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Flow analysis

A report on the 6th International Conference on Flow Analysis held in Toledo, Spain, June 8–11, 1994.

Every three years the flow analysis community assembles to confer; and this time we were the guests, or so it appeared, of Miguel Valcarcel and Lola Luque de Castro. The sense of being a guest rather than a delegate was heightened by the format; (nearly) all attendees were staying in the conference hotel, we had breakfast and lunch together in our own function room, there was just one lecture stream, there were no events opposing the poster sessions, there was plenty of time to relax and the organizers had taken care over the social program.

In this age of rapid publication, e-mail, fax and phone, I wonder increasingly about the role of the scientific conference. I am slowly moving towards the conclusion that the novel scientific content of such gatherings is becoming of less importance in comparison with other features of such a coming together of scientists with a common interest. However, I acknowledge that there are certain expectations concerning what a conference report should contain and, in Table I, details of the oral presentations are given. A sub-set of the presentations will be appearing in the special conference issue of *Analytica Chimica Acta*.

It was clear that most delegates were attending as researchers in the area of flow analysis rather than as users or manufacturers/vendors of equipment and that very few were attending in order to find out what flow analysis is. Thus, it is clear that the nature of the conference has changed since that first meeting in Amsterdam in 1979, when a considerable number of delegates, myself

included, were attending because they wanted to learn about flow injection analysis.

And so what is the status of flow analysis in 1994? In addition to the data shown in Table 1, some figures may help. There were representatives from 29 countries (12 countries had only one representative) totalling 193 conferees. Of these, 76 were from Spain, 18 from the UK, 12 from Portugal, 10 from Japan, 8 each from the USA and Germany and 7 each from Australia, Brazil and France. During the two and a half days, 178 posters were presented (divided equally between three sessions) and 36 oral presentations were made. In addition, two discussion sessions kept the conscientious delegate occupied on the Wednesday and Friday evenings. A small instrument exhibit ran concurrently with the poster sessions.

The flow injection literature now stands at well over 5000 publications, so even the most avid reader is unlikely to be familiar with all recent developments and thus the conference certainly met the need of providing an easily assimilated update on what has been happening in various areas of analytical chemistry in which flow techniques are applied. Clearly the organizers had this aspect of a conference in mind when inviting speakers. The oral presentations had also been carefully chosen not only to give a proper representation to the various countries participating, but also to the various topic areas. It is clear that one way of classifying flow techniques is by the type of detection employed and that another is by the type of sample under scrutiny.

It was hard not to be impressed by the diversity of analytical chemistry problems which would seem to be soluble by the use of flow injection techniques. Flow procedures

are clearly a unifying theme in modern analytical chemistry and it is surely time that a portion of this conference was given over to the educational implications of this development. There are certainly a number of teaching experiments in the chemical education literature (such as it is) and probably a lot more in use than are described in the pages of the *Journal of Chemical Education* and, I suspect, no shortage of delegates prepared to share their philosophy of analytical chemistry (including the teaching of, the practice of and research in) as it might manifest itself through the medium of flow analysis.

It would be invidious to attempt to single out individual contributions as particularly novel or exciting (though I will succumb to the temptation to do just this later) and with over 200 presentations to digest in a relatively short time, even the most conscientious delegate would be hard put to make evaluative comments on all of the presentations. Not all of the presentations excited my interest to the same degree and, in common with all conferences these days, the poster presentations varied considerably in their clarity.

Another novel feature of this meeting was the discussion sessions; one concerning nomenclature and the other the formation of an international society. The former was moderated by W.E. van der Linden (University of Twente, The Netherlands) who, prior to the meeting, had circulated to members of the scientific committee a draft of a document prepared for publication by Commission (V.1) on General Aspects of Analytical Methods of IUPAC entitled 'Classification and Definition of Analytical Methods Based on Flowing Media'. The document was also made available to

Table 1
Oral presentations at the Flow Analysis 6 Conference

Author	Title
J. Ruzicka	Flow injection bioanalysis — from sample to a living cell
G.S. Wilson	New developments in flow injection immunoassays
R. Kellner	Dual valve flow injection system with FTIR detection for the determination of hydrolytic enzyme substrates
E. Domínguez	Biosensor development for environmental analysis of phenols and related compounds
H. Ukeda	Dynamic analysis of binding process of protein on glutaraldehyde-activated support
P.K. Dasgupta	Electroosmosis as a pumping means in miniaturized flow analysis. FIA, SIA and beyond
E.A.G. Zagatto	Crystal seeding in flow injection turbidimetry: Determination of total sulfur in plants
W. Kunnecke	Combined separation and sample introduction in flow analysis
J.F. Van Staden	Tandem (hyphenated or coupled) flow injection systems: A new dimension in flow injection analysis
D.C. Olson	Process flow injection analysis of liquid and gas streams in the chemical and petrochemical industries
P.J. Worsfold	In situ monitoring of nutrients (nitrogen and phosphorus) in marine, freshwater and terrestrial environments
L. Gorton	On-line flow system for automatic monitoring of fermentations based on microdialysis sampling, flow injection–column liquid chromatography and amperometric biosensing
P.B. Stockwell	The role of atomic fluorescence detectors for speciation studies on mercury, arsenic and selenium
S.D. Kolev	Mathematical modelling of flow injection systems
B. Hitzmann	Multivariate data analysis of flow injection signals
T.A. Nieman	Electrogenerated chemiluminescence detection in flowing streams
M.E. Díaz-García	Flow-through cell luminescence sensors for clinically important chemical species
D. Schepers	Membrane-based gas sensors for the determination of NO ₂
T. Imato	Spectrophotometric flow injection determination of metals using indicator-immobilized flow cell
W. Frenzel	Flow injection and electrochemical analysis, an alliance of mutual fructification
N.W. Barnett	The use of chemiluminescence detection for flow analysis
D. Price	Determination of hydrogen peroxide in seawater by flow injection and chemiluminescence detection
S.J. Haswell	Development of an FIA system with on-line microwave enhanced reaction for inorganic and organic analyte preparation
J.L. Burguera	Determination of iron and zinc in adipose tissue by microwave-assisted mineralization and flow injection graphite furnace atomic absorption spectrophotometry
I.D. McKelvie	On-line digestion and filtration for determination of total phosphorus in anhomogeneous environmental samples
H. Bergamin F ^o	Determination of cadmium in fertilizers and foodstuffs by flow-injection spectrophotometry
G.R. Scollary	Discontinuous flow-analysis: generation of fluid flows by differential pumping
E.H. Hansen	Flow injection analysis leaving its teen-years and maturing. A personal reminiscence of its conception and early development
M. de la Guardia	Vapour generation FTIR: a new analytical technique
S. Motomizu	Micro-flow injection analysis (mFIA) instrumentation and application to phosphorus determination
B. Welz	The development of flow injection atomic spectrometry as a product line
M. Burguera	A time-based device used for the determination of tin by hydride generation, flow injection atomic absorption techniques
M. Sperling,	Possibilities of pressurised flow-injection sample pretreatment for atomic absorption spectrometry
J.F. Tyson	Flow injection chemical vapor generation atomic spectrometry
A.P. Wade	Automated optimization strategies for flow methods of analysis

all delegates as an insert in the program booklet. Lively discussion ensued. A number of additional terms for possible inclusion in the document were identified such as 'reverse flow injection' and 'sample throughput'. It also emerged that there is considerable dissatisfaction with the way in which many authors present their results in publications and everyone involved with this process, authors, referees and edi-

tors were urged to pay more attention to the use of appropriate terminology and figures of merit. With regard to the terms included in the document, there was little dissention concerning the definitions assigned by the Commission. It was recognized that there are always difficulties in regularizing nomenclature and definitions, as other branches of science are sure to be already using some of the words

(flow analysis is no exception with 'dispersion' being an excellent example of this particular problem). However, we were all agreed on the desirability of moving towards unambiguous communication between the practitioners of flow analysis and the eventual publication of some IUPAC recommendations was seen as a positive step towards this goal.

The other discussion session showed that the need felt most by the flow analysis community, as represented by delegates at this conference, was the dissemination of news. It was not felt that a specific primary journal was needed as the type of information needed involved details of conferences and seminars, availability of equipment, results from laboratories trying to repeat procedures already reported in the literature, developments in the incorporation of flow techniques into standard methods and so on. There was also an interest in getting ready access to the flow injection literature and it was discovered that at least two research groups have substantial data bases (both using the same software as it happens). In addition, there are at least two 'local newsletters' in existence serving specific interest groups. After considerable discussion, the view was articulated that what was needed was an international newsletter and the best way of producing this was as the primary activity of a society; this met with general assent and the session was terminated.

Only a short gestation period was needed before a practical means of getting such a society started was suggested by a Spanish-German pressure group and thus delegates were accosted at the conference

banquet by the session convenor vigorously shaking a collection box. I am still wondering what to do with the \$205 so collected. However, I have a list of e-mail addresses, the names on which I will shortly be contacting through this medium. I welcome suggestions and or comments (which may be communicated by any means) relevant to the formation and activities of the society, but it may be assumed that I will be working on the production of at least one edition of a Newsletter before we all meet again in Piracicaba, Brazil for Flow Analysis 7.

This discussion also revealed that many of the delegates do not think of themselves in any terms other than as analytical chemists; providing solutions to chemical problems by the most appropriate means. The view was expressed that it was really the rest of the analytical chemistry community who needed to be educated as to the utility of flow techniques and the best way to do this might be for appropriate individuals to strive to include flow analysis sessions at major analytical chemistry meetings. The success of the Electrochemical Society in this regard was pointed out.

One feature that always strikes me about this conference in comparison with many of the other much bigger and broader meetings I

attend, is the enthusiasm of the delegates. It is hard not to be infected by Jarda Ruzicka's unflagging zeal, and hard not to be impressed by the continued creativity of the research collaboration between himself and Gary Christian. And even those of us who prefer photons to electrons found Wolfgang Frenzel's lively demonstration, of the determination of chloride (in coffee, orange juice and a soil extract) by tubular ion-sensitive electrodes, to be compulsive viewing.

The various sponsors of the event deserve acknowledgement. They were the Spanish Society for Analytical Chemistry, the University of Cordoba, the University of Castilla-La Mancha, the Ministry of Education and Science (DGCyT, Madrid), the Interministry Commission of Science and Technology (CICYT, Madrid), the European Union (Measurement and Testing Programme, DG XII), the Junta de Andalucia and Elsevier Science.

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