THE 1960 GAMOW LECTURE

In the 1950's and 60's the Ontario Cancer Treatment and Research Foundation (now part of Cancer Care Ontario) sponsored annual talks by distinguished speakers at medical and scientific meetings. They paid travel and accommodation expenses and an honorarium to the selected speaker. Since most of the speakers were of the medical profession, the amount available was generous.

In 1960 I was Chairman of the Division of Medical and Biological Physics of the CAP, and Lloyd Elliott, of Chalk River, was the President.

I had the idea, in a discussion with Gerry Cosbie, Medical Director of the OCTRF, to have the grant for 1960 awarded to the Canadian Association of Physicists at their annual meeting. When the Board asked me to choose a speaker, I conclude that it should be someone who could relate physics to the life processes.

Having recently read Erwin Schrodinger's monograph on "The Nature and Origin of Life" I wrote to him in Switzerland, inviting him to speak and to amplify his thoughts. In return, I received a very polite refusal which said, in effect, that he would have to fly, which, at his advanced age, he didn't!

My next choice was George Gamow, because of his contribution in solving the sequence of the genetic code. I knew that he was on the faculty of the University of Colorado, but couldn't contact him there.

I finally tracked him down, with the assistance of a faculty member of McMaster (whose name escapes me) at a physics meeting in India. He agreed to come to Kingston, since he would be on his way to Europe at that time.

By way of background. Gamow was born in Odessa in 1906. He attended university in Odessa and in Leningrad, and obtained a doctorate at Gottingen. From there he went to the University of Copenhagen, and spent some time with Rutherford in Cambridge. In 1934 he moved to George Washington University where he remained until 1954. After a year at Berkeley, he moved to the University of Colorado at Boulder. While his contributions to nuclear physics, cosmology, and other areas of physics and chemistry during this time were tremendous, his interests were even more wide-ranging. He wrote the 'Mr Tomkins' series of books popularizing physics, and he was a superb teacher. When Watson and Crick postulated the double helix as the structure of DNA, Gamow became involved in genetic code sequencing. Hence my invitation.

So Lloyd Elliott, Art Holloway and I met him at the railway station in Kingston one evening. He was a very big man, with thick glasses, yellow shoes, a booming voice and a
tremendous sense of humour.

After mutual pleasantries, the first point he brought up was "Dr MacDonald, are the liquor stores in Kingston still open?" I said "No, but I'm sure that we can get you what you'd like". His reply was "When I'm in Canada, I always prefer Teacher's Highland Cream". When I asked why, his reply was "It doesn't have those fiddly little wires around the top- you can just pull the cork straight out".
We found, that evening and at other times during his visit, that he had a tremendous capacity for scotch whiskey, without showing the slightest effect. One evening in my room at the hotel, we talked for four hours over two bottles of Teachers, and he covered everything from the origin of the universe to the origin of life on earth to the teaching of physics in universities. All very brilliantly!

His address to the CAP was equally brilliant. With no microphone and nothing but a blackboard and a box of multi-coloured chalk, he talked for over an hour about the 'Nature and Origin of Life', illustrating what he said with fantastically detailed chalk drawings. Reading the text of his talk today (forty five years later) shows how clearly he saw the subject then and how he foresaw how it would evolve in the years to come.

Fortunately, the OCTRF required that the contents of the lectures that they sponsored be published in the next annual report of the Foundation. So I was committed to edit his oration (which he gave to me in hand-written form) for publication. This was a real

pleasure, since it gave me the opportunity to examine what he had said at leisure.

He started by discussing the single cell and how it divides into two daughter cells with identical properties. This led to a discussion of the structure of the DNA molecule as proposed by Watson and Crick, and of how the information is contained and passed on. He even touched on how mutations come about by invoking statistical mechanics and the Boltzman constant and the absolute temperature. This was followed by a discussion of proteins, amino acids and peptide bonds. He even brought in a discussion of poker hands to explain how a sequence only four base units in DNA can be transformed into the instructions expressed by the sequence of twenty amino acids in proteins. He also pointed out how the study of viruses could advance our knowledge in this regard. Some of what he said was speculation, and has been disproven as more information has become available in the years since 1960.

All this led him to the subject of how life began on earth. The Kant-Laplace hypothesis meant that the early protoplanets were formed from condensation from a fast-rotating solar nebula, so they must have been giant spheres of hydrogen and helium, with much smaller solid cores in the centre. The radiation pressure from the sun stripped away the

gaseous atmospheres of those closest to it, leaving only the solid cores. This meant that there was an excess of free hydrogen which formed compounds with oxygen, nitrogen and carbon to form water vapours, ammonia and methane. Under the action of ultraviolet radiation from the sun and electrical discharges in the primordial atmosphere, these hydrogen compounds united into molecules of various amino acids. When these settled down into the ocean they formed a concentrated soup in which, as a result of polymerization, the amino acids started the formation of long protein molecules. These molecules were to be the foundation of life.

Nucleic acids, which are absolutely necessary for the life process, must have originated, over a few billion years, as a consequence of some type of undersea tectonic activity, since both high temperatures and the availability of phosphorus are necessary for their creation.

Gamow concluded that, since both the formation of planetary systems and the origin of life on planets which present favourable physical and chemical conditions appear to be natural processes, then life in some form must be present in the plurality of worlds.

He closed his talk by quoting Enrico Fermi, who said " If life exists in many other worlds, it should be less advanced than ours in some and more advanced in others. And if a much more technologically advanced race could make it possible to travel between the stars, then where is everybody!"

My brief association with George Gamow made me realize just how much one individual can not only contribute to the sum total of human knowledge, but also to disseminate it to others. He was truly a remarkable man!!