

The canon: a whirligig tour of the beautiful basics of science – a book review es...

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The Canon: A Whirligig Tour of the Beautiful Basics of Science - A Book Review
Natalie Angier, in her book, "The Canon: A Whirligig Tour of the Beautiful Basics of Science," highlighted the importance of science and thinking based on scientific evidences. Science is not only important for the daily lives but may prove useful as well in terms of large scale economics and public safety and health. Thinking scientifically is not only something that is encouraged in the current social setting but is also something that a lot of students seem to run away from. However, Angier implied that science including math, chemistry, physics, and biology should not be perceived as something unreachable and incomprehensible but should rather be approached with willingness to be learned and without apprehension.

Some topics may seem to be very big but not entirely unlearnable. The most unattractive part of science, maybe, is mathematics. Nevertheless, Angier argues that mathematics is just a language and not the language.

Mathematical equation could also be explained in plain English with the implication just as comprehensive. Although basics of mathematics will appear every now and then, mastery of all mathematical theories is not required for you to be successful in other fields of science.

Science should also not be confined in just a body of facts. The interpretation of these facts and drawing conclusion out of them is also important; hence, the necessity of statistics. Science today is by no means able to provide all the answers to every little question. Science, like all others, is also dynamic, full of uncertainties, and by no means deal with absolutes.

The body of knowledge develops through researches which further opens more questions than before. However, Angier tries to make the reader understand that in order to appreciate science and think scientifically, a critical mind that is open to possibilities and unrestricted by a dogma is of utmost importance. In the chapter about chemistry, Natalie Angier approached the topic that usually makes the students feel overwhelmed in a different light. Instead of starting with the big words that are usually found in thick chemistry books, she introduced the topic step by step. First she conveyed that chemistry is all about molecules, which are basically made up of a combination of different elements. The combination of all the 115 elements enables the formation of countless molecules. This allows functional diversity of the molecules that could be found within the human body and everything outside it.

Its presence everywhere signifies the importance of chemistry. Next, she introduced the concept of chemical bonds and described it in a fashion that is very easy to understand. Bonds are the chemical force of attraction that makes the very specific combination of elements to form a specific molecule possible. The formation of molecules does not only require that different elements are proximal or within the vicinity of each other but also requires the presence of chemical affinity between the elements as well. As Natalie Angier puts it simply, the password for the elements to form a molecule is “bond, James Bond.” Chemical bonds could be produced via the sharing of the outermost electrons between the elements or through the coming together of oppositely charged atoms.

Angier further say that chemistry is all about molecules, forming bonds, and breaking bonds. Chemistry exploits the thousands of configurations that bonds could take in order to make a different molecule. This makes chemistry almost alone in the science of forming new things. Besides the formation of molecule, the molecules themselves could also be put together to form a compound. Compounds are still something that should worry the students because in actuality, the products of chemistry could be seen anywhere one looks.

The formation of still many things that could provide medical and technological breakthroughs that could benefit mankind is a chemist's dream. All the raw materials of all compounds could actually be seen in the periodic table; however, the complexity lies on the fact that the compound is a product of specific formation of bonds of different specific molecules. The different types of bonds discussed in the book are the (1) covalent bond, (2) ionic bond, (3) metallic bond, (4) hydrogen bond, and (5) van der waals force.

All of which are important for both living organisms and non-living matter. Covalent bond was said to be the strongest and occurs when two molecules share electrons to complete each other's outermost electron orbital shelf to make them more stable. The more filled the orbital shelf, the more stable the bond is, and the less reactive the resulting compound would be. However, the attraction between the two molecules is limited by the tendency of their nucleus containing protons to repel each other. The bond length therefore determines the distance of the two molecules bound together. Covalent

bonds could occur between the same (H₂ and O₂) or different molecules (nitric oxide or NO) to form a compound.

On the other hand, ionic bonds are said to be less pliable and more predictable. In contrast to covalent bond, ionic bond can only bind two different elements. It is formed between two electrically charged atoms, which we call ions. Ionic bonds bind negatively charged ion with positively charged ion that are attracted by the virtue of their opposite charges.

The bonds are so strong that the resulting ionic compound form crystals. Ionic compounds are present in abundance and can be found at our own home like the table salt, alkaseltzer, and many household products. Ionic bond also allows the edibility of sodium chloride or table salt when both sodium and chloride, by themselves, are toxic. Metallic bond, as described by Angier, is the almost "socialist" sharing of electron between metallic elements. The outermost electrons of the metallic elements are very mobile which allows them the capability to conduct electricity. Meanwhile, hydrogen bonds are weak bonds exemplified by the bonds binding hydrogen to oxygen forming water. However, the electrons in water molecules are not fairly shared with the electrons clouding more on the oxygen atom while the electrons are drawn away from the hydrogen atom. This gives the oxygen a slightly negative charge while hydrogen gets a little positive.

Therefore, the water molecule exhibits polarity. Furthermore, when water is put together they form a strong bond which gives the water a characteristic surface tension and allows them to form droplets. In addition, what they lack

in strength, hydrogen bonds make up with their elasticity. This enables water to be used biologically. It is also considered as the universal solvent.

The last type of bond discussed was the van der waals force which was said to be the weakest of all the chemical bonds discussed before but is very essential in the integrity of many essential compounds. Van der waals forces bind several " sheets of molecules" where each sheet was bound beforehand by other stronger bonds. In essence, van der waals, though very weak, is virtually the only force capable of forming really complex molecular structures. For example, various proteins in the bones interact with the calcium phosphate deposits (ionic compounds) via van der waals forces. The interaction lends elasticity to the bones, prevents it from being brittle, and makes it a stable structure. After the basics of chemistry, Natalie Angier then introduces organic chemistry which basically deals about the organic compounds with which all living organisms are made up of.

Organic compounds are compounds with carbon backbones that are bonded to hydrogen or another carbon atom. Carbon is very special because of its capability to form four strong covalent bonds and produce complex yet stable compounds. The carbon bond is also capable of being twisted hence allows different conformations of the molecules. All these facts point to the competence of carbon to take part in the blueprint of life, the DNA. It is really wonderful how Angier had presented all these information in a manner that is easy to reach and comprehend. She presented examples of several complex theories that are could be analyzed in parallel to the familiar concepts we see everyday. For example, she compared the specific

combination of different bonds and bond strength to a manner like how the fabric of tie had been woven and how the tie had been fixed into a knot.

This gives us the idea that chemistry as well as the other fields of science are not scary at all and should not thwart us from studying them. Knowledge on chemistry is, indeed, very important as chemistry operates within us and around us. Chemistry is not at all irrelevant in our lives but rather applicable to every individual. It seems that the best thing to do with it is approach chemistry and science, in general, with enthusiasm and a critical, inquiring, and open mind.

Reference Angier, Natalie. *The Canon: A Whirligig Tour of the Beautiful Basics of Science*. Mariner Books, 2008.