Mathematics of Life - the Science in the Art of Nature

The word -" Science " - as we understand it today, has come into english language , less than 200 years back. The root word in old latin/french - scien - for centuries earlier, always meant - to discern/ cut/ separate/ make distinct. Today, of course we have further categorised science into - Natural Science (Physics (Old Greek word itself meaning "Nature"), Chemistry (Old Egyptian word meaning "Earth"),Biology (Greek meaning "Study of Life") etc) & Applied Science (Engineering, Computer Science etc) & even Social/Behavioural Sciences (Economics, Psychology, Political Science etc). In antiquity, the closest words to describe the modern subject/study of what we today call "science", was " Nature Philosophy" or "Study of Nature". This description held true for centuries - From Aristotle & Plato down to Da Vinci & even Newton.

The word "Art" on the other hand, is an antique word in etymology. Its latin roots emerge from "Arm" - when you " created something for others" (i.e. not for yourself/your body), it was "Art". For centuries, "Art" meant "creative skills " & "crafts" in the modern understanding of these terms. Its current interpretation of "skills used to produce an aesthetic output" , is infact of a more recent origin. Today, art does tend to mean different things to different people. Most artists themselves are quite happy about this. If their profession can't be boxed in words, it appears to give them a freedom of choice, a basic human desire.

In recorded history, " Mathematics" is as old as "Art". The origins of the word are in the ancient Greek word - "Mathema" - which meant "knowledge". The word "Mathematika " in the time of Aristotle & for centuries thereafter, primarily meant " anything related to studies " or "studious", in the modern context. To be knowledgeable was to be " all things mathematika". Our modern usage of the term - Mathematics - mostly to seek patterns in the study of quantity, structure, space & change - is not new, though it certainly is very limiting, compared to the definition of the ancients. Its also interesting to note that the classifications of mathematics - Arithmetic (from Greek - Arithmetik meaning "Number"), Geometry (from Greek - Geo (earth) & Metrik (measure)) & Algebra (from Arabic - Al-Jabr meaning "Restoration") - isn't new at all.

Arguably one of the most creative geniuses of recorded history, Leonardo da Vinci foretold the coming age of specilaisation & went to great lengths in his diaries to explain the need to keep Arte/Scienza together as disciplines, in the interest of creativity. There is a wonderful book by Michael Gelb, which explains the genius of Leonardo da Vinci in 7 Steps. Its a self-improvement framework, as prescribed in the diaries that da Vinci left behind :

1) Curiosità: An insatiably curious approach to life and an unrelenting quest for continuous learning.

2) Dimostrazione: A commitment to test knowledge through experience, persistence, and a willingness to learn from mistakes.

3) Sensazione: The continual refinement of the senses, especially sight, as the means to enliven experience.

4) Sfumato: A willingness to embrace ambiguity, paradox, and uncertainty.

5) Arte/Scienza: The development of the balance between science and art, logic and imagination. "Whole-brain" thinking.

6) Corporalitá: The cultivation of grace, ambidexterity, fitness, and poise.

7) Connessione: A recognition of, and appreciation for the interconnectedness of all things and phenomena. Systems thinking.

Since the time of da Vinci, the segregation between Arts & Science, is only getting more & more hard-coded. This obsession about career choices & a debate about the contributions to mankind of Arts versus Science , is of relatively recent origin - the so-called era of specialisation. Education systems are designed towards creating younger & younger specialists, each passing year and the Corporate Sector continues with its archaic model of rewarding specialists at each step of the corporate ladder & then suddenly expecting the specialist to do a butterfly act & transform into a multi-dimensional leader/CEO.

In all of this classification & re-classification of Arts & Science, & even attempted re-unions through terms like Applied-Arts & Applied-Science, the "Mathema" of old Greek & "Mathematics" of modern day, is being sidelined into "Numerology", which it certainly isn't & never was intended to be. The confusion on Mathematics reflects in the graduate education system where you could spend several years studying mathematics & could come out with a certificate which either reads - Bachelor of Arts in Mathematics or Bachelor of Science in Mathematics, depending on the interpretation of your university's management team. Away from the screams of Arts vs Science,

the academia of today seems hell-bent on making Mathematics, more & more abstract, while the average world citizen rarely sees any applicability of mathematics apart from the so-called "social/behavioral sciences" like economics & finance. Even in the world of finance, there are few bankers who really understand mathematics. If there were a few more folks who had, what Aristotle described as "all things mathematika" , perhaps the world would never experience a banking crisis or a global recession.

The important link between Mathematics & Life, has long been fractured in academia. Its now getting lost in the world of words, classifications & new jargon. But as ever there are some folks , who have understood the essence of education & broken through the mental walls between Art, Science & Mathematics.

The trick of "Mathematics in Life" it seems lies in searching for the - "the Science in the Art of Nature" or if you prefer the ancient definition - "the Art in the Science of Nature". Either way , in our increasingly poly-temporal world, the choice of the final words, really shouldn't matter. Creativity after all seems to be linked to our ability to blur the lines between Art & Science, using Mathematics. Have a look now at the beauty of the following works, below - a few links to how maths is helping to understand our own selves & the world that surrounds us, acting as a bridge between the artificial chasm of Art & Science :

A) UNDERSTANDING US (Humans) -
Gregor Mendel, a monk in the town of Brno, Czech Repubic, experimented with peas & bees in his abbey gardens, wrote down the mathematics of hereditary in some papers & passed away. Some years later, his writings were accidentally discovered in an antiquarian bookshop & lead to the foundations of genetics, as we know it today (For more details see - http://www.mendel-museum.com/eng/1online/room2.htm). The "human genome" project success now gives each & every human an opportunity to take a look at their own , unique mathematical code. Brahmins with superiority complex & Sudras with inferiority complex in India, dont need to wait for the government's UID (Unique Identification Number) project implementation in India. They are just USD 99 away from decoding their personal DNA, now. Its time to stop using vague terms like "race" & "caste" , & define the more acceptable term of "ethnicity" in mathematical terms. Google founder, Sergei Brin's wife has even set up an innovative company to do just that. Check out the product line of www.23andme.com (23 chromosomes). They're also producing some fab animation to explain the subject. Do check out the following videos -
a) Basics of Genetics -
https://www.23andme.com/gen101/genes/

b) The journey of homo-sapiens from their first steps in Africa -
https://www.23andme.com/gen101/prehistory/prologue/

For those of you who prefer more text on the subject of genetics & the human genome project, look up-
http://www.realalternativesite.com/replacement-hypothesis-a-618.html

B) UNDERSTANDING THEM (Plants, Animals & Matter) -
Ever wondered why the tiger has stripes & the leopard has spots ? There are folks like the mathematician, James Murray who spent several years trying to answer these questions. He has now worked out the maths behind the two chemicals produced in cat skins, one of which stimulates the production of melanin, while the other inhibits this effect. Using simulated computer models with precise quantities of melanin & its inhibitor, he can show you why a tiger generates stripe patterns in its embroyo stage , while a leopard generates spots.
On flowers, the Polish computer scientist, Przemyslaw Prusinkiewicz has spent 3 decades building mathematical models atop fractals discovered by Benoit Mandlebrot in the 70s. His digital models mathematically simulate different plant species. Its well worth your time, dropping into his garden at -

http://www.biologie.uni-hamburg.de/b-online/virtuallaboratory/Animations.html

Matter, in the form of Elements, was first arranged by Russia's Sergei Mendeleev on the basis of the atomic number. Though the atomic number was the key driver in arranging the elements in the Periodic Table, a quick look at the Atomic Weight & other mathematical measures like Melting/Boiling Points & Density of known elements, itself revealed the presence of hitherto unknown elements on planet earth - the patterns of nature in Mendeleev's table were too obvious to ignore. (See -
http://www.periodictable.com)

C) UNDERSTANDING THAT (Universe) -
The word "geometry" itself means "measure of earth". Seeking patterns in space & understanding the context of earth & our sun, vis-a-vis other celestial bodies, is one of the early & most consistent usage of mathematics. (See - http://www.nasa.gov/worldbook/index.html)

For more on how maths is helping us understand life around us, see this you-tube clip for a primer version -

http://www.youtube.com/watch?v=w4NF_cPr5zo
But, if you have more of a scientific temperament, then take a look at this file & further explore the works of lesser known geniuses like Alan Turing (father of cryptology & Britain's secret weapon of WW2), -
http://www.tbi.univie.ac.at/~pks/Presentation/wien-esi08.pdf