

The History of ISOPOW

The Beginnings

By R.B. Duckworth



“As water is common to be met with and comes to be used on every occasion, men are apt to imagine they thoroughly understand its nature: but those who have carefully applied themselves to the examination thereof, find it one of the most difficult subjects in all natural philosophy to be acquainted with” (Boerhaave, 1753).

Scientific interest in the properties of water in biological materials is, of course, as old as biological science itself. In the earlier part of the “modern” period, i.e. in the fifties and sixties, two basic concepts, “borrowed” from physical chemistry, dominated thinking by food scientists in this field, namely those of “water binding” and of “water activity”. Awareness of the former had, in fact, been manifest in some of the earliest chemical writings on water substance (e.g. Boerhaave, 1753) and the importance of this phenomenon in the study of foods was especially highlighted by the extensive work on food dehydration (and, to a lesser extent, freeze-drying and freezing) carried out during, and in the period following, the second world war. This concern with water-binding among food scientists at the time was shared with workers in several related fields, e.g. medical, biological and agricultural science, and thus had a useful bridging effect across to these more traditional disciplines.

The nature and strength of the associations between water molecules and those of the other constituents of biological materials underlies both the water-binding phenomenon and the concept of water activity. The latter was first brought to prominence in the food field by the work of microbiologists, in particular that of the Australian worker, Scott, in the nineteen fifties. Whereas the term water-binding directed attention primarily to the association of water with the surfaces of macromolecular “structural” constituents of foods, water activity, as originally applied in this area, was concerned more with subtle modifications in the availability of water to microorganisms, due to the effects of associations between molecules of water and those of relatively low-molecular-weight components forming “solutions” within moist food materials.

It had become clear that, in many applications in the food field, but particularly in relation to the properties of low-and intermediate-moisture products, it was not so much the actual amount of water present within a food that determined its behaviour but the condition of that water. In this connection, the water activity parameter, reflecting as it does the relative physico-chemical state of the water present, should afford a valuable index. Moreover, the beauty of water activity was that theoretically it provides, in a single value, a measure of the state

of water throughout a material at any given level of moistness, and that it could be readily determined, for practical purposes, as the equilibrium relative water pressure over a sample.

The claim of water activity as a valuable indicator of the susceptibility of foods to spoilage by microorganisms had, indeed, already been established by the work of Scott and his colleagues and it was quickly adopted, almost universally, as one of the key parameters of food science and technology. Many attempts were made to relate water activity to other aspects of food quality and stability, in particular to purely chemical causes of food deterioration, and the preparation of water sorption isotherms of foods became one of the commonest activities in laboratories interested in the study of the stability of foods at intermediate and low moisture levels.

By the late sixties, both of these concepts of water-binding and water activity had become firmly entrenched in the lore of the subject, yet it was already beginning to be realised that, whereas they had played and would continue to play a useful part in the development of ideas, they had in some cases been applied too loosely with insufficient regard for their limitations and insufficient attention to more recent advances in the physical sciences, which were leading to a better understanding of the underlying phenomena. The term “binding” in this context was, for example, really a misnomer. Water was never bound in the strict sense and it was simply a question of differences in rates of exchange. Again, in real situations, the water in a food was never likely to be in true equilibrium and strictly, therefore, in the basic physico-chemical sense, one should avoid using the term “activity”. This,

then, was the “state of play” as the decade of the sixties neared its end.

The year 1970 stands out in the history of Food Science as the year in which the International Union of Food Science and Technology (IUFoST) formally came into being with the holding of the third International Congress, SOS 70, in Washington D.C. in the United States. One initiative of the new international body, under its first President, Professor Georges F. Stewart of the University of California at Davis, was to institute a series of broadly-international, inter-congress symposia on topics of especially wide interest within the general field.

The newly-elected Vice-President of IUFoST at the time was Professor John Hawthorn of the Food Science Department of the University of Strathclyde in Glasgow, Scotland, whom the writer of this article had joined some fourteen years earlier to help in the development of the first university department of Food Science to be established in the United Kingdom.

The writer’s background immediately before moving to Glasgow had been with the U.K. Ministry of Food’s Defence Research Establishment in Aberdeen, where a major programme of work on the dehydration of food had been taking place during the early fifties. Aberdeen had become, in fact, an important international centre for work on food dehydration and it was therefore entirely appropriate that it subsequently provided the venue for a number of major international symposia in the field, most notably perhaps one in 1958 on “Fundamental Aspects of the Dehydration of Food”.

The department in Glasgow also soon established a reputation for organising major international meetings dealing with recent advances in various aspects of food science and technology and it therefore naturally appeared as a suitable choice for a site at which to hold an inter-congress symposium under IUFoST auspices. In 1966, a meeting on the “Low Temperature Biology of Foodstuffs” had been successfully organised there as a NATO Advanced Study Institute and, during the early seventies, the writer initially developed a proposal to hold a similar, NATO-sponsored, symposium on “Water Relations of Foods” as one in the newly instituted series of inter-congress IUFoST meetings. It is interesting at this point to recall the composition of the Organising Committee, which he set up to help him develop such a meeting. This was:

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J. G. Kapsalis, U.S. Army Natick Laboratory, Natick (U.S.A.)

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Academic Food science, in those days, on a world scale, was still in its infancy and was

having to battle hard for full and proper recognition. Within this new field, it was becoming possible, through emerging patterns of research interest, to distinguish certain especially-important unifying concepts, which, while they clearly “belonged” to the new discipline, overlapped with related disciplines and with areas of the basic sciences and therefore also established a real community of interest between workers in food research and those in the more traditional areas. The properties of water in foods and in other biological materials was beginning to emerge clearly as one such conceptual area. The idea, then, was to bring together in one meeting scientists concerned with all aspects of the influences of water on food quality, while also involving selected “visitors” from other disciplines to share in the discussion of outstanding problems.

In the event, obtaining support from NATO for such a meeting proved more difficult than had been expected. The original timetable had to be put back and some re-thinking carried out on the way in which the meeting was to be financed. The food industry internationally was showing great interest in the particular subject area at the time and it was decided to proceed on the basis of solicitation of support from the industry. George Stewart, the IUFoST President, who had participated in some of the earlier symposia organised by the department in Glasgow, took a leading part in approaching food companies in the U.S.A. and in Japan, while John Hawthorn was similarly active in the U.K.

The plan for the meeting, which would be held in Chesters House, the residential Department of Business Administration of the

University of Strathclyde, situated in Bearsden, Glasgow, was that numbers would be deliberately restricted to around 80—a maximum it was felt at the time in order to encourage optimum involvement in discussion by all participants—and that food companies would be invited to take part on the basis that, if they made an appropriate financial contribution, this would guarantee them a place for one of their senior scientific personnel who would be expected to take an active part in discussions. The meeting would be held over one week, with between 30 and 35 formal papers interspersed with adequate discussion periods, participants being housed and fed together with ample opportunity for informal person to person exchanges.

The proposed meeting being the first of its kind, it was decided to begin with a section on the fundamentals of the physical chemistry of water and of its interactions with the other main constituents of foods. This would be followed by a survey of the main techniques currently applied to the study of water in foods and in other biological materials. A third section would cover influences of water on the behaviour of microorganisms and a fourth the effects of water on enzyme activity in foods. Section 5 would be concerned with the effects of water on the progress of non-enzymic chemical changes at low and intermediate moisture levels, Section 6 with effects associated with freezing and thawing and a final section with various aspects of the condition and properties of water in relatively moist food materials.

The meeting was finally held between 9th and 14th September 1974. It was timed for the week immediately before the fourth International

Congress of Food Science and Technology which was held in Madrid, with the idea that such timing would be useful for participants coming long distances who also wished to attend the Congress. There were 76 full participants, representing thirteen different countries, 32 of these being speakers and the proceedings, edited by the present writer, were published the following year by Academic Press under the title “Water Relations of Foods”.

A number of factors combined to make this particular meeting especially successful. In the first place, there was at the time a growing realisation among scientists of the wide-ranging importance to the food industry of the subject matter covered. Secondly, this had been the first serious attempt to bring together such a combination of people, some working in apparently quite separate areas, but who had a community of interests because of their need for a better understanding of the behaviour and properties of that most ubiquitous of all biological constituents—water. There was, indeed, a sense in which the meeting had successfully delineated a recognisable area within the developing field of food science with which many scientists could really identify. Again, the way the meeting was organised was conducive to generating a particularly good rapport between those taking part and to encouraging valuable in-depth discussions between participants, who were drawn from academia, research institutes and associations and, of course, from the industry itself. The expertise represented ranged from pure physics and other basic physical and biological sciences to practical food technology and the degree of understanding, good will and cross-

fertilisation of ideas generated across the board was remarkable.

There had been no thought during the preparation of the Glasgow meeting that this might be the first of a series. It is interesting, however, to quote from Dr. Tracey's closing remarks: *"I referred to my hopes that in the near future new concepts will develop that will have the same liberating effect as that of Scott some 20 years ago. Many...would wish to join me in the hope that the organisers, or others present here ...will quite soon...organise another conference on the same broad topic"*.

In the event, it was left to a group of American food scientists including, in particular, Dr. L. B. (Lou) Rockland and Professor George F. Stewart to take the initiative by setting up an informal international committee with a view to organising a second meeting around the time of the next projected International Congress, which was due to take place in Kyoto, Japan, in 1978.

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