

***B-Characters*TM**: Giving science a cool, animated twist.

When you hear the words “science”, “biology”, “molecule”, and “chemistry”, the first image that probably comes to mind is something like a less than attractive, antisocial, self-professed geek with thick-rimmed glasses who struts around in a white lab coat murmuring esoteric stuff that no ordinary person could, or even want to, possibly understand. This image problem has been a national issue that Presidents Bush and Obama have tried to address. The key question is how to reinvent science education to inspire students? Currently, many American kids do not want to study math and science, which is detrimental for developing analytical and logical thinking skills. Several notable, worried figures including Bill Gates and Thomas Friedman have voiced their concerns about this growing trend as the percentage of American students enrolled in the nation’s top science and engineering graduate programs has been significantly decreasing over the past decades.

A Stanford scientist, Nam-Joon Cho, Ph.D., suggests an alternative, interesting idea: do not drag reluctant kids into boring science, but rather deliver fun science to kids. He has created “***B-characters*TM**,” which are toy and animation characters designed from the fundamental macromolecules that make up the foundations of biological life (Figure 1). The most interesting thing about B-characters is that individual characters have their own unique personalities and background stories based on their scientific properties. By playing with the B-character toys and watching their animation stories, children can be naturally drawn to science while most importantly having fun.

For example, ***Lipid-Zzangs*** (Figure 1,3) are inspired from phospholipids, the main constituent of the cell membrane. Lipid-Zzangs’ ages are related to their height since their ages correspond to the length of their two carbon chain “legs”, which are characteristic of all phospholipids. As well, Lipid-Zzangs’ personalities are based on the physical and chemical properties of their respective lipid head group. The main Lipid-Zzang character, ***ZunZun-Zzang*** whose nickname is ***Triple Z***, is created from the lipid head group ethylphosphocholine. In scientific terms, ethylphosphocholine is a positively charged headgroup, which is rare among phospholipids. It is commonly used as a transfection agent to inject life (transfer DNA) into cells. Based on its lively and positively electric scientific properties, Triple Z’s personality is quite charming. He is bright-eyed and makes the world around him exciting. Strutting around with an infectious optimism, he is smart, funny, cool, and popular, a rare combination just like his scientific character. Another example is ***TripleZ***’s friend ***Serine-Zzang***, a lipid girl who attracts people with her electric personality (Figure 1,3). However, she is negatively charged so she tends to keep her true emotions private. Even though she is very popular, she shoots down the date offers from all of the guys because she is still looking for that special someone. Her scientific name is phosphatidylserine, which is negatively charged and attracts positively charged molecules via electrostatic interactions. It generally composes 10 to 20% of a cell’s plasma membrane (the outer cell wall) and is essential for the activity of many proteins who just can’t stay away from her. And what about ***Bandi-Zzang***? She is inspired from Texas Red (DHPE) (Figure 1,3), a synthetic lipid that fluoresces a bright, red color. It is commonly used in natural lipid mixtures to study how lipids move within the membrane. The head group is rather bulky and sticks out from the crowd. As a B-character, her cheeks are always red because she blushes a lot in front of the

guys. She is shy, in large part due to her rather large head. However, she is still a cutie in that way no schoolboy would be willing to admit.

Another group of B-characters example are the **Amino-Tribe (Figure 2,4)**. They are derived from amino acids, which are the building blocks of proteins. There are twenty-two Amino-Kuns characters that are grouped into five different groups based on their electric charge, polarity, and relative abundance: Nonpolar, neutral (N^E group), Polar positive (P^2 group), Polar neutral (P^E group), Polar negative (P^N group), and Rare (R group). Each Amino-kun group has a unique color and shape.

The inspiration for B-characters came from Dr. Cho's basic philosophy toward his research: *“To study any research problem, we first need to be fascinated by an interesting biological phenomenon. Only then can a research question be developed, stemming from our attempt to understand the phenomenon. Finally, we can apply a wide range of innovative science and engineering principles in a novel way to solve this question. For kids, the same logic can be applied. Most importantly, fun stories have to be told. Then, the education comes next.”*

When Dr. Cho first took a cell biology course, he was amazed by the seemingly limitless boundaries of biological systems and viewed his textbook as a source of an unlimited number of stories. He realized that animated stories based on these biological pathways could reach out to children's imaginations, just like his own, and inspire them. Many fun personalities are hidden in each molecule and their stories can be interwoven to form a plot, just like a real pathway. Stories inspired by real biological pathways are sometimes necessarily complex due to the intricacies of life at a molecular level. This mirrors the complexity of life at the daily level as well and teaches kids important analytical and cognitive skills to navigate the increasingly complex, real world.

Dr. Cho created the B-characters together with his wife Dr. Y. Park, a Harvard Ph.D. graduate in Biostatistics who is currently working at Boston Consulting Group, to celebrate their son Isaac's (whose nickname is ZunZun!) first birthday. Through the B-characters, they want to help familiarize children with the biological foundations of life and get them interested in science education from a young age.

For Drs. Cho and Park, Lipid-Zzang and Amino-Tribe are just the beginning of their dreams. They believe that the paradigm for science education needs to evolve as our children's world, which is becoming increasingly digital, is also evolving. Making science fun will naturally lead to kids asking questions about what they see, making inferences, and most importantly learning how to think. Instead of a textbook-based learning environment, B-characters create an interactive experience where kids can learn from a wide range of possibilities including toys and animation. They are hoping that the B-characters are a small step in the right direction for this emerging transformation.

Figure legends

Figure 1. lipid tribe.JPG

Why B-Characters? B-Characters are an innovative, new approach to bring fun science to kids. The Lipid Tribe is a group of B-Characters called the Lipid-Zzangs. Inspired by phospholipids, which are the main constituent of the cell membrane, the Lipid-Zzangs' personalities are related to the properties of the lipid head group. The three main characters are Bandi-Zzang, Serine-Zzang, and ZunZun-Zzang.

Figure 2. amino.JPG

The Amino Tribe is a group of B-characters inspired by the building blocks of proteins, amino acids. The group is divided into five smaller clans based on their electric charge, polarity, and relative abundance in biological systems. Each Amino-Kun has a unique color and shape that relates to the corresponding amino acid's scientific properties.

Figure 3. Toy.jpg

Introducing the Lipid-Zzang Toys. The characters' personalities reflect the scientific properties of the phospholipids they are inspired from. The three main characters are ZunZun-Zzang, Serine-Zzang, and Bandi-Zzang.

Figure 4. Amino.jpg

Compared to a textbook-based learning environment, B-characters create an interactive experience where kids can learn from a wide range of possibilities including toys and animation. By playing with the B-character toys and watching their animation stories, children can be naturally drawn to science while most importantly having fun. Rather than dragging kids into boring science, the goal is to bring fun, creative new perspectives on science to them. "Science is Fun" and "I Love Science" with Amino-Kuns

Figure 5. poster.JPG

The Triple *Z* Project, inspired by our son Issac's nickname *ZunZun-Zzang*, is an innovative approach to give science a cool, animated twist. Rather than dragging kids into boring science, the goal is to bring exciting animations and toys inspired by the fundamentals of biological life to children. Making science fun will naturally lead to kids asking questions about what they see, making inferences, and most importantly learning how to think. The red and blue graphs are real scientific data from a biological interaction between a small protein derived from the hepatitis C virus and a model cell membrane. You can find scientific articles regarding these studies, which are the scientific inspiration of the "*B-characters*TM," at: *Cho et al.* JACS, 129 10050-1, 2007, *Cho et al.* Analytical Chemistry 79 7027-35, 2007, and *Cho et al.* Analytical Chemistry 2009, *In press*.

*B-Character*TM is project developed by Creative Solution Laboratory (CSL), a new innovative way of thinking about science and and education.

Figure 1

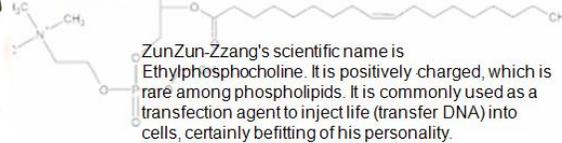
Why B-Characters ?

- Each B-character's personality is based on its scientific properties, helping **children understand science at an intuitive level**
- Stories inspired by real biological pathways, helping **children appreciate the dynamics of scientific processes**
- Biology has an unlimited source of stories that can **reach out to children's imaginations.**
- The characters can be self-assembled, developing **children's analytical and cognitive abilities**

About ZunZun-Zzang...



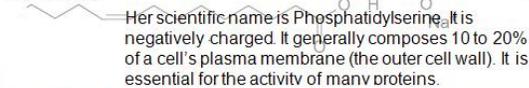
ZunZun-Zzang is very optimistic. He is bright-eyed and makes the world exciting. His optimism is infectious. He is smart, funny, cool, and popular!



About Serine-Zzang...



Serine-Zzang is popular because of her electric personality. However, she tends to keep her true emotions private. She shoots down the date offers from all of the guys because she is still looking for that special someone



About Bandi-Zzang...



Bandi-Zzang's cheeks are always green because she blushes a lot in front of the guys. She is shy, in large part due to her rather large head. However, she is still a cutie in that way no schoolboy would be willing to admit.

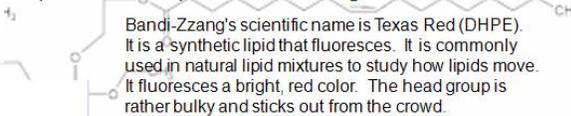


Figure 2.

About Amino-tribe...

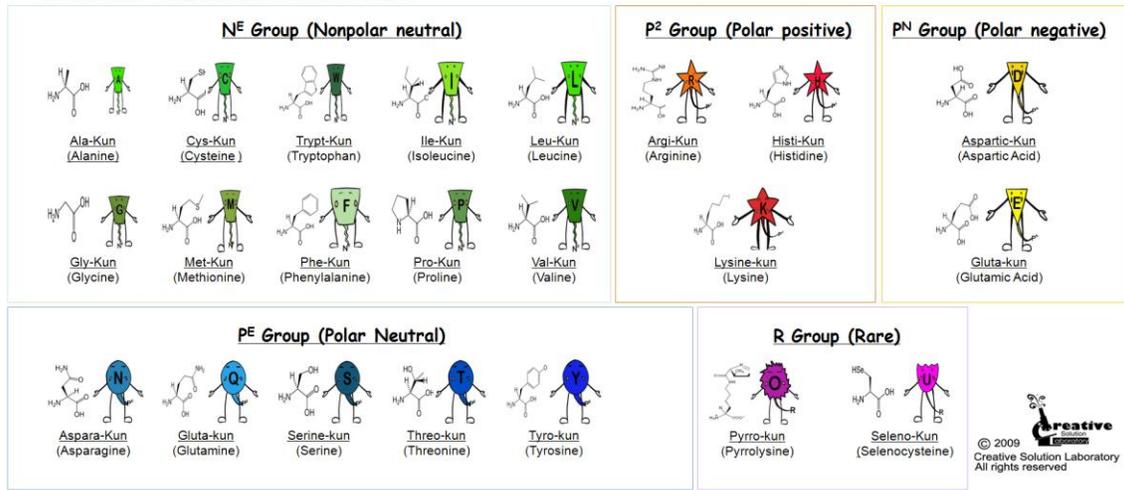


Figure 3.



Figure 4.

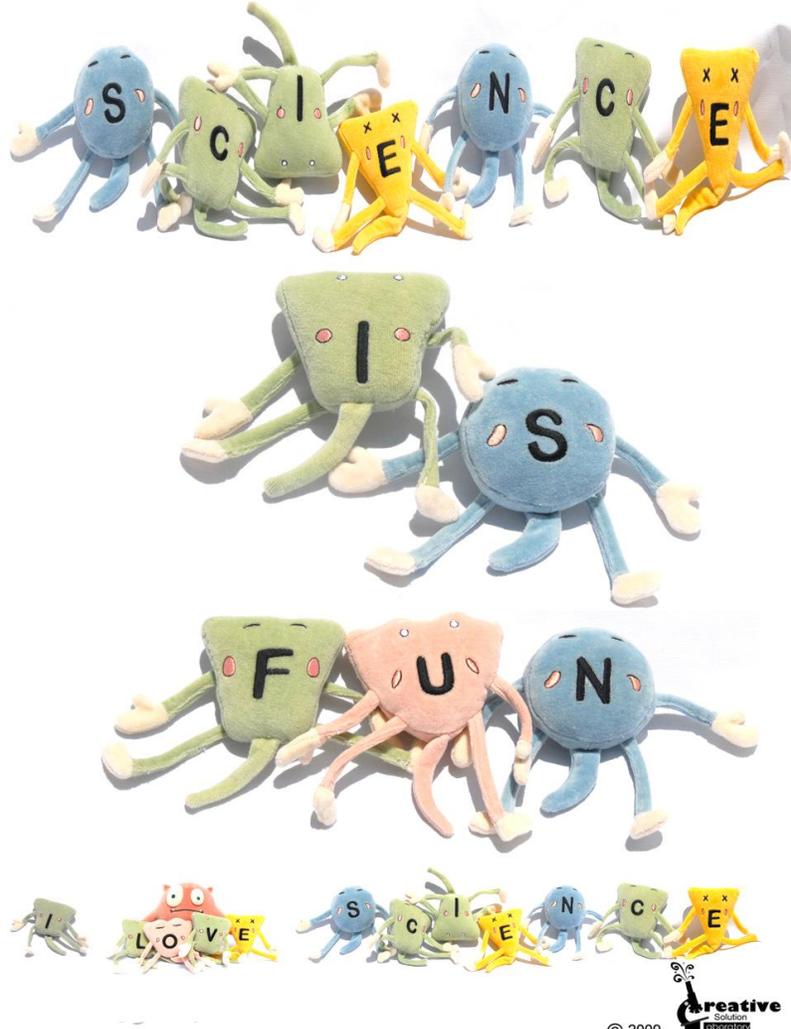


Figure 5.

Creative Solution Laboratory **PRESENTS**

