GENE FAMILIES

**Studies of
DNA, RNA, Enzymes and Proteins**

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Published by

World Scientific Publishing Co. Pte. Ltd.

P O Box 128, Farrer Road, Singapore 912805

USA office: Suite 1B, 1060 Main Street, River Edge, NJ 07661

UK office: 57 Shelton Street, Covent Garden, London WC2H 9HE

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library.

GENE FAMILIES: STUDIES OF DNA, RNA, ENZYMES AND PROTEINS

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ISBN 981-02-4384-7

Printed in Singapore by World Scientific Printers

GENE FAMILIES

Studies of DNA, RNA, Enzymes and Proteins

Proceedings of the October 5 –10, 1999 Congress, Beijing, China
The 10th International Congress on Isozymes

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ACKNOWLEDGEMENTS

Technical & Logistics Support for Proceedings Production

D'Trends, Inc., USA

Financial Support for Proceedings Production

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PREFACE

As Chairman of the International Executive Committee of the 10th International Congress on Genes, Gene Families, and Isozymes, I am pleased to make the opening remarks for this special volume. The meeting, held in Beijing, coincided with the celebrations of the 50th anniversary of the founding of People's Republic of China.

The Congress was organized by Dr. Guoxiong Xue and his Co-Chairs, Drs. Boqing Qiang, Fangzhen Su, and Laining Yu. The Chair of the Congress, Dr. Zhihong Xu, is Vice President of the Chinese Academy of Sciences, and since the Congress was appointed also as President of Peking University. As Presiding Chair of the Congress, and on behalf of all of the participants, I thank the organizers and the Chair for the effort they committed to making the meeting a huge success scientifically as well as socially and culturally.

The 10th Congress continued the precedent, established at the 9th Congress, of emphasizing genes and gene families as the primary determinants of isozymes and of protein multiplicity. Toward that goal, the organizers structured the Congress around the following themes:

- Gene Families and Isozymes
- Gene Families and Enzymes
- Population Variation of Gene Families
- Gene Families and Human Disease
- Genetic Mutation and Disease
- Gene Families and Evolution
- Mammalian Gene Families
- Gene Families and Plants
- Gene Families and Gene Expression
- Gene Families and Biotechnology
- Genomes and Bio-information

The 10th Congress also continued the tradition of exploring the interfaces among various biological disciplines, rather than focusing on individual disciplines as is most common at scientific meetings. Cross-fertilization was highly evident among cognate disciplines in the biological sciences in studies of disease, evolutionary biology, medical genetics and gene regulation. Moreover, research was presented involving a wide range of organisms including bacteria, protozoa, plants, and mammals.

This volume contains selected papers from the Congress, all of which have gone through a rigorous peer review process. These papers are representative of the breadth of scientific topics discussed at the meeting and of the high scientific quality of the meeting. I thank the authors, the reviewers, and the editors for their

commitment to the excellence of this volume as a lasting tribute to the Congress and to the field that was founded by Professor Clement Markert.

The 10th Congress began with a tribute to Professor Markert, who passed away just four days before the opening of the meeting. Professor Markert had been named as the Honorary President of the Congress, in recognition of his role in discovering isozymes and pioneering the concepts of isozymes and gene families. Professor Graeme Hammond presented a moving tribute to Professor Markert and to the professional and personal contributions that he made to science and to society throughout his life. The 10th Congress was held 30 years after Dr. Markert and his colleagues first published the concept of isozymes.

The Congress had a strong international flair, with presentations from scientists representing 29 countries and regions. They included Australia, Austria, Belorussia, Brazil, Canada, the Czech Republic, Denmark, Finland, Germany, Greece, Hong Kong Special Administrative Region of China, India, Ireland, Israel, Italy, Japan, Malaysia, The Netherlands, People's Republic of China, Portugal, Russia, Singapore, Spain, Sweden, Switzerland, Taipei, Thailand, United Kingdom, and USA.

As has been traditional from this series of Congresses, the organizers arranged a variety of special social and cultural activities that complemented the scientific activities of the Congress. These included a superb welcoming reception, a visit to the Chinese Opera, and a day trip to the Great Wall and other local attractions.

Since their inception in 1961, this series of congresses has provided an opportunity for scientists working in a wide variety of fields involving isozymes and gene families to interact and to learn from the isozyme concept as it is applied diversely to many biological disciplines. I look forward to the 11th International Congress on Genes, Gene Families, and Isozymes to be hosted by Dr. Hans Jörnvall of the Karolinska Institute in Stockholm in 2001, the 30th anniversary of this series of congresses.

September 2000

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OBITUARY

Clement L. Markert (1917-1999)

The concept of isozymes was developed by Clement Markert and Freddy Möller in 1959,¹ which paved the way for extensive studies on enzyme, protein and gene multiplicity across all living organisms. This important scientific discovery has had a profound influence on the biological sciences for more than 40 years, and provided the basis for regular international meetings to discuss the biological and biomedical implications of enzyme multiplicity. More recently, this concept has been extended to a wide range of gene families for DNA, RNA, proteins and enzymes.

As the Honorary President of the 10th International Congress on Genes, Gene Families and Isozymes, recently held in Beijing China in October 1999, Dr Markert was planning to attend and participate in his 10th 'Isozyme' Conference. Unfortunately, it was announced at the Congress Opening by Clem's friend and collaborator from Yale University, Dr Graeme Hammond, that he had passed away four days earlier following a recent illness. As Clem would have wanted it, the Congress proceeded in his absence and was an outstanding success. All of us attending the meeting, however, were saddened by the absence of a wonderful scientist who established the field of gene families and isozymes as a fundamental concept of living organisms. We also missed his friendship, good humor and contributions of criticism, advice and commendation of the papers presented at the Congress.

Clem Markert was born on April 11 1917 in Los Animas, Colorado USA, and passed away in Colorado Springs on October 1 1999. His 82 years were filled with hard work, adventure, outstanding science, international travel, love for his wife Margaret and their children Alan, Robert and Betsy, and in his younger years, controversy. Clem graduated from the University of Colorado in 1940, following activities in Spain fighting with the International Brigades against the fascist regime in that country in 1938.

During the Second World War, he served in the U.S. merchant navy, following completion of his Masters degree at UCLA. After the war, he completed his Ph.D. in 1948 at John Hopkins University in Baltimore, followed by a two-year Postdoctoral at the California Institute of Technology. His first academic appointment as Assistant Professor was at the University of Michigan during 1950-56. It was during this period that he came under scrutiny by the Committee for Unamerican Activities, commonly referred to as the McCarthy Committee. The response from Clem and Margaret, and the outstanding support provided by his

¹Markert and F. Möller, Multiple forms of enzymes: Tissue, ontogenetic and species specific patterns. *Proc. Natl. Acad. Sci. USA* **45** (1959) pp. 753-763.

scientific colleagues and friends, reflected their strength and resilience, and their desire to ensure that free speech was a protected right.

His appointment at Johns Hopkins University during 1956-65 was enormously productive and rich in biological discovery and conceptual development. In 1957, the 'zymogram' technique was published jointly with Robert Hunter, a colleague from the University of Michigan.² This method combined the resolution power of multiple forms of enzymes by starch gel electrophoresis with the specificity derived from histochemistry in the staining of enzymes. It was applied initially to esterases and subsequently to many other enzymes, including lactate dehydrogenase. It was the latter path-breaking work that led to the 'isozyme' concept, and many scientific discoveries around the world, with studies on micro-organisms, plants and animals revealing the extensive multiplicity of genes, gene families and isozymes in all biological species.

In 1965, Dr. Markert moved to Yale University to become Chairman of the Department of Biology during 1965-1971, and continued on at Yale as Professor of Biology until 1986. During 1974-86, he served as the Director of the Center for Reproductive Biology, reflecting his pioneering role in the related field of transgenics. Together with his collaborator, Jon Gordon, Clem developed a powerful tool for developmental genetics, involving the microinjection or micromanipulation of nuclei of mammalian eggs.

After 21 years at Yale University, Clem and Margaret moved to North Carolina State University, where he was appointed as a Distinguished University Professor during 1986-93. There, he joined a longstanding friend and colleague, John Scandalios, who had been appointed to a similar prestigious position supported by the State of North Carolina, in its enhancement program for scientific research. At the age of 76, Clem became an Emeritus Distinguished Professor of the University, and returned to live in Colorado Springs, which is near where the Markert family spent their summer break at their 'cabin' high in the Santa Cruz Mountains.

During this distinguished career, Clem was recognized with many honors and awards, including election to the National Academy of Sciences (governing Council member during 1970-71, 1977-1980); American Institute of Biological Sciences (President, 1965); American Genetic Association (President, 1980); American Society of Naturalists (Vice-President, 1967); American Society of Zoologists (President, 1967); and many other societies. He has served as a scientific editor on a number of journals and other publications, including positions as Managing Editor of the *Journal of Experimental Zoology* (1963-85); member of the Editorial Board of the *Archives of Biochemistry and Biophysics*; *Differentiation*; *Cancer Research*; *Developmental Genetics*; *Transgenics*; and Editor of the *Proceedings of the 3rd*, and

²R.L. Hunter and C.L. Markert, Histochemical demonstration of enzymes separated by zone electrophoresis in starch gels. *Science* **125** (1957) pp. 1294-1295.

5th-7th Isozyme Congresses and of the Prentice-Hall Series in Developmental Biology.

Ten international congresses have now been held on isozymes and gene families: the first (1961) and second (1966) in New York under the sponsorship of the New York Academy of Sciences, and the third (1974) at Yale University and Chaired by Clem, with outstanding support from Margaret. Subsequent Congresses have been regularly held at various locations, including Austin, Texas (4th, 1982); Island of Kos, Greece (5th, 1986); Toyama, Japan (6th, 1989); Novosibirsk, Russia (7th, 1992); Brisbane, Australia (8th, 1995); San Antonio, Texas (9th, 1997); and Beijing, China (10th, 1999). All of these Congresses, with the exception of the last Congress, were attended by Clem, who played major roles in them all by the delivery of Plenary Lectures as Congress President or Plenary/Symposium Chairman, and strong participation in the scientific and social activities of the Congresses.

We have not only lost a great scientist and pioneer in field of isozymes and gene families, he has been a friend, mentor, student and postdoctoral supervisor, collaborator, editor, referee and supportive critic for many of us. Clem has been strongly supported throughout his distinguished career by his wife Margaret, who accompanied him to conferences, Isozyme Congresses and other visits with friends and colleagues around the world. They were always generous hosts, inviting us into their homes in Ann Arbor, Baltimore, New Haven, Raleigh and Colorado Springs, as well as to their mountain retreat in the Santa Cruz mountains.

Clem was a strong person in every sense of the word, physically and mentally. He was an engaging conversationalist with a remarkably broad knowledge of the biological sciences, and with strong interests in science policy, which were expressed at the highest levels in government and scientific organizations. He also was an internationalist, with a healthy cohort of 'foreigners' undertaking graduate and postdoctoral study. His contribution to the development of science in many countries is well known, including China and Russia.

Clem Markert will be remembered by many scientists, colleagues and friends around the world and has given all of us a lasting legacy in the biological sciences with the isozyme concept now being applied in a broad range of gene families in molecular biology and biochemistry, cellular differentiation, developmental biology, biomedical science, gene regulation, structure and function of enzymes and isozymes, transgenics, and population biology.

Farewell Clem. Our condolences go to Margaret and the Markert family with our love and best wishes.

September 2000

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Photo 1. A rest during a picnic on an island on the Ob Sea - a man-made sea in Siberia, Russia. (l to r): Mrs. and Erwin Goldberg, John Scandalios, Clement Markert, Mrs. and Athanasios Tsaftaris, (unidentified), Eviatar Nevo, Robert Gracy, Michael Crawford. Prof. Markert was an active participant in every single congress since the inception of the Congress series in 1961.
(The 7th International Congress on Isozymes, Novosibirsk, Russia, September 6-13, 1992).

Photo 2. A business dinner at Oleg Serov's residence. (l to r): Leonid Korochkin (Congress Co-Chair), Roger Homes, Oleg Serov (Congress Co-Chair), John Scandalios and Clement Markert.
(The 7th International Congress on Isozymes, Novosibirsk, Russia, September 6-13, 1992).

Photo 3. Clement Markert opening the 8th International Congress on Isozymes.
(The 8th International Congress on Isozymes, Brisbane, Australia, June 25-July 1, 1995).

Photo 4. Margaret and Clement Markert, between sessions at the Congress Auditorium.
(The 8th International Congress on Isozymes, Brisbane, Australia, June 25-July 1, 1995).

Photo 5. Sidney Altman and Clement Markert. Sid, 1989 Chemistry Nobel Laureate for the discovery of catalytic properties of RNA, is Clement's longtime colleague and friend. Sid was one of the six Nobel keynote speakers at the Congress to commemorate Clement's 80th birthday.
(The 9th International Congress on Isozymes, San Antonio, USA, April 14-19, 1997).

Photo 6. Clement Markert speaking at a dinner to celebrate his 80th birthday.
(The 9th International Congress on Isozymes, San Antonio, USA, April 14-19, 1997).

Photo 7. Guoxiong Xue and Clement Markert. Guoxiong is Executive Co-Chair of the 10th International Congress on Isozymes, Genes, and Gene Families. Clement was Honorary President of the Congress. This photo was taken in 1995, Brisbane, Australia.

Photo 8. Congress banquet at a Yunan restaurant in Beijing. The Congress Chairman, Professor Zhihong Xu (President, Peking University), is taking part in one of the entertainment programs. Conspicuously absent is Prof. Clement Markert, who passed away four days before the 10th Congress commenced.

(The 10th International Congress on Isozymes, Beijing, China, October 5-10, 1999).