

PREFACE
PROCEEDINGS IAU SYMPOSIUM 112

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1. THE SYMPOSIUM AND THE PROCEEDINGS

IAU Symposium 112 - The Search for Extraterrestrial Life: Recent Developments, was held in Boston and in particular at the new Science Center of Boston University, June 18-21, 1984, and was attended by about 150 participants from 18 different countries. It was the first official scientific meeting organized by IAU Commission 51, the youngest of all IAU Commissions, which was established only in 1982 at the 18-th IAU General Assembly at Patras, Greece.

This Volume of the Proceedings contains nearly 70 papers with about 90 authors from 20 different countries, including two papers from our Soviet colleagues (Kardashev and Slysh) who had not been able to attend our Symposium in Boston. The Volume is divided into eight Sections, the first of which serves as a general introduction, and the other seven correspond to the seven Sessions of the Symposium.

Since this was the first IAU Symposium in this new field, I have tried to make this Volume as complete and as readable as possible. I delayed its publication by several months to assure that extensive review articles by world authorities, and articles representing the state of the art in the search for planets, in the radio searches and in the development of new instrumentation, were included in this Volume. I have also written extensive introductions for each one of the eight Sections to provide helpful background in the corresponding area. Each Introduction includes also a summary of the key points addressed by the papers of that Section. In this manner a non-specialist would be able to get a good introduction to the different multi-disciplinary aspects of this new field by simply reading Section I and the Introductions to the other seven Sections, i.e., a total of about 60 pages. After that it would be much easier to read and understand the more specialized papers contained in this Volume. It is my hope that this arrangement will make this Volume friendlier to many more people who are not specialists but have a genuine interest in this new interdisciplinary branch of Astronomy, which is rapidly becoming known with the new term Bioastronomy.

2. THE ORGANIZATION OF THIS VOLUME

Section I serves as an introduction to the entire Volume. It starts with a historical review of the development of this new field by M. Papagiannis, followed by individual papers by P. Morrison and G. Cocconi, the two pioneers who ushered in the experimental era of the Search for Extraterrestrial Intelligence (SETI) with their historic paper to *NATURE* in 1959. Since our Symposium coincided with the 25-th anniversary of their paper, we organized a special event at Boston's Museum of Science where Prof. Morrison was the key speaker and we honored him with a commemorative plaque (Figure 1). Section I contains also addresses from the Symposium Banquet, which was attended by many of the pioneers (Figure 2). Carl Sagan was the banquet speaker, and we honored him too for his many contributions in the explorations of our Solar System and his efforts to save our planet from a nuclear holocaust.

The seven Sections that follow (II - VIII) represent a natural sequence of steps in the search for extraterrestrial life, both primitive and advanced. Planets seem to be the cosmic wombs and nurseries where life originates and evolves. Section II, therefore, is devoted to the search for other planetary systems. This is a key area where unfortunately we still know very little, but where impressive developments have occurred in the recent years, especially with the IRAS data, and where exciting progress is expected to occur in the next 10 - 20 years.

Chemical evolution is the formation of complex organic compounds of importance to life from simple gases (methane, ammonia, water vapor, etc.) under a variety of natural conditions and environments. Their presence brings us a step closer to life and therefore Section III covers our searches for organic compounds. The results show that chemical evolution is a common phenomenon both in our Solar System and in interstellar space.

Section IV deals with the origin and evolution of life on Earth, the only example we know. The facts here are that life started very early, essentially as soon as the Earth was capable of holding it, but it took very long (nearly 4 billion years) to evolve to an advanced civilization. Does it always take that long? How do spurious or periodic externally induced effects, such as mass extinctions, affect the rate of biological evolution? Does the phenomenon of convergence, which we observe on Earth, has a universal validity? These are some of the questions that we discussed that are of great importance to our searches, and which we are still trying to understand from the only example of life in the Universe we know.

Section V deals with our searches for radio signals from other advanced civilizations. The publication of this Volume coincides with the 25-th anniversary of the first radio search, the celebrated Project OZMA, conducted by Frank Drake in 1960. Nearly 50 searches have been undertaken in these 25 years, logging close to 120,000 hours of observations. The sophistication of these searches has been increasing at a rapid pace, as has also the international participation.

Section VI covers recent technological developments and the plans for the future. They include the construction of a new generation of multichannel spectrum analyzers with eight million channels and the development of special signal recognition algorithms for the on-line detection of a variety of signals. The NASA SETI Program, which will conduct comprehensive targeted and all-sky searches over a wide (1 - 10 GHz) frequency range, is now in the development stage and is expected to become operational toward the end of the decade of the 1980's.

Section VII addresses the controversy that surrounds the question of galactic colonization and the apparent absence of extraterrestrials from the Earth. A happy message that emerges from this Section and permeated our entire meeting was the general consensus that experimental work, and not debates, is the only way to resolve our questions, and therefore our search strategy ought to be broad and flexible enough to allow also for the experimental testing of different theoretical alternatives.

Section VIII is the last Section of this Volume and tries to summarize what has been achieved so far and what are the long term prospects. It is quite clear that tremendous progress has been achieved in these past 25 years, including scientific recognition, interdisciplinary collaboration, international participation, hours devoted to searches, funding, number of people involved, technological innovations, etc. In his first search in 1960, Frank Drake used a receiver with a single channel, the frequency of which was continuously changed to cover the spectral range around the hydrogen line. By comparison, we are now getting ready to embark on radio searches using spectrum analyzers with 8 million channels.

We can be proud of what has been accomplished in the past 25 years and may look with considerable confidence and optimism toward the next 25 years when many of the more advanced searches for planetary systems, organic compounds, and radio signals will be implemented.

3. PERSONAL ACKNOWLEDGEMENTS

I want to express my personal appreciation to the many people who helped me with the organization of the Symposium and with the preparation of this Volume. This is not an easy task because there are indeed many people to thank whose help and support made this whole effort possible.

I would like to start with President John R. Silber of Boston University and thank him for his strong support and for the allocation of University funds for our Symposium. Dr. A.G.B. Metcalf, the Chairman of the University's Board of Trustees for representing Boston University at the Symposium and for his kind words in his Welcoming Address. Dr. Geoffrey Bannister, the Dean of the College of Liberal Arts and the Graduate School for hosting a fine welcoming reception for all the Symposium participants and for his personal support. My colleagues in the Astronomy Department, Drs. K. Janes, M. Mendillo, K. Brecher, J. Aarons, J. Hughes, A. Marscher and especially Tom Bania and Bob Stefanik for their invaluable help with the many organizational tasks of the Symposium. Also Bishop Demetrios Trakatellis for his inspirational

Invocation at the Banquet, and Dr. Gene Malove of Lincoln Labs who was also of great help with the running of the Symposium.

I am deeply indebted to the Executive Committee of the IAU and especially to its General Secretary Dr. Richard West and its Assistant General Secretary Dr. J.P. Swings for the financial support they provided for the Symposium, and for their personal encouragement at many difficult moments. I am also grateful to NASA and especially to Drs. Donald DeVincenzi, John Billingham and Bernard Oliver for NASA's financial support of the Symposium and for their useful advice and personal help both at the Symposium and with the Proceedings.

I want to thank Frank Drake and Carl Sagan who helped me start the planning of the scientific sessions of the Symposium at my trip to Cornell in the fall of 1983, and Carl Sagan especially for agreeing to be our Banquet Speaker. I am also grateful to Dr. Roger Nichols, the Director of Boston's Museum of Science, and to Mr. Jack Carr, the Director of its Hayden Planetarium, for organizing our very successful special event at the Museum of Science, and to Dr. Philip Morrison for his eloquent and inspiring talk at this event.

My appreciation to all the members of the Scientific Organizing Committee and of the Local Organizing Committee of the Symposium for their help and support. Also to the Presidents of IAU Commissions 15, 16, 24 and 40, and of the International Organizations COSPAR, IAF/IAA, ISSOL and IUBS for co-sponsoring our Symposium. I want to thank also Drs. C. Sagan, J. Jugaku, W. Irvine, D. DeVincenzi, L. Margulis, J. Billingham, E. Purcell, E. Lilley, F. Drake, G. Marx, P. Morrison, and H. Smith who chaired the Sessions of the Symposium. Also to the many distinguished scientists from all around the world who presented important papers at the Symposium and sent their contributions for the Proceedings. I hope they will all forgive me for any pressure I might have exercised when time for the Proceedings was getting short.

I am grateful to my good friend Dr. George Marx for offering to organize the next IAU Symposium of our Commission 51 in Hungary in the summer of 1987, and to Drs. N.S. Kardashev, V.I. Slysh and V.S. Troitsky for their warm hospitality during my visit to Moscow right after our IAU Symposium and for sending me their contributions for the Proceedings in spite of the fact that they were not able to attend our Symposium.

I want to express my deep appreciation to our Librarian, Ms. Fenn Duncan, who did most of the typing in the word processor for this Volume, which with all the Introductions I wrote and the several papers that needed to be retyped amounted to more than 100 pages. Also to our Administrative Assistant Ms. Cecilia Piccolo, and to the Curator of our Planetarium Mr. David Bradford for their great help both during the Symposium and in the completion of this Volume. I am also grateful to the many people in the Housing, Conferences, and Food Services departments of Boston University who did a splendid job during our Symposium.

Finally I want to thank Mrs. N.M. Pols - v.d. Heijden of the D. Reidel Publishing Co. for her support and for her patience in the preparation of these Proceedings of IAU Symposium 112. I hope we have all labored for a good and worthy cause. AD ASTRA PER ASPERA.