harms. Researchers did not expose the children to greater risks than those they would otherwise have been exposed to (there was no "excessive risk").

1. *The research provided valuable information about viral hepatitis and its treatment. It established that two types of hepatitis (A and B) occurred at Willowbrook and that injections of gamma globulin can have a protective effect against infection by hepatitis A virus.*
2. *In addition to this larger benefit to society, the research benefited the participants and everyone in the institution. The research reduced the amount of hepatitis among patients and employees by 80 to 85 percent because of better care. Many of the children who participated lived in a special facility where they were less likely to get sick from other diseases that were common at Willowbrook and their health could be monitored closely. Some children benefited from the vaccination as well as from the better health conditions in the special facility.*
3. *There was little additional risk of harm because there was so much hepatitis at Willowbrook—children were exposed to the same strain of hepatitis even if they were not in the study and had more serious symptoms if they got hepatitis naturally from other children. The researchers minimized risks by first observing the side effects of a low dose of virus.*

Con: Respect for persons and fairness were violated. The study provided an undue inducement because students were given a coveted spot in Willowbrook in a newer part of the facility if they participated in the research. Parents and their children were not truly informed about the risks of the study. Also, it could have been done on the adults in the facility instead of the children.

1. *Children in a mental health facility can't fully understand the risks of a study they are participating in.*
2. *The methods by which children were recruited are also questionable. Parents were unduly induced to give their consent. For example, when the main school was closed to new admissions in 1964 due to overcrowding, parents were told there were openings in the hepatitis unit for children who could participate in the study. The public outcry over this case was largely due to the impression that parents had little choice over whether or not to participate in the research. Parents who wanted care for their children may not have had any other options.*
3. *There is no compelling reason to study viral hepatitis in children before studying it in adults; none of the 1,000 adults working at Willowbrook was enlisted for the study. Why wasn't the research conducted on them first?*
4. *Hepatitis was present at high levels because of overcrowding and unsanitary conditions, which the healthcare professionals had a duty to improve. Instead, they took advantage of the situation to conduct an experiment.*

(Fill out individually.)

Conclusions from Group Discussion

Agreement (if any)—After listening to both sides, did most people in your group agree on any points? If so, list those points here:

Answers will vary; students should justify their positions with facts from the case and reasons that relate to the ethical considerations.

Disagreement (if any)—Is there strong disagreement on any points? If so, list them here:

Answers will vary; students should justify their position with facts from the case and with reasons that relate to the ethical considerations.

(Fill out individually.)

Your Own Views

After listening to all the arguments, what are your own views on the Willowbrook Study?

- **Respect for Persons**

  Was this study respectful of the individuals involved? Why or why not?

  Students should clearly demonstrate an understanding of the ethical consideration of respect for persons, as expressed through voluntary, informed consent. Students may also mention concern for vulnerable participants (institutionalized and mentally disabled children).

- **Harms and Benefits**

  Did the benefits outweigh the risks (potential harms)? Why or why not?

  Students should clearly demonstrate an understanding of the ethical consideration of harms and benefits, as expressed through the ideas of benefits to society and benefits and risks to participants.

Do you think that researchers conducted the study ethically? Does it meet the guidelines for research that your class identified? If so, how? If not, why not?

Students should justify their position by making specific reference to the guidelines for research the class identified.

Excerpt from the Nuremberg Code

The voluntary consent of the human subject is absolutely essential.

This means that the person involved should have legal capacity to give consent; should be so situated as to be able to exercise free power of choice, without the intervention of any element of force, fraud, deceit, duress, over-reaching, or other ulterior form of constraint or coercion; and should have sufficient knowledge and comprehension of the elements of the subject matter involved as to enable him to make an understanding and enlightened decision. This latter element requires that before the acceptance of an affirmative decision by the experimental subject there should be made known to him the nature, duration, and purpose of the experiment; the method and means by which it is to be conducted; all inconveniences and hazards reasonably to be expected; and the effects upon his health or person which may possibly come from his participation in the experiment.

The duty and responsibility for ascertaining the quality of the consent rests upon each individual who initiates, directs or engages in the experiment. It is a personal duty and responsibility which may not be delegated to another with impunity....

Source: *Trials of War Criminals before the Nuremberg Military Tribunals under Control Council Law No. 10*. Nuremberg, October 1946–April 1949. Washington, DC: U.S. Government Printing Office, 1949–1953.

The Belmont Report

Office of the Secretary

Ethical Principles and Guidelines for the Protection of Human Subjects of Research

The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research

April 18, 1979

AGENCY: Department of Health, Education, and Welfare.

ACTION: Notice of Report for Public Comment.

SUMMARY: On July 12, 1974, the National Research Act (Pub. L. 93-348) was signed into law, there-by creating the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. One of the charges to the Commission was to identify the basic ethical principles that should underlie the conduct of biomedical and behavioral research involving human subjects and to develop guidelines which should be followed to assure that such research is conducted in accordance with those principles. In carrying out the above, the Commission was directed to consider: **(i)** the boundaries between biomedical and behavioral research and the accepted and routine practice of medicine, **(ii)** the role of assessment of risk-benefit criteria in the determination of the appropriateness of research involving human subjects, **(iii)** appropriate guidelines for the selection of human subjects for participation in such research and **(iv)** the nature and definition of informed consent in various research settings.

The Belmont Report attempts to summarize the basic ethical principles identified by the Commission in the course of its deliberations. It is the outgrowth of an intensive four-day period of discussions that were held in February 1976 at the Smithsonian Institution's Belmont Conference Center supplemented by the monthly deliberations of the Commission that were held over a period of nearly four years. It is a statement of basic ethical principles and guidelines that should assist in resolving the ethical problems that surround the conduct of research with human subjects. By publishing the Report in the Federal Register, and providing reprints upon request, the Secretary intends that it may be made readily available to scientists, members of Institutional Review Boards, and Federal employees. The two-volume Appendix, containing the lengthy reports of experts and specialists who assisted the Commission in fulfilling this part of its charge, is available as DHEW Publication No. (OS) 78-0013 and No. (OS) 78-0014, for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Unlike most other reports of the Commission, the Belmont Report does not make specific recommendations for administrative action by the Secretary of Health, Education, and Welfare. Rather, the Commission recommended that the Belmont Report be adopted in its entirety, as a statement of the Department's policy. The Department requests public comment on this recommendation.

National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research

Members of the Commission

Kenneth John Ryan, MD, Chairman, Chief of Staff, Boston Hospital for Women.
Joseph V. Brady, PhD, Professor of Behavioral Biology, Johns Hopkins University.
Robert E. Cooke, MD, President, Medical College of Pennsylvania.
Dorothy I. Height, President, National Council of Negro Women, Inc.
Albert R. Jonsen, PhD, Associate Professor of Bioethics, University of California at San Francisco.
Patricia King, JD, Associate Professor of Law, Georgetown University Law Center.
Karen Lebacqz, PhD, Associate Professor of Christian Ethics, Pacific School of Religion.
*** *David W. Louisell, JD, Professor of Law, University of California at Berkeley.*
Donald W. Seldin, MD, Professor and Chairman, Department of Internal Medicine, University of Texas at Dallas.
*** *Eliot Stellar, PhD, Provost of the University and Professor of Physiological Psychology, University of Pennsylvania.*
*** *Robert H. Turtle, LLB, Attorney, VomBaur, Coburn, Simmons & Turtle, Washington, DC.*

*** Deceased.

Ethical Principles and Guidelines for Research Involving Human Subjects

Scientific research has produced substantial social benefits. It has also posed some troubling ethical questions. Public attention was drawn to these questions by reported abuses of human subjects in biomedical experiments, especially during the Second World War. During the Nuremberg War Crime Trials, the Nuremberg code was drafted as a set of standards for judging physicians and scientists who had conducted biomedical experiments on concentration camp prisoners. This code became the prototype of many later codes[1] intended to assure that research involving human subjects would be carried out in an ethical manner.

The codes consist of rules, some general, others specific, that guide the investigators or the reviewers of research in their work. Such rules often are inadequate to cover complex situations; at times they come into conflict, and they are frequently difficult to interpret or apply. Broader ethical principles will provide a basis on which specific rules may be formulated, criticized and interpreted.

Three principles, or general prescriptive judgments, that are relevant to research involving human subjects are identified in this statement. Other principles may also be relevant. These three are comprehensive, however, and are stated at a level of generalization that should assist scientists, subjects,

reviewers, and interested citizens to understand the ethical issues inherent in research involving human subjects. These principles cannot always be applied so as to resolve beyond dispute particular ethical problems. The objective is to provide an analytical framework that will guide the resolution of ethical problems arising from research involving human subjects.

This statement consists of a distinction between research and practice, a discussion of the three basic ethical principles, and remarks about the application of these principles.

A. Boundaries between Practice and Research

It is important to distinguish between biomedical and behavioral research, on the one hand, and the practice of accepted therapy on the other, in order to know what activities ought to undergo review for the protection of human subjects of research. The distinction between research and practice is blurred partly because both often occur together (as in research designed to evaluate a therapy) and partly because notable departures from standard practice are often called "experimental" when the terms "experimental" and "research" are not carefully defined.

For the most part, the term "practice" refers to interventions that are designed solely to enhance the well-being of an individual patient or client and that have a reasonable expectation of success. The purpose of medical or behavioral practice is to provide diagnosis, preventive treatment or therapy to particular individuals.[2] By contrast, the term "research" designates an activity designed to test an hypothesis, permit conclusions to be drawn, and thereby to develop or contribute to generalizable knowledge (expressed, for example, in theories, principles, and statements of relationships). Research is usually described in a formal protocol that sets forth an objective and a set of procedures designed to reach that objective.

When a clinician departs in a significant way from standard or accepted practice, the innovation does not, in and of itself, constitute research. The fact that a procedure is "experimental," in the sense of new, untested or different, does not automatically place it in the category of research. Radically new procedures of this description should, however, be made the object of formal research at an early stage in order to determine whether they are safe and effective. Thus, it is the responsibility of medical practice committees, for example, to insist that a major innovation be incorporated into a formal research project.[3]

Research and practice may be carried on together when research is designed to evaluate the safety and efficacy of a therapy. This need not cause any confusion regarding whether or not the activity requires review; the general rule is that if there is any element of research in an activity, that activity should undergo review for the protection of human subjects.

B. Basic Ethical Principles

The expression "basic ethical principles" refers to those general judgments that serve as a basic justification for the many particular ethical prescriptions and evaluations of human actions. Three basic principles, among those generally accepted in our cultural tradition, are particularly relevant to the ethics of research involving human subjects: the principles of respect of persons, beneficence and justice.

1. Respect for Persons. Respect for persons incorporates at least two ethical convictions: first, that individuals should be treated as autonomous agents, and second, that persons with diminished autonomy are entitled to protection. The principle of respect for persons thus divides into two separate moral requirements: the requirement to acknowledge autonomy and the requirement to protect those with diminished autonomy.

An autonomous person is an individual capable of deliberation about personal goals and of acting under the direction of such deliberation. To respect autonomy is to give weight to autonomous persons' considered opinions and choices while refraining from obstructing their actions unless they are clearly detrimental to others. To show lack of respect for an autonomous agent is to repudiate that person's considered judgments, to deny an individual the freedom to act on those considered judgments, or to withhold information necessary to make a considered judgment, when there are no compelling reasons to do so.

However, not every human being is capable of self-determination. The capacity for self-determination matures during an individual's life, and some individuals lose this capacity wholly or in part because of illness, mental disability, or circumstances that severely restrict liberty. Respect for the immature and the incapacitated may require protecting them as they mature or while they are incapacitated.

Some persons are in need of extensive protection, even to the point of excluding them from activities which may harm them; other persons require little protection beyond making sure they undertake activities freely and with awareness of possible adverse consequence. The extent of protection afforded should depend upon the risk of harm and the likelihood of benefit. The judgment that any individual lacks autonomy should be periodically reevaluated and will vary in different situations.

In most cases of research involving human subjects, respect for persons demands that subjects enter into the research voluntarily and with adequate information. In some situations, however, application of the principle is not obvious. The involvement of prisoners as subjects of research provides an instructive example. On the one hand, it would seem that the principle of respect for persons requires that prisoners not be deprived of the opportunity to volunteer for research. On the other hand, under

prison conditions they may be subtly coerced or unduly influenced to engage in research activities for which they would not otherwise volunteer. Respect for persons would then dictate that prisoners be protected. Whether to allow prisoners to "volunteer" or to "protect" them presents a dilemma. Respecting persons, in most hard cases, is often a matter of balancing competing claims urged by the principle of respect itself.

2. Beneficence. Persons are treated in an ethical manner not only by respecting their decisions and protecting them from harm, but also by making efforts to secure their well-being. Such treatment falls under the principle of beneficence. The term "beneficence" is often understood to cover acts of kindness or charity that go beyond strict obligation. In this document, beneficence is understood in a stronger sense, as an obligation. Two general rules have been formulated as complementary expressions of beneficent actions in this sense: **(1)** do not harm and **(2)** maximize possible benefits and minimize possible harms.

The Hippocratic maxim "do no harm" has long been a fundamental principle of medical ethics. Claude Bernard extended it to the realm of research, saying that one should not injure one person regardless of the benefits that might come to others. However, even avoiding harm requires learning what is harmful; and, in the process of obtaining this information, persons may be exposed to risk of harm. Further, the Hippocratic Oath requires physicians to benefit their patients "according to their best judgment." Learning what will in fact benefit may require exposing persons to risk. The problem posed by these imperatives is to decide when it is justifiable to seek certain benefits despite the risks involved, and when the benefits should be foregone because of the risks.

The obligations of beneficence affect both individual investigators and society at large, because they extend both to particular research projects and to the entire enterprise of research. In the case of particular projects, investigators and members of their institutions are obliged to give forethought to the maximization of benefits and the reduction of risk that might occur from the research investigation. In the case of scientific research in general, members of the larger society are obliged to recognize the longer term benefits and risks that may result from the improvement of knowledge and from the development of novel medical, psychotherapeutic, and social procedures.

The principle of beneficence often occupies a well-defined justifying role in many areas of research involving human subjects. An example is found in research involving children. Effective ways of treating childhood diseases and fostering healthy development are benefits that serve to justify research involving children—even when individual research subjects are not direct beneficiaries. Research also makes it possible to avoid the harm that may result from the application of previously accepted routine practices that on closer investigation turn out to be dangerous. But the role of the principle

of beneficence is not always so unambiguous. A difficult ethical problem remains, for example, about research that presents more than minimal risk without immediate prospect of direct benefit to the children involved. Some have argued that such research is inadmissible, while others have pointed out that this limit would rule out much research promising great benefit to children in the future. Here again, as with all hard cases, the different claims covered by the principle of beneficence may come into conflict and force difficult choices.

3. Justice. Who ought to receive the benefits of research and bear its burdens? This is a question of justice, in the sense of "fairness in distribution" or "what is deserved." An injustice occurs when some benefit to which a person is entitled is denied without good reason or when some burden is imposed unduly. Another way of conceiving the principle of justice is that equals ought to be treated equally. However, this statement requires explication. Who is equal and who is unequal? What considerations justify departure from equal distribution? Almost all commentators allow that distinctions based on experience, age, deprivation, competence, merit and position do sometimes constitute criteria justifying differential treatment for certain purposes. It is necessary, then, to explain in what respects people should be treated equally. There are several widely accepted formulations of just ways to distribute burdens and benefits. Each formulation mentions some relevant property on the basis of which burdens and benefits should be distributed. These formulations are **(1)** to each person an equal share, **(2)** to each person according to individual need, **(3)** to each person according to individual effort, **(4)** to each person according to societal contribution, and **(5)** to each person according to merit.

Questions of justice have long been associated with social practices such as punishment, taxation and political representation. Until recently these questions have not generally been associated with scientific research. However, they are foreshadowed even in the earliest reflections on the ethics of research involving human subjects. For example, during the 19th and early 20th centuries the burdens of serving as research subjects fell largely upon poor ward patients, while the benefits of improved medical care flowed primarily to private patients. Subsequently, the exploitation of unwilling prisoners as research subjects in Nazi concentration camps was condemned as a particularly flagrant injustice. In this country, in the 1940s, the Tuskegee syphilis study used disadvantaged, rural black men to study the untreated course of a disease that is by no means confined to that population. These subjects were deprived of demonstrably effective treatment in order not to interrupt the project, long after such treatment became generally available.

Against this historical background, it can be seen how conceptions of justice are relevant to research involving human subjects. For example, the selection of research subjects needs to be scrutinized in order to determine whether some people—such as welfare patients, particular racial and ethnic minorities, or people confined to institutions—are being systematically selected simply because of their

easy availability, their compromised position, or their manipulability, rather than for reasons directly related to the problem being studied. Finally, whenever research supported by public funds leads to the development of therapeutic devices and procedures, justice demands both that these not provide advantages only to those who can afford them and that such research should not unduly involve persons from groups unlikely to be among the beneficiaries of subsequent applications of the research.

C. Applications

Applications of the general principles to the conduct of research leads to consideration of the following requirements: informed consent, risk and benefit assessment, and the selection of subjects of research.

1. Informed Consent. Respect for persons requires that subjects, to the degree that they are capable, be given the opportunity to choose what shall or shall not happen to them. This opportunity is provided when adequate standards for informed consent are satisfied.

While the importance of informed consent is unquestioned, controversy prevails over the nature and possibility of an informed consent. Nonetheless, there is widespread agreement that the consent process can be analyzed as containing three elements: information, comprehension and voluntariness.

Information. Most codes of research establish specific items for disclosure intended to assure that subjects are given sufficient information. These items generally include: the research procedure, their purposes, risks and anticipated benefits, alternative procedures (where therapy is involved), and a statement offering the subject the opportunity to ask questions and to withdraw at any time from the research. Additional items have been proposed, including how subjects are selected, the person responsible for the research, etc.

However, a simple listing of items does not answer the question of what the standard should be for judging how much and what sort of information should be provided. One standard frequently invoked in medical practice, namely the information commonly provided by practitioners in the field or in the locale, is inadequate since research takes place precisely when a common understanding does not exist. Another standard, currently popular in malpractice law, requires the practitioner to reveal the information that reasonable persons would wish to know in order to make a decision regarding their care. This, too, seems insufficient since the research subject, being in essence a volunteer, may wish to know considerably more about risks gratuitously undertaken than do patients who deliver themselves into the hand of a clinician for needed care. It may be that a standard of "the reasonable volunteer" should be proposed: the extent and nature of information should be such that persons, knowing that the procedure is neither necessary for their care nor perhaps fully understood, can decide whether they wish to participate in the furthering of knowledge. Even when some direct benefit to them is anticipated, the subjects should understand clearly the range of risk and the voluntary nature of participation.

A special problem of consent arises where informing subjects of some pertinent aspect of the research is likely to impair the validity of the research. In many cases, it is sufficient to indicate to subjects that they are being invited to participate in research of which some features will not be revealed until the research is concluded. In all cases of research involving incomplete disclosure, such research is justified only if it is clear that **(1)** incomplete disclosure is truly necessary to accomplish the goals of the research, **(2)** there are no undisclosed risks to subjects that are more than minimal, and **(3)** there is an adequate plan for debriefing subjects, when appropriate, and for dissemination of research results to them. Information about risks should never be withheld for the purpose of eliciting the cooperation of subjects, and truthful answers should always be given to direct questions about the research. Care should be taken to distinguish cases in which disclosure would destroy or invalidate the research from cases in which disclosure would simply inconvenience the investigator.

Comprehension. The manner and context in which information is conveyed is as important as the information itself. For example, presenting information in a disorganized and rapid fashion, allowing too little time for consideration or curtailing opportunities for questioning, all may adversely affect a subject's ability to make an informed choice.

Because the subject's ability to understand is a function of intelligence, rationality, maturity and language, it is necessary to adapt the presentation of the information to the subject's capacities. Investigators are responsible for ascertaining that the subject has comprehended the information. While there is always an obligation to ascertain that the information about risk to subjects is complete and adequately comprehended, when the risks are more serious, that obligation increases. On occasion, it may be suitable to give some oral or written tests of comprehension.

Special provision may need to be made when comprehension is severely limited—for example, by conditions of immaturity or mental disability. Each class of subjects that one might consider as incompetent—such as infants and young children, mentally disabled patients, the terminally ill, and the comatose—should be considered on its own terms. Even for these persons, however, respect requires giving them the opportunity to choose to the extent they are able, whether or not to participate in research. The objections of these subjects to involvement should be honored, unless the research entails providing them a therapy unavailable elsewhere. Respect for persons also requires seeking the permission of other parties in order to protect the subjects from harm. Such persons are thus respected both by acknowledging their own wishes and by the use of third parties to protect them from harm.

The third parties chosen should be those who are most likely to understand the incompetent subject's situation and to act in that person's best interest. The person authorized to act on behalf of the subject should be given an opportunity to observe the research as it proceeds in order to be able to withdraw the subject from the research, if such action appears in the subject's best interest.

Voluntariness. An agreement to participate in research constitutes a valid consent only if voluntarily given. This element of informed consent requires conditions free of coercion and undue influence. Coercion occurs when an overt threat of harm is intentionally presented by one person to another in order to obtain compliance. Undue influence, by contrast, occurs through an offer of an excessive, unwarranted, inappropriate or improper reward or other overture in order to obtain compliance. Also, inducements that would ordinarily be acceptable may become undue influences if the subject is especially vulnerable.

Unjustifiable pressures usually occur when persons in positions of authority or commanding influence—especially where possible sanctions are involved—urge a course of action for a subject. A continuum of such influencing factors exists, however, and it is impossible to state precisely where justifiable persuasion ends and undue influence begins. But undue influence would include actions such as manipulating a person's choice through the controlling influence of a close relative and threatening to withdraw health services to which an individual would otherwise be entitle.

2. Assessment of Risks and Benefits. The assessment of risks and benefits requires a careful arrayal of relevant data, including, in some cases, alternative ways of obtaining the benefits sought in the research. Thus, the assessment presents both an opportunity and a responsibility to gather systematic and comprehensive information about proposed research. For the investigator, it is a means to examine whether the proposed research is properly designed. For a review committee, it is a method for determining whether the risks that will be presented to subjects are justified. For prospective subjects, the assessment will assist the determination whether or not to participate.

The Nature and Scope of Risks and Benefits. The requirement that research be justified on the basis of a favorable risk and benefit assessment bears a close relation to the principle of beneficence, just as the moral requirement that informed consent be obtained is derived primarily from the principle of respect for persons. The term "risk" refers to a possibility that harm may occur. However, when expressions such as "small risk" or "high risk" are used, they usually refer (often ambiguously) both to the chance (probability) of experiencing a harm and the severity (magnitude) of the envisioned harm.

The term "benefit" is used in the research context to refer to something of positive value related to health or welfare. Unlike "risk," "benefit" is not a term that expresses probabilities. Risk is properly contrasted to probability of benefits, and benefits are properly contrasted with harms rather than risks

of harm. Accordingly, so-called risk and benefit assessments are concerned with the probabilities and magnitudes of possible harm and anticipated benefits. Many kinds of possible harms and benefits need to be taken into account. There are, for example, risks of psychological harm, physical harm, legal harm, social harm and economic harm and the corresponding benefits. While the most likely types of harms to research subjects are those of psychological or physical pain or injury, other possible kinds should not be overlooked.

Risks and benefits of research may affect the individual subjects, the families of the individual subjects, and society at large (or special groups of subjects in society). Previous codes and Federal regulations have required that risks to subjects be outweighed by the sum of both the anticipated benefit to the subject, if any, and the anticipated benefit to society in the form of knowledge to be gained from the research. In balancing these different elements, the risks and benefits affecting the immediate research subject will normally carry special weight. On the other hand, interests other than those of the subject may on some occasions be sufficient by themselves to justify the risks involved in the research, so long as the subjects' rights have been protected. Beneficence thus requires that we protect against risk of harm to subjects and also that we be concerned about the loss of the substantial benefits that might be gained from research.

The Systematic Assessment of Risks and Benefits. It is commonly said that benefits and risks must be "balanced" and shown to be "in a favorable ratio." The metaphorical character of these terms draws attention to the difficulty of making precise judgments. Only on rare occasions will quantitative techniques be available for the scrutiny of research protocols. However, the idea of systematic, nonarbitrary analysis of risks and benefits should be emulated insofar as possible. This ideal requires those making decisions about the justifiability of research to be thorough in the accumulation and assessment of information about all aspects of the research, and to consider alternatives systematically. This procedure renders the assessment of research more rigorous and precise, while making communication between review board members and investigators less subject to misinterpretation, misinformation and conflicting judgments. Thus, there should first be a determination of the validity of the presuppositions of the research; then the nature, probability and magnitude of risk should be distinguished with as much clarity as possible. The method of ascertaining risks should be explicit, especially where there is no alternative to the use of such vague categories as small or slight risk. It should also be determined whether an investigator's estimates of the probability of harm or benefits are reasonable, as judged by known facts or other available studies.

Finally, assessment of the justifiability of research should reflect at least the following considerations: **(i)** Brutal or inhumane treatment of human subjects is never morally justified. **(ii)** Risks should be reduced to those necessary to achieve the research objective. It should be determined whether it is in

fact necessary to use human subjects at all. Risk can perhaps never be entirely eliminated, but it can often be reduced by careful attention to alternative procedures. **(iii)** When research involves significant risk of serious impairment, review committees should be extraordinarily insistent on the justification of the risk (looking usually to the likelihood of benefit to the subject—or, in some rare cases, to the manifest voluntariness of the participation). **(iv)** When vulnerable populations are involved in research, the appropriateness of involving them should itself be demonstrated. A number of variables go into such judgments, including the nature and degree of risk, the condition of the particular population involved, and the nature and level of the anticipated benefits. **(v)** Relevant risks and benefits must be thoroughly arrayed in documents and procedures used in the informed consent process.

3. Selection of Subjects. Just as the principle of respect for persons finds expression in the requirements for consent, and the principle of beneficence in risk and benefit assessment, the principle of justice gives rise to moral requirements that there be fair procedures and outcomes in the selection of research subjects.

Justice is relevant to the selection of subjects of research at two levels: the social and the individual. Individual justice in the selection of subjects would require that researchers exhibit fairness: thus, they should not offer potentially beneficial research only to some patients who are in their favor or select only "undesirable" persons for risky research. Social justice requires that distinction be drawn between classes of subjects that ought, and ought not, to participate in any particular kind of research, based on the ability of members of that class to bear burdens and on the appropriateness of placing further burdens on already burdened persons. Thus, it can be considered a matter of social justice that there is an order of preference in the selection of classes of subjects—adults before children, for example—and that some classes of potential subjects, such as the institutionalized mentally infirm or prisoners, may be involved as research subjects, if at all, only on certain conditions.

Injustice may appear in the selection of subjects, even if individual subjects are selected fairly by investigators and treated fairly in the course of research. Thus injustice arises from social, racial, sexual and cultural biases institutionalized in society. Thus, even if individual researchers are treating their research subjects fairly, and even if IRBs are taking care to assure that subjects are selected fairly within a particular institution, unjust social patterns may nevertheless appear in the overall distribution of the burdens and benefits of research. Although individual institutions or investigators may not be able to resolve a problem that is pervasive in their social setting, they can consider distributive justice in selecting research subjects.

Some populations, especially institutionalized ones, are already burdened in many ways by their infirmities and environments. When research is proposed that involves risks and does not include a

therapeutic component, other less burdened classes of persons should be called upon first to accept these risks of research, except where the research is directly related to the specific conditions of the class involved. Also, even though public funds for research may often flow in the same directions as public funds for health care, it seems unfair that populations dependent on public health care constitute a pool of preferred research subjects if more advantaged populations are likely to be the recipients of the benefits.

One special instance of injustice results from the involvement of vulnerable subjects. Certain groups, such as racial minorities, the economically disadvantaged, the very sick, and the institutionalized may continually be sought as research subjects, owing to their ready availability in settings where research is conducted. Given their dependent status and their frequently compromised capacity for free consent, they should be protected against the danger of being involved in research solely for administrative convenience, or because they are easy to manipulate as a result of their illness or socioeconomic condition.

[1] Since 1945, various codes for the proper and responsible conduct of human experimentation in medical research have been adopted by different organizations. The best known of these codes are the Nuremberg Code of 1947, the Helsinki Declaration of 1964 (revised in 1975), and the 1971 Guidelines (codified into Federal Regulations in 1974) issued by the U.S. Department of Health, Education, and Welfare Codes for the conduct of social and behavioral research have also been adopted, the best known being that of the American Psychological Association, published in 1973.

[2] Although practice usually involves interventions designed solely to enhance the well-being of a particular individual, interventions are sometimes applied to one individual for the enhancement of the well-being of another—for example, blood donation, skin grafts, organ transplants. Or, an intervention may have the dual purpose of enhancing the well-being of a particular individual, and, at the same time, providing some benefit to others. Vaccination is one example of a dual purpose intervention because it protects both the person who receives the vaccine and society generally. The fact that some forms of practice have elements other than immediate benefit to the individual receiving an intervention, however, should not confuse the general distinction between research and practice. Even when a procedure applied in practice may benefit some other person, it remains an intervention designed to enhance the well-being of a particular individual or groups of individuals; thus, it is practice and need not be reviewed as research.

[3] Because the problems related to social experimentation may differ substantially from those of biomedical and behavioral research, the Commission specifically declines to make any policy determination regarding such research at this time. Rather, the Commission believes that the problem ought to be addressed by one of its successor bodies.

Source: *http://www.hhs.gov/ohrp/humansubjects/guidance/belmont.htm*.

World Medical Association Declaration of Helsinki
Ethical Principles for Medical Research Involving Human Subjects

Adopted by the 18th WMA General Assembly, Helsinki, Finland, June 1964, and amended by the:
29th WMA General Assembly, Tokyo, Japan, October 1975
35th WMA General Assembly, Venice, Italy, October 1983
41st WMA General Assembly, Hong Kong, September 1989
48th WMA General Assembly, Somerset West, Republic of South Africa, October 1996
52nd WMA General Assembly, Edinburgh, Scotland, October 2000
53th WMA General Assembly, Washington 2002 (Note of Clarification on paragraph 29 added)
55th WMA General Assembly, Tokyo 2004 (Note of Clarification on Paragraph 30 added)
59th WMA General Assembly, Seoul, October 2008

A. INTRODUCTION

1. The World Medical Association (WMA) has developed the Declaration of Helsinki as a statement of ethical principles for medical research involving human subjects, including research on identifiable human material and data.

   The Declaration is intended to be read as a whole and each of its constituent paragraphs should not be applied without consideration of all other relevant paragraphs.

2. Although the Declaration is addressed primarily to physicians, the WMA encourages other participants in medical research involving human subjects to adopt these principles.

3. It is the duty of the physician to promote and safeguard the health of patients, including those who are involved in medical research. The physician's knowledge and conscience are dedicated to the fulfilment of this duty.

4. The Declaration of Geneva of the WMA binds the physician with the words, "The health of my patient will be my first consideration," and the International Code of Medical Ethics declares that, "A physician shall act in the patient's best interest when providing medical care."

5. Medical progress is based on research that ultimately must include studies involving human subjects. Populations that are underrepresented in medical research should be provided appropriate access to participation in research.

6. In medical research involving human subjects, the well-being of the individual research subject must take precedence over all other interests.

7. The primary purpose of medical research involving human subjects is to understand the causes, development and effects of diseases and improve preventive, diagnostic and therapeutic interventions (methods, procedures and treatments). Even the best current interventions must be evaluated continually through research for their safety, effectiveness, efficiency, accessibility and quality.

8. In medical practice and in medical research, most interventions involve risks and burdens.

9. Medical research is subject to ethical standards that promote respect for all human subjects and protect their health and rights. Some research populations are particularly vulnerable and need

special protection. These include those who cannot give or refuse consent for themselves and those who may be vulnerable to coercion or undue influence.

10. Physicians should consider the ethical, legal and regulatory norms and standards for research involving human subjects in their own countries as well as applicable international norms and standards. No national or international ethical, legal or regulatory requirement should reduce or eliminate any of the protections for research subjects set forth in this Declaration.

B. BASIC PRINCIPLES FOR ALL MEDICAL RESEARCH

11. It is the duty of physicians who participate in medical research to protect the life, health, dignity, integrity, right to self-determination, privacy, and confidentiality of personal information of research subjects.
12. Medical research involving human subjects must conform to generally accepted scientific principles, be based on a thorough knowledge of the scientific literature, other relevant sources of information, and adequate laboratory and, as appropriate, animal experimentation. The welfare of animals used for research must be respected.
13. Appropriate caution must be exercised in the conduct of medical research that may harm the environment.
14. The design and performance of each research study involving human subjects must be clearly described in a research protocol. The protocol should contain a statement of the ethical considerations involved and should indicate how the principles in this Declaration have been addressed. The protocol should include information regarding funding, sponsors, institutional affiliations, other potential conflicts of interest, incentives for subjects and provisions for treating and/or compensating subjects who are harmed as a consequence of participation in the research study. The protocol should describe arrangements for post-study access by study subjects to interventions identified as beneficial in the study or access to other appropriate care or benefits.
15. The research protocol must be submitted for consideration, comment, guidance and approval to a research ethics committee before the study begins. This committee must be independent of the researcher, the sponsor and any other undue influence. It must take into consideration the laws and regulations of the country or countries in which the research is to be performed as well as applicable international norms and standards but these must not be allowed to reduce or eliminate any of the protections for research subjects set forth in this Declaration. The committee must have the right to monitor ongoing studies. The researcher must provide monitoring information to the committee, especially information about any serious adverse events. No change to the protocol may be made without consideration and approval by the committee.

16. Medical research involving human subjects must be conducted only by individuals with the appropriate scientific training and qualifications. Research on patients or healthy volunteers requires the supervision of a competent and appropriately qualified physician or other health care professional. The responsibility for the protection of research subjects must always rest with the physician or other health care professional and never the research subjects, even though they have given consent.
17. Medical research involving a disadvantaged or vulnerable population or community is only justified if the research is responsive to the health needs and priorities of this population or community and if there is a reasonable likelihood that this population or community stands to benefit from the results of the research.
18. Every medical research study involving human subjects must be preceded by careful assessment of predictable risks and burdens to the individuals and communities involved in the research in comparison with foreseeable benefits to them and to other individuals or communities affected by the condition under investigation.
19. Every clinical trial must be registered in a publicly accessible database before recruitment of the first subject.
20. Physicians may not participate in a research study involving human subjects unless they are confident that the risks involved have been adequately assessed and can be satisfactorily managed. Physicians must immediately stop a study when the risks are found to outweigh the potential benefits or when there is conclusive proof of positive and beneficial results.
21. Medical research involving human subjects may only be conducted if the importance of the objective outweighs the inherent risks and burdens to the research subjects.
22. Participation by competent individuals as subjects in medical research must be voluntary. Although it may be appropriate to consult family members or community leaders, no competent individual may be enrolled in a research study unless he or she freely agrees.
23. Every precaution must be taken to protect the privacy of research subjects and the confidentiality of their personal information and to minimize the impact of the study on their physical, mental and social integrity.
24. In medical research involving competent human subjects, each potential subject must be adequately informed of the aims, methods, sources of funding, any possible conflicts of interest, institutional affiliations of the researcher, the anticipated benefits and potential risks of the study and the discomfort it may entail, and any other relevant aspects of the study. The potential subject must be informed of the right to refuse to participate in the study or to withdraw consent to participate at any time without reprisal. Special attention should be given to the specific information needs of individual potential subjects as well as to the methods

used to deliver the information. After ensuring that the potential subject has understood the information, the physician or another appropriately qualified individual must then seek the potential subject's freely-given informed consent, preferably in writing. If the consent cannot be expressed in writing, the non-written consent must be formally documented and witnessed.

25. For medical research using identifiable human material or data, physicians must normally seek consent for the collection, analysis, storage and/or reuse. There may be situations where consent would be impossible or impractical to obtain for such research or would pose a threat to the validity of the research. In such situations the research may be done only after consideration and approval of a research ethics committee.
26. When seeking informed consent for participation in a research study the physician should be particularly cautious if the potential subject is in a dependent relationship with the physician or may consent under duress. In such situations the informed consent should be sought by an appropriately qualified individual who is completely independent of this relationship.
27. For a potential research subject who is incompetent, the physician must seek informed consent from the legally authorized representative. These individuals must not be included in a research study that has no likelihood of benefit for them unless it is intended to promote the health of the population represented by the potential subject, the research cannot instead be performed with competent persons, and the research entails only minimal risk and minimal burden.
28. When a potential research subject who is deemed incompetent is able to give assent to decisions about participation in research, the physician must seek that assent in addition to the consent of the legally authorized representative. The potential subject's dissent should be respected.
29. Research involving subjects who are physically or mentally incapable of giving consent, for example, unconscious patients, may be done only if the physical or mental condition that prevents giving informed consent is a necessary characteristic of the research population. In such circumstances the physician should seek informed consent from the legally authorized representative. If no such representative is available and if the research cannot be delayed, the study may proceed without informed consent provided that the specific reasons for involving subjects with a condition that renders them unable to give informed consent have been stated in the research protocol and the study has been approved by a research ethics committee. Consent to remain in the research should be obtained as soon as possible from the subject or a legally authorized representative.
30. Authors, editors and publishers all have ethical obligations with regard to the publication of the results of research. Authors have a duty to make publicly available the results of their research on human subjects and are accountable for the completeness and accuracy of their reports. They should adhere to accepted guidelines for ethical reporting. Negative and inconclusive as well as positive results should be published or otherwise made publicly

available. Sources of funding, institutional affiliations and conflicts of interest should be declared in the publication. Reports of research not in accordance with the principles of this Declaration should not be accepted for publication.

C. ADDITIONAL PRINCIPLES FOR MEDICAL RESEARCH COMBINED WITH MEDICAL CARE

31. The physician may combine medical research with medical care only to the extent that the research is justified by its potential preventive, diagnostic or therapeutic value and if the physician has good reason to believe that participation in the research study will not adversely affect the health of the patients who serve as research subjects.
32. The benefits, risks, burdens and effectiveness of a new intervention must be tested against those of the best current proven intervention, except in the following circumstances:
    - The use of placebo, or no treatment, is acceptable in studies where no current proven intervention exists; or
    - Where for compelling and scientifically sound methodological reasons the use of placebo is necessary to determine the efficacy or safety of an intervention and the patients who receive placebo or no treatment will not be subject to any risk of serious or irreversible harm. Extreme care must be taken to avoid abuse of this option.
33. At the conclusion of the study, patients entered into the study are entitled to be informed about the outcome of the study and to share any benefits that result from it, for example, access to interventions identified as beneficial in the study or to other appropriate care or benefits.
34. The physician must fully inform the patient which aspects of the care are related to the research. The refusal of a patient to participate in a study or the patient's decision to withdraw from the study must never interfere with the patient-physician relationship.
35. In the treatment of a patient, where proven interventions do not exist or have been ineffective, the physician, after seeking expert advice, with informed consent from the patient or a legally authorized representative, may use an unproven intervention if in the physician's judgment it offers hope of saving life, re-establishing health or alleviating suffering. Where possible, this intervention should be made the object of research, designed to evaluate its safety and efficacy. In all cases, new information should be recorded and, where appropriate, made publicly available.

20.10.2008

Source: *http://www.wma.net/e/policy/b3.htm.*

Sample List of Modifications

In Activity 1, students are asked to generate a list of modifications to the natural world. Here is a range of examples you can use to help students generate ideas. Although modifications to plants and the environment are not the focus of this module, you might also want to mention them.

Viruses

Some viruses are being used as vectors to get medicines and genetic material into organisms.

Bacteria

Some species of bacterium thrive in harsh conditions and can be used to clean up low-level radioactive waste. Scientists are also trying to genetically engineer bacteria to decontaminate more deadly radioactive waste.

Escherichia coli has been genetically modified to react to a special light source so that researchers can create photographs with superior images.

Bacteria and Fungi

Some food-producing enzymes can be extracted from genetically modified bacteria and fungi and used in food processing but are not found in the final food product. Examples include enzymes that

- convert starch to simple sugars,
- clot milk protein to make cheese,
- improve fruit juice clarity, and
- improve bread dough structure.

Animals

For centuries, animals have been cross-bred to produce traits that humans desire (swimming, hunting, and guarding, for example). Recently, scientists have been using genetic modification to produce desirable traits. Examples include

- sheep that produce human blood clotting factor in their milk—to be taken and purified for human use for people with clotting disorders and to use in surgeries, and
- goats that produce spider-web silk in their milk—to use in manufacturing where an exceptionally strong fiber is needed.

Plants

For centuries, plants have been cross-bred to produce desirable traits for farmers and hobbyists (height, color, and fruit, for example). Since the 1920s, scientists have been looking for ways to modify the genetic structure of plants, and since the 1980s, it has been possible to genetically engineer plant DNA. Examples include

- engineering plants to be draught, pest, and herbicide resistant;
- turning on genes in rice so that the rice grains produce beta-carotene to help populations with vitamin A deficiency (this kind of rice has been nicknamed golden rice); and
- growing human vaccines in banana plants.

Environment

Deliberate modifications of the environment include activities such as mining, logging, drilling, and cloud seeding—where humans insert particles (dropped by planes or shot by cannons) into clouds to try to make it rain.

Changes to ecology have occurred through the introduction of nonnatural species. For example, cane toads were introduced in Australia to eat cane beetles. Today, the toads have reproduced uncontrollably and altered the ecosystem because they eat any animal small enough to fit in their mouths, including native Australian frogs.

Creating Transgenic Organisms

An organism can acquire a new trait by having a new gene introduced into its DNA. By changing the genetic makeup (*genotype*) of the organism, the characteristics it displays—or its *phenotype*—can also be altered. Under appropriate conditions, the new gene can be inserted into the DNA of a cell; this gene will be transcribed and translated into protein along with all the other genes being expressed in the cell.

How does a multicellular organism such as an animal, which has many, many cells, acquire a new trait encoded by a gene from a different organism? Several different methods have been developed. The first step in all of them involves insolating the gene of interest and then linking it to another piece of DNA that contains sequences that enable the gene to be expressed in the appropriate tissues of the recipient organism. This constructed segment of DNA is then inserted into the animals using one of the techniques described below.

Microinjection

In this method, eggs are isolated from animals and fertilized in vitro, and then the constructed DNA containing the foreign gene is injected—using a very fine needle—into the nucleus of the egg. The foreign DNA is inserted at random locations into the DNA of the fertilized egg. The egg is then implanted into the oviduct of a surrogate animal, where the egg then develops. This method has been used to create many different kinds of transgenic animals, from mice to large animals such as cattle. However, its efficiency in producing transgenic animals is low; only a small percentage of the implanted eggs develop into transgenic animals, and only a small proportion of these animals express the inserted gene efficiently because of the random insertion into the organism's genome.

Retroviral Vectors

The gene of interest is inserted into the genome of a retrovirus and then this virus is used to infect embryonic cells, which then develop into organisms carrying the gene of interest. However, like microinjection, this method is very inefficient. The gene is inserted randomly into different sites in the DNA of different embryonic cells. Not only might the DNA be expressed at low levels or not at all, as in microinjection, but it may be expressed only in certain cells.

Embryonic Stem Cell Transfer

This method allows for the insertion of the genes of interest into very specific sites in the genome of the recipient organism. Embryonic stem cells are isolated from the recipient organism and grown in tissue culture flasks. These cells are then modified by inserting DNA containing the gene of interest and sequences that enable the DNA to be inserted into specific sites in the genome. These modified embryonic stem cells are then injected into the blastocyst stage of a developing recipient organism, and this blastocyst containing the gene of interest is implanted into a surrogate mother. The resulting organisms express the gene more efficiently. This method has only been used to develop transgenic mice.

Source: European Initiative for Biotechnology Education. 1998. Transgenic animals—unit 11. Retrieved August 18, 2008, from *http://www.ipn.uni-kiel.de/eibe/UNIT11EN.PDF.*