"One language sets you in a corridor for life. Two languages open every door along the way." *(F.Smith)*

Nature's Amazing Palette

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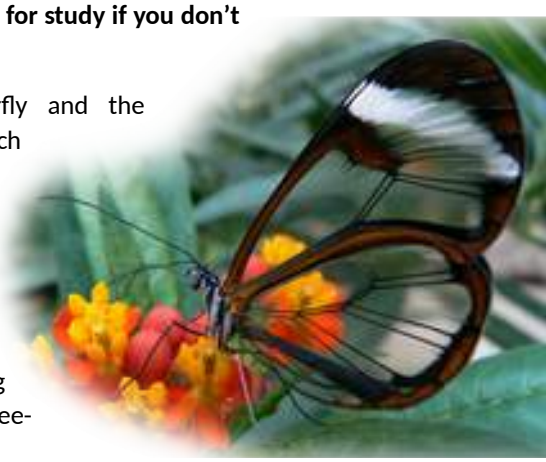
Here is my story. It is about a pretty butterfly and an ugly sea worm. Specifically, it is about the way in which these animals produce color, and how that has helped develop technologies we do not want to live without. But, if you choose to remember only one thing from it, then hopefully it is this: **that mathematics is a good choice for study if you don't know what you want to do later on in your life.**



Amazingly, the green patches of the Parides butterfly and the transparent parts of the glasswing butterfly are chemically very much the same material called chitin. Neither has any significant amount of pigment in it. So why is the glass wing transparent, and Parides bright green? The secret is an intricate, beautifully complex three-dimensional maze – called the Gyroid – within the wing-scales of Parides, at a tiny size that is comparable to the wavelength of light. This geometric pattern, rather than a chemical pigment, cause the light to diffract in a way that green light is reflected. Scientists call this mechanism for color production "Structural Color". Needless to say, the glass wing butterfly lacks that pattern, and given that the material is transparent, it is hence see-through.

Another animal, an ugly sea worm ironically termed *aphroditae*, uses a similar effect to produce colorful reflections on some spikes on its body. Rather than a three-dimensional geometry, it uses a rather simple pattern, namely long circular hollow tubes, arranged into a honeycomb-like structure. The biological purpose of this structure remains elusive, but it has set the evolutionary precedence for a technology none of us wants to do without: the fibre-optics cables that power (or not) the National Broadband Network. It is everyone's guess which optical or communication technology the butterfly structure will ones inspire.

The main message of my presentation shall not relate to the object of my study, the butterflies. Rather it relates to my path that has led me to doing research on butterflies. It is a tortuous path through many wonderful projects that was enabled by three qualities: solid maths, solid fundamental science and computer programming skills. I was lucky to have the highschool and university teachers that set me up on that path. Throughout the last twenty years, I have been able to work on many different projects –from chemical nanoengineering to biomedical bone tissue materials. What has helped me cope with the variety of challenges is the ability to abstract each problem to a mathematical model, to quantitatively analyse the model and, last but not least, to know how to translate a problem to an algorithmic solution. My friends from my own university days in physics and maths have gone on to become investment banking consultants, medical imaging researchers, aeronautic engineers, high school teachers, government consultants and town planners. Each and everyone of them is likely to attribute their success to the same reason, that is, their ability to speak …

… the universal language of all science and technology – mathematics!

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