# Interview with Professor Kerson Huang

Emeritus Professor Kerson Huang was born in 1928 in Nanning, China. He received his S.B. (1950) and Ph.D (1953) at MIT. After a brief stint at the Institute of Advanced Study, Princeton, he joined the physics faculty at MIT in 1957. His research in Theoretical Physics has included works on Bose-Einstein Condensation and Quantum Field Theory. He retired from teaching in 1999. Nowadays, he devotes his time on Biophysics.

***Can you tell us about your background?***

**KH:** I retired from MIT in 1999, after teaching physics there since 1957. I used to do research on high energy theory and statistical mechanics, but have recently started research on biophysics.

***What research are you doing on biophysics?***

**KH:** The main problem in biophysics is about protein folding and protein structure. A protein is a long chain of molecules or amino acids. This chain folds into a specific shape when put into water, and it is this particular shape that makes it useful in human cells. It needs this shape to fit with other molecules in order to perform biological functions. If we know how this protein changes from a chain to a folded shape, we can then apply it to protein engineering. At present, research on biophysics is done by very few scientists; from a theoretical point of view, little effort has been put in. However, by applying the laws of physics, we can solve the problem of this protein structure changing shape.

I have been working on a specific model that I hope will be useful. This model is called conditioned self-avoiding walk (CSAW). As its name implies, it is a model whereby the protein avoids itself when it is denatured in water. It conditions itself to avoid similar folding patterns. This model is generated by a computer program. It depends on chance or random element, and is all statistical. I proposed this model 2 years ago, and am currently working on developing it with some colleagues in Tsinghua University, China, and Nanyang Technology University, Singapore. I also recently conducted a workshop on this model that attracted international participants.

The immediate goal of this model is to know how a protein folds into its final stage. Knowing how it folds into a certain state, we can then design the protein. The end usage of this model can be in the pharmaceutical industry, for instance. When big pharma companies design drug entities to cure diseases, they do this in a trial-and-error manner. They will keep trying to come up with drug molecules in the hope that some will be the right fit. Obviously, this approach is very costly — it takes billions of dollars to design a drug — and takes up too much time. With this model, however, we can work backwards and design a drug that will be suitable.

This model is not the same as bioinformatics. Bioinformatics is like a library catalog consisting of information that can be retrieved. This novel model, on the other hand, depends on physics, much like the whole universe is governed by the laws of physics. It treats proteins as dynamic molecules that interact. It is a computer-driven program with a theory, and it implements or applies the theory. To my knowledge, no one else is doing this type of research at the moment.

***You published an English translation of the I Ching in 1984. Can you briefly tell us what the I Ching is?***

**KH:** The I Ching is the oldest the Chinese classic texts, and is very obscure. It is essentially a set of predictions represented by 64 hexagrams, and was popularized during the Zhou Dynasty as a kind of fortune-telling exercise, in the same way that the Greek king sought the advice of the oracle Delphi. The I Ching is based on the Chinese philosophy of "yin" and "yang", with each line in a hexagram representing either one or the other — hence, it is an attempt at identifying order in seemingly chance events through this dynamic balance of opposites. No one person wrote the I Ching; rather, it was gathered from years of experience. Personally, I believe that the I Ching does not work in trivial things, but it does work in very important things. So, ultimately, it is psychological.

***When you were a young postgraduate of physics, you also adapted Edward Fitzgerald's English translation of the Rubaiyat of Omar Khayyam (Persian poems) into classical Chinese verse. What sparked off your interest in these two books (Rubaiyat and I Ching), and how did you get the idea to write on these areas?***

**KH:** I have always been fascinated not only by science, but also by history and the arts. In fact, when I was a young man, I used to write poetry.

***It seems to me that science is based on hard facts and evidence, whereas works such as the I Ching and Rubaiyat are based on mystical and spiritual phenomena. Isn't there a fundamental conflict between these two areas?***

**KH:** No, there is no conflict. Certainly, physics is the only thing that can concretely predict the future; however, it cannot deal with human emotion. This is where the I Ching comes in. These two areas are separate from each other, but I wouldn't say that they are mutally exclusive.

***From an author's standpoint, are there any major differences between writing a scientific book and a literary book (besides the scientific theory)?***

**KH:** Yes and no. In science, you think. In poetry, you think with a different part of the brain, but you still need to think. Science is analytical thinking, but what people do not realize is that it is also very sensual. Once you have found the right theory, you still need to figure out how to fit it nicely in an elegant way — only then will there by Eureka!

***Now that you are retired from teaching, what do you spend most of your time on nowadays?***

**KH:** I have recently picked up golf. I live in Florida now.

***Do you have any future plans to write/translate new books?***

**KH:** I am actually writing a semipopular book on modern physics with World Scientific Publishing. The title is Fundamental Forces of Nature: The Story of Gauge Fields, and it should be published later this year.

***What areas of research or subjects do you think that there will be more surprises and excitement in the future?***

**KH:** From a physics perspective, the potential to handle single atoms is very exciting, as it will impact quantum computing. We can also try to understand more complicated phenomena, such as life processes, why and how Chinese medicine like acupuncture works, etc.

***Any last comments?***

**KH:** Science is interesting, but so is history. Young people should know about both science and history. By "history", I don't mean the history of science, but history in general. After all, the history of science is basically about the wrong theories that do not work, so it is not really useful.

Computers are definitely the way of the future, but they can never replace human thought.