

Breeding a sustainable future

Learning Experience 3

Review with the teacher the following resources:

<http://www.factmonster.com/ipka/A0932440.html>

Science discoveries can come from surprising places and collaboration from people from all different walks of life. It has been through collaboration that many of the innovations in science have been developed:

- Discovery of radium by Marie Curie
- Newtons Law of Gravitation
- Evangelista Purkinje – discovered fingerprints in 1823
- Michael Faraday – discovered electricity in 1821 and 10 years later created the first generator
- Post-it – researching a strong adhesive

Expanding on different science discoveries:

Probably the most important “accidental” discovery was penicillin. It was discovered in 1928 when Sir Alexander Fleming, a Scottish biologist who was studying the bacterium *staphylococcus*, left his petri dishes stacked on a bench while he went on holiday. When he returned, he noticed that a mould in a discarded petri dish (which he identified as *Penicillium notatum*) was growing in such a way that it dissolved all the bacteria around it. Fleming didn’t even hold out much hope for his discovery: it wasn’t given much attention when he published his findings the following year, it was difficult to cultivate, and it was slow-acting – it wasn’t until 1945 after further research by several other scientists that penicillin was able to be produced on an industrial scale, changing the way doctors treated bacterial infections forever. Penicillin antibiotics are historically significant because they are the first drugs that were effective against many previously serious diseases such as syphilis and Staphylococcus infections.

In 1839, Charles Goodyear was looking for a way to fix the current flaws of rubber, which solidified and cracked in winter, and melted in the summer heat. But Goodyear discovered vulcanised rubber quite by accident when he happened to spill a mixture of rubber, sulfur and lead on a hot stove. The mixture charred and hardened, but the rubber was still malleable enough to be usable. He patented his vulcanization process in 1844, long before the age of automobiles. Years later, in 1898, the men who started the Goodyear Tyre & Rubber Company named it after the man who made their business possible.

The concept behind the thermal ink-jet printer was discovered by accident in 1977 when an engineer at Canon in Tokyo, Ichiro Endo, rested a hot soldering iron on a syringe, which held ink, causing the syringe to eject the ink. This concept eventually became the mechanism behind the first BubbleJet printer.

Have you heard of Friedrich Miescher? Miescher first identified and isolated DNA (called nuclein) in 1869. It was nearly 100 years later in 1953 that Watson and Crick first discovered the double helix structure of DNA.

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1. In discussion with your teacher write some dot points that summaries the science knowledge developed through collaboration across disciplines from the information above

e.g. *a scientist looking at the biology of a plant/bacteria, and discovering a medical breakthrough. Science disciplines: Biology and Medicine.*

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Mix and Match

Problem	Industry	Solution	What sciences are involved with these solutions?
Need to produce more crop with less water	Commercial and recreational fishing sectors	Using precision irrigation systems that automatically and continuously re-adjust the irrigation application decision based on the environment	Engineer (Agricultural, multidisciplinary) Plant pathology
Not enough people to work on farm during harvest - a time when the demand for labour is at one of the peaks	Cotton	No till or low till farming involving planting directly into the stubble of the previous crop, machinery with thin wheels, reducing the number of vehicles required to pick a crop from three (picker, boll buggy and tractor) to one.	Engineering <ul style="list-style-type: none"> - mechanical - environmental - agricultural - robotic - software Microbiology Soil biology Soil Physics
Lack of effective monitoring means loss of catch, income and recreation and jeopardises sustainability.	Pork	Breed with sows which have a high milk production (and high quality milk)	Biology Chemistry Biotechnology Reproduction
Increase the wean weight of piglets	Cotton	The Genetag Hook is a fishing hook designed to remove tissue samples from the mouth of a fish, without harming the fish. This biopsy tissue sample becomes a DNA tagging system for fish research. This information is vital for managing fish stocks	Biology Genetics Microbiology Pathology

Mix and Match

Challenge	Industry	Solution	What sciences are involved with these solutions?
High water loss (<40%) through evaporation in water storages	Pork	GPS mapping of catch zones for abalone for future management	Technology/GIS Biology Management/Policy
Depletion of wild stocks in their natural environment	Fisheries	Precision Agriculture using GPS in tractors to accurately plant rows of wheat to ensure no overlap or gaps	Digital Technology GIS mapping
Errors in planting crop	Aquaculture	A 10-year selective breeding program, using genetic markers to identify family lines. Natural mating is now a cost-effective alternative (boosting pond yields by >50%) to rearing each breeding family in separate tanks. Viral screening technology is assisting the industry to develop breeds that are highly tolerant to endemic diseases.	Biology Genetics Microbiology Pathology
Need to produce high muscled pigs with minimum fat (consumer demand)	Cotton	Development of an ultra-thin film (monolayer) evaporation mitigation system	Chemical Engineering
Reliance of Australian prawn farming on spawning of wild caught prawns	Grain	Development of genetic lean varieties	Biology Chemistry Biotechnology Reproduction

Mix and Match

Problem	Industry	Solution	What sciences are involved with these solutions?
Depletion of wood stocks to use in construction and paper products.	Pork	Pasture management using aerial surveillance	Biology Technology GIS
Pest and diseases in crops and the need for vaccines.	Dairy	Genetic modification has helped to create pigs that can digest phosphorous better, which decreases the pig's phosphorous output. The result is that manure, which is often made from pig waste, is less destructive to the environment due to its lower phosphorous content.	Biology Gene technology Chemistry
Not enough feed for herd	Crops	Demand for wood can be met by trees that grow faster than average. Genetic engineering has produced trees that can ward off biological attacks, grow more quickly and strongly, and create better wood than trees that are not genetically modified.	Botany Biology Gene technology
Pig waste has harsh environmental impacts	Forestry	The banana vaccine - Bananas were developed through genetic modification that offer vaccine against diseases such as cholera and hepatitis. Just like with a needle vaccine, people who eat them develop disease-combating antibodies that make them immune to a disease.	Gene tech Biology Plant pathology

Mix and Match

Challenge	Industry	Solution	What sciences are involved with these solutions?
Depletion of wild stocks in their natural environment	Forestry	Better housing conditions to increase litter sizes and survivorship	Animal behaviour Physics Engineering
Difficulties in decision making when to harvest	Fisheries	Development of genetic varieties suitable in drier conditions	Biology Chemistry Gene technology
Piglets being squashed by mother pig and decreasing litter sizes	Cotton	GPS mapping of catch zones for abalone for future management	Technology/GIS Biology Management/Policy
High demand crop requiring water	Grain	Precision Agriculture using GPS in tractors to accurately plant rows of wheat to ensure no overlap or gaps	Technology GIS mapping
Over or under planting fields with seeds	Pork	Lidar and GIS mapping of biomass for harvesting	Geography GIS Technology Biology/Botany