

The International Society of Biometeorology:

A Fifty Year History

By

G. Edgar Folk, PhD

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Origins

My purpose in this monograph is to describe the origin and history of the International Society of Biometeorology (ISB). A previous history, covering 1956 to 1996, was written by Wolf H. Weihe (1997). However, his most thoughtful history does not explain why the ISB is an international society instead of just a European society. The answer to this question partially depends upon an explanation and definition of biometeorology.

Biometeorology is an interdisciplinary science, representing an amalgam of other disciplines: phenology, physiological ecology, and environmental physiology (See Figure 1). When there is some emphasis upon meteorological information, any material originating from these other sciences can rightly be called biometeorology (Folk 1997). What brought these disparate disciplines together?

In 1953, a group of European scientists became interested in combining the disciplines of biology and meteorology. If this group had continued independently, the ISB could have been composed strictly of European scientists. Many organizations of scientists are duplicated in several parts of the globe (for example, the British Physiological Society and the American Physiological Society). The ISB, on the other hand, has been international from the start because of one important formative event described below.

In the United States, a division of the American Meteorology Society with

the name Biometeorology had already been formed in 1952. The following year, hoping to interest Americans in this new discipline, Dutch geologist Solco Tromp journeyed to Washington, D.C. He met with Frederick Sargent, Konrad Buettner, and Edgar Folk. Tromp explained to this committee that an active and enthusiastic group had met previously in Paris to discuss the formation of a new society, Biometeorology. The most active members there, along with Tromp, were Hans Ungeheuer (Fig. 3) and H. Primault. A description of the work of these two scientists is included in the previous history of the ISB (Weihe 1997).

Tromp had laid the foundations in the Paris meeting, but it was the fusion of the dynamism and enthusiasm of Solco Tromp and Frederick Sargent that led to the formation of the ISB. I had not met Solco until he came to meet with us in Washington in June of 1953. Sargent had asked Konrad Buettner and me to come to the meeting. Buettner's opinion was sought because of his many publications on the physics involved in the interaction between animals and the physical environment. I was invited because I was the chair of Physiological Ecology, a division of the Ecological Society. Also, Fred Sargent and I had shared a staff office for years in the Harvard Fatigue Laboratory, the first laboratory of Exercise and Environmental Physiology in the United States.

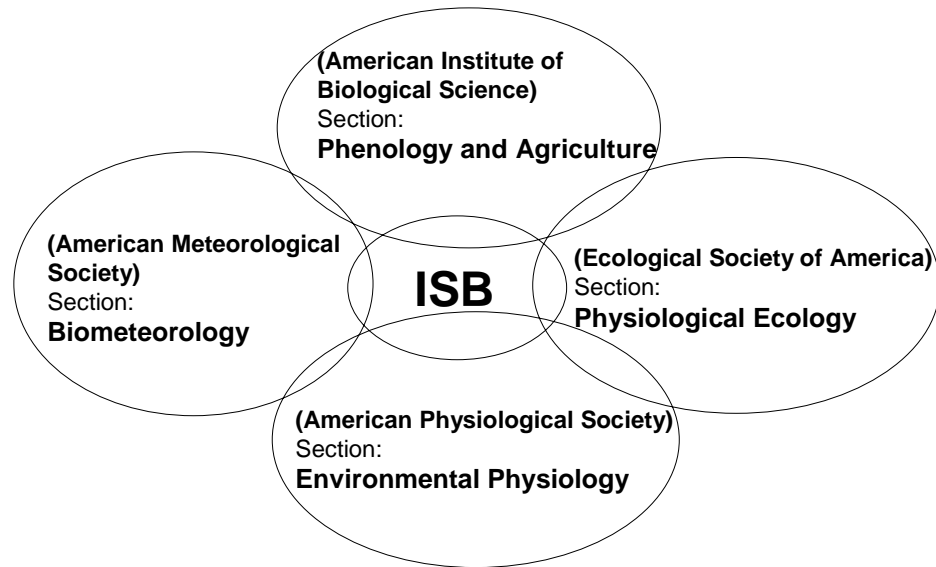


Figure 1: Examples of American contributing societies similar to those in Europe
Ref: International Journal of Biometeorology (1997) 40:41.

Founder Biographies

The successful establishment of the ISB can be accredited largely to creative energy and interest on the part of its founders. Solco W. Tromp had already, by 1953, achieved a substantial bibliography on topics which we may refer to as biomedical science or medical geography. His remarkable productive energy continued to the time of his death in 1993. Figure 2 lists the output emanating from his laboratory, which included lectures, refereed papers, handbooks, and chapters in books. An example is the 687 page volume of Proceedings held at the Royal Society of London (Tromp, Ed, 1962).

His co-worker and friend, Wolf Weihe, has this to say about Tromp: “Solco was highly internationally minded. As a geologist, he searched for oil in Indonesia, was interned during the war and then spent time in Cairo, Egypt. He then returned to Holland after a vast experience in coping with different climates. He belonged to an old family, important in Naval History. This seemed to give him a certain sovereignty to behave stubbornly and at times as a despot. This also helped him to build up an odd interdisciplinary science in spite of his lack of degree credentials.”

Hans Ungeheuer represented a different approach to our field of discussion, with more of an emphasis on microclimates and botanical material. He was classified as a geophysicist. An outline of his work is found in Figure 3.

Hard-cover books on biomedical topics or medical geography; editor-in-chief or author	16
Monographs: author or co-author	13
Institute reports: author	17
Refereed journal articles	31
Articles in society proceedings	40
Published lectures, reviews, and chapters in books, encyclopedias, or handbooks	88
Total	205

Figure 2: Publications of Dr. Solco W. Trump, co-founder of the ISB

<p>BS Geophysics and Meteorology, Frankfurt/Main</p> <p>PhD topic: Forest Microclimates</p> <p>1933 - Climate Research in Obersdorf</p> <p>1935 - Flight Meteorologist</p> <p>1955 - Director: Medical Meteorological Research Station in Bad Tolz</p> <p>1957 - Director of Geophysical Service (Lech)</p> <p>1963 - Geophysicist at Karlsruhe</p>

Figure 3: Career overview of Dr. Hans Ungeheuer (1908 – 1966), co-founder of the ISB (1956)

Equally a stimulus to the society, and an active supporter of all of its aspects, was Frederick Sargent. Fred's undergraduate degree at MIT in 1942 was in meteorology, followed by a medical degree at Boston University in 1947. We were well aware of Fred's interest in "relations between the patient and the weather" because of the number of books and articles on this topic always to be found on his desk between 1942 and 1946. Both Landsberg and Petersen wrote books on this topic. We were surprised to find that this interest took Fred far afield. When I arrived by boat as the new director of the Bowdoin Biological Station on Kent Island in the Bay of Fundy in 1947, Fred had just left. The resident meteorologist who came each summer to study the climate around the island, Dr. Robert Cunningham, said that Fred Sargent had worked there for several summers. His remark was, "Fred knew that in this region of the Bay of Fundy there are, in meteorological terms, sudden changes with cold fronts changing to warm fronts, and the reverse. Fred and I worked together to try to find a correlation between these weather changes and some physiological measurements which he made on several of us. Actually, we did not find any pattern in the data."

The relationship between Fred Sargent and the development of the society is outlined in Figure 4. After the international society was formed in 1956, Fred Sargent was elected the first president. He established a plan within the society meetings which has lasted to the present day: the various areas of

interest were designated as study groups, which organized speakers in the fashion of seminars. Fred continued in the administration of the society up to the time of his early death. One of his large contributions was the design, with Champ Tanner, of a Biometeorology PhD Program, which will be described in more detail later in this paper.

Associated with Fred Sargent was Konrad Buettner, a founding member of the society as mentioned earlier. He might best be classified as a biophysicist. He was particularly interested in the relationship between the physical environment and human physiology when individuals are in environmental extremes. He was later to be called an “Environmental Physiologist.” He collected much of his original data in the field, often a perilous endeavor. At one time a mule carrying his instruments fell off the trail on Mount Ranier, and his instruments were destroyed.

The London Congress in 1960

Our history now progresses to a large Congress in 1960. Readers who look through the program of the London Congress of 1960 will be impressed with the vitality of the Congress at that time, and with the spectrum of science represented there. Of the 235 participants, a few are named in Figure 5. Some of these outstanding biometeorologists are described in this history. At the time of this writing in 2007, five of the participants designated on the chart are still

1. Early history: studied effect of weather on human subjects on Kent Island, Canada.
 2. The Society's first symposium was published by a division of the American Meteorological Society. Principles of biometeorology were first stated there in 1955.
 3. The Society was formed in 1956, after Dr. Tromp came to the U.S. to obtain the support of the American scientific community.
 4. As first president, Dr. Sargent designed "the Study Groups to work like seminars on a complex theme across disciplines."
 5. A major research theme of his: "The Patient and the Weather."
 6. His degrees: BS in Meteorology, MIT
 MD, Boston University
- Appointments: Professor of Physiology Professor of Human Ecology
 University of Illinois University of Texas

Figure 4: Career highlights of Dr. Frederick Sargent, II (1920 – 1980), co-founder of the ISB

Bianca Scotland	Glaser Great Britain	Spurr U.S.A. ★
Buettner Germany	Haufe Canada ★	Tromp Netherlands
Carlson U.S.A.	Hensel Germany	Weiner Great Britain
Cloudsley-Thompson Great Britain ★	Janowski Poland	Whittow Scotland
Dingle U.S.A.	LeBlanc Canada ★	Wilbur U.S.A.
Folk U.S.A. ★	Rodahl U.S.A.	Wilson Sweden
Fontaine France	Sargent U.S.A.	Wyndham S. Africa

★ Living and Active Members

Figure 5: Leaders in Biometeorology who stood the test of time – The London Congress of 1960 (235 participants)

living and active. To make a comparison, there were about 250 attendees at our 50-Year Congress. Examination of the 1960 Congress is important because the attendance at that meeting indicates the vigor and enthusiasm of the scientists contributing to a new, developing, interdisciplinary field. Another reason for emphasizing this particular Congress is the spectrum of countries represented by the attendees, extending from Sweden to the United States to South Africa.

The other Congresses are recorded in the following table:

Past Venues of International ISB Congresses	
1956: Paris, France	1978: Shafayiam, Israel ¹
1957: Vienna, Austria	1981: Osnabruck, Germany
1960: London, England	1984: Tokyo, Japan
1963: Pau, France	1987: West Lafayette, U.S.A.
1966: New Brunswick, U.S.A.	1990: Vienna, Austria ²
1969: Montreux, Switzerland	1993: Calgary, Canada
1972: Nordwijk, Netherlands	1996: Ljublijana, Slovenia
1975: College Park, U.S.A.	1999: Sydney, Australia
	2002: Kansas City, U.S.A.

¹ A particularly successful Congress mostly due to the efforts of three individuals, Dr. Z. Zemel (Israel) and Drs. J. Stolwijk and G. Krasnow (U.S.A.).

² One of the larger Congresses. The committee consisted of 15 prominent biometeorologists, most of whom are active today. There were 300 persons pre-registered and over 100 abstracts filed.

The Origin of a Companion Discipline: Phenology

An equivalent term which is more accurate for this discipline is phytophenology. The discipline is defined as the science of relating microclimate to periodic events in plant life. This discipline was called to the attention of some interested students as far as back as 1939. At that time, Hugh Raup at Harvard University gave a field course in which students filed a series of reports based upon weekend sojourns to many different forest types. These trips took place throughout New England and beyond. I was an enthusiastic member of that class, along with Eric Watson from the University of Reading in England, who was later to write *The Mosses of Great Britain*. Another member was Donald R. Griffin, who was to become the best-known animal behaviorist in American science. Hugh Raup liked, as it was once expressed, “to teach while sitting at one end of a log on the forest floor with a student at the other end of the log,” or with several students scattered around while he smoked his pipe and described principles relating microclimate to plant life. Several of us, even today, are influenced by his teaching (see Figure 6). For example, he believed that more biologists should use maximum-minimum thermometers to describe the environment around plants and animals. As a result, for a few pre-Castro years, I left a maximum-minimum thermometer in a Cuban bat cave, read occasionally by me or some Cubans. It may still be in the cave.

Of course, Raup also emphasized carrying into the field other instruments,

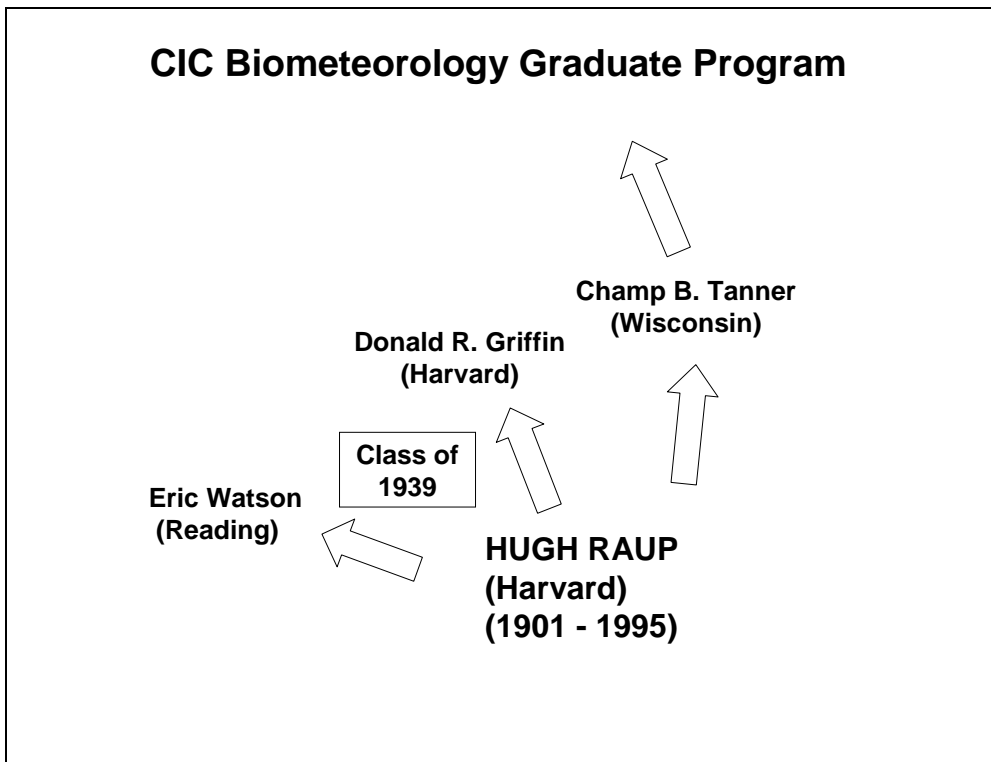


Figure 6: Some of Hugh Raup's influential students

such as thermocouples, sling cyclometers, and dew point recorders. His emphasis upon field instrumentation created a lifetime of habits in all his students. I don't remember whether he used the term philology, but he certainly was teaching that discipline.

The most important individual to come under his influence was Champ B. Tanner at Wisconsin. Figure 7 presents the likeness of Hugh Raup, who retired in 1985 from Harvard University and spent the rest of his professorial life at the Smithsonian Institute in Washington D.C.

Champ Tanner is mentioned above because of his importance in the history of phenology. We now add some detail about his career, and the way in which he contributed to our society and to phenology. He was one of the most prominent and successful members of the Society of Micrometeorology. During his lifespan, from 1920 to 1990, he achieved the status of being a member of the National Academy of Sciences in the United States, an appointment which was made in 1981. His work at the University of Wisconsin is typified by his micrometeorological measurements of the environment of agricultural plants, on both the solar side and the underside of corn and soybean leaves. He carried the science of micrometeorology to a fine art.

The work of Jen Yu Wang, another trailblazer in the field of phenology, was carried out during the years 1958 to 1992. He was very influential in the

invention of and perhaps the earliest use of the term phenology. He wrote a keystone article for a symposium in 1968. This symposium had the title “Biometeorology,” and was published by the Oregon State University Press and edited by William Lowry (1968). This volume contained important papers by other experts such as David M. Gates. The title of Wang’s paper was “Phytophenology as a Microclimatological Surveillance Tool.” His long survey of the field included nine references to his own work beginning in 1958. Wang was a pioneer in his field.

We turn next to the work of John L. Monteith, who spent most of his career at the University of Nottingham in England. His active period began in 1963, although as of this date (2006) he is still active in his laboratory each day. John has written a large number of papers for refereed journals, but he is probably best known in the biometeorology community for his text book, *Principles of Environmental Physics*. His first edition was published in 1973, but the principles which he presents are ageless.

The above ends our review of classical work in phenology, the landmark events of which are listed in Figure 8, but the discipline is being carried forward actively in the 21st century. For example, there is a Phenology Commission as a part of the International Society of Biometeorology. The active individuals there are doctors Schwartz, Chan, and Chmielewski, representing the United States, China, and Germany. They have published a report each year beginning in



Figure 7: Hugh Raup

- I. The work of Hugh Raup 1935 – 1990*
- II. The work of Champ Tanner 1940 – 1990*
- III. The work of Jen Yu Wang 1967 – 1992*
- IV. The work of John L. Monteith 1963 – 1990*
- V. The Six Annual Reports of the Phenology Commission

M.D. Schwartz (USA), X. Chen (Peking) and F. Chmielewski (Berlin)
(1998 – 2004)

* Period of most productive work

Figure 8: Landmark events in Phenology

1998. Furthermore, there is a journal entitled *New Phytologist* from Blackwell Publishing Company.

The CIC Biometeorology Graduate Program

A key event in the development of the discipline of biometeorology was the successful training program financed by the U.S. National Institute of Health. This was an inter-university program, which depended initially on the energy of Champ B. Tanner and Frederick Sargent (as shown in Figure 9). The original inspiration came from D. Bruce Dill. The program lasted from 1963 to 1971. The appeal to the granting agency was that this was to be a joint program between the Big Ten Midwest Universities. The grant was actually given to a Big Ten University organization called The Committee for Institutional Cooperation (CIC). The program was adequately funded, and upon request to the board of directors any faculty member interested in biometeorology in any of the Big Ten Universities could apply for financing for the support of a PhD student, or for visiting speakers.

One characteristic of the program (which was probably partly why the grant was funded) was the requirement that each candidate have interdisciplinary training. This was accomplished by having each biology major take two courses in meteorology or atmospheric measurements, or by having each meteorologist candidate take four courses in biology.

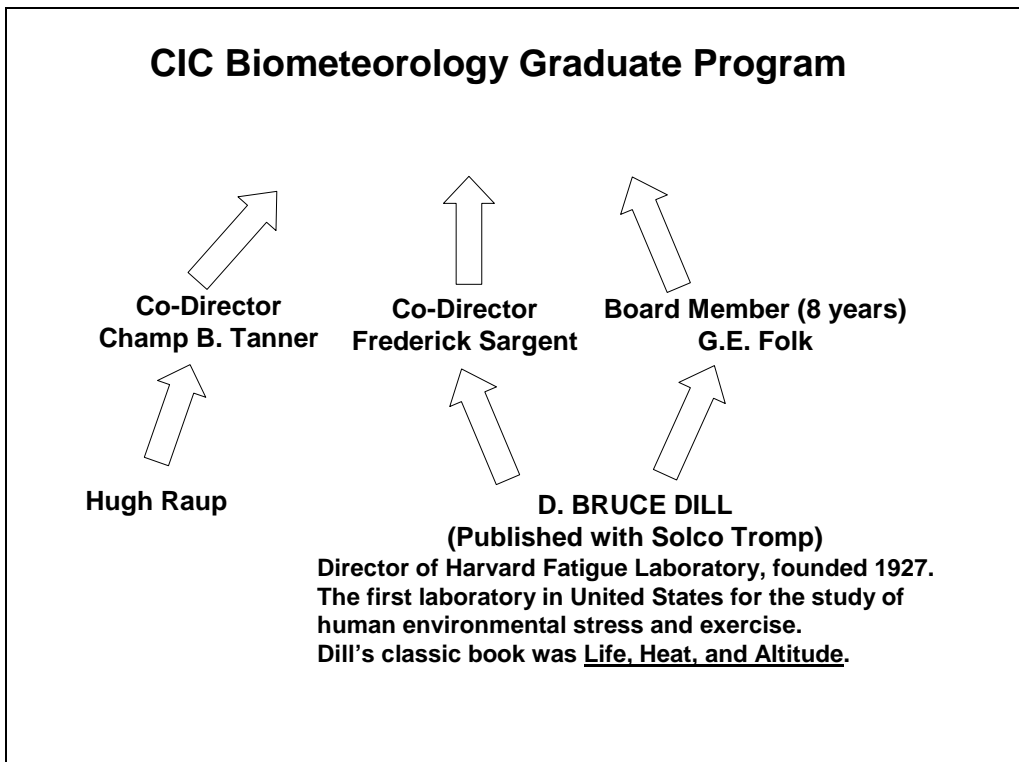


Fig 9: Development of the CIC Biometeorology graduate program, which awarded 30 PhD's between 1963 and 1971



Fig. 10: The Australian rabbit-eared bandicoot as depicted by Victor MacFarlane

Thirty students earned a PhD in Biometeorology in the CIC Program. Here is a description of two of them to serve as an example of the success of the program. Professor Dennis Driscoll at Texas A&M University wrote many papers; an example is cited in the bibliography. James Gessaman of Utah State University also wrote many papers which included records of the microenvironments of the animals he studied.

Gessaman (a member of the ISB) illustrates the use of one of the CIC Fellowships provided to E. Folk by the ISB program. Gessaman and his wife were funded to live in the Arctic for two years to collect data for his PhD thesis. They resided at the Naval Arctic Research Laboratory at Barrow, Alaska. Elaborate metabolism equipment was built under the guidance of the laboratory director, Dr. Max C. Brewer. In his experiments with the arctic snowy owl, Gessaman measured the highest increase in resting metabolism due to extreme cold exposure (-60°F) of any vertebrate.

There was another student who spent two years on an ISB fellowship at Point Barrow to collect the data for his PhD thesis, namely Joel J. Berberich, who held two fellowships (the other was from the National Science Foundation). At Barrow he did a landmark piece of research, which involved whether there was a need for cold acclimatization in small animals which live on the shore of the Arctic Ocean, or whether such animals were cold-acclimatized in all seasons. Joel received his PhD in Biometeorology from the University of Iowa and later a

MD from the University of Illinois.

Another provision of the grant provided an exciting impetus to the ISB; a portion of the money provided was to bring experts in biometeorology from around the globe to any of the Big Ten Universities. This introduced a special vitality to the CIC Biometeorology Graduate Program. As examples, two of the individuals who were brought to the University of Iowa (and to other Midwest Universities) were Professor John Cloudsley-Thompson from the deserts of Africa, and Professor Victor MacFarlane from the deserts of Sydney, Australia. These individuals, as did others, gave seminars and lectures for the biological community at the University of Iowa and at other Big Ten Universities.

John Cloudsley-Thompson was a lifetime member and active supporter of the ISB. His bibliography includes many papers on the microclimate in African deserts. As of this writing he still maintains an active office at University College, London.

Professor MacFarlane was known in Australia for his climatological measurements and analysis of the water-balance of mammals in the desert. He was an accomplished artist, as was John Cloudsley-Thompson. MacFarlane delighted his audiences with drawings of exotic desert mammals, drawings which his wife converted to engravings. Some of our faculty at the University of Iowa were studying mammalian hibernation, and so after his visit Victor sent us an engraving with the following caption: "We are having desert winds, hot and wild

and dry now, so here is a portrait of the rabbit-eared bandicoot who lives in the howling desert and puts up metabolism 30-50% at night, increases red cell ATPase activity, then turns it all off again by day, when body temperature falls to 33°. Not your hibernation, but useful in the desert” (see Figure 10).

Another scientist must be mentioned because of his influence on the successful granting of the CIC graduate program, namely D. Bruce Dill (see Figure 11). He was a special influence on Frederick Sargent, who was the key person in acquiring the grant, and also a sponsor and source of inspiration for the author (E. Folk), who was a board member of the CIC program for eight years. Bruce Dill proved his interest in biometeorology by publishing with Solco Tromp at a very early time and by attending our Congresses. He was a long-time director of the Fatigue Laboratory at Harvard University. He wrote a classic book entitled *Life, Heat, and Altitude*, a book which inspired many individuals to emphasize or go into the science of biometeorology. Dill was especially well-known because of his contribution to the building of the Hoover Dam. The climatic problem there was that the workers were frequently sick from heat stroke. Bruce Dill was called in as a consultant because he had published, from the Fatigue Laboratory, the first experimental evidence for human acclimatization to heat. He proposed a series of solutions to the problems at the Hoover Dam. One was simple; rather than having the workers sleep in the valley where they

were building the dam, transport them each night to the coolest point of altitude near the construction camp. Later, D. Bruce Dill was elected president of the American Physiological Society.

This completes our discussion of the eight-year CIC biometeorology program, and we now turn our attention to some of the other scientists who have added vitality to the continuing history of biometeorology.



Fig. 11: D. Bruce Dill

David M. Gates	Biometeorology	1968-1990*
Jen Yu Wang	Phenology	1968-1991
John L. Monteith (Still Active)	Environmental Physics	1963-1990
LeRoy Hahn (Still Active)	Livestock-Climate Relations	1966-2005
Champ B. Tanner**	Micrometeorology	1956-1990

* Most productive period of publication
 ** Lifespan: 1920 – 1990 A member of the National Academy of Science (1981)

Fig. 12: Some Hall of Fame members who defined their discipline and published consistently over time

The Biometeorology Hall of Fame

Although it is hazardous to select outstanding people for special attention in any discipline, I think it is suitable at this time to honor living members of the society who are still making large contributions (Figure 12).

To start with, we call attention to the career of Helmuth Lansberg. He combined his work in our ISB society with contributions in the World Meteorological Organization. He was a successful integrator of two disciplines, publishing a book on *Weather and Health* (1969). His work from 1930 to 1985 has been reviewed by David Miller (1987).

A completely different field is represented by Dr. B. Givoni from Halfa. In 1958, after years of work in his field, he wrote a book entitled *Man, Climate, and Architecture*.

I wish to emphasize that a great contributor to the society and to this history is W. Weihe who made a lasting contribution to the society, not only by his vital presentations at the Congresses and in the literature of our field, but especially because he was editor-in-chief of our journal from 1961 to 1982. Much of his personal research was done at high altitude.

Another long-time activist for this society is Wilbur Haufe. He served as president for nine years, and before that was the chair of the section on entomology between 1972 and 1981.

LeRoy Hahn represents yet another field. He has actively contributed to

the society in its role of providing good science from 1966 to the present. His field of study is the climate influences on livestock, especially cattle. In addition to his work with many students, and his science contributions, he has had the unenviable position of serving as treasurer of this society from 1999 to 2006. He should receive special thanks for his many conscientious hours devoted to the ISB.

Helmut Lieth was president of the society for many years. He was editor of a very successful biometeorology series published in an attractive form, ending in about 1998. A typical example of these publications is the one for 1995 (Lieth et al. 1995).

A leader in presenting data on animal acclimatization before the society was J. Stolwick of the Pierce Laboratory at Yale University. With other members of that staff he contributed to several of our Congresses.

Several of the early members deserving recognition added to the life of the society for about thirty years and then went on to administrative positions which they still hold. Examples are Jacques LeBlanc, whose lifetime of work is found in the book *Man in the Cold* (1975). Another is David M. Gates, mentioned earlier, whose two books on the topic of man and his environment (1972) (1993) are classics. A third is Mohamed K. Yousef who has contributed many papers and volumes on biometeorology; his book on *Animal Production for the Tropics* is unique (1982).

Of course, in this Hall of Fame the hardworking presidents, secretaries, and treasurers of this society must be included. They are listed in following table:

<u><i>Years</i></u>	<u><i>President</i></u>	<u><i>Secretary</i></u>	<u><i>Treasurer</i></u>
1960-1963	F. Sargent	S.W. Tromp	S.W. Tromp
1963-1966	F. Sargent	S.W. Tromp	S.W. Tromp
1966-1969	Dr. D.H.K. Lee	S.W. Tromp	S.W. Tromp
1969-1972	Dr. D.H.K. Lee	S.W. Tromp	J. Greenleaf
1972-1975	W.O. Haufe	S.W. Tromp	J. Greenleaf
1975-1979	W.O. Haufe	Bernaud Primault	S. Krasnow
1980-1984	H. Lieth	Bernaud Primault	S. Krasnow
1984-1988	N. Kikuchi	Bernaud Primault	S. Krasnow
1988-1991	J. Newman	Bernaud Primault	S. Krasnow
1991-1994	Wolf H. Weihe	Bernaud Primault	Wayne Decker
1994-1996	Russel J Reiter	Nayana Barthakur	Wayne Decker
1996-1999	Andris Auliciems	Paul Beggs	Wayne Decker
1999-2002	Peter Hoeppe	Paul Beggs	LeRoy Hahn
2002-2005	Ian Burton	Scott Greene	LeRoy Hahn
2005-2008	Laurence Kalkstein	Scott Greene	LeRoy Hahn

In Retrospect

As we bring to a conclusion this fifty-year history of the society, we must ask whether the field has changed. One original emphasis was on acclimatization and Darwinian genetic adaptations of animals and plants (Folk 1966). Interest in these topics has continued to grow. The term “Environmental Physiology” was frequently used and several members of ISB contributed to the large volume on that topic edited by Fregly and Blatheis (1996).

In about 1985, the Japanese Biometeorology Society was formed. Since then, they have been rigorous and active, with many meetings and publications that have proved invaluable to their colleagues in the ISB. They carefully continue with an emphasis on acclimatization and environmental physiology which are major themes in Biometeorology.

We can also derive a concept of the history of change in our society by looking at its journal. This journal had a slow start; Solco Tromp published the first four editions, one a year for four years, as several large, loose-leaf notebooks into which new copies of the journal could be inserted. The journal has become successful thanks to decades of hard work by its editors.

If we examine the articles in *The International Journal of Biometeorology*, we detect a change in theme over the years (Figure 13). In 1960 the emphasis, as we see in the table, was on animal physiology. In the year 2005, in volumes 47–49, we find less emphasis upon animal biometeorology and more on the reac-

tions between plants and the environment. These figures show that biometeorology is a vital and changing field, and we look forward to many years ahead for this most successful society.

Portions of this History have been contributed by Dr. Wolf H. Wiehe. His deep affection for the society and his remarkable memory is evident in the extensive material which he provided for this final draft.

Much credit for the early work of this History goes to Rosemary Kueny, as well as to Anjali Sachleva, MFA, who made suggestions for organization and style.

The conscientious typing and formatting of the final draft of this history by Dana Rogers is much appreciated.

Percent of Article Topics Published

TOPIC:	ANIMAL	PLANT	PHYSICAL
* Volumes 5 – 9 C. 1960	64%	22%	14%
* Volumes 47 – 49 C. 2005	54%	42%	4%

* 10 years

Fig. 13: The changing theme of *The International Journal of Biometeorology*

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