The BRAINWAVES Club

Semester 1 2019: Einsteins - Years 4, 5 and 6

Venue: Ryde

Immerse Yourself

They say that curiosity killed the cat. Which is a shame really. But if you think about it, where would we be without that overwhelming urge to explore, experiment and discover? Could Albert Einstein have surmised the Theory of Relativity (and countless other laws of physics!) without a desire to investigate the properties of the world around him? Could Thomas Edison have invented the light bulb (and countless other functional/non-functional inventions!) without a desire to push the limits of what was known? Would the effective treatment of infectious diseases even be possible if Alexander Fleming hadn't investigated a mysterious antibacterial substance, that subsequently turned out to be penicillin? Of course not. The advancement, both of our society and of our quality of life, has been highly dependent on nurturing and entertaining curiosity. This semester, Einsteins will investigate the biology, chemistry, physics and geology of our world. In the process, you will have ample opportunity to entertain your curiosity, immerse your intellect and push the boundaries of what you know.

16 February

Meeting 1 – Riveting Radiation **Focus: Physics**

Radiation is one of the scariest words in the English language. The mere mention of this word can induce panic, foment anxiety and plummet sales (if you don't believe me, then try listing your house as having good radiation exposure!). Yet it turns out that radiation isn't always so bad. Without electromagnetic radiation, we would not be able to perform x-rays, investigate crime scenes – or even see for that matter! In this session, Einsteins will learn about the different types of radiation that exist, and how they can be both beneficial and detrimental to humanity. In the process, we will get the chance to model the different types of radioactive decay, write out the equations for each type of decay, investigate the properties and societal importance of gamma and x rays, and experiment with some real-life applications of ultraviolet light. Finally, we will learn about the complex effects of ultraviolet radiation on the human skin and will get the opportunity to model the biological processes underlying these effects.

2 March

Meeting 2 – Super Skin **Focus: Anatomy and physiology**

At first, the skin may seem remarkably – well, unremarkable! But did you know that it's made up of approximately 35 billion cells? Wow! As one of the largest organs in our body, it not only protects us from the wear and tear of modern life, but it also allows us to feel different sensations. In this session, Einsteins will explore the many answers as to why the cutaneous system is so important. Along the way, we will also investigate the apparent miracle of the skin's ability to tell pressure, pain, and different temperatures.

16 March

Meeting 3 – Food! Focus: Chemistry and biochemistry

If I asked you to name one thing that everyone loves, what would you say? (No, definitely not politicians!). Clearly, food is an essential part of our lives, but why is it that food can be so important and yet, often, so detrimental? In this club meeting, Einsteins will investigate the chemistry of food, and how this chemistry is fundamentally important to human health and disease. We will first consider the links between the molecules making up food and organic, metal, redox and acid-base chemistry, before performing a series of experiments to explore the chemistry of various food types. Einsteins will then learn about the macromolecules that make up all food items and will experimentally demonstrate the presence of these macromolecules in select food products. Finally, we will learn about the importance of food chemistry in dictating the onset and progression of metabolic disease – now that's food for thought!

30 March

Meeting 4 – Planet Earth Focus: Geology and geography

It goes without saying that the Earth is very important to humanity. But while we go about our daily lives, do we ever stop to consider what processes may have formed the ground that we are standing on or the landscape that is around us? In this meeting, Einsteins will learn about the first principles of geology, and how tectonic processes have shaped the environment. After modelling the interactions between the Earth's core, mantle and crust, we will explore the major tectonic processes that are responsible for the formation of mountains, volcanoes and deep sea trenches. Einsteins will then get the chance to model the interactions that occur at various types of plate boundaries, before learning about the variable roles of different tectonic processes in propagating natural disasters. Finally, we will investigate how scientists classify different types of volcanoes and eruptions, before getting the chance to apply our newfound knowledge and skills to the prediction and mitigation of a fictional volcanic hazard!

4 May

Meeting 5 – Reduction and Oxidation Focus: Chemistry

Reduction and oxidation are two of the most important chemical processes in existence. From batteries and metal refinement to rust and food spoilage, reduction and oxidation (redox chemistry) play a massive role in our daily lives. In this meeting, Einsteins will discover the chemical basis of redox chemistry, and why it is so important to our world. In the process, we will learn how to construct chemical equations to describe redox reactions and we will perform a series of experiments to demonstrate their real-life applications. Einsteins will then learn about the redox basis of electrochemistry and will perform an electrochemical experiment to put knowledge into practice.

18 May

Meeting 6 – The World in Numbers Focus: Mathematics and physics

What if I told you that numbers are the universe? As crazy as this may sound, the fact is that numbers, and the equations used to derive them, can be used to describe, evaluate and explain virtually all the properties that are fundamental to our world. In this session, Einsteins will learn about the physics equations that underlie a wide variety of scientific phenomena. We will subsequently perform a variety of experiments in order to calculate the densities of various objects, demonstrate the laws of equilibrium, find an object's centre of mass and measure atmospheric pressure. By the end of this session, Einsteins should come to appreciate that numbers aren't just tokens of our imagination but are instead innumerably important in facilitating our understanding of the world.

1 June

Meeting 7 – Fabulous Fungi **Focus: Microbiology, epidemiology and biochemistry**

Fungi are so much fun – get it? Annoying jokes aside, fungi are some of the most unique and incredible organisms to exist. What other organisms can secrete digestive enzymes and absorb nutrients from the ground? And how many other life forms can boast the ability to reproduce via wind disseminated spores? In this meeting, Einsteins will take a closer look at the biology and chemistry of yeasts and moulds, as we endeavour to investigate the similarities and differences between fungi and other multicellular organisms. In the process, we will learn about the different types of fungi that exist, how the life cycles of each of these fungal classes varies and what chemical processes allow fungi to adapt so easily to the harshest of environments. We will then perform experiments to examine the different parts of a fungus and explore their functions, before having the opportunity to investigate the cause of a fictional outbreak of fungal disease. Einsteins will need to bring their detective hats in this funky case of fungal folliculitis!

22 June

Meeting 8 – Grow a Brain! **Focus: Anatomy and physiology**

Congratulations – you have successfully read this brochure! Who would you like to thank? Your brain might be a good start. Obviously, our brain is the 'be all and end all' of our existence – lose the proper functioning of your brain, and your consciousness will cease to exist. In this meeting, Einsteins will discover the anatomy and physiology of the brain, and how structure of the brain allows it to be so functionally important. We will investigate the complex tracts of neurons that weave together to form different brain lobes and structures, before performing a lamb brain dissection to investigate how these lobes and structures fit together in three dimensions. Einsteins will then learn about the different strategies that our body employs to protect the brain, before having the chance to experimentally investigate the effectiveness of various bodily structures in providing this protection. So, what do you say – is your brain up to it?

What to bring:

Each week please bring an A4 notebook and a well-stocked pencil case containing (at least) pens, pencils, a calculator and a ruler. Einsteins should also bring a pair of disposable gloves to **Meetings 7 and 8.**

Please also bring a hat, drink and snack for the break (no nuts please).

About the Club Leader: Rengen Parlane

Rengen is studying the Bachelor of Science (Advanced)/Doctor of Medicine at the University of Sydney. He is passionate about both disciplines, and how they inform us about the world around us. Rengen has tutored or taught young learners for the past four years, including as a Brainwaves Club leader, Eureka presenter and Journeys presenter, and loves sharing the inspirational world of science with eager young minds.