**SCIENCE IN TEN MINUTES**

Chandra Emani\*

**A monk in a pea garden**

Ever wonder how scientists and doctors predict the probability of a disease occurring in a population and then the probability of inheriting the disease in subsequent generations down to precise and specific numbers just by looking at family histories? Or how an agronomist can predict the exact percentage of crop characters that pass from generation to generation down to the exact numbers? The answer came to us from pea pods. The person who put the math in biology was not a scientist in a lab, but a church abbot and a high school science teacher, who in his spare time did some interesting experiments with pea plants in his 4.9 acre backyard church garden. In 1864, at a monastery in Brno, Moravia in the then Austro-Hungarian empire, an Augustinian Friar named Gregor Johann Mendel, crossed some yellow seeded pea plants with green seeded pea plants. The progeny from his cross all displayed yellow seeds. When he planted these seeds, in the second generation, he found that out of 100 plants, roughly 75 had yellow seeds and 25 had green seeds. The hidden green seed character miraculously reappeared in the second generation. Over the course of the next four years, Mendel studied 7 different characters of pea plants such as flower color, plant height, seed texture and so on when he planted and seeded over 29,000 plants in his garden. Every time, he found that one character would mask the related character in the first generation, and in the second generation, the characters would reappear in the 75-25 combination per 100 plants or a ratio of 3:1. When Mendel attributed this to the mathematical precision of units of inheritance (the term gene came much later) and sent a paper to renowned scientists of those time, nobody understood the significance. In essence, Mendel was the first biologist who showed that when parents pass their traits to offspring, genes do not blend or average (as in a black dog and white dog won’t have grey pups), but genes retain their individuality in perfect mathematical numbers like the 3:1 or its multiples, and what was observed in peas stands good for any life form be it a bacteria or an elephant or a plant or a man and their traits. Mendel’s paper published in 1865 lay obscure in a local newsletter, till in 1900, a Dutch Botanist named Hugo Devries replicated similar results and talked about them to a colleague in Germany named Carl Correns. Correns had a 35 year old letter in his possession written by Mendel to his mentor. An Austrian Agronomist colleague of Devries and Correns named Eric Tschermark traced Mendel’s location as he happened to be the grandson of Mendel’s botany teacher at the University of Vienna. Talk of an exciting detective story that criss-crossed a continent to give credit to the original work in science done by a non-traditional science researcher. In the history of science, there was never an instance when a person is credited to have given birth to an entire discipline. Brother Mendel with his pea garden gave us a discipline called Genetics. The 3:1 ratio that he found in pea plants is found in the genes of all living genetic traits across life forms, and this and related ratios observed are called Mendelian ratios. The precision of this mathematical patterns is what enables present researchers to exactly predict the probability of any trait that passes from parents to offspring down to the last number. Mendel and his fathered field Genetics thus gave us a precise tool to track down genes, useful or otherwise, and this revolutionized experimental science in botany, zoology, agriculture and medicine. A simple and precise study by a monk in his pea garden thus enriched our understanding of life and our genes in mathematical precision.

Talking of peas, did you know that a cup of peas is a loaded nutritional package? For starters, it is a veritable storehouse of vitamins, namely, 51%DV vitamin K (%DV or percentage daily value is the amount you would consume in a serving), 38% vitamin C, plenty of folates, vitamins A, E and B6, along with 35% dietary fiber, 40% manganese and other useful minerals such as phosphorus, magnesium, cooper, iron, and zinc – all in 1 cup, or 134 calories. Vitamin C, A, and E, zinc, and an array of phytonutrients found in peas all act as antioxidants that help improve overall health, and prevent cancer. They do so by flushing out and neutralizing free radicals that otherwise roam around the body creating renegade cells that divide abnormally to cause cancer tumors. Free radicals also stress cells out, so eating peas can help combat stress. Peas are a heart healthy food as they reduce bad LDL cholesterol in the heart through lots of alpha lipoic acid (ALA), one of the Omega-3 fatty acids, which has been shown to promote heart health. The high protein and fiber levels in peas help keep blood sugar levels in check and also prevent onset of colon cancer. So, just boil a cup of peas and have them everyday.

\**Chandra Emani is an Assistant Professor of Biology at western Kentucky University-Owensboro. Apart from teaching introductory and advanced courses in molecular biology and Genetics and researching on utilizing plants to make useful products such as biofuels and anti-cancerous pharmaceuticals, he enjoys explaining science in simple words to his daughter.*