

THE FIRST TEN YEARS AFTER THE FOUNDATION OF THE INTERNATIONAL
SOCIETY FOR STEREOLOGY IN 1961

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The International Society for Stereology (ISS) was founded in 1961 and this year celebrates its 25th birthday. In the meantime stereology has become a well established science, and the ISS has turned out to be a lively society. After 25 years a new generation of younger scientists has taken over the leadership and is responsible for the future development of this science and the society. The generation of first members is slowly retiring or, like Hans Elias, has passed away. I consider it worthwhile that the early history of the ISS should be told by one of the active founders.

It is surely of interest for the following scientific generation to know what the beginning of this new direction in science was like and what difficulties had to be solved in the founding period.

In the first half of the 17th century Cavalieri, Galilei's pupil, was engaged in mathematical considerations which we today call stereology. At the end of the 18th century Buffon, a philosopher and mathematician, published a problem regarding geometrical probability. The reflections of these two scientists did not have any implications for a practical use. In 1847 the geologist Delesse was the first scientist who was actually interested in the knowledge of the composition of stones and, therefore, introduced a new solution which we now call the "Delesse-principle".

In the following 110 years many ideas concerning the problem of evaluation of 3 dimensional structures out of their two-dimensional aspect were published (Weibel 1979, Underwood 1968, Haug 1986). Such thoughts emerged in many countries and in many disciplines. However, a connection between the countries and disciplines did not exist. Therefore, some developments took place independently in different regions without the knowledge of a similar work done by other scientists. This process increased rapidly after 1945.

It was time for the scientists, engaged in different developments, to hear from each other and first communications could be observed from about 1950 in the different disciplines. One of these disciplines was microscopical anatomy, in which the twodimensional images of threedimensional structures have given a lot of problems as to the estimation of the actual values in space. In 1960 three anatomists (Hans Elias, Ewald Weibel and myself) met each other informally during the 7th International Congress of Anatomy in New York.

Ten months later Elias wrote a letter to me dated 28th February 1961, asking me to participate in a foundation meeting to establish a society

concerned with the above mentioned problems. This meeting took place on the 11th to 12th May 1961 in the Black Forest (Feldberger Hof) in Germany.

Ten persons participated and discussed such a foundation. Some of the participants' papers illuminated the scientific importance of the project and the necessity to give an impulse to the further development of this scientific discipline. After the basic decision to found a society the name of the newly-introduced science was debated. Elias suggested the expression "Stereology" and convinced the others. But, there was a possibility that this name could have already been held by other disciplines. A call to the Library of the University of Freiburg convinced us of the correct introduction of this name.

The business part of this meeting concerned mainly the status and the preliminary statutes of the "International Society for Stereology". It was decided to register the society in Germany and in the USA as a "Non-Profit Organization". A preliminary Board of officers was elected and their duties defined. The first congress of the society was to take place in the following year 1962.

The participants in this foundation meeting were: G. Bach, H. Elias, M. Gahr, H. Haselmann, H. Haug, A. Henning, A. Hossmann, C. Kraus, R. Lorenz and W. Treff. The following disciplines were represented: Anatomists (4), Biologists (2), Mathematicians (3) and one medical practitioner. These participants appointed the Board of officers: President: H. Elias (USA), Vicepresident: H. Haug (Germany-West), First Secretary: G. Bach (Germany-West), Treasurer: A. Hossmann (Norway), Second Secretary: W. Treff (Germany-West). A report regarding this meeting was published in 1963 by G. Bach.

After this foundation meeting the elected officers were aware that the actual realization of the foundation was a very hard job. Hundreds of letters were exchanged between Hans Elias and myself within the next two years. A lot of further letters went back and forth between the members of the Board who had moreover the task of informing scientists interested in becoming members of the society. The lawyers and the authorities had their own rules for registration of the society and these rules differed in Germany and the USA. It was unavoidable that tensions arose between the officers regarding the way in which the future activities of this embryonic society should be realized. These difficulties occurred mainly because every little problem had to be discussed by letters which were sometimes on route by airmail for up to ten days and not through personal and oral contact. However, after many intense discussions by letter all the problems could be solved to the Board's satisfaction.

The first decision in the fall of 1961 was the postponement of the first congress from 1962 to 1963. The second was the choice of the city in which the congress should take place. In the spring of 1962, 42 members had voted on which country they would prefer the first congress to be held in. We got 19 votes for Austria, 11 for the USA and 12 for various other countries. Therefore, we decided in favour of Vienna as the place for the first congress. The organization was assigned to me. A second point was the retirement of A. Hossmann from the position of treasurer for health reasons. This position was transferred to E. Underwood, which was a real improvement, as he was the first materials scientist on the Board of the society and furthermore, its international character was accentuated by a second officer from the USA.

The membership increased from 10 in the Black Forest to about 60 in the spring of 1962. After the invitation to the first Congress in Vienna this increase accelerated to 125 (56 from America, 65 from Europe and 4 from other continents) up to the first of August 1962. At the beginning of the first congress (April first 1963) the membership amounted to 157.

There were 81 from Europe (31 Germany-West), 70 from America (64 USA) and 6 from other continents. The disciplines were represented by 82 Bioscientists (51 Anatomists), 53 Materials scientists (36 Metallurgists) and 22 from various other disciplines including 4 mathematicians.

This composition of the membership was a first great success, because it was possible to establish a really international and interdisciplinary society within the first two years of the organization. A further important point was the beginning of scientific connections between the scientists and their various disciplines. First exchanges regarding principles and methods began and the scientists learned that the stereological problems were very similar all over the world. However, the kind of formulation and expressions were quite different depending on the disciplines or regional communications. The members came from 20 different countries in four continents. They worked in various disciplines of the natural sciences. In actual fact it was the morphological sciences, with a common experience in practice, such as Anatomy and Metallography, which were mainly represented. However, both disciplines came from quite different fields of the life and material sciences. The mathematicians were not represented to the same extent after the first two years of the development as they were in the foundation meeting. But, this has changed during the further development of the ISS and the presidency of R. Miles in 1983 to 1987 illuminates this process.

The first International Congress of Stereology was held in Vienna from 18th to 20th April 1963. President was H. Elias, Secretary General H. Haug, the local organization was performed by the Wiener Medizinische Akademie. The scientific program was opened by H. Elias. The inaugural address was held by the famous architect Buckminster Fuller (USA). Altogether 40 papers were given, two thirds of them dealt with stereology in the restricted sense. The others applied to topics which were more in the direction of the borderline e.g. serial sections reconstruction, stereoscopic reconstruction and similar procedures. The papers were composed as follows: 8 from stereological basic science, 14 concerned the methodical use, 11 gave examples concerning results and the rest concerned reconstruction, stereoscopy and other procedures. All disciplines with various stereological conceptions were represented. The bioscientists had a slight predominance the metallurgicalists, however, were the second largest group.

In the business meetings the establishment of the society was finally confirmed and the new Board elected. Both points were necessary for the definite registration as a "Non-Profit Organization". The new Board also had the duty of organizing the stereologically scientific communication between the members and disciplines. The introduction of a Bulletin was suggested covering information about single members. Furthermore, the Board was to develop a conception for an interchangeable language and a common nomenclature. It was decided to hold the second congress in three years in the USA. About 60 active participants (one third from the USA) and their accompanying persons enjoyed a full social program including a final trip to the Burgenland on the border of Hungary.

For the new Board of the ISS the following officers were elected: President: H. Elias (USA), Vicepresident: H. Haug (Germany-West), Secretaries: E.R. Weibel (Switzerland), W. Treff (Germany-West), Treasurer: E.E. Underwood (USA). These officers were assisted by two Editors: R.T. de Hoff (USA) and G. Bach (Germany-West) and regional representatives (F. Marin-Giron, Spain and M. Palkovits, Hungary for Eastern Europe).

The new Board completed the legalization as a "Non-Profit Organization" in the USA and Germany-West. The scientific organization

took high rank during the next period. The standardization of the stereological terms was more difficult than the scientists had initially anticipated. The reason was that, in some regions and in the different disciplines, discussions concerning this problem had already taken place. However, these first steps of standardization were performed differently and have developed a certain persistence. Nevertheless, the basic equations were accepted, but some problems arose as to the value of the expression of letters e.g. for "Point". In short: The question arose, is "P" the symbol representative for all kinds of points, independently of the stereological frame of reference? The discussion about this problem is still not resolved, as it is still being debated, whether "P" is only a pure point P, or whether P can also be an intersection or a transection. However, one fact is important, that is that the basic formulae are independent of this question. In reality they have the same mathematical power without prejudice to the letters used.

Place and time regarding the second congress caused the new Board some trouble. This congress should have initially taken place in Gainesville, Florida but, because of some unsolvable problems, the Board decided to postpone the second congress for one year and to choose the city of Chicago. The advantage of this change was the fact that the president was able to take over the organization himself and H. Elias began immediately with the preparations.

In the four year period of the second Board, E. Weibel organized a Symposium "On quantitative procedures in Morphology", held during the VIIth International Anatomical Congress in Wiesbaden 1965. This was the first meeting organized in the four year period of the Stereological Congresses. One of the invited speakers at this Symposium was the materials scientist H. Fischmeister (Austria), a fact that indicates that the communication between the disciplines is reality. This symposium was a real novelty for the Anatomists, because this older science was not very fond of mathematical formulae. However, this symposium was a success and the papers were printed (Elias and Weibel 1967).

In the time between 1963 and April 1967 the membership increased to 247. The composition was from America 141 (126 USA), from Western Europe 86 (33 Germany-West), from Eastern Europe 16 and from other continents 4. Some changes in the membership could also be observed. There were those who had become members mainly in order to observe and find out whether the ISS was a development for their own procedural facilitation, or just as a friendly act towards one of the retired founders. Most of the new members had a real interest in stereology as science.

The second International Congress of Stereology took place from April 8 to 13, 1967 in Chicago under the presidency of H. Elias. The proceedings of the meeting "Stereology" were edited by Hans Elias and printed by Springer 1967. The president's introductory speech on "Problems of Stereology" gave a survey of the basic procedures and a framework of how to find a common scientific language. In the opening section E. Weibel gave an important keynote-paper on "Structure in space and its appearance on sections".

Altogether 15 invited speakers and about 50 free communications were presented. The theory and mathematics of stereology was represented by about 20%, the methodical aspect by about 40% and the application by 25%. The other papers dealt with reconstruction, stereoscopy and diverse procedures. The life and material sciences were about equally represented. The participants used the meeting for discussions and got a lot of stimulation for their further work.

There is one point to be mentioned. The use of computers or automated evaluations had only a marginal relevance during the Vienna Congress.

However, in Chicago, this field gained a certain significance because automatization and/or computers were used in about 15% of the contributions. This shows the beginning of a new important development for Stereology, especially for an efficient application.

The business meetings of this congress were determined by an intense discussion concerning future development. It was decided to introduce a 4 to 5 year period for the staging of the international stereological congresses and to alternate between Europe and the USA. Furthermore the statutes were improved and adapted to the development. The positions of the treasurer and first secretary were unified. Regional activities were suggested and the members were to organize such meetings. The Board was to appoint a small nomenclature-committee and a bulletin was to be introduced containing information on activities of the ISS and its members.

The composition of the new Board was discussed. The former president and vicepresident resigned, because, in their opinion, the young society should change the presidentship in each period. The members elected the following new Board: President: E.R. Weibel (Switzerland), Vicepresident: E.E. Underwood (USA), Secretary-Treasurer: H. Fischmeister (Sweden), Secretaries: A. Lazarow (USA) and J.E. Hilliard (USA). The new president expressed thanks to H. Elias and H. Haug. The assembly appointed H. Elias as its honorary president.

After this congress it was clear that geometrical probability lies at the centre of the stereological sciences in the sense of sections through three-dimensional structures. The congress avoided solving the question of whether the procedures of reconstruction were inside the border of stereology. I think this was prudent, because the newest development of image reconstruction with computers gives, to-day, the opportunity to combine the geometric probability with the reconstruction procedures.

The following developments were of interest within the period between the second and third international congress. The latter was scheduled 1971 in Bern. The membership increased from about 250 to 350 members. In 1968 Weibel had the opportunity to contact the Royal Microscopical Society of England. In this way the ISS obtained the possibility to be represented in a journal. Thus, the ISS decided that the Journal of Microscopy should become the official organ for publication. The first issue in collaboration with the ISS was volume 89 in 1969. From that time on one of the editors was nominated by the ISS. The first editor for stereology was G.C. Amstutz. Underwood and E. Weibel were nominated for the editorial advisory Board of this Journal. Up to the present time the editors for stereology have been G.C. Amstutz, E.W. Weibel, H. Gundersen and V. Howard. Furthermore, the president and the editorial secretary of the ISS were members of the editorial advisory Board.

The activity of the members in contributing to the Bulletin of Stereology was not considerable therefore the Board decided to introduce, instead of the Bulletin, a rather small "Stereological Newsletter" in order to inform the members of the activities of the ISS.

In 1970 E. Weibel and H. Haug organized a symposium on Stereology during the 9th International Congress of Anatomy in Leningrad (USSR). During the 10th International Congress of Anatomy in Tokyo in 1975, a symposium on Stereology was also held and organized by H. Haug. Since this 10th International Congress of Anatomy the use of stereological procedures have been commonly accepted. However, the papers regarding stereological application were placed in the relevant field concerned with the anatomical sessions.

The members of the ISS had organized some local, discipline orientated smaller meetings on stereology. But, the ISS was not formally engaged in these meetings and a real interdisciplinary symposium was not held. The

Board of the ISS had had intense consultations both internally and with some interested members, as to how the further development could be stimulated. The result of these considerations were to be discussed during the congress in Bern 1971.

The third congress of the ISS was a joint meeting with the Swiss Society for Optics and Electron Microscopy. Weibel was the chairman of the congress and the organization was performed by the Department of Anatomy at the University of Bern. Nearly 150 participants joined the meeting. 25 were from overseas including Australia. A total of 24 countries from 4 continents were represented. The program was opened with welcome addresses and two fundamental lectures. The following sessions concerned: Mathematical Foundation of Stereology, Analysis of Shape and Topological Properties of Structures, Size Distribution and Number of Particles, Instrumentation, Automatic Image Analysis and Data Processing and Application. Each chapter contained one or more invited lectures with fundamental statements. Altogether 11 invited lectures and 51 contributed papers were given. The social program included tours of wonderful countryside of central Switzerland.

The business meetings changed the composition of the new Board. The position of the secretary was revalorized to a second vicepresident. Both vicepresidents were to represent their continents and organize meetings between the International Congresses in their continents. The following officers were elected: President: E.E. Underwood; Vicepresidents: J.E. Hilliard for America and H. Haug for Europe; Secretary-Treasurer: Anna-Mary Carpenter; Secretary for publication: G.C. Amstutz. Four Committees were founded for Mathematics (R.T. DeHoff), Biological Sciences (A.V. Loud), Material sciences (H.E. Exner), Instrumentation (G.A. Moore).

Through this new construction the Board and the scientific committees were obliged to increase the public activities of the ISS. The future development of the activities showed that the new organization was able to facilitate the communication between the different disciplines represented in the ISS. In 1974 during the time between the third and the fourth congress the European section of the ISS organized a meeting on "Quantitative Analyse of Microstructures" in Leoben, Austria. According to our later enumeration of the meetings, this meeting was the First European Symposium for Stereology. However, the name and the numbering were finally introduced during the third symposium in 1981 in Ljubljana, Yugoslavia. In the other continents similar developments could be observed. However, unfortunately, the author of this history was mostly not informed.

The proceedings of all seven subsequently held International Congresses of Stereology and of the four European Symposia for Stereology as well as other events regarding Stereology in Europe were published and can be found in the references section of this article. I think the change of editor and publisher for the Proceedings of each international congress is due to the rotation of the Board and to changes of the location of the congresses. This shortcoming may be tolerated. However, one disadvantage cannot be avoided, because the acquisition of a copy of the older proceedings is very difficult. The introduction of the "Acta stereologica" under the editorship of M. Kališnik can probably eliminate this deficiency in the future.

The time after the Congress in Bern is only roughly sketched, because the activities have been too intense to be related by only one scientist. Thus, I feel that the history of this time after Bern should be written by members from two continents, in my opinion, a very good sign for an active and expanding society.

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1) A reprint of the first proceeding of Vienna in 1963 can be ordered from the author of this article.