



The Biometric Society: The First Twenty-Five Years (1947-1972)

Author(s): Gertrude M. Cox

Source: *Biometrics*, Jun., 1972, Vol. 28, No. 2 (Jun., 1972), pp. 285-311

Published by: International Biometric Society

Stable URL: <https://www.jstor.org/stable/2556148>

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THE BIOMETRIC SOCIETY THE FIRST TWENTY-FIVE YEARS (1947-1972)

GERTRUDE M. COX
1116 Blenheim Drive, Raleigh, N. C. 27609, U.S.A.

1. INTRODUCTION

For this jubilee year of the Biometric Society, a 25-year anniversary report of its activities was requested. The object of this article is to give information about the Society, not only for historical reasons, but especially to give the younger members a brief report of the Society's activities and of the contributions to statistical literature that have been made by the papers in *Biometrics*. The historical and classical material contained in the 947 articles (from 1950 to and including 1971) make it desirable that every biometrician should possess a full set of the back issues of *Biometrics*.

The Biometric Society has held 11 International Conferences and Symposia. However, the bulk of activities of the Society takes place in the Regions which hold meetings, thus enabling the influence of this Society to be world-wide. Many of the Regional meetings were co-sponsored by other statistical, biological, and scientific societies. *Biometrics* has become well established and recognized by 3,229 members and 2,135 other subscribers as of January 1, 1972. The Society still is in fair financial condition but with rising costs of printing and mailing, it will be necessary either to decrease the size of the Journal, or increase the number of members and subscribers, or raise the dues.

The Regions and National Groups, their dates of becoming a part of the International Biometric Society, and the number of members for most of the years that records are available are given in Table 1. It is interesting to note that most of the larger regions reached a peak in 1967 to 1969 except Região Brasileira, Eastern North America, and the Österreich-Schweiz Regions, which have increasing membership. It is the counteracting effect of these three regions plus the new Region and the new National Groups that enabled the membership increase of 102 from 1970 to 1971.

The number of pages and number of articles per volume are given in Table 2. Volumes 6 to 27 (1950 to 1971) and the March 1972 issue have been used for this review and discussion, for it was in 1950 that the Biometric Society took over ownership of *Biometrics*.

TABLE 1
GROWTH OF THE SOCIETY

	Region or National Group	National Group	Region	DATE															
				June 1948	July 1953	1957	1958	1959	1963	1964	1965	1966	1967	1968	1969	1970	1971		
Alled	Ardeing Netherland	1949	1962		17	42	43	42	41	38	38	37	36	36	36	37	37		
AR	Australasian Region		1948	37	38	69	61	73	78	84	81	82	94	99	23	99	92		
BR	British Region		1948	111	138	181	198	207	249	270	279	289	292	283	272	275	278		
DR	Deutsche Region	1952	1955		22	97	103	113	158	174	207	218	220	243	218	205	219		
EMAR	Eastern North American Region		1947	478	499	479	510	794	1038	1134	1142	1182	1280	1268	1363	1371	1417		
RBe	Région Belge	1952	1953		64	59	63	85	99	103	95	90	98	94	92	65	75		
RBras	Região Brasileira	1954	1957		9	70	38	56	66	79	62	59	52	69	61	87	87		
RF	Région Française	1949	1949	47	50	64	78	77	101	99	102	85	120	123	118	112	112		
RItl	Regione Italiana	1949	1953		51	73	70	90	99	122	131	133	135	123	111	112	119		
ROes	Region Österreich-Schweiz	1954	1962		14	22	27	32	92	95	103	94	93	108	117	115	130		
WNAR	Western North American Region		1948	73	94	102	103	151	219	245	254	279	303	282	305	274	278		
RGDR	German Democratic Republic	1969	1972												38	49	92		
aL	At Large			99	72	51	54	77	70	74	68	60	93	94	86	86	87		
GDe	Group Denmark	1949			13	14	16	14	17	17	18	18	18	15	16	17	18		
GHu	Group Hungary	1965									12	10	12	10	10	10	14		
GInd	Group India	1952			13	14	31	29	29	32	34	40	39	38	38	37	38		
GJap	Group Japan	1953	1949	43	38	45	46	50	72	80	84	84	91	89	93	92	91		
GMex	Group Mexico	1967												30	30	33	33		
GNor	Group Norway	1960							12	12	13	14	14	13	13	13	12		
GRO	Group Romania	1971			10	14	13	13	15	15	16	17	18	19	21	19	20		
GSD	Group Sweden	1954																	
NGI	Group Indonesia	1972																	
				888	1142	1396	1454	1503	2455	2673	2739	2792	3018	3036	3183	3127	3229		

TABLE 2
GROWTH OF *Biometrics*

<u>Year</u>	<u>No. of Pages</u>	<u>No. of Articles</u>	<u>Year</u>	<u>No. of Pages</u>	<u>No. of Articles</u>
1950	440	38	1961	669	41
1951	452	28	1962	643	37
1952	394	27	1963	679	44
1953	539	33	1964	932	58
1954	576	34	1965	1041	67
1955	561	33	1966	974	53
1956	544	39	1967	893	47
1957	558	34	1968	1055	60
1958	585	31	1969*	818	46
1959	652	40	1970	885	57
1960	709	43	1971	1121	<u>57</u>
					947

* Size of printed page increased by about 10%.

2. INTERNATIONAL

The international affiliations, conferences, symposia, and general activities of the Society will be discussed first. The Biometric Society's association with the International Statistical Institute (ISI) began in 1947. This led to our formal affiliation with ISI in December 1948. Our first Society conference followed, and the 2nd, 3rd, and 6th conferences preceded, ISI meetings. The Biometric Society has also planned and sponsored sessions at the ISI meetings and has cooperated with ISI and other societies in planning special international symposia and conferences. The 4th and 5th Biometric Conferences followed meetings of the International Congress of Genetics.

In 1952 the Biometric Society became the Biometric Section of the International Union of Biological Sciences (IUBS), which holds membership in the International Council of Scientific Unions. The Biometric Society has been represented at the general assemblies of IUBS and has received grants and loans from them for conferences and symposia.

The Biometric Society is associated with the World Health Organization (WHO) but has not pursued very active cooperation. The Society was represented at a Round Table Conference sponsored by the Council for International Organizations of Medical Sciences (under the auspices of WHO). This meeting was held at Geneva in September 1970. The Society has been represented at other WHO meetings.

On the international level, our major projects have been the International Biometric Conferences and the Symposia; the latter were centered on particular fields of application. The British Region has proposed, and a committee is working on, the idea of more inter-regional meetings.

2.1. *The First International Biometric Conference*

The general concept of a society of individual members without national or other quotas, with the idea of having regional and national subgroups, had been formulated while pre-conference plans were being made. This first conference was held September 5 and 6, 1947, at the Marine Biological Laboratory, Woods Hole, Massachusetts, United States, with 89 delegates present.

The first day included an opening welcome speech, followed by business and scientific sessions. The second day started with another business session, followed by a scientific paper. The papers presented were:

- (1) A quantitative theory of genetic recombination and chiasma formation,
- (2) A group of four papers on recent biometric developments in Denmark, India, Australia, and the Netherlands, and
- (3) La relation d'allométrie: sa signification statistique et biologique.

At the September 6 morning business meeting, a draft constitution was debated and approved, making the Biometric Society a reality. At the first Council Meeting, September 15, it was decided to publish the proceedings of the Conference in *Biometrics*, which was a journal of the Biometrics Section of the American Statistical Association (ASA). The Proceedings of the First Biometric Conference, the original Constitution, reports of the Council meetings, a list of officers and copies of papers are presented in the December 1947 and March 1948 issues of *Biometrics*. The Council adopted the descriptive clause, 'An International Society Devoted to the Mathematical and Statistical Aspects of Biology,' which has appeared on the cover of *Biometrics* since March 1964.

As the regions were being organized, a question naturally arose over the relationship between the Society and its regional and national groups. This item and other policies were clarified with the adoption of the Council By-Laws, dated July 12, 1948. The first Directory of the new Biometric Society, which listed the interests of each member, was published in the spring of 1949 and included names of 888 members in 33 different countries.

2.2 *The Second International Biometric Conference*

This conference was held at the University of Geneva, Switzerland, August 30 to September 2, 1949. There were 103 delegates present, coming from 19 countries, and 14 papers were presented at 7 organized sessions:

- (1) Experimental design,
- (2) Recent applications of biometrical methods in genetics,
- (3) Biometrical aspects of biological assay,
- (4) Present status of biometry,
- (5) Industrial applications of biometry,
- (6) Teaching and education in biometry,
- (7) Contributed papers.

Two Council meetings were held at which there was considerable discussion of 'Training in Biometry.'

All Biometric Society Conference delegates were invited to attend the ISI meeting in Bern. Many took advantage of a special train from Geneva to Bern via Sion, Lotschberg, Interlaken, and Lucerne. At all our international conferences and symposia, besides the enormous amount of work required to provide for scientific sessions, the committees have provided extensive entertainment schedules. This aspect of these meetings, enjoyed most by the members, will not be reported.

During 1950 ownership of *Biometrics* was transferred from the American Statistical Association to the Biometric Society. The September 1950 issue of *Biometrics* was the first one to appear with 'Journal of the Biometric Society' as a subtitle.

The Society's Constitution was amended in 1951 to provide for Sustaining Members. There were 8 sustaining members listed in 1952 and only 17 in 1971. The positions of Secretary and Treasurer were combined in 1951 but were made separate positions again in 1956.

2.3. *The First International Biometrics Symposium*

This symposium was held December 17–18, 1951, at the Indian Statistical Institute, Calcutta, India, with an attendance of about 150 persons the first day and approximately 100 persons the second day. The topic discussed was 'Biometric Problems in the Prediction and Estimation of the Growth of Plants in Tropical and Sub-Tropical Regions.'

Papers were given on: contribution to a discussion on crop predictions, crop prediction in England, sampling experiments for the estimation of cinchona yield in Madras (1950), recent experiments relating to crop and pastures in Australia, and some problems arising in crop-cutting experiments.

In order to bring *Biometrics* before a wider circle, the Council approved a statement of policy as given in the March 1953 issue. It was emphasized that papers presented at meetings sponsored or co-sponsored by the Biometric Society, whether national, regional or international, usually would be appropriate for publication in *Biometrics*. It was stipulated that abstracts of papers presented at the Society meetings should be sent to the General Secretary. Discussions regarding the publication of articles with extensive tables or illustrations had taken place at various times. As a result, policy regarding the handling of the excessive expense of publishing such articles was established.

The second membership Directory was published in the summer of 1953 with a listing of 1,152 members in 50 countries as compared to the 888 members in 33 countries listed in the 1949 Directory. Forty percent of those listed in 1949 were no longer members four years later. There was a shift to more statisticians as members, which reflected that more people had been trained in statistics in 1953 than in 1949.

2.4. *The Third International Biometric Conference*

This Conference was held at Lake Como, Bellagio, Italy, September 1–5, 1953, with 125 participants from 24 different countries.

Sessions

- (1) The first course in biometry (a symposium),
- (2) Mathematical problems in genetics,
- (3) Methodological problems in biometry,
- (4) Biometry in immunology,
- (5) Biometric methods in agriculture,
- (6) Functional relations in experimentation,
- (7) Industrial applications of biometry,
- (8) Contributed papers.

At the 12th General Assembly of the International Union of Biological Sciences, held in Rome, April 1953, the Biometric Section of IUBS and the Biometric Society distributed a Syllabus of Biometry, a 6-page mimeographed report on 'Biometric Needs and Opportunities.'

2.5. The Second International Biometric Symposium

This Symposium was held at the Instituto de Educaçao Carlos Gomez, Campinas, Brazil, July 4-9, 1955, with an attendance of 98 participants from 17 different countries.

Papers were given on: biometrical genetics, experimental designs for perennial crops, statistics applied to animal feeding experiments, sampling techniques, and medical statistics. There were also two panel discussions on bio-assay.

2.6. The Fourth International Biometric Conference

It was held at the Dominion Bureau of Statistics, Ottawa, Canada, August 28- September 2, 1958, with nearly 200 participants registered.

Sessions

- (1) Theoretical genetics,
- (2) Design of experiments,
- (3) Experimental results,
- (4) Multivariate analysis,
- (5) Chi-square and other biometric techniques,
- (6) Interpretation of experimental results,
- (7) Mathematical and statistical models in biology,
- (8) Biometry in clinical research,
- (9) Ecology and animal behavior.

2.7. The Third International Biometric Symposium

This Symposium was held at the University, Department of Physiology, Leiden, Netherlands, May 10-13, 1960. The general topic for discussion was 'Quantitative Methods in Pharmacology.'

The June 1961 issue of *Biometrics* carried an announcement about 'Graduate Traineeships in Biometry' which called attention to the fact that more than 20 universities in the United States at that time had training programs designed to prepare students in the application of statistical and mathematical methods to biological problems, particularly those related to

health and medical sciences. Traineeship stipends were provided by training grants from the Public Health Service, National Institutes of Health.

In 1962 the presidents of several statistical societies in the United States (including ENAR and WNAR) formed a cooperative program called COPSS which is composed of presidents of these statistical societies. It is of general interest that this group has put out a brochure on 'Statistics as a Career' (now being revised), a joint 'Directory of Statisticians,' and has secured National Science Foundation funds to support Visiting Scientists Lectures.

2.8. *The Fifth International Biometric Conference*

This conference was held in Cambridge, England, at the Gonville and Caius College on September 9–14, 1963, and was dedicated to the memory of Sir Ronald Fisher. There were 299 participants, accompanied by 70 family members.

Sessions

- (1) Biometrical genetics,
- (2) Problems of experimentation,
- (3) Mathematical models in biology,
- (4) Multivariate analysis,
- (5) Medicine and bio-assay,
- (6) Statistical methods,
- (7) Screening and selection.

At the Council meeting on September 12, 1963, the 'Award Fund' was established and some suggestions were made on how this money was to be used. A few small amounts have been granted but no procedure for selection has been established. An Award Fund Committee was activated in 1969 to recommend how the money should be used.

The September 1964 issue of *Biometrics* announced the first granting of 'Honorary Life Membership.' The Council considered the very special services to the Society by three of its earliest members. This honor went to Dr. Chester Ittner Bliss and Dr. Gertrude Mary Cox, and the Council placed on record recognition of Sir Ronald Aylmer Fisher.

2.9. *The Fourth International Biometric Symposium*

It was held September 17–18, 1964, at the University of Bern, Bern, Switzerland. The general topic for discussion was 'Teaching Statistics and Biometry at the Undergraduate and Graduate Level for Non-Mathematicians.'

The Minutes of the August 1966 Annual Business Meeting of ENAR stated, 'There seems to be a need for revitalization of the Council of the Society.' A lengthy correspondence between the President of ENAR and the officers of the Biometric Society followed. The President of ENAR appointed a Committee to make recommendations to the Council of the Biometric Society for changes in the Constitution and By-Laws regarding election of Council members. After revisions, the changes were approved by

the members. The revised Constitution and By-Laws are in the 1971 Membership Directory.

2.10. *The Sixth International Biometric Conference*

This Conference was held August 20-25, 1967, at Wentworth Convention Hotel, Sydney, Australia. There were 241 participants from 17 countries of the world, accompanied by 20 family members. Fifty-two papers were presented by their authors and 26 more were on the program by title only.

Sessions

- (1) Medical and physiological biometry,
- (2) Quantitative aspects of ecology and taxonomy,
- (3) Experimental strategy,
- (4) The role and influence of the computer in biometrical research,
- (5) Teaching mathematics and statistics for biology,
- (6) Homeostatic mechanisms in biological systems.

Most of the business of the Society is handled by mail, except for meetings of the Executive Officers, for the Council members seldom have an opportunity to hold a meeting. Complaints from Society members were circulated stating that they were not being kept informed of Society plans and activities and the General Secretary was having considerable difficulty getting replies from Council members. The Council members met August 27, 1967, at Sydney and were urged to send replies to the memoranda from the Secretary. They were also requested to inform their respective Regional members about Society activities. It was decided that it might help keep members informed if Reports of Council action were published in *Biometrics*.

The June 1969 issue carried a 'Presidential Report' giving members information about activities during the previous year. This report told of the new centralized Biometrics Business Office which was being established to handle operational procedures of the Journal and of the Society. The Society members were informed of the discussion and action regarding 'Honorary Life Membership.' A committee was appointed in 1968 to consider the specifications and procedures for election of such members and to recommend the necessary modifications in the Constitution and the additions to the By-Laws which would be needed. These changes and additions have been made. Honorary Life Membership provides an excellent way to recognize members for their scientific distinctions and service to the Society. Besides the three members selected by the Council in 1964, three more members have been selected according to the newly established rules. They are Dr. Gustavo Barbensi in 1969 and Drs. Frank Yates and George Snedecor in 1971.

A second Presidential Report appeared in the March 1970 issue of *Biometrics*. The report stated that the Business Office had been established at the Institute of Statistics, Raleigh, N. C., with Dr. L. A. Nelson as Business Manager. The third Presidential Report appeared in the March 1972 issue of *Biometrics*.

The Regional news reports have decreased substantially in the last two years, even with 12 Regions and 9 National Groups with whom the Society should keep active connections. Without these reports, how can the Regions be brought closer together?

2.11. *The Seventh International Biometric Conference*

This Conference was held at Stadthallensäle, Hannover, Germany, August 16–21, 1970, with a large attendance and an excellent series of scientific sessions and social affairs.

Sessions

- (1) Testing and monitoring of drugs,
- (2) Multivariate methods,
- (3) Medical documentation and computation,
- (4) Contingency tables,
- (5) Planning of experiments,
- (6) Statistical methods in animal and plant genetics,
- (7) Biological assay,
- (8) Mathematical models in biology,
- (9) Human genetics,
- (10) Five contributed papers sessions.

The 1971 Directory is the seventh published by the Biometric Society during its 25 years. In previous editions, information about the kinds of interest and activities of members, and the date they became affiliated with the Society, had been included. The present Directory does not include such information but does contain considerable information about the officers of the Society since 1948 to date, the Constitution, By-Laws of the Council and of all Regions, Honorary Life Members, Sustaining Members, growth of the Society, and a listing of members (alphabetically and geographically). It also provides a list of the International Biometric Conferences and Symposia.

3. REGIONS AND NATIONAL GROUPS

The Biometric Society is a single society in which some functions are delegated to regional sub-divisions. The activities of the Regional and National Groups seem to be related to such other statistical organizations as exist in the region, the extent of cooperation between biologists and statisticians, the leadership available in the area, and, of course, the size of the membership. Each Region has been free to develop the pattern of meetings best suited to its needs and, as a result, interesting and varied programs have developed within the Regions.

The major portion of the information about the 12 Regions and 9 National Groups used in this report came from reading 'The Biometric Society' and the 'News and Announcements' sections of *Biometrics*. It is obvious that some groups are not properly represented by this source of information, for considerable difference exists in the amount and the regularity of reported meetings and activities. This lack of reporting may be

due to the local secretary's failure to send the information, or maybe the Editors of *Biometrics* and the Officers of the Biometric Society have not put sufficient pressure on the regional and national secretaries to submit reports.

Titles of individual papers given at sessions, seminars, and colloquia will seldom be listed here except where they indicate a shift in interest or developments. Almost every Region holds joint meetings with other statistical and biological associations.

3.1. *Afdeling Netherland (ANed)*

A National Group of the Biometric Society was established in the Netherlands by the naming of a National Secretary in 1949. The Afdeling Netherland was organized as a Region in 1962. During 1949–1958 one or two meetings were reported each year. These were usually joint sessions with the two other Statistical Societies: the Medical and Biology Sections of the Netherlands Statistical Association and the Section on Statistical Techniques of the Netherlands Association for Agricultural Science. When these groups met, they invited the ANed members to join them to hear papers on such topics as precision in clinical methods, factor analysis and regression, partially balanced designs, electronic computers and Monte Carlo methods, and confidence intervals in industry. The meetings were held at the University of Utrecht, at Leiden, at Wageningen, or elsewhere.

The 3rd International Biometric Symposium was held at The University, Department of Physiology, Leiden, on May 10–13, 1960. The general topic was 'Quantitative Methods in Pharmacology.' These activities took place before this group became a Region. Their membership was the highest in 1958 with 43 members; during the last 8 years, membership has stayed around 36–38.

3.2. *Australasian Region (AR)*

This Region started in 1948 with 28 charter members of the Biometric Society. The first annual meetings were usually held with the Australian and New Zealand Association for the Advancement of Science (ANZAAS) and the fifth meeting was held at the University of Melbourne. Several visiting statisticians gave lectures and seminars in Sydney, Canberra, Melbourne, and Adelaide during 1955 and 1960. Two Symposia, (a) Statistics and (b) Statistical Genetics, were held January 16–23, 1957. In 1961–62 the Region met only in conjunction with biennial sessions of the ANZAAS. The branch groups in Melbourne and Sydney met more frequently.

The 6th International Biometric Conference was held in Sydney, August 20–25, 1967. The Australasian Region members spent an abundance of time preparing for and efficiently handling this conference. On August 24–26, 1971, they held a joint conference with the New South Wales branch of the Statistical Association of Australia at the University of New South Wales.

Membership increased from 23 to 123 in the first 22 years. In the last reported two-year period (1970–71) there has been an uncomfortable decrease in members.

3.3. *British Region (BR)*

The British Region had 20 charter members of the Biometric Society when it held its first meeting in London, January 1948, with the inaugural meeting in April of the same year. It started, and has continued, with a regular annual meeting and one or two other meetings per year. The 12th meeting was held in February 1952 and there were 30 meetings held during the first 10 years. This has increased to 4 to 6 meetings per year with two or more papers presented at each meeting. This Region has held regularly scheduled series of sessions covering a wide range of biological areas. Reports of its meetings have been given in *Biometrics* during their 23 years of activities.

The British Region has joint meetings with such groups as the British Pharmacological Society, National Institute for Medical Research, Society of Analytical Chemistry, Society of Experimental Biology, and the Medical Section of the Royal Statistical Society. In 1960 it started the unique annual summer meetings which provide an opportunity for the statisticians to see the operations and research activities of experiment stations, laboratories, and universities where the meeting is held. The local staff members report on the statistical aspects of their research and arrange demonstrations of their work.

Their meetings have been devoted to such topics as: multivariate analysis, application of electronic computers to biological problems, the data-processing of disease information, and sensory testing. On September 9–14, 1963, the 5th International Biometric Conference was held at Gonville and Caius College, Cambridge, England. This conference was dedicated to the memory of Sir Ronald Fisher. In March 1966 the British Region held its first Fisher Memorial Lecture, at which time the paper, 'Computers, the Second Revolution in Statistics,' was given.

At the 79th Ordinary Meeting (December 1969), a new type of program was introduced, 'The Interpretation of a Body of Multivariate Data.' Data from a classical apple experiment at East Malling Research Station were circulated to all members some months before the meeting. A general description of the experiment was included with the data. Three speakers were invited to open the discussion.

The British Region members have been concerned about ways of promoting more cooperation and communication between Regions. These prospects are being explored by the Society. The British and Western North American Regions tied for second place in number of members in 1971. The BR had a continuous increase in membership up to a maximum of 292 in 1967 but there has been a slight decrease in recent years.

3.4. *Deutsche Region (DR)*

The German section became a National Group in 1952. Its first session was held in September 1953 at Frankfurt. In 1954, January 15–17, it held its first Biometric Colloquium at Kerekhoff Institute in Bad Nauheim.

There were 150 participants at the 1956 and 132 at the 1958 colloquia. At the 1960 colloquium, 25 papers were read on topics such as population structure, dynamics, genetics, and analysis of multi-factor experiments. At the 7th (1961) Colloquium, there were sessions on sequential analysis and variate transformations. The 12th Colloquium was held in 1965 and was the last one reported in *Biometrics*. In the earlier years, these meetings were held at Kerckhoff Institute, Bad Nauheim, but later the meetings were held in such other places as Hannover, Leipzig, and Prague.

In 1955 this National Group became the Deutsche Region, with members from both East and West Germany. In 1959 the Region started its own journal, *Biometrische Zeitschrift*. Reports of its meetings are probably in its own journal; however, it would be helpful to have them also in *Biometrics*.

During August 16–21, 1970, the 7th International Biometric Conference was arranged by the DR and held at Stadthallensäle, Hannover, Germany.

In 1969 the Deutsche Region was divided, with the German Democratic Republic members forming a National Group (DDR). This Group had grown to 52 members in 1971 and in 1972 it became the Region of the German Democratic Republic (RGDR).

3.5. *Eastern North American Region (ENAR)*

The first meeting of ENAR was held in two parts: with the American Statistical Association on December 27 and with the American Association for the Advancement of Science on December 30, 1947. At these two meetings, the Biometric Society members adopted their by-laws and became a Region.

The annual meetings of ENAR are usually joint meetings in either the fall or in December with the Biometrics Section of the American Statistical Association (ASA), with various sections of the American Association for the Advancement of Science (AAAS), or with the American Institute of Biological Sciences (AIBS). Besides the Annual Meeting, the Region holds regular spring meetings, and in between, ENAR has two to four other meetings each year jointly with other groups, frequently with such groups as the Institute of Mathematical Statistics, the Vital Statistics Section of the American Public Health Association, the American Association of Economic Entomologists, the Ecological Society of America, the American Society of Pharmacology and Experimental Therapeutics, the American Fisheries Society, and the American Society of Horticultural Science.

In 1948 a Round Table session on morbidity surveys was held in co-operation with the American Public Health Association. Biometric Clinics on entomological and pharmacological problems were held in 1948, 1949, and 1950. A series of symposia has been held, including the following: in 1954 with the American Association of Immunologists, a session on biometric methods in immunology; in 1956 with the American Society of Pharmacology and Experimental Therapeutics, a discussion of synergism; in 1963 and 1966 with AIBS, sessions on biological research, using mathematical approach and computer use in biology, fisheries and horticulture; in 1967

and 1969 with AAAS, two topics each year on estimating the numbers in insect populations and testing of compatibility of kidney transplants and the second year on population mathematics and evaluating family planning programs; and in 1969, again with AIBS, a meeting on modeling biological populations.

ENAR co-sponsored a 5-week Biomathematics Conference at Iowa State University, held June 16–July 18, 1952. The papers presented were published in a 600-page volume by Iowa State College Press.

At the Annual Meeting in 1958 the session topics were: cardiac problems, response surface problems, multivariate analysis, unequal subclass numbers, and smoking and lung cancer. As early as 1960 the programs included topics on computer techniques. In the first decade ENAR was reported to have sponsored some 37 meetings with one to ten scientific sessions at each meeting. The regular spring meetings in 1966 and 1968 consisted of 36 and 48 papers, respectively.

It was decided in 1958 that the Region should have a President-Elect. A few years later, the desirability of transferring the clerical functions to an outside agency was discussed and in 1964, ASA took over these duties for ENAR. There has been a steady increase in members in this Region, reaching 1,417 in 1971.

3.6. *Région Belge (RBe)*

The 43 members of Belgium and the Belgian Congo formed a National Group in 1952 and in 1953 this group became the Région Belge (Société Adolphe Quetelet).

From 1952 to 1962 they held their annual business meeting, usually in Brussels, and then, in some years, held a second meeting. In 1963 they held three conferences: December 4 at the Institut Agronomique de l'Etat at Gambloux; December 5 with the Société d'Hygiène et de Médecine, the subject discussed being drug testing and safety; and December 6 at Ghent. On December 9, 1964, a conference was held at the Université de Liège, the topic being growth studies in biology; and on December 10 at the Université de Louvain where the topic was experimental design in fruit research. For several years following these conferences there were seminars held with different research groups. The decrease in recent reports from this region may be partly due to the fact that in January 1960 Région Belge started to publish the journal *Biométrie-Praximétrie* in 3 issues a year.

The membership in this Region reached a peak in 1964 with 103 members. Since then there has been a slight decrease in membership with a drop to 65 in 1971.

3.7. *Região Brasileira (RBras)*

The Brazilian members of the Biometric Society became a National Group in 1954 and a Region in 1957. Immediately after becoming a National Group, they arranged for the Second International Biometric Symposium, which was held July 4–9, 1955, at Instituto de Educação Carlos Gomez and

Instituto Agronomico at Campinas, Brazil. The title of the Symposium was 'The Role of Biometric Techniques in Biological Research.'

There were meetings in January of 1956 and 1957 at the Instituto Biologico, São Paulo, and July 1956 and 1957, with Brazilian Association for Advancement of Science. Their 5th meeting was held in São Paulo in 1958 and the 6th meeting was at Piracicaba at the Escola Superior de Agriculture. Again in 1964, 1965, and 1966, there were two meetings of the Região Brasileira each year with the organizations mentioned above and with the Department of Statistics, Faculty of Hygiene and Public Health, University of São Paulo. During the period March 1964-March 1967, there were 31 papers presented at their meetings. From January 29-February 2 and again February 4-5, 1968, a course on programming electronic computers was given in Campinas.

In April 1971 in Campinas members of the Região Brasileira held their annual meeting. Five papers were presented: variance components in experiments in incomplete blocks by matrix theory; sequential treatment of variance components in numerical taxonomy; design of experiments as applied to coffee testing trials; rate of dependence studies by coefficients of variation, and a type of exponential regression. There are indications that 4 or 5 papers have been given at each of their one-day meetings. The reports of meetings have been brief. From 1956 to 1969 membership fluctuated with an average of 62 members. A good increase to 87 in 1970 and 1971 has been noted.

3.8. *Région Française (RF)*

The members of the Biometric Society in France organized as Société Française de Biométrie in 1949. They have held two or three meetings each year, mostly in Paris, with two or three papers presented at each half-day meeting. The topics covered have ranged over all of biometry with special emphasis on the analysis and application of experimental designs, on mathematical and statistical genetics, and on medical statistics. The Region held a special 10th Anniversary Meeting on January 28, 1959, and met jointly with the Société de Génétique later the same year.

Beginning in 1960 the Secretary of the French Region has taken the responsibility for preparing French translations of summaries of papers in *Biometrics*.

There has been an upward trend in membership, reaching 123 in 1968.

3.9. *Regione Italiana (RIIt)*

The Biometric Society members in Italy became a National Group in 1949. Its first meeting was held March 14, 1950, at the University of Milan. At the 3rd meeting in Florence, April 1953, the discussion was on how to get the teaching of statistics into University curriculums. This National Group became a Region in 1953 and that year it was host to the 3rd International Biometric Conference, held at Hotel Grande Bretagne, Bellagio (Como). This was a big, but successful, undertaking for a young Region.

The main activities of the Regione Italiana during 1954-55 were dedi-

cated to the organization, with IUBS (and UNESCO) support, of a summer course. As a result, under the sponsorship of the Italian Region, an International Seminar on Biometric Methods was given at Varenna, September 7–23, 1955. Fifty-six students took the four courses offered: (a) theoretical foundations, (b) applied statistical methods, (c) design of sampling surveys and experiments, and (d) single degrees of freedom in χ^2 and in analysis of variance.

A similar Biometric Seminar was held in Milan from October 6–20, 1956, and a second course in Biometric Methodology was held at Istituto Sierterapico. There have been few reports in *Biometrics* about the activities of the Regione Italiana since 1956. It is understood that it has continued to center its activities in one or two weeks' training courses in statistics for biologists. The membership went up rather steadily until 1967, but there has been a slight decrease during the last four years.

The Italian journal *Statistica* has been published for many years. Its 22nd volume's 'Table of Content' began to appear in *Biometrics* in the September 1962 issue.

3.10. *Region Österreich-Schweiz (ROeS)*

The Swiss members of the Biometric Society arranged for our 2nd International Biometric Conference, held at the University of Geneva, Geneva, August 30 to September 2, 1949. Not until 1954 was there a National Group in Switzerland. Its first meeting was in November at the University of Geneva. A joint meeting was held with the Swiss Society of Genetics in May 1955 and a Biometric Seminar for agronomists in Zurich in July 1956. The Swiss Section organized an International Meeting held in Bern, September 28–October 2, 1959, with 90 people from different countries in attendance. The program was devoted to the use of statistical methods in medical research and in the pharmaceutical industry. The Swiss Group also helped arrange a two-week International Biometric Seminar and Symposium held in Linz, Austria, September 24–October 3, 1956.

In 1962 the Swiss and Austrian members of the Biometric Society formed the Österreich-Schweiz Region. A Biometric Seminar was held September 23–27, 1963, on 'The Use of Statistical Methods in Biology and Chemistry.' The 4th International Biometric Symposium was held September 17–18, 1964, at the University of Bern. This symposium dealt with 'Teaching Statistics and Biometry at the Undergraduate and Graduate Level for Non-Mathematicians.'

A seminar on 'Methods of Planning and Evaluation in Experimental Agriculture and Agrochemistry' was held September 27–October 2, 1971, in Zollikofen/Bern. The membership of the Region has increased from 92 in 1963 to 130 in 1971.

3.11. *Western North American Region (WNAR)*

This Region was organized at Berkeley, California, in June 1948. Its annual meeting, usually in June, is held jointly with the Institute of Mathematical Statistics. It held meetings with AAAS at Berkeley, December

27–29, 1954, and at Denver, December 1961; meetings were also held with the Pacific Division of AAAS in June 1959 and 1964. It co-sponsored three sessions joint with ASA, IMS, and the Ecological Society of America in December 1954. The annual meeting in 1956 was held in August, joint with IMS, the American Mathematical Society, the Mathematical Association, and the Economic Society. At this meeting they had two specially invited speakers.

In 1962 WNAR initiated an Annual Student Award consisting of a free one-year student membership in the Biometric Society. These awards go to students in statistics and biostatistics.

August 23–28, 1964, WNAR had a joint meeting with ENAR and the American Institute of Biological Sciences at the University of Colorado, Boulder. The sessions dealt with these topics: recent advances in quantitative genetics, statistical problems in fisheries, biometrical genetics, and general biometrics.

In 1966 WNAR chose to have a President-Elect. Its membership increased steadily until 1969, followed by a decrease in 1970 and 1971. WNAR has transferred its clerical functions to ASA.

3.12. *National Groups*

A National Secretary may be named for any nation or area, outside an organized Region, in which there are 10 or more members. On behalf of the members, the National Secretaries shall arrange meetings with scientific programs, keep members informed of Society activities, endeavor to get new members and collect and transmit the annual dues to the Treasurer of the Society.

Group India (GInd). The Indian members formed a Region in January 1949. Probably due to devaluation of the rupee, the members found it difficult to pay dues and the group became small. In 1953, the Region was reactivated as a National Group. The Indian members arranged for the 1st International Biometric Symposium, which was held December 17–18, 1951, at the Indian Statistical Institute, Calcutta, India. The sessions dealt with the topic 'Biometric Problems in the Prediction and Estimation of the Growth of Plants in Tropical and Sub-Tropical Regions.'

In February 1953 the Indian Group held a Symposium jointly with the Indian Society of Agricultural Statistics. In January 1965 and January 1966 joint meetings with the Biology, Statistics, and Medical Sections of the Indian Science Congress were held. An all day joint meeting with the Indian Society of Agricultural Statistics took place in Madras, December 1970. The membership in India has averaged about 38 during the last 5 years.

Japanese Group (GJap). The Japanese Group had its first meeting in Tokyo, August 1953, at the National Institute of Agricultural Science. In some years this Group held a spring meeting as well as a late summer or fall meeting.

Since 1953 the *Japanese Journal of Biostatistics* has been issued quarterly.

The October 1955 meeting was held jointly with the Biometric Society of the Research Association of Statistical Sciences. During 1957 and 1958 some of their papers dealt with analysis of variety trials, effects of drugs, and genetic variance and heritability. A summary of the proceedings of the 13th and 14th meetings of the Japanese Chapter was issued by the Faculty of Agriculture, Tokyo. The last report in *Biometrics* was about its 15th meeting held April 1963 at Tokyo University, when 8 papers were read. The Group has had a steady increase in membership from 38 in 1953 to 91 in 1971. The Japanese Chapter has chosen to remain a National Group even though it has enough members to become a Region.

Hungarian Group (GHu). The Hungarian members had a National Secretary named in 1965. In December 1966 they held their first meeting in conjunction with the Biometric Section of the Hungarian Biological Association. On March 19–22, 1968, a meeting was held in Budapest in cooperation with the Hungarian Academy of Science and neighboring regions of the Biometric Society. The topics discussed were models and interpretation of results, genetics in general, and statistical methodology. Each topic was introduced by a 30–50 minute review paper. The results were published in German by the Publishing House of the Hungarian Academy of Science. The Hungarian Group has had 10–14 members each year.

Mexico Group (GMex). This Group was established in 1967 and held its inaugural meeting in June 1967 at Chapinga. In the 4 years from 1968 to 1971, its membership has been 30 to 33.

Romania Group (GRo). This Group was started in 1971 with a membership of 20.

Denmark, Norway, and Sweden Groups. The Danish members became a National Group in 1949 and during the last ten years its membership has remained between 15 and 18 members. The members of Norway became a National Group in 1960 with 12 to 14 members. The members in Sweden became a National Group in 1954 with membership showing a slight increase during the last 10 years.

Indonesia Group. This is our most recent National Group.

4. BIOMETRICS

4.1. *Format and General Content*

The Biometrics Section of the American Statistical Association started the *Biometrics Bulletin* in 1945 with 6 issues per year. In 1947 the name was changed to *Biometrics* with 4 issues a year. The Biometric Society was founded in September 1947 and began at once using this Journal as their

official publication channel. The December 1947 issue carried the 'Proceedings of the 1st International Biometric Conference.'

Biometrics became the 'Journal of the Biometric Society' in September 1950. The comments that follow will be about the content of *Biometrics* from 1950 to and including the March 1972 issue. In its earliest years, considerable effort was necessary to get articles submitted to the journal but the situation changed rather quickly.

Biometrics, in 1950, contained the following sections: Articles, Queries, Abstracts, The Biometric Society, and News and Notes. At the end of each year the December issue carried a summary of the content of the volume by an author and a subject index. In 1956 the News and Notes became News and Announcements, and in 1957 Queries became Queries and Notes.

The yearly summary section was enlarged in 1959 to include, in addition to author and subject indices, the listing of the Editor, the Editorial Associates and Committee Members of *Biometrics*, the Officers and Council Members, Regional Officers and National Secretaries of the Biometric Society, a list of Sustaining Members, and in 1965 an Index of Books Reviewed. The Book Reviews section was started in 1960. There have been various inserts, such as letters to the Editor, editorial notes, correspondence, and obituaries.

Biometrics began publishing the 'Table of Content' of other journals in June 1957. The first was that of the *Journal of the American Statistical Association*. Eight other journals send their 'Table of Content' regularly to *Biometrics*.

The Constitution states, 'The Biometric Society is an international society for the advancement of biological science through the development of quantitative theories and the application, development and dissemination of effective mathematical and statistical techniques.' In the March 1961 issue there was an Editorial Note stating that the Editor believed 'that mathematicians and statisticians contributing to *Biometrics* have an obligation to present their work so that the natures of the problems in the biological sciences to which the methods apply are clearly understood by those who may profit by the use of the methods.'

In 1961 the Editor of *Biometrics* sought suggestions for the improvement of the Journal. The respondents urged that a series of expository articles be secured. A Committee was appointed to encourage the flow of expository articles which were called 'Invited Papers.' The Committee called attention to the fact that in early issues of the Journal there were many expository articles, 'some of which have become classics.'

The articles in this series have been:

- | | |
|--------------------|--|
| <i>March 1965:</i> | Factor analysis: An introduction to essentials.
I. The purpose and underlying models. R. B. Cattell |
| <i>June 1965:</i> | Factor analysis: An introduction to essentials.
II. The role of factor analysis in research. |

R. B. Cattell

- September 1967*: Genetic equilibrium under selection. C. C. Li
June 1969: Survey of histocompatibility testing: biological background, probabilistic and statistical models and problems. Regina Elandt-Johnson
March 1971: Topics in variance component estimation. S. R. Searle.

The December 1968 issue inaugurated a new feature with the publication of a paper together with discussion, resulting from a special session organized by ENAR and WNAR. Such papers were put through the usual refereeing process.

The articles with discussion published recently were:

- December 1968*: Another look at Henderson's method of estimating variance components. S. R. Searle
December 1969: The Bayesian outlook and its applications. J. Cornfield
March 1971: Stochastic compartmental analysis: Model and least square estimation from time series data. J. H. Matis and H. O. Hartley
June 1971: On some desirable patterns in block designs. T. Caliński
December 1971: The analysis of incomplete data. H. O. Hartley and R. R. Hocking

In 1958 the Editor of *Biometrics* began printing along with prices of back issues a list of 'Special Issues.' This list follows.

- March 1947*: Analysis of Variance,
March 1951: Components of Variance,
September 1957: Analysis of Covariance,
June 1964: Fisher Memorial Issue,
March 1972: Multivariate Analysis.

Also available are:

- March 1949*: Fishery Reprint Series,
1963: Appreciation of Sir Ronald Fisher from Vol. 17 and Vol. 18,
1965: Cumulative Index. Subject and Author Index, Vol. 1-20 (1945-1964).

Several other issues have articles, on a given subject, grouped as in the September 1952 issue, which contains 6 articles on 'The Design and Interpretation of Clinical Experiments with Drugs.'

4.2. *Articles in Biometrics*

For discussion purposes, the articles in *Biometrics* will be grouped by techniques, research areas, and theory developments. It must be kept in mind that the extent of usefulness of statistical methods is determined largely by the status of their theoretical backing.

The intent of the following comments is to give some feeling of the value and use of statistical methods and the trends in their development and use. (1) **SAMPLING.** Official descriptive statistics is the oldest branch of statistics, for it existed in the classic and medieval world. It is concerned with measuring large populations for basic information about the people, labor force, crops, health, and other essential facts. By 1947 a great deal of work had been done on the best methods of collecting, summarizing, and presenting data using a sample from the population.

Biometrics has carried very few articles on sampling, yet in all fields of experimentation, whether collecting descriptive data or doing experiments, only a sample from the population can be considered. In the period 1950 to 1955, there were four sampling articles and three of these dealt with sequential methods. In 1956-61 articles on errors in estimates and methods of sampling animal populations were published. From 1962 to date, more sampling articles have appeared, articles dealing with variety trials, family selection, orchard and forest surveys, gamma rays, and wildlife and articles including technique studies of sampling systems as censored, multivariate stratified, cluster, line transects, removal, and distance. The limitations that sampling places on interpretation of data seems to be receiving more attention in recent years.

(2) **DESIGNS OF INVESTIGATIONS AND EXPERIMENTS.** By the time *Biometrics* became the journal of the Biometric Society, researchers doing controlled experiments were using the basic experimental designs quite extensively in agricultural research and in bio-assay studies. The June 1964 memorial issue for Sir Ronald Fisher presents a summary of his great contributions to the area of experimental designs.

Articles in *Biometrics* show the expansion of the use of planned experiments and statistical analysis into research areas as industrial, chemical, medical, public health, epidemiology, and clinical trials.

Only a few articles emphasizing basic designs (completely randomized, randomized blocks, latin squares, and incomplete blocks) have been published during these 25 years. *Biometrics* contains many articles illustrating variations in these basic designs, such as paired comparisons, triple and latinized rectangular lattices, partially and doubly balanced, chain block, cross-over, quasi-latin, three-dimensional, and cyclic balanced incomplete blocks, sequential, tied-double-change-over, and composite designs. Selection of the treatment combinations to be used in these designed research plans received considerable attention.

In the latter part of these 25 years, there have been fewer articles on variations in the basic designs and considerably more emphasis and consideration of their unique use, the analysis and proper interpretation of results.

Biometrics carried articles in its earlier years which emphasized the industrial applications of biometry, response surface designs, composite designs for quadratic response surfaces, and steepest ascent experiments. In

1959, the new journal *Technometrics* was started and articles with emphasis on industrial applications were sent to it.

(3) ANALYSIS OF VARIANCE. This section will deal mostly with the application of the analysis of variance technique to actual experimental data. When *Biometrics* was started, the t-test was well known and extensively used and analysis of variance was being used in agricultural research. The first 'Special Issue' of *Biometrics* was on 'Analysis of Variance.' This is now a classical issue and reprints of it continue to be sold for teaching purposes. As early as 1952, articles began to deal with topics such as analysis of factorial arrangements when data are proportional, variance of weighted means, additivity restrictions, analysis of disproportionate data when interaction is present, and multiple classifications with unequal numbers of observations. About 1964 to date, concern shifted to technique problems such as analysis of variance of mixed models with disproportionate sub-class frequencies and how to estimate fixed effects and variance components from mixed model data. It should be noted that between 1954-1961, there were at least 3 articles on rank analysis.

(4) REGRESSION. This statistical technique is an integral part of most analytical procedures when the measures of response or the treatment combinations involve continuous variables. The assumptions which underlie analysis of variance and covariance require an understanding of regression. Regression as an independent topic has been represented (during these 25 years) by one or two articles per volume. The articles deal with asymptotic and polynomial regression, multi-hit survival curves, regression analysis for causal and non-linear paths, growth curves, estimation of regression slope from tail region, the precision of some unbiased regression estimators, discrimination between regression models, and linear discriminant analysis.

As a special regression problem, *Biometrics* has carried a few articles on orthogonal polynomials. There have been two articles on path coefficients and a very few articles on correlation analysis as such.

(5) VARIANCE COMPONENTS. When separate sources of variability are to be identified and estimated, the technique of variance components is used. An article which presents the current status of variance component analysis is given in the March 1951 'Special Issue' on 'Variance Components.' This technique has been used most extensively by quantitative genetics research workers who have developed some of the necessary theory. Many of the articles on variance components use genetic data for their examples. Some articles which deal with this topic will be mentioned, such as variance components with reference to genetic population parameters, a population with binomial frequency, precision of estimates of variance components, maximum likelihood estimates of genetic components of variance, variance components estimation in 3-(or r-) way classifications, and an interactive estimation of variance components for non-orthogonal data. During 1970-71, the articles began to deal more with variance component models, robustness, and unbalanced data.

(6) ANALYSIS OF COVARIANCE. This technique is not easy to use either from the data analysis or the interpretation standpoint. Responsible are probably the complexities involved and the lack of sufficient theoretical developments regarding the critical aspects of the assumptions. However, covariance often increases the efficiency of the results substantially. The September 1957 journal was a 'Special Issue' on 'Analysis of Covariance.'

There are articles in *Biometrics* from 1952–1969 which are presented with applications, such as use of covariance to control gradients in experiments, use for 3×4 triple rectangular lattice design, observations of homogeneity of covariance matrices, covariance analysis with unequal sub-class numbers and with unequal errors, the power of a test in covariance analysis, and multivariate analysis of covariance.

(7) MULTIVARIATE ANALYSIS. In the 'Fisher Memorial Issue,' June 1964, there is an article on 'The Architect of Multivariate Analysis.' Articles on this topic have been interspersed in *Biometrics*, articles such as multivariate analysis in medical and agricultural experiments, classification problems with multivariate qualitative data, stepwise multivariate analysis of variance based on principal variables, multiple discriminant analysis and screening, and discriminant function techniques in medical taxonomy. The March 1972 'Special Issue' is devoted entirely to the applied aspects of multivariate analysis.

(8) OTHER ANALYTICAL METHODS. A few additional articles will be mentioned in order to call attention to the wide range of techniques presented in the articles in *Biometrics*. Several articles dealt with sequential experimentation and analysis, such as the use of sequential analysis for whitefish sampling, sequential medical plans, sequential multiple decision procedure for selecting the best plan, and sequential estimates of vaccine effectiveness.

There have been articles on multiple range tests, cluster analysis, optimal spacing of repeated measurements, variance heterogeneity, handling of non-parametric data, analysis of successive or groups of experiments, and procedures for testing the differences between sets of means.

(9) GENETICS. In the June 1964 'Fisher Memorial Issue' appeared an article regarding his interest and contributions to genetics. The article listed about 150 published articles and two books. Due to Sir Ronald Fisher's close association with workers in the quantitative genetics area, *Biometrics* contains many articles on the statistical techniques and theory used in genetic research. At least 8 percent of the total number of articles in *Biometrics* deal with genetic research problems.

Some articles, between 1953–1964, dealt with estimation of heritability by regression of offspring on parent, confidence limits for heritability, and coefficients of variation of heritability estimates. In 1960–61 and again in 1966 and later there were several articles which dealt with partial diallel cross, variety cross diallel, selection among diallel classified variables, genetic correlations with multiple alleles, self-incompatibility, and selection of k

alleles. A few articles have appeared on selection indices, process, or intensity along with a discussion of restriction on a selection index. The study of genetic and environmental effects produced articles on estimation of environmental and genetic trends, their interaction variance and correlations. Some of the other articles dealt with prediction equations in quantitative genetics, discrimination of interactions and linkage in continuous variation, optimum group size for progeny tests, a generalization of the inbreeding coefficient, a boundary problem arising in population genetics, use of concomitant variables and incomplete survival information, and the design and efficiency of selection experiments to estimate genetic parameters.

(10) BIOLOGICAL ASSAY. Nearly 7 percent of the articles in *Biometrics* dealt with drug assay, response, and evaluation. There were articles throughout this period on bio-assays, such as error of bio-assays, bio-assay from a parabola, potency estimates on a biological assay method of parallel line type, the chick assay for lysine, and response criteria for the bio-assay of vitamin K. The estimation of relative potency for multiple response data and in multiple assays, estimation of relative potency to dilution assay by distribution free methods, estimation of time-response curves and their confidence limits, and measurement of the potencies of drug mixtures have been discussed.

From 1963 to 1965 there were 8 articles on screening experiments using two sequential two-sample grouped rank tests, using designs (as balanced and partially balanced incomplete blocks) for drug screening, screening system for anti-cancer agents, 2- or 3-stage screening procedures, screening tests in medical diagnoses, for improved mutants in antibiotic research, and in 1967 an article on the effective use of both positive and negative controls in screening experiments.

The topic of quantal response was part of 11 or more articles distributed over the years from 1956 to date. In recent years, articles on the use of prior information to design a routine parallel line assay and multivariate probit analysis have appeared.

(11) MEDICAL AND CLINICAL. Many articles either directly or indirectly related to the medical and clinical areas have been mentioned among the genetic and biological assay articles. About one other article per year dealt with subjects such as procedure for bacterial plate counts, errors and variations in white cell counts, contagious distributions, estimate of age-specific infection rate, the spread of an epidemic, the mathematical analysis of an epidemic, disease clustering, and quantitative guidelines for communicable disease control programs. Articles appeared on epidemiological research, clinical statistical systems for psychiatry, truncated sequential designs for clinical trials, fitting the multi-hit survival curve, and a comparison of continuous distributions of parameters of exponential decay curve.

In the cancer area there have been a few articles, such as a mathematical analysis of the growth and spread of breast cancer, a stochastic model for the growth of cells in cancer, and infectious process in the origin of childhood leukemia.

(12) **POPULATIONS.** These articles dealt with animal and human populations studies, but most methods can be applied to both. In the animal area some articles appeared on evaluation and removal method for estimating animal populations, an analysis of catch curve, estimation of mortality intensities, estimation of mortality rates for tag recoveries, size of population using sequential rules, mammalian reproduction data fitted to mathematical model, line transect method of estimating grouse population density, and the use of mathematical models for control of pest population.

In the human area, some articles were on human reproduction, a comparison of two life table methods, an enumeration problem in self sterility, a stochastic model of human fertility, orthogonal contrasts in slope-rate investigations, a model for studying birth rates given time-dependent changes in reproduction parameters, a deterministic matrix model for handling birth, death, and migration rates, and a generalized probability distribution for couple fertility. Note that in both the animal and human population studies, mathematical models have been used in the last few years.

(13) **OTHER AREAS.** The area of taste testing and odor of foods provided at least 9 articles during the period 1950–1971, articles such as quantifying subjective appraisals of odor, scoring two experiments in incomplete blocks, taste testing and quality evaluation, design and analysis of taste tests, use of contingency tables in the analysis of consumer preference studies, and measurement and evaluation of safety in food additives.

In the accident area, there were 4 articles, one dealt with detection of individual differences in accident susceptibility and another with a contagious distribution suggested for accident data.

(14) **THEORY.** Considerable statistical theory has been given in the articles in *Biometrics*. There have been at least 14 articles that dealt with distribution theory. Nine of these articles were on Poisson distributions of which 4 were on truncated Poisson and the others were on topics such as significance of deviation from expected in Poisson series, some small sample tests of significance for a Poisson distribution, estimating a parameter in a conditional Poisson distribution, and the log-zero Poisson distribution. Response-time, contagious rectangular hyperbola, and folded binomial distributions have been discussed.

Most of the articles on mathematical models published in *Biometrics* appeared in the last 10 or 12 years. There have been over 40 articles dealing with stochastic, diagnostic, logistic, multicompartment migration, longitudinal response, multiple classification, regression, a deterministic matrix, general probability, and 2-stage and quadratic models. Along with the above were articles on the mathematical and statistical models for diagnosing zygosis, for interpretation of experiments using tracer compounds, for phase reproduction in bacterium, for estimating the production of red blood cells, for spread of epidemics by carriers, for genetic effects, for the estimation of inter-plant competition, and for quantal response to mixtures.

A great deal of emphasis has been given to the value of the χ^2 test. Over 20 articles called attention to the conditions under which the χ^2 test

can be used, and the articles have illustrated extensively the usefulness of this statistical tool. The χ^2 tests for goodness of fit and for linear trends were presented, but almost all the articles dealt with the use of χ^2 for analysis of contingency tables. An early article was on the automatic machine method for calculating contingency χ^2 and later other articles dealt with strengthening the common χ^2 tests, partition of χ^2 contingency table, χ^2 to test the no-interaction hypothesis, and additive partitioning of χ^2 .

Many articles contained considerable theory, such as maximum likelihood estimate of correlation in contingency tables, loss in test efficiency due to misclassification, robustness of homogeneity tests in $2 \times n$ tables, combination of results from 2×2 tables, incomplete two-dimensional tables, analysis of contingency tables with quantitative response, effect of collapsing multidimensional contingency tables, estimating interaction in a censored $2 \times 2 \times 2$ contingency table, and incomplete contingency tables.

As has been noted in previous comments, the use of stochastic process methods in biological research proved desirable. There were articles on the application of stochastic processes to experimental studies, human reproductions (a stochastic process), and analysis of effects of antibiotics on bacteria by means of stochastic models.

5. EDUCATION AND TRAINING IN STATISTICS

During these last 25 years, there has been an increase in the cooperation between the biometricians and the biologists. Research workers are confident that statistics is a valuable tool and they have been requesting the statistician to help both in planning experiments or surveys and in the analysis and interpretation of the results. This cooperative spirit already was established in many places before 1950, but it has spread now to more statisticians, researchers, research centers, and areas of research. This trend has created an unprecedented demand for intelligent and well-trained consulting statisticians. What has the Biometric Society done about education and training in statistics?

There have been very few articles in *Biometrics* on biostatistics or statistics course offerings and on the content of these courses. The few articles related to this problem are:

- March 1950:* Teaching and education in biometry (with discussion),
- June 1955:* An introductory course in biometry for graduate students in biology,
- December 1956:* Recent advances in biometry in Japan (with extensive listing of Japanese books and articles on statistics),
- September 1959:* Biometric method: past, present, and future (with discussion of development of theory),
- June 1966:* Computers: the second revolution in statistics (Computers are good servants but bad masters.),

- March 1968:* Teaching biometry in the university,
December 1968: Some observations on the teaching of statistical consultants (study of the scientific method and relevant biological principles),
September 1969: Models, inference, and strategy (refers to the way statistics is usually taught),
March 1971: The practical psychology of biostatistical consulting.

The International Biometric Conferences have given limited time at their meetings to this subject. At the 2nd International Biometric Conference in 1949, a session on 'Teaching and Education in Biometry' was given. At the 3rd Conference a symposium was held on 'The First Course in Biometry' and at the 6th Conference, a session and forum dealt with 'Teaching Mathematics and Statistics for Biology.'

A questionnaire concerning the teaching of biometry was distributed in February 1950 by a committee whose members were from the Biometric Society which is also the Biometric Section of the International Union of Biological Sciences. The most frequently expressed desire was for information about the content of courses in biometry.

There have been numerous international, regional, and national statistical and biological societies and organizations giving education and training courses in statistics throughout the world. These course offerings and course contents have been revised, improved, and partially modernized.

There have been discussions, papers, sessions, and symposia on training in statistics in some of the Regions. Regione Italiana, at its third meeting discussed how to get the teaching of statistics into university curricula. The main activities of this Region have been centered in summer courses. It held an International Seminar in Biometric Methods in 1955 at which they offered four courses in statistics. These seminars have been continued.

The Österreich-Schweiz Region has held biometric seminars and symposia dealing with the use of statistical methods. The 1964 International Biometric Symposium was held in Bern and the program concentrated on 'Teaching Statistics and Biometry at the Undergraduate and Graduate Level for Non-Mathematicians.'

Região Brasileira held a symposium in 1968 on the preparation of the statistician.

ENAR and WNAR have sponsored or been associated closely with many special and regular summer and yearly statistics training programs. The two earliest extensive and continuing summer sessions were the Southern Regional Cooperative Graduate Summer Session which is scheduled to hold its 19th session this summer and the Summer Session at Berkeley, which has continued for many years.

The National Institutes of Health began providing funds in 1957 to help finance the Summer Sessions of Statistics in Health Sciences. Special attention has been given since 1960 to the training of biomathematicians, also financed to a great extent by the National Institutes of Health, Division of

General Medical Sciences. The first Conference on 'Training in Biomathematics' was held August 1961 at Cullowhee, North Carolina. The first Annual Symposium on Biomathematics and Computer Science in the Life Sciences was held in March 1963.

In 1961 more than 20 and in 1971 more than 80 universities in the United States and Canada are giving degrees in statistics, biostatistics, and biomathematics. Most universities now consider statistics as an integral part of the curriculum.

Looking through the 'Announcement' sections of *Biometrics*, one finds the many notices of short courses, summer institutes, symposia, international conferences, and regular degree offerings of the universities. These notices are almost entirely about such programs in the United States and Canada. It would be helpful if the regions in other parts of the world would send in their announcements of such training and education programs.

6. CLOSING COMMENTS

It is certain that the Biometric Society, especially through its Regional members, can play an even greater role in its major activities within the next 25 years. Probably it is time to take a really good look at what the Society wishes to do about its influence and membership. What the Biometric Society is like tomorrow depends on the wisdom used today in planning for the future.

There is still much work to be done towards finding better techniques, towards the understanding of effects of non-normality, heterogeneity of variance, non-randomness and non-independence of observations to which standard statistical methods are being applied. Even in the areas of multivariate analyses and discriminant functions, the questions of how to use both continuous and discontinuous data with both quantal and graded responses are problems yet to be solved. It is clear that the multivariate covariance technique has not been developed as extensively as is desirable. There is always the need for better ways of interpreting and presenting the results in biological language for ease of comprehension. Communication and information theory have made great advances, but our Society still needs to learn more about how it can make maximum contributions through meetings and publications.

Statisticians and research biologists are learning more mathematics and statistics. The most difficult job remains: knowing when and how to use new techniques and how to present the results. We want the Biometric Society to be truly 'An International Society Devoted to the Mathematical and Statistical Aspects of Biology.'

Received February 1972

Key Words: International conferences; Regional activities; Types of articles; Trends in methodologies; Historic records.