Notes on The Singularity

Future Man

Take note of the years between inventions/discoveries

The Revolution Begins – The invention of the battery was crucial to the future development of computers as was Faraday's discovery of electro magnetism.

Charles Babbage was considered the father of the computer. He was encouraged to work on his inventions by Ada Lovelace who corresponded with him and developed an algorithm for the Analytical Engine to calculate a sequence of Bernoulli numbers. Ada Lovelace is considered the first computer programmer.

Morse code developed by Samuel Morse was obviously important where data communication is concerned.

The Revolution Continues

Edison's Light Bulb first step needed to Fleming inventing the Thermionic Valve

Heinrich Hertz confirmed James Clarke Maxwell's equations on Electromagnetic Waves by proving they existed through experiment.

The Age of the Computer

Discuss Moore's Law

What about Biological & Medical Advances

Galen was a major influence on various biological and medical disciplines though he believed in Humorism – black bile, yellow bile, blood and phlegm in balance in healthy person was still studied up to the industrial revolution.

The invention of the Microscope was a major innovation and especially after Leeuwenhaok refined it

The Origin of the species by Charles Darwin was considered the foundation of evolutionary biology and went right up against the current theology. It was only in the 1930's that his ideas became fully accepted by the scientific community.

Biology & Medicine into the 21st Century

Gregor Mendel born in Brno in Czech Republic and taught at the University of Vienna radical but amazingly boring experiments with peas with different lengths of stem etc. Father of Genetics showed how family trait were carried across generations. Previously, traits were believed to be recorded by the passage of blood (or some other fluid) through the body and transferred to ovum via sperm. But major flaws existed with this theory. But even though Mendel provided an understanding of the hereditary process no one knew what a Gene looked like.

Watson, Crick, Wilson and Franklin defined structure of DNA's double helix. The **nitrogen bases** form the double-strand of **DNA** through weak hydrogen **bonds**. The **nitrogen bases**, however, have specific shapes and hydrogen **bond** properties so that guanine and cytosine only **bond with each other**, while adenine and thymine also **bond** exclusively.

The Human Genome Project published draft on 26th June, 2000 and was a close competition between Craig Venter and Celera Genomics and a consortium of Universities. Initially it was thought there were 150,000 genes in the human Genome however subsequent research has only uncovered 21,000 about the same number as a worm.

The Height of Progress

Graph showing the almost exponential growth of technology since the Industrial Revolution. The nearer the major dates are the steeper the graph.

Back to the Future

What did you think the world would be like in the year 2000 from way back in the 60's?

1961 – Supercar
1962 – The Jetsons – treadmill, mobile phone, Internet, moving walkways, fashion visualization computer.
Space Patrol – nothing particular innovative apart from the Galaxsphere being very un-aerodynamic and being propelled by reactionless drive.
Fireball XL5 – 2 stage space ship launched from track, used wings to fly and had a Robbie the robot, also Jet packs and flying scooters.
1963 – Dr Who – brought time travel to the public's attention.
1964 – Thunderbirds, Stingray
1966 – Star Trek was a major source of inspiration to many youngsters who then grew up to become scientists, engineers and entrepreneurs like Elon Musk of Tesla and Space-X.
1968 – Joe 90 – Innovative glasses think Google Glass with mind link which allows for skill transfer.

A Modern Take

1968 – 2001 a Space Odyssey – Main innovative idea, HAL 9000 AI with bad programming causing havoc. Also tablet computers.
1982 – Blade Runner – Dangerous asteroid mining was being carried out by intelligent genetically Engineered synthetic Human slaves who began to revolt.
1985 – Terminator – again AI, but this time in the form of a computer program gone viral over Internet eventually gaining consciousness and taking over the world and using robots/cyborgs to do fighting
1999 – The Matrix – AI using humans for energy find they need to keep humans happy in a virtual world for optimum results.

So, what is the Singularity?

When we discuss the Singularity and AI we are talking about General AI not the specialised AI used for driverless cars, robot assistants, weather forecasting, playing chess etc.

The **singularity**[1] is the hypothesis that the invention of artificial superintelligence will abruptly trigger runaway technological growth, resulting in unfathomable changes to human civilization.[2] According to this hypothesis, an upgradable intelligent agent (such as a computer running software-based artificial general intelligence) would enter a 'runaway reaction' of self-improvement cycles, with each new and more intelligent generation appearing more and more rapidly, causing an intelligence explosion and resulting in a powerful superintelligence that would, qualitatively, far surpass all human intelligence. John von Neumann first uses the term "singularity" (c. 1950s[3]), in the context of technological progress causing accelerating change: "The accelerating progress of

technology and changes in the mode of human life, give the appearance of approaching some essential singularity in the history of the race beyond which human affairs, as we know them, cannot continue".[1]

Most recent exponent – Ray Kurzweil, American author, inventor and futurist, and some interesting quotes.

The 5th Epoch

Basically –

Epoch 1, is all about atoms and simple molecules forming and Physics and Chemistry ruling early existence

Epoch 2, is where Biology begins and DNA is the basis of life

Epoch 3, Biology develops intelligence, the brain and neural pathways

Epoch 4, intelligent life creates technology, computers and software

Epoch 5, intelligent life merges with the intelligent technology it created

Epoch 6, combined intelligence reaches out and spreads throughout the universe

Convergence

I have tried to list some (not all) of the technologies I see as being instrumental in the coming of the Singularity. Here are some of the more important ones –

Artificial Limbs – The most obvious technologies affecting some of us are artificial limbs for people who have lost or non-functional arms, legs, hands etc. The development in this field is especially of interest in modern day warfare where enhanced limb capability is seen as an advantage. A recent development has allowed a man who has an artificial hand to “feel” the objects he handles with Haptic feedback sensors.

Exoskeletons – are one area where technology is being utilised from warehousing to the battlefield.

Bio Implants – Current Bio implants cover everything from teeth, silicon breasts, pace makers, artificial hearts and other organs, Subdermal RFID authentication devices, defibrillators to neural implants which pass on signals to and from nerves or the brain from devices such as the ear, cochlea implants, retinal implants in the eye – early days yet, to controlling artificial limbs and other devices, motorised wheel chairs, speech synthesisers, computers etc.

Artificial Intelligence – There are two main types of Artificial Intelligence.

1. Weak AI designed for a specific set of tasks and
2. Artificial General Intelligence or Strong AI. This is basically what we are, all round general intelligence, capable of understanding and responding to a wide range of situations. It’s a little like the difference between a calculator and a computer.

Recent developments in AI have created systems that can play and defeat the greatest human exponents of games such as chess, Go and the US game show Jeopardy. Chess is a game where AI plays only a small role as a decent computer only has to look maybe a dozen or so moves ahead and this only needs shear processing power, whereas both Go and Jeopardy are so complex that just

shear processing power is not enough. Evidently there are more moves in Go then there are atoms in the universe. An AI playing Jeopardy, on the other hand, needs an extremely wide and varied knowledge to be able to participate. This can only be achieved by hooking up a self-learning algorithm with Big Data.

Big Data – The world is awash with data from a vast number of sources. This data, if tapped appropriately, can help forecast/predict future events and their probability of happening. By using Big Data, companies, organisations, governments, Tesco's etc. can make decisions on what their AI thinks you're going to do, based on patterns built up over some time of your habits i.e. where you shop, what you buy, how much you spend, when you spend it and many other factors. The Internet has been a massive boon to the collection and use of Big Data.

The Human Brain Project – Started in 2013, The Human Brain Project has 6 main objectives –

- Create and operate a European scientific Research Infrastructure for brain research, cognitive neuroscience, and other brain-inspired sciences
- Gather, organise and disseminate data describing the brain and its diseases
- Simulate the brain
- Build multi-scale scaffold theory and models for the brain
- Develop brain-inspired computing, data analytics and robotics
- Ensure that the HBP's work is undertaken responsibly and that it benefits society.

Synthetic Biology – Is a relatively new science, but has expanded incredibly fast over the last few years. It aims to give scientists the ability to design, engineer and manufacture synthetic genes, proteins and other biological entities that can be inserted and expressed within target organisms. There are a number of existing web sites that offer off the shelf products including genes that can be used by researches, schools, colleges or for that matter Citizen Scientists.

Craig Venter, who was one of the main players in mapping the human genome, has been able to create an artificial bacterium containing just 473 genes. The cell is a milestone in his team's 20-year quest to reduce life to its bare essentials and by extension, to design life from scratch using SB techniques.

Genomics – is a branch of molecular biology connected with the structure, function, evolution and mapping of the genome, which is the complete set of DNA within a single cell of an organism.

CRISPR – Full acronym CRISPR/CAS9, is a method by which individual genes can be cut out from the genome and replaced with a modified version. See video.

Epigenetics – I also a relatively new science which tries to investigate why and how some genes in a genome are active while others seemed to be turned off. The process of turning genes off is called methylation. It has been found that external environmental conditions such as hunger can affect whether or not certain genes are on or turned off and this condition can be passed down generations.

DNA Origami – is the nanoscale folding of DNA to create two or three dimensional shapes that can be used for holding other molecules in place or for forming structures all on its own. Potential applications for this include enzyme immobilization, drug delivery systems, self-assembly materials, molecular walkers and switches for algorithmic computing.