



scinema

STUDY GUIDE

Program Three: Technology & Development

Mankind has always been in a struggle to improve itself. Over the last century especially, we have developed at an incredible rate, with new inventions making our lives better than ever before. While technology (which the dictionary defines as 'The scientific method and material used to achieve a commercial or industrial objective') has made our lives better, there is a downside to its application as well. The five films in this program are about both the positives and negatives of technology and development.

What are some of the ways technology has improved our lives? Is technology and development that make some people's lives worse, or is it the misuse of technology and development? In what ways can the misuse of technology affect people in a negative way? How might technology be better used so this does not happen? What are the common themes that link the films in this program together?

Ocularist

by Vance Malone

Open your eyes to the fascinating world of an ocular prosthetician. This award-winning documentary brilliantly displays how art and science are intertwined in the creation of acrylic eyes. Beyond the works of art he creates, what is most beautiful is the confidence he re-instills in people who have suffered eye trauma.



What is an ocularist?

An ocularist is a carefully trained technician skilled in the arts of fitting, shaping, and painting ocular prostheses. In addition to creating it, the ocularist shows the patient how to handle and care for the prosthesis, and provides long-term care through periodic examinations.

The history of artificial eyes

Artificial eye-making has been practiced since ancient times. The first ocular prostheses were made by Roman and Egyptian priests as early as the fifth century B.C. In those days, artificial eyes were made of painted clay attached to cloth and worn outside the socket. It took many centuries for the first in-socket artificial eyes to be developed. At first, these were made of gold with coloured enamel. Then, in the later part of the sixteenth century, the Venetians started making artificial eyes out of glass. These early glass eyes were crude, uncomfortable to wear, and very fragile. Even so, the Venetians continued making them and kept their methods secret until the end of the eighteenth century. After that, the center for artificial eye-making shifted to Paris for a time; but by the mid-nineteenth century, German glass-blowers had developed superior techniques, and the center for glass eye-making moved to Germany. Shortly thereafter, glass eye-making was introduced in the United States. During World War II, the imported German glass used for glass prostheses became unavailable in this country. As a result of this shortage, the U.S. Government, in conjunction with a number of American firms, popularized the techniques for making artificial eyes out of acrylic plastic.

The popularity of this method has continued to increase over the years, and today the vast majority of patients wear ocular prostheses made of acrylic. The difference between "stock" and "custom" eyes "Stock" or "ready-made" ocular prostheses are mass-produced. Since a "stock eye" is not made for any particular person, it doesn't fit any particular patient. A "custom" ocular prosthesis, on the other hand, is made by your ocularist to fit you and you alone.

How does a person learn to become an ocularist?

There are no schools that teach ocularistry. A person must learn how to make artificial eyes through an apprenticeship with an approved ocularist (a Board Approved Diplomate Ocularist). The ASO Apprentice Program requires that the apprentice must study all aspects of ocular prosthetics, and spend five years (10,000 hours) in practical training. The apprentice must also successfully complete 750 credits of related study courses offered by the Education Program of the ASO. Upon successful completion of all requirements, the title, Diplomate of the American Society of Ocularists, is awarded.

Some reviews

"Very tastefully done, and the doc is a rare breed, a saint. I liked the way the maker of this film added touches like the film blinking, like one's eye. Worth a watch!"

"Breath-taking... a completely different look on a relatively narrow field of medicinal-artistry. The camera effects were wonderfully done and played into the theme of sight. Bravo to the filmmakers for the presentation of the subject, and to the Ocularist for a completely personalized mirage."

"A surprisingly powerful film about a subject that could easily have been portrayed in a grisly manner. The scene where the ocularist wipes away a tear formed by excess liquid used to make an impression of the eye socket was truly symbolic."

Activities

Words to spell and learn

- Perception
- Peripheral
- Inferior
- Iris
- Pupil
- Socket
- Impression

Answer these questions

- What is an ocularist?**
- Where did Fredric Harwin (ocularist) first get his artistic inspiration from?**
- How many steps are involved in making an eye?**
- What are some of the materials the ocularist uses to make an artificial eye?**

Further Reading and Resources

- <http://www.ocularist.org/>
- <http://www.losteye.com/ocularst.htm>
- <http://www.ocularists.org/medicare.htm>
- <http://www.neboboard.org/>
- <http://www.ocularist.com/>

ExperiMentals: Propulsion

Bernie Hobbs and Ruben Meerman are the experiMENTALS! For these two dedicated scientists, no experiment is too big, too crazy or too inexpensive, to show you! The experiMENTALS tackle everything from outer space to dating tricks and the kitchen sink performing simple experiments with bits of paper and glue, balloons, glasses, eggs, and anything else they can find... exploding, demystifying and explaining everyday science along the way. In this episode, watch Bernie & Ruben go up, up & away - but not before proving that hot air definitely rises!

Soft drinks are full of dissolved carbon dioxide gas. The gas has been forced in there under pressure, and as soon as you open the lid on the drink you can see the gas bubbling out of the liquid and hear it escaping from the bottle.

Bubbles can't just form on their own - they always need a place to start growing. That starting place can be a speck of dust, a bit of uneven surface, or even a lolly. Whatever it is, the starting place is called a centre of nucleation.

Adding all those lollies to the soft drink means there are hundreds more centres of nucleation than normal, so the gas comes out as bubbles much more quickly - and the rest is rocket history. To make a rocket, the Experimentals use their old friends baking soda and vinegar, which are at their gas-making best here!

When baking soda and vinegar mix, they make carbon dioxide. Gases like carbon dioxide can be squashed down into really small spaces, but that builds a lot of pressure. When enough carbon dioxide gas is made in the canister, the pressure gets high enough to blow the lid off. That's mini-extreeme!

Activities

Words to spell and learn

Carbon dioxide	React
Chemical reaction	Pressure
Rocket	blow
Baking soda	

Answer these questions

What causes the bubbles in the glass of lemonade?

What two ingredients are at their gas making best when combined?

What is the starting place for a bubble?

After adding all those lollies to the soft drink, there are hundreds more centres of nucleation than normal. What does this mean?

Individual/Group Projects

Extreme Fountain

What you need:

- . a packet of lollies
- . a plastic bottle of softdrink (not orange flavoured - we don't know why, but orange doesn't always work)
- . some paper
- . a friend who'll lend a hand

What to do:

- roll up the paper into a cylinder that's just wide enough for the lollies to slide through
- put one finger over the bottom of the roll, and get a friend to help you put all the mints into the paper roll
- get your friend to loosen the lid on the soft drink bottle, then hold the roll of lollies just above the bottle and remove your finger so all the lollies drop straight in

. *stand back!!!*

Further Reading and Resources

- <http://www.abc.net.au/science/experimentals/default.htm>
- <http://www.abc.net.au/spark/default.htm>
- <http://www.abc.net.au/science/surfingscientist/default.htm>
- <http://www.abc.net.au/science/default.htm>
- <http://www.abc.net.au/science/experimentals/freaky/default.htm>

Cities of Smog

by Jacob Gottschau

During the last 100 years, the world has experienced an enormous growth, unequalled in the entire history of mankind. Production has increased more than 13 times, and this enormous step is linked to our capacity of exploiting the fossil fuels - coal and oil. In early industrialization, smoky chimneys, swinging cranes and burning melting furnace were potent symbols of power, optimism and money. But progress had its price. During the 20th century, millions of people die of lung cancer, heart- and respiratory diseases - only because of the air pollution in the big cities all over the world.



Smog - What is it?

The term "smog" was first coined more than three decades ago to describe a mixture of smoke and fog in the air. The term was invented in England during the 1950s to name the haze caused by a combination of smoke and fog. Today, smog in large cities consists of pollutants from car exhaust and other sources, chemically reacting in sunlight. The brown tint of smog is due to the presence of nitrogen dioxide.

History of Air Pollution

Air pollution, particularly in cities, is certainly not a new problem. Back in the Middle Ages the use of coal in cities such as London was beginning to escalate. The problems of poor urban air quality even as early as the end of the 16th century are well documented.

In the UK the Industrial Revolution during the 18th and 19th centuries was based on the use of coal. Industries were often located in towns and cities, and together with the burning of coal in homes for domestic heat, urban air pollution levels often reached very high levels. During foggy conditions, pollution levels escalated and urban smogs (smoke and fog) were formed. These often brought cities to a halt, disrupting traffic but more dangerously causing death rates to dramatically rise. The effects of this pollution on buildings and vegetation also became obvious. The 1875 Public Health Act contained a smoke abatement section to try and reduce smoke pollution in urban areas.

During the first part of the 20th century, tighter industrial controls lead to a reduction in smog pollution in urban areas. The 1926 Smoke Abatement Act was aimed at reducing smoke emissions from industrial sources, but despite the declining importance of coal as a domestic fuel, pollution from domestic sources remained significant.

The Great London Smog of 1952

London's 1952 smog resulted in around 4,000 extra deaths in the city, and led to the introduction of the Clean Air Acts of 1956 and 1968. These introduced smokeless zones in urban areas, with a tall chimney policy to help disperse industrial air pollutants away from built up areas into the atmosphere. The smog was caused by a mass of cold, heavy air settling over the city. Trains and factories belched out clouds of smoke, while homes were heated by cheap coal with a high sulphur content. (Good coal was sold abroad to pay off Britain's war debts.) City dwellers could see only a few yards ahead. Buses and cars were abandoned, trains ground to a halt and hospitals saw thousands with chest ailments. In 1956, the Clean Air Act was passed. 'The effect was dramatic,' said Tony Fletcher, organiser of a conference on 'The Big Smoke: 50 Years after the 1952 London Smog', at the London School of Hygiene and Tropical Medicine on 9 December. 'There has been a hundredfold reduction in atmospheric particulate levels.'

Following the Clean Air Acts, air quality improvements continued throughout the 1970s. Further regulations were introduced through the 1974 Control of Air Pollution Act. This included regulations for the composition of motor fuel and limits for the sulphur content of industrial fuel oil. However, during the 1980s the number of motor vehicles in urban areas steadily increased and air quality problems associated with motor vehicles became more prevalent. In the early 1980s, the main interest was the effects of lead pollution on human health, but by the late 1980s and early 1990s, the effects of other motor vehicle pollutants became a major concern. The 1990s have seen the occurrence of wintertime and summertime smogs. These are not caused by smoke and sulphur dioxide pollution but by chemical reactions occurring between motor vehicle pollutants and sunlight.

These are known as 'photochemical smogs'.

In 1995, the Government passed its Environment Act, requiring the publication of a National Air Quality Strategy to set standards for the regulation of the most common air pollutants. Published in 1997, the National Air Quality Strategy has set commitments for local authorities to achieve new air quality objectives throughout the UK by 2005. It is reviewed periodically.

Smog in Australia

During Melbourne summers, the main type of smog is photochemical. Hydrocarbons and oxides from car and factory emissions react together in warm sunshine to form the gas ozone. Summer smog is measured by the amount of ozone in the air. During Melbourne winters, the main causes of smog include wood heaters, open fires, and car and factory emissions. Winter smog is measured by the reduction in visibility, which indicates the amount of airborne particles. Prolonged exposure to smog affects the lungs and reduces lung functioning. There is some evidence to suggest that smog may even trigger asthma in people with no previous history of the disorder.

What is smog made up of?

Smog contains numerous small particles, which can be inhaled. It may contain many different chemicals and particles, including: Nitrogen oxides, Volatile organic compounds, Hydrocarbons, Ozone, Nitrogen dioxide, Road dust, Topsoil, Pollens, Wood smoke.

Smog can cause or contribute to a range of health problems, including:

Red and irritated eyes, Inflammation of the lung's airways, Increased risk of asthma attacks, Increased risk of hay fever attacks, Temporary drop in lung function, Unproven but suspected increased risk of chronic bronchitis, Unproven but suspected increased risk of emphysema.

Suggestions for improving air quality include the following.

- Have your car regularly maintained to reduce exhaust emissions.
- Don't drive your car when you can walk or catch public transport.
- Car pool with friends or neighbours.
- If you have a wood burner, gather your untreated wood in summer and leave it to dry for at least eight months before using it.
- Maintain your wood heater and use it correctly.
- Switch to other forms of heating.
- Don't use incinerators or burn rubbish in the open air.
- Don't burn fallen autumn leaves.

Researchers believe bad air still causes more than 24,000 deaths a year in Britain and double that if deaths from cancers triggered by air particles are included.

Studies by the US Cancer Society on American air pollution levels suggest that in Britain, with similar pollution problems, up to 400,000 people could be killed every year by the air they breathe.

Robert Maynard of the Department of Health said: 'Air pollution is not a problem of the past, though the fact that levels of pollutants - low in comparison to levels recorded in the 1950s - continue to damage health has come as an unwelcome surprise to many. In particular, it is now clear that inhabiting a relatively polluted city for a prolonged period leads to a shortening of life expectancy.'

A report by the National Society for Clean Air, to be published next month, makes grim reading. 'Claims that vehicle emissions have been reduced a hundredfold through regulation over the past decades are at best selective and misleading,' state Malcolm Fergusson and Ian Skinner of the Institute for European Environmental Policy in the report. They point to work in Sweden showing that catalytic converters - expected to lead to significant reductions in pollutant levels - are also increasing ammonia emissions from cars.

Activities

Words to spell and learn

Fossil fuel
Industry
Pollution
Smog
Loophole
Smoke
Economy

Answer these questions

What is smog? What illnesses can exposure to smog cause? In what year did 4000 people die in London from smog related deaths? How many days did the smog in London last?

Discussion Questions

In 1923, German workers went on strike for six months, and the smog improved. Farmers reported that their fruit trees and improved due to the cleaner air. Why do you think this is so?

Individual/Group Projects

Vitamin D deficiency, as well as rickets and osteomalacia, tends to occur in persons who do not get enough sunlight and who fail to eat foods that are rich in vitamin D. Do a web search and find out:

- What is vitamin D and why is it a vital part of our diet?
- What are the causes of vitamin D deficiency?
- What are the symptoms of vitamin D deficiency?
- What is rickets?

Further Reading and Resources

<http://www.epa.vic.gov.au/Air/Issues/smogalerts.asp>
<http://www.smogcity.com/welcome.htm>
http://news.bbc.co.uk/2/hi/uk_news/england/2545759.stm
<http://www.chclibrary.org/micromed/00070460.html>

Corollary

by Ian Gouldstone

1. A proposition that follows with little or no proof required from one already proven.
 2. A deduction or an inference.
 3. A natural consequence or effect; a result.
- A short film centered on the atrophy of a theoretical math education.



Activities

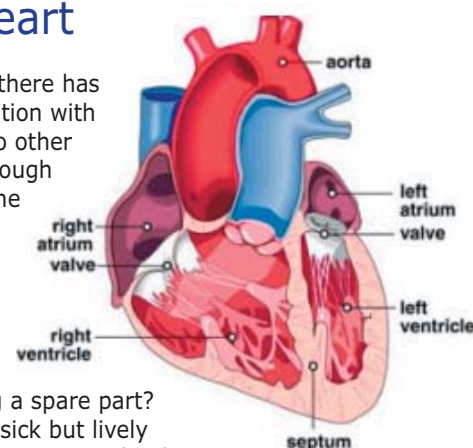
Individual/Group Projects

If you remember that corollaries usually state more complicated theorems in a language simpler to use and apply, think about some of the complicated theories behind the things and actions that occur around us in everyday life. For example - gravity, which is "the natural force of attraction exerted by a celestial body, such as Earth, upon objects at or near its surface, tending to draw them toward the center of the body." One very simple explanation of the gravity we feel here on earth is the phrase 'What goes up, must come down.'

Is this phrase a corollary? Research some of the more famous scientific theories, and try to put them in the simplest language you can to explain them.

Change of Heart

Since the dawn of time there has been a universal fascination with the human heart that no other organ has inspired. Although modern western medicine tells us it's just a pump, the belief that the heart is something far greater persists. But are people who have a heart transplant just receiving a spare part? Ask Elka, a desperately sick but lively young 17 year old girl, waiting restlessly



in St Vincent's Hospital. Or John and Anna Gava who are traveling up to Brisbane to meet the recipient of their deceased son's heart. What really happens when a human heart gives life to a body other than the one it was created in?

The Human Heart

Day and night, the muscles of your heart contract and relax to pump blood throughout your body. The heart is actually located almost in the center of the chest, between the lungs. It's tipped slightly so that a part of it sticks out and taps against the left side of the chest, which is what makes it seem as though it is located there. Your heart beats about 100,000 times in one day and about 35 million times in a year. During an average lifetime, the human heart will beat more than 2.5 billion times.

Heart transplantation

Heart transplantation has dramatically changed since Dr. Christiaan Barnard performed the world's first heart transplant on December 3, 1967 in Cape Town, South Africa. Anti-rejection drugs and other advances during the 1980s have made heart transplantation an effective therapy for carefully selected patients with advanced heart disease.

How does the heart work?

The heart is a hollow organ with tough, muscular walls located under the breast bone (sternum). The heart is about the size of a fist and contracts rhythmically to pump blood to the lungs and to the rest of the body. The heart is divided into two sides by a vertical wall (septum). Each side of the heart again divides into upper and lower chambers. Valves inside these chambers prevent blood from flowing backwards. The heart receives deoxygenated blood from all parts of the body, and pumps this blood to the lungs. Here, the lungs supply the blood with oxygen. After receiving this oxygen-rich blood, the heart pumps it back to the body through the aorta (the largest blood vessel leaving the left side of the heart). Because the heart is a muscle doing continuous work, it needs its own oxygen-rich blood supply. This blood is supplied by the coronary arteries which branch off from the aorta.

Who needs a heart transplant?

Patients who need heart transplants have one common characteristic – they are suffering from heart failure as a result of advanced heart disease. For these patients, transplantation is the only hope for survival as medical therapy or conventional heart surgery is no longer helpful. Without a heart transplant, survival will be limited to one or two years. Transplantation is performed for many heart conditions, but the two most common heart diseases leading to transplantation are coronary artery disease (narrowing or hardening of the coronary arteries) and cardiomyopathy (weakening of the heart muscle). Other disorders, such as heart valve diseases, congenital defects, and viral infections, can also weaken the heart and may lead to transplantation.

Activities

Words to spell and learn

Transplant	Oxygen
Rejection	Artery
Sternum	Aorta
Organ	

Discussion Questions

What are some of the emotions we associate with the heart? Why do we draw a heart when we want to show that we love somebody or something? What are some of the common phrases or clichés that use the word heart? Why is the word heart used in these instances?

If some cultures believe a person's soul is carried in their heart, what do you think happens when a person receives a transplanted heart?

Further Reading and Resources

<http://www.pbs.org/wgbh/nova/heart/>
<http://www.americanheart.org/presenter.jhtml?identifier=10000056>
<http://www.acc.org/media/patient/index.htm>
<http://www.nhlbi.nih.gov/>

Evil Dust – the History of Asbestos

by Jacob Gottschau

Asbestos: What is it?

Asbestos (Greek a-, "not"; sbestos, "extinguishable") is a group of fibrous metamorphic minerals. The name is derived for its historical use in lamp wicks; the resistance of asbestos to fire has long been exploited for a variety of purposes. It was used in fabrics such as Egyptian burial cloths and Charlemagne's tablecloth, which, according to legend, he threw in a fire to clean. When asbestos is used for its resistance to fire or heat, the fibers are typically mixed with cement or woven into fabric or mats. It was used in brake shoes and gaskets for its heat resistance, on electric oven and hotplate wiring for its electrical insulation at elevated temperature, and in buildings for its flame-retardant and insulating properties, its tensile strength, flexibility, and resistance to chemicals.

However, the inhalation of asbestos fibers is now known to cause various illnesses, including cancer, and thus most uses of asbestos are banned in many countries. Fiberglass has been found to be a suitable substitute for thermal insulation and woven ceramic fiber performs as well or better as an insulator of high-temperature electrical conductors.

Asbestos-related diseases

The fine asbestos fibres are easily inhaled, and can cause a number of respiratory complaints, including a potentially serious lung fibrosis called asbestosis. Exposure to asbestos has also been determined to cause a very serious form of cancer, mesothelioma, that occurs in the chest and abdominal cavities. This aggressive disease is not properly referred to as a lung cancer, as the malignant cells are derived from the mesothelium, a tissue found on the inner walls of the chest and abdominal cavities and on the outer surface of the lungs rather than in the lung itself.

Activities

Words to spell and learn

Resistance	Fibre
Insulation	Flexibility
Inhale	

Individual/Group Projects

Before electricity was discovered, people used things like whale oil to light their homes. Now people are using renewable energy resources to power their homes, like solar power, or wind power. This is an example of mankind improving upon itself, using technology and development to make life simple, and also to limit the affect we have on the environment and the world around us.

Think about the applications we have used asbestos for - what are they? Now that asbestos is found to be harmful, what products do we use instead of asbestos?

What are some of the things you use in your everyday life - cars, refrigerators, books, televisions, cutlery - anything - and now imagine it is 200 years in the future. How might the thing you thought of be different? What ways might technology have made this thing better?

Further Reading and Resources

<http://asbestos.blogspot.com/>
<http://www.epa.gov/asbestos/index.html>
<http://www.asbestosnews.com/html/schools.html>
<http://www.hse.gov.uk/asbestos/>
<http://www.aisolutions.co.uk/community/hse-awareness-campaign/>
http://www.tuc.org.uk/h_and_s/index.cfm?mins=262
http://www.mccord-museum.qc.ca/en/keys/webtours/VQ_P3_11_EN
<http://en.wikipedia.org/wiki/Asbestos>

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