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## CCC 2002—Beijing, Second International Conference on Countercurrent Chromatography: Trends in Research and Applications

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### ABSTRACT

The scientific content and the attendance at the second international conference on countercurrent chromatography, CCC 2002, held in Beijing, China, April 15–20, are presented. The major events, scientific as well as social, are described. The CCC 2004 conference in Tokyo, Japan, was announced.

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*Key Words:* Symposium report; CCC 2002 Beijing China.

## INTRODUCTION

Countercurrent chromatography (CCC) was named after the countercurrent distribution method (CCD) that operates essentially by the same principle of partitioning solutes between two liquid phases." Countercurrent distribution method was developed in the early 1940s mainly by the effort of Dr. L.C. Craig, and during the 1950s the Craig CCD apparatus was widely used for separation and purification of a variety of natural products.<sup>[1]</sup> In 1966, when Dr. Craig saw the first CCC prototype he was amazed to observe his 20 mL-capacity CCD partition unit being reduced to a few microliters capacity in a segment of coiled Teflon tubing.<sup>[1]</sup> Since then, Yoichiro Ito has never stopped working in the CCC field, developing a wealth of different instruments and applications.

After several thematic sessions at various major international symposia, such as the Pittsburgh Conference, The First International Conference on Countercurrent Chromatography (CCC 2000) was held in London in September 2000.<sup>[2]</sup> At the end of that meeting, the CCC International Committee agreed on the candidacy of Dr. Tianyou Zhang and the Beijing Institute of New Technology Application for the second international CCC symposium (CCC 2002) to be held in Beijing. China is a rapidly developing country, a new member of the World Trade Organization, with a long history and a rich experience in traditional Chinese herbal medicines in which CCC is becoming an essential tool.

Countercurrent Chromatography 2002 was successfully organized by a local committee chaired by Pr. T. Zhang and Pr. X. Qiu. The major facts and figures of this event are reported in this article. This special issue gathers works that were presented in Beijing.

## COUNTERCURRENT CHROMATOGRAPHY 2002 IN FIGURES

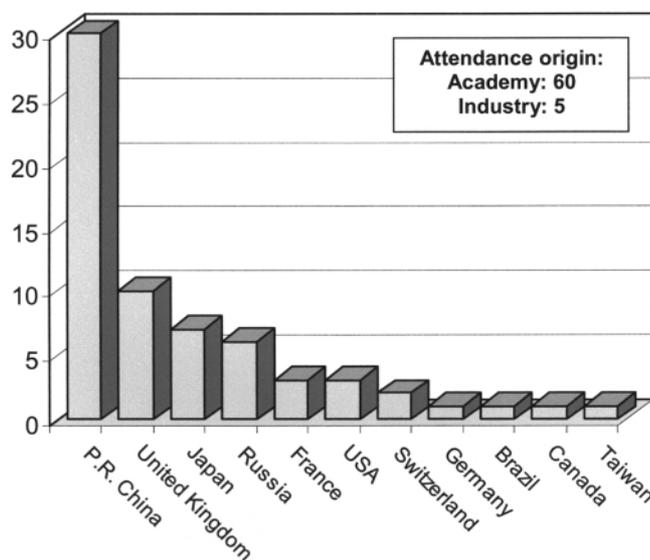
### Attendance

Sixty-five scientists attended the symposium. Many came with family making the number of badges issued approaching 100. The London attendance was 100 people. The 35% decrease can be clearly attributed to



the flight problem due to the terrorist attacks in the USA and to an economical melancholy that shrank the industrial attendance to a rock bottom low: only five conferees came from industrial companies or less than 8% of the total number of attendants. The quasi-absence of the Americans was striking: only three US scientists were present compared to the 12 US participants in London. When the Symposium List of Participants is consulted, it turns out that there was actually only one person from the USA since the two others were Dr. Ito himself and Dr. Chou, President of the Pharma-Tech CCC Company, both invited. The British delegation comprised the significant number of 10 people (Fig. 1). This number is 60% lower than the CCC 2000 attendance (25 participants) for an obvious reason: Beijing is far compared to London. This reason also holds for the French with only three delegates compared to 16 in London or a 80% decrease, and for the Germans with only one representatives (five in London).

China, the organizing country, was logically the most present (Fig. 1). It sent 30 scientists compared to seven in London. Japan sent seven participants, only 30% more than the five present in London. The same increase in attendance is notably observed with the Russian scientists with six people in Beijing for four in London.



**Figure 1.** The international diversity of the CCC 2002 attendance in Beijing.





### Scientific Content

During the three days of the symposium (April 16–18, 2002), seven sessions of plenary lectures and talks were organized on the subjects listed in Table 1. Nine plenary lectures and 29 oral communications were given during the seven sessions in the large conference room selected by the committee (Fig. 2). Thirteen posters were also displayed during the symposium. All the articles included in this special issue were presented in Beijing.

### Technical Exposition

Only one company, Shenzhen Tauto Biotech Ltd. ([www.tautobiotech.com](http://www.tautobiotech.com)), exhibited the latest hydrodynamic CCC instrument developed in China. An analytical unit was presented along with a preparative instrument and the necessary computer hardware and software developed by Amersham Biosciences ([www.amershambiosciences.com.cn](http://www.amershambiosciences.com.cn)) (Fig. 3).

Pharma-Tech Research Corporation (Dr. Edward Chou, President) sponsored the symposium but did not present any new instruments. Shenzhen Tauto Biotech Ltd. and Zhejiang Recover Biology Technical Co. were the two other generous sponsors of CCC 2002. AstraZeneca, Syngenta, and Romulus Technology from the UK also made contributions to the conference by sponsoring student travel.

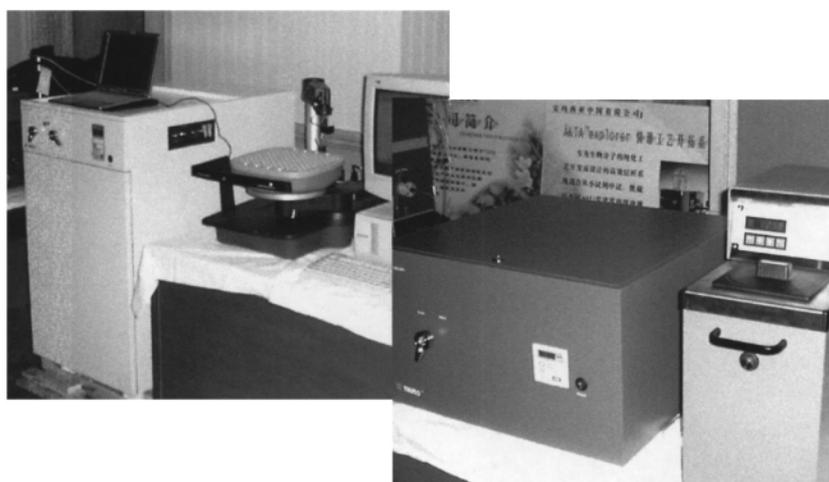
*Table 1.* Subjects and chairmen of the CCC 2002 sessions.

Session	Subject	Chairmen
1	General presentations	Y. Ito and T. Zhang
2	Methodology I—theory and scale-up	A. Berthod and H. Oka
3	Methodology II—liquid systems	I. A. Sutherland
4	Applications I—vegetal and environmental samples	I. A. Sutherland and B. Y. Spivakov
5	Applications II—proteins and ions	K. A. Hostettman and A. V. Marston
6	Technology and instrument development	G. J. Lye and Y. Ito
7	Centrifugal partition chromatography	A. P. Foucault and T. Zhang





**Figure 2.** The welcome address given by Pr. Tianyou Zhang (left) and the audience (right).



**Figure 3.** The Tauto Biotech Ltd. instrument (Shenzen, China). Left: the 1 L prep hydrodynamic unit with a fraction collector and a computer running the Atka Explorer<sup>®</sup> software from Amersham Bioscience. Right: the 100-mL analytical Tauto coil planet centrifuge.

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## SCIENTIFIC AND SOCIAL EVENTS

## Scientific Exchanges

Countercurrent chromatography 2002 had conferences and talks that proved that the knowledge and understanding of liquid–liquid technology in both hydrodynamic and hydrostatic CCC instruments are steadily improving. The British school presented the constant pressure pump theory for the hydrodynamic instruments and new ideas that will allow the efficient scaling-up of hydrodynamic instruments. The French school presented the recent advances obtained in the understanding of hydrostatic instruments. The contributions of Chinese teams were impressive: attractive software able to predict the physicochemical properties of biphasic liquid systems in any proportions and the partitioning and elution order of solutes in the studied mixture. Various research groups described the CCC separation of a wealth of vegetal, biological, or inorganic samples. Only two new instruments were presented: one, the Milli-CCC, is a classical coil planet centrifuge but with oil-encased gearing, a minimal volume, and stainless steel tubing. The other one used a spiral disk assembly.

A vivid open discussion was held at the end of the second day. Participants discussed their problems and basic issues in CCC. A wish was expressed that the CCC nomenclature and terminology be standardized by IUPAC to make CCC recognized and accepted by the scientific and industrial community. Instruments are improving, but the perfect CCC instrument is not yet marketed. Berthod presented his book due in September.<sup>[3]</sup> In an informal way, Dr. Ito taught some of his non-CCC expertise to participants (Fig. 4).



**Figure 4.** Dr. Yoichiro Ito (Bethesda, USA, center) teaches origami, the Japanese art of folding paper into decorative shapes, to Pr. Xueli Cao (Beijing, China, left) and Pr. Yuren Jin (Shaanxi, China, right) during an informal session at CCC 2002.



Pr. Zhang hosted a visit to the Beijing Institute of New Technology Application. He showed his research facility where he routinely uses CCC to prepare Certified Reference Material standards of the active compounds found in many natural products. He also presented the NT-GS20 coil planet centrifuge that his institute is marketing.

### Social Events

The conferees were invited to the Popular Theatre in downtown Beijing where they saw a show of acrobatic dancers and local Chinese dances (Fig. 5). A rapid visit of Tian'anmen Square and the nearby shopping centers was organized on Friday afternoon. The symposium banquet took place on Friday night, chaired by Pr. Zhang and Pr. Fei of the Chinese Chemical Society (Fig. 6). A magnificent display of fine Chinese cuisine culminated with the presentation and carving of roasted ducks.

A Chinese proverb says that if you have not seen the Great Wall, you have not seen China. So, the next Saturday was dedicated to a visit to the Great Wall. This one thousand year old "military equipment" is so long that it is the only man-made building that can be seen from the moon. On the way, we had a stop to visit a ceramic and stone-carving factory and lunch in an excellent



*Figure 5.* Acrobatic demonstration at the Theatre of Popular Dance in Beijing.

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**Figure 6.** Banquet at the Golden Gate Restaurant in Beijing. Standing from left to right: A. Foucault (St. Nazaire), Mrs. Zhang, T. Zhang (Chairman, Beijing), H. Burgaud (L'Oréal, Aulnay, France). Seated: A. Berthod (Lyon), Y. Ito (Bethesda, USA), C. Fei (Beijing).

restaurant. The Ming tombs were also visited with their impressive underground chambers. The Great Wall and its imposing majesty did not disappoint the visitors, although the weather was very cloudy. A huge crowd, including the symposium participants, was gathered at the bottom of the Great Wall. The first steps up the wall were so packed by people, it was difficult to pass. However, strangely, there was less and less of a crowd as more steps were climbed. Figure 7 shows that only a few of the CCC people made it to the highest watchtower. Dr. Ito proved his great physical shape: he was not the first, but he was far from being the last.

### CONCLUSION

The venue of CCC 2002 confirms that the CCC technique is mature enough for a useful and viable symposium to be held every other year. Following a tradition established by Ian Sutherland in London, the international CCC committee met to decide the location of the next CCC symposium (Table 2). There was only one candidate: Tokyo presented by Pr. Oka. The





**Figure 7.** On the highest watchtower on the Great Wall near Beijing. From left to right and back to front: back row: E. A. Tinnion (Brunel), G. Lye (London), L. Janaway (Brunel), D. Fisher (Brunel), P. Wood (Brunel), S. Ignatova (Moscow), I. A. Sutherland (Brunel). Middle row: A. Berthod (Lyon), M. H. Pearce (Brunel), Y. Ito (Bethesda), A. J. Booth (London), D. Garner (London). Front row: U. N. Wanasundara (Saskatoon), H. Nakazawa (Tokyo), M. J. Pearce (Brunel), and K. Inoue (Tokyo) (Photo by C. Berthod).

**Table 2.** The CCC international committee.

Name	Country	Affiliation
Alain Berthod	France	Université de Lyon 1, CNRS
Edward Chou	USA	Pharma-Tech Research Corp.
Walter Conway	USA	Conway Centrichrom Inc.
Alain Foucault	France	GEPEA, St. Nazaire
Kurt Hostettmann	Switzerland	Université de Lausanne
Yoishiro Ito	USA	National Institute of Health
Gary Lye	UK	University College London
Andrew Marston	Switzerland	Université de Lausanne
Tatiana Maryutina	Russia	Russian Academy of Sciences
Hisao Oka	Japan	Aichi Prefectural Institute of Health
Ian Sutherland	UK	Brunel Institute for Bioengineering
Tianyou Zhang	China	Beijing Institute of New Technologies
Tonghui Zhou	China	Chinese Academy of Medical Sciences

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European members would have preferred a venue in America as a logical succession after London in Europe and Beijing in Asia. However, the two US members of the committee supported Tokyo. Dr. Ito expressed his interest to see a CCC symposium in his native homeland. To ensure a regular geographical rotation of the symposium venue in the future, Ian Sutherland proposed that the geographical locations for the 2006 and 2008 symposia be America and Europe, respectively. The committee gave a unanimous agreement to Pr. Oka to organize CCC 2004 in Tokyo, probably early September and recommended that the 2006 and 2008 venues be in America and Europe. After the symposium, Brazil suggested it would be willing to organize CCC 2006. The committee is open to such suggestions.

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