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A brief history of INA and ICOH SCNP: International Neurotoxicology Association and International Congress on Occupational Health Scientific Committee on Neurotoxicology and Psychophysiology

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ABSTRACT

Two international scientific societies dedicated to research in neurotoxicology and neurobehavioral toxicology are the International Neurotoxicology Association (INA) and the International Congress on Occupational Health International Scientific Committee on Neurotoxicology and Psychophysiology (ICOH SCNP). From June 5–10, 2011 these two societies held a joint conference in Xi'an China entitled the Xi'an International Neurotoxicology Conference, Neurotoxicity and Neurodegeneration: Local Effect and Global Impact. At the conference two featured talks presented a brief history of the two societies. This article is a synthesis and expansion of those two presentations. The history of INA and ICOH SCNP is described in relation to the antecedent events leading to the formation of the two societies, their parallel developments, the nature of the societies and their scientific conferences, and a brief description of some of their accomplishments. Together, the historical development of these two societies is an important component of the development of the scientific discipline of neurotoxicology.

1. Introduction

The discipline of neurotoxicology encompasses a diverse set of expertise including clinical neurology, occupational medicine, veterinary medicine, epidemiology, experimental toxicology, pharmacology, experimental psychology and the neurosciences. The origins of the science of neurotoxicology can be traced to ancient times and discoveries of the toxicity of a variety of plants and materials. During the nineteenth and twentieth centuries, episodes of lead and mercury poisoning, clinical discoveries of the toxic effects of carbon monoxide, strychnine and curare, poisonings from adulterated beverages during prohibition, the development of synthetic pesticides and industrial chemicals, and the unwanted side effects of pharmaceuticals led experimental scientists to try and reproduce such toxic effects in laboratory settings, to describe their characteristics and understand their pathophysiological basis. The modern field of neurotoxicology emerged from the efforts of these many clinicians and scientists (Lucchini et al., 2012).

The discipline variously called Behavioral Toxicology, Neurobehavioral Toxicology, and Behavioral Neurotoxicology was born in the 1970s. Research in the 1930s set the stage for this new discipline when surveys and neuro-psychiatric interviews were conducted on workers and their families to evaluate the effects of carbon disulfide (CS_2) in Pennsylvania (Pennsylvania Dept Labour and Industry, 1938). In the 1960s and 1970s, Helena Hanninen (Fig. 1) of the Finnish Institute of Occupational Health (FIOH) conducted the first psychological assessment in the Finnish viscose rayon industry (Hanninen, 1966, 1971); neuropsychological deficits in exposed workers were also identified in Germany and Italy (Cassitto et al., 1978). Hanninen used clinical psychological tests, finding fairly large effects, which those clinical tools were designed to detect. Early in the 1970s the Swedish National Board of Occupational Safety and health in Sweden began developing automated psychometric methods to test humans (Gamberale and Svensson, 1974), marking the beginning of a key goal in this developing field of research.

2. The first meetings of behavioral toxicologists in the 1970s

As the early research was published, scientists began to meet to talk about their research and to learn about the research being

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Fig. 1. Dr. Helena Hanninen of the Finnish Institute of Occupational Health (FIOH).

conducted by others. The first such large international meeting was organized in Rochester, NY, USA, in 1972 by Drs. Bernard Weiss and Victor Laties of the University of Rochester (Fig. 2). They invited scientists who were primarily conducting research in which animals were experimentally exposed to neurotoxic chemicals. In many cases, the scientists were working in the field of Behavioral Pharmacology to identify behavioral effects of drugs to characterize the relationships between CNS targets and behavior; this field of study brought extensive funding and produced significant research to identify the possible neurotoxicity

Fig. 2. Drs. Bernard Weiss and Victor Laties of the University of Rochester in Rochester, New York, USA.

of new pharmaceuticals. These scientists began applying the same methods to the study of potentially toxic chemicals (Weiss and Laties, 1975). This led to the development of the Behavioral Pharmacology and Behavioral Toxicology Societies, and were the intellectual precursor to the International Neurotoxicology Association (INA), although the leadership of these organizations were completely independent.

The second large international meeting of scientists studying neurotoxicity was held in 1973, but it was aimed at research to identify early neurotoxic effects in humans exposed to chemicals in the workplace. This meeting, the Workshop for Early Detection of Occupational Hazards, was convened by Drs. Charles Xintaras and Barry Johnson of the National Institute for Occupational Safety and Health (NIOSH) in Cincinnati, Ohio, USA (Fig. 3). US research was just beginning in this area, so European scientists who had been conducting behavioral research on people exposed to occupational chemicals played a leading role in the meeting. The results were published in 1974 (Xintaras et al., 1974), the first book dedicated to the subject. This meeting was a direct precursor of the International Congress on Occupational Health International Symposium on Neurobehavioral Methods and Effects in Occupational and Environmental Health (ICOH SCNP) meetings, lead by

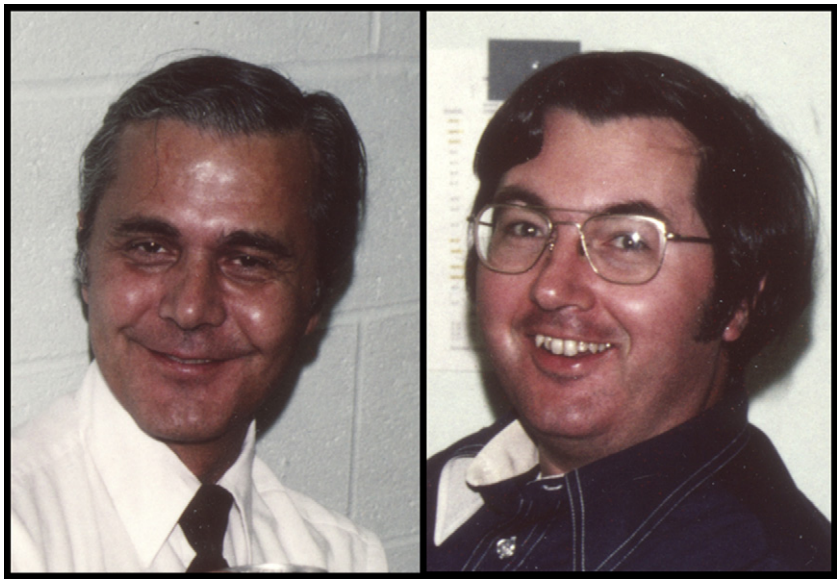


Fig. 3. Drs. Barry Johnson and Charles Xintaras of the US National Institute for Occupational Safety and Health (NIOSH) in Cincinnati, Ohio, USA.

Fig. 4. Participants at a WHO Conference, Moscow, USSR, 1983.

the same people from the US and Europe who were prominent in the Cincinnati meeting.

These two meetings, the early research by Hanninen and others, and work by Beard and Wertheim (1968) in the US who found adverse effects of carbon monoxide at very low levels, stimulated the funding that created a new field. A great deal of grant funding was directed to universities and in the US major research units were funded at the US Environmental Protection Agency (EPA) (Neurotoxicology Division led by Larry Reiter and later Hugh Tilson), US National Institute for Environmental Health Sciences (NIEHS) (Laboratory of Behavioral and Neurological Toxicology led by Cliff Mitchell and Hugh Tilson), National Center for Toxicological Research (NCTR) (Division of Neurotoxicology led by Bill Slikker and later Merle Paule), and the National Institute of Occupational Safety and Health (NIOSH) (Neurobehavioral Research Section in NIOSH led by Charlie Xintaras and Barry Johnson (who later led the Agency for Toxic Substances and Disease Registry)). These meetings and the early research findings also led to increased funding of neurotoxicology research units at the European agencies that were already hard at work studying neurotoxic endpoints, most notably laboratories led by Helena Hanninen and Anna Maria Seppalainen at the Finnish Institute for Occupational Health (FIOH), Renato Gilioli and Maria Cassitto at the University of Milan, Philippe Grandjean at the University of Denmark, Gerhard Winnecke at the University of Dusseldorf, and Francesco Gamberale at the Research Department of the Swedish National Board of Occupational Safety and Health.

In follow-up to the NIOSH meeting in 1973, the Occupational Health Office of the World Health Organization (WHO), neurotoxicologists, occupational physicians, and psychologists voiced the concern that the diversity of methods used in human subject research was too great and no systematic findings were being reported despite many publications describing many field research projects. They recommended the development of more uniform and comparable testing for the field of human neurotoxicology (Johnson et al., 1987). At about the same time, meetings were spearheaded by Cliff Mitchell and Hugh Tilson of NIEHS, also under the aegis of the WHO, to recommend a series of animal behavioral tests that would span the range of cognitive and motor functions shown to be or anticipated to be affected by neurotoxic chemicals (WHO, 1986). These meetings were held in Moscow in 1983 and in Prague in, 1984 (see meeting participants from 1983 in Fig. 4).

3. The triennial ICOH and biennial INA Symposia are borne

By 1980, there was significant funding and enough research produced by the funding that it was time for the scientists involved to meet regularly to discuss methods and outcomes of their research. The Scientific Committee of Neurotoxicology and Psychophysiology (SCNP) of the International Congress on Occupational Health (ICOH) adopted these proposed meetings, and the first one was organized in 1982 in Milan by Renato Gilioli, who published the proceedings as a book (Gilioli et al., 1983). In 2009, the ICOH SCNP voted to meet every two years, thus changing to biennial instead of triennial meetings.

The origins of the International Neurotoxicology Association can be traced to two initially independent groups. One originated after a neurotoxicology course sponsored by The North Atlantic Treaty Organization (NATO) and the American National Standards Institute and the (ANSI) that was held in 1984 in Belgirate Italy (Fig. 5). The course drew a number of young and enthusiastic investigators from a diverse set of countries and disciplines who wanted to stay in communication and form a community of neurotoxicologists. Because of the cross-disciplinary nature of the scientists studying neurotoxicology (ranging from subcellular mechanistic studies to field epidemiology), many felt isolated in their native disciplines and believed that an organization was needed to facilitate communication and exchange of information about their mutual interests. After the meeting, Dr. Michael Csicsaky of Düsseldorf Germany began a periodic informal newsletter to a "Neurotoxicology Interest Group" composed of about 36 attendees at the Belgirate course, and which quickly attracted other interested scientists. Many of these INA Newsletters that emerged from this initiative are archived on the International Neurotoxicology Association website (http://www.neurotoxicology.org). The newsletter was intended to build a network of neurotoxicologists who could share news and information and to form a basis for collaborations. The name of the

Fig. 5. Attendees at the NATO-ANSI neurotoxicology course in Belgirate Italy, 1984.

interest group was changed to the International Neurotoxicology Association (INA) after a poll of the members. Concurrently, a "Neurotoxicology Club" in The Netherlands of about 25 members began to hold 2–3 meetings per year under the organization of the late Dr. Jacob Hooisma (Fig. 6). The two groups soon joined forces to form the core of the International Neurotoxicology Association. The first meeting of the INA was held in Lunteren, The Netherlands in 1987. Since 1987, the INA has held a scientific conference every two years in locations hosted by members of the society. Since 2003, the INA meetings have featured a central theme to serve as a focal point of the presentations, but neurotoxicology research from all perspectives was and is welcome. Each INA meeting has produced a published volume composed of peer-reviewed scientific reports from selected presentations at the meeting.

The ICOH scientific committee and the INA are designed to support research on neurotoxicology and to hold meetings to disseminate information and facilitate collaborations. However, the focus of their meetings is quite different. ICOH focuses almost entirely on human research in occupationally and environmentally exposed populations with an emphasis on neurobehavioral testing, while the recent INA meetings have developed central themes and encouraged a variety of scientific approaches to address these issues. These approaches include experimental laboratory work, and occupational, clinical and field epidemiological investigations. The ICOH meetings are designed to stimulate collaboration in research, training and education with scientists from developing countries. The initial emphasis was on providing leadership in human behavioral and psychophysiological testing methods, followed shortly by emphases on neurotoxic effects and prevention of neurotoxic effects. INA, on the other hand, is focused on multidisciplinary scientific research that reveals neurotoxic mechanisms. The INA originally emphasized shared resources, community, communication, and encouraging young scientists, and the fostering of a neurotoxicology research community continues to be a major role of the organization.

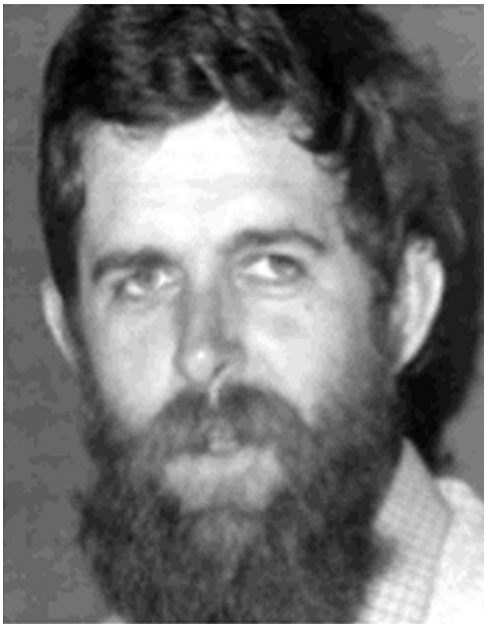


Fig. 6. Dr. Jacob Hooisma of the TNO Medical Biological Laboratory, Rijswijk, The Netherlands.

4. Composition of meetings

The INA and ICOH meetings have a parallel structure, seen in Table 1, each starting with a memorial lecture dedicated to an early pioneer in the field. INA's lecture is dedicated to Jacob Hooisma (1945–1994) who was a major influence in the development of the INA meetings, and ICOH's lecture is dedicated to Helena Hänninen (1925–2005) due to her seminal role in the early human neurotoxicology research and the influence of that research on the methods used in the field. While the INA meetings have a

Table 1
Structure of the INA and ICOH SCNP meetings.

INA	ICOH SCNP
Hooisma Memorial Lecture	Hänninen Memorial Lecture
Scientific plenary sessions	Scientific plenary sessions
Student symposium	Encourage participation from developing countries
Posters	Posters
Social day & local culture visit	Local company visit
Football (soccer) game	Football (soccer) game
Banquet	Banquet
Business meeting	Business meeting
Ample interaction time	Ample interaction time

Table 2
INA Biennial Symposia by number, year and location, theme, organizer, and reference to the published proceedings.

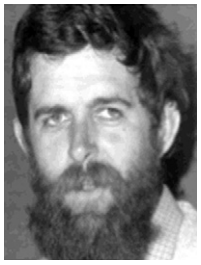
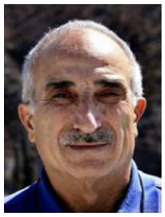
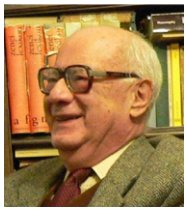
Meeting, year, location	Theme	Organizers (local organizing committee)	Reference
INA-1, 1987, Lunteren, The Netherlands	Neurotoxicology topics ranging from mechanistic to field epidemiology research	Jacob Hooisma 	Toxicol 49(1) 1988
INA-2, 1989, Sitges, Spain	Neurotoxicology topics including the effects of pesticides, organic solvents and metals	E. Rodriguez-Farre 	Neurotoxicol Teratol 12(6), 1990
INA-3, 1991, Parma, Italy	Neurotoxicology in humans, developmental neurotoxicity, neurotoxicology and aging, and mechanisms of neurotoxicology	I. Franchini (photo not available)	NeuroTox, 13(1), 1992
INA-4, 1993, Elsinore, Denmark	The hippocampus and neurotoxicology, second messenger systems, nutrition and neurotoxicology, and clinical assessment of neurotoxicology	Ole Ladefoged, 	NeuroTox, 15(3), 1994
INA-5, 1995, Port Ludlow, Washington, USA	Environmental chemicals and neurodegenerative disorders, neurotoxicity of polychlorinated biphenyls, glial cells and neurotoxicity, neurotrophic factors in treatment. The first Jacob Hooisma Memorial Lecture: Dr. Gerhard Winneke. "Inorganic lead as a developmental neurotoxicant: some basic issues and the Dusseldorf experience"	Steven G. Gilbert 	NeuroTox, 17(3–4), 1996
INA-6, 1997, Szeged, Hungary	Mechanisms of insecticide action, pesticide neurotoxicity, role of genetic polymorphisms, metallothionen, and immunotoxins as tools in neurotoxicology Hooisma Memorial Lecture: Dr. Hugh Tilson, "The neurotoxicity of polychlorinated biphenyls"	Illes Desi 	NeuroTox, 19(4–5), 1998
INA-7, 1999, Leicester, United Kingdom	Neurotoxicology methods, mechanisms, sensitive subpopulations, sensory systems, and effects of organophosphates and PCBs Hooisma Memorial Lecture: Dr. Pierre-Luigi Nicotera, "Factors controlling the balance between apoptotic and necrotic modes of neuronal death"	David Ray 	NeuroTox, 21(4), 2000
INA-8, 2001, Estoril, Portugal	Developmental neurotoxicity, manganese, gene function and gene–environment interactions in Parkinson's Disease and occupational neurotoxicolgy Hooisma Memorial Lecture: Dr. John Olney "New insights and new issues in developmental neurotoxicology"	Ana Paula dos Santos 	NeuroTox, 23(6), 2002

Table 2 (*Continued*)

Meeting, year, location	Theme	Organizers (local organizing committee)	Reference
INA-9, 2003, Dresden, Germany	*Neurotoxicological Mechanisms of Occupational and Environmental Exposure.* Hooisma Memorial Lecture: Dr. Hans Rosling,:Konzu: a new neurotoxicological disease induced by poverty"	Andreas Seeber 	Environ Toxicol Pharmacol 19(3), 2005
INA-10, 2005, Porvoo, Finland	*Neurotoxicology: from molecules to clinical disorders and human behavior* Hooisma Memorial Lecture: Dr. Clive Harper, "Neurotoxicity of alcohol"	Markku Sainio 	Human & Experimental Toxicol, 26(4) 2007
INA-11, 2007, Asilomar California USA	*Neuroprotection and Promotion of Repair Following Neurotoxic Injury* Hooisma Memorial Lecture: Dr Fred Gage, "Regulation and Function of Neurogenesis in the Adult Hippocampus"	Larry Fechter 	NeuroTox, 29(3), 2008
INA-12, 2009, Jerusalem, Israel	*Gene–Environment Interactions in Neurotoxicology* Hooisma Memorial Lecture Dr. Hermona Soreq "Gene–Environment Interactions in the Mammalian Cholinergic System"	Yoram Finkelstein 	NeuroTox, 31(5), 2010
INA-13, 2011, Xi'an, China	*Neurotoxicity and Neurodegeneration: Local Effect and Global Impact* Hooisma Memorial Lecture Dr. David Bellinger, "Estimation of global population burden of disease of neurotoxicity in children" *Neurodevelopmental Basis of Health and Disease*	Wei Zheng, Jingyuan Chen 	This volume
INA-14, 2013, The Netherlands		Didima de Groot 	

special presentation slot for students and give awards to those students with the best posters, ICOH encourages talks from scientists from developing countries and supports the publication of those talks in the meeting proceedings that are also peer reviewed scientific publications. INA devotes a day to a cultural visit while ICOH typically has a visit to a local factory or occupational setting. Both meetings have time for scientific sessions with oral and poster sessions, and both have business meetings to plan the next meeting and attend to society business. Both meetings include ample time for informal interactions among the scientists.

5. Themes

The INA meetings have been funded through grants including from US NIEHS, EPA and other granting agencies, and through fundraising by the local organizing committees. The ICOH meetings are generally funded almost exclusively by the local organizing committee. Because INA applies for grant funds, their themes are generally articulated at least one meeting ahead (Table 2), while the ICOH themes tend to emerge from the proceedings of the meetings (Table 3). The year and location, themes, organizer and the reference to the meeting proceedings are listed in the tables.

Table 3
ICOH International Symposia by number, year and location, theme, organizer, and reference to the published proceedings.

Year, location	Themes	Organizer	Reference
FIRST – 1982, Milan, Italy	Diversity of methods used in research and the need to provide guidance to the field on valid methods for occupational neurotoxicology research.	Renato Gilioli 	Gilioli et al. (1983)
SECOND – 1985, Copenhagen, Denmark	Validity of the methods used to detect neurotoxicity. A multitude of tests are available and the test batteries used differ considerably from study to study. Presentations focused on lead, methyl mercury, and solvent mixtures.	Phillippe Grandjean 	Grandjean (1985)
THIRD – 1988, Washington, DC, USA	Training and hands-on educational opportunities for the use of several neurobehavioral test batteries, including the Neurobehavioral Core Test Battery developed by WHO that became the primary "paper and pencil" tool for such studies throughout the world. Identified as a priority the development, validation and application of computer-based test batteries. First Hanninen lecturer: Peter S. Spencer	Barry L. Johnson 	Johnson et al. (1990)
FOURTH – 1991, Tokyo, Japan	Improve preventive strategies compatible with local resources. Emphasis on neuropsychological changes and disorders in developing countries from Asia. Review of epidemiological and clinical features of Minamata disease (methyl mercury intoxication from contaminated fish). Hanninen lecturer: Barry L. Johnson	Shunichi Araki 	Araki et al. (1994)
FIFTH – 1994, Cairo, Egypt	Development of neurobehavioral test methods and questionnaires, Effects of solvents, manganese, pesticides, hazardous wastes and exposures due to oil and other chemicals used in warfare. Hanninen lecturer: You-xin Liang	Mahmoud Amr 	Amr et al. (1997)
SIXTH – 1997, Shanghai, China	Presentations from developed countries from throughout the world and developing countries in southeast Asia.	Hui Qing Jin, You-Xin Liang  	Liang (1998)
SEVENTH – 1999, Stockholm, Sweden	Development of Swedish Occupational Exposure Limits (OEL) for neurotoxicants based on psychological performance (regulatory risk assessment), studies of the influence of personality traits on neuropsychological features in solvent encephalopathy, importance of concurrent aging, utility of vibratory sense testing to detect neurotoxic effects. Hanninen Lecturer: Bengt Knave	Anders Iregren 	Iregren et al. (2000)
EIGHTH – 2002, Brescia, Italy	 Neurobehavioral and sensory methods were a dominant theme, along with effects of manganese and solvents. Hanninen Lecture: Rick Letz (pictured)	Roberto Lucchini 	Lucchini et al. (2003)

Table 3 (*Continued*)

Year, location	Themes	Organizer	Reference
NINTH – 2005, Gyeongju, Korea	Neurobehavioral methods development was a major theme, along with the effects of metals and solvents. Development effects received increased attention. Hanninen lecturer: Kent Anger	Seong-kyu Kang 	Kang et al. (2007)
TENTH – 2008, San Jose, Costa Rica	Multiple exposures to neurotoxic substances and to various pollutants in communities residing near industrial plants, as well as contributing such as malnutrition, poor indoor air, inadequate childhood intellectual stimulation, long working hours, noise. Hanninen lecturer: Leslie London	Ineke Wessling, Donna Mergler 	Anger et al. (2009)
ELEVENTH – 2011, Xi'an, China	Benefits of conducting cellular, molecular, animal, and human neurotoxiciology research in concert or in parallel. Hanninen lecturer: Donna Mergler	Wei Zheng 	This issue of NeuroToxicology
TWELFTH – 2013, Capetown, South Africa	Symposium in development	Jonny Myers, Leslie London	To be determined

6. Joint or combined meetings

Previously, the ICOH SCNP has held meetings with other organizations. The Third ICOH Symposium (1988), in Washington, DC, USA, was held in conjunction with the Pan American Health Organization (PAHO). The ICOH SCNP collaborated with the ICOH Scientific Committee on metals to hold the joint workshop Neurotoxic Metals: Lead, Mercury, and Manganese-from Research to Prevention (NTOXMET) in Brescia, Italy in 2006 (Landrigan et al., 2007). The tenth ICOH meeting (2008) in Costa Rica was in conjunction with the ICOH International Conference on Epidemiology in Occupational Health (EPICOH). The 12th INA meeting and 11th ICOH SCNP International Symposium on Neurobehavioral Methods and Effects in Occupational and Environmental Health were held together in Xi'an, China, in 2011. This article is based on presentations by the authors at that meeting, though expanded to give more of the history of the two organizations and the field. The meetings were integrated with joint symposia combining speakers from both organizations, melding basic and applied or human research. To give ample time to each society's interests and emphasis, several parallel or simultaneous symposia were also held. The two organizations' scientific committees, in a joint meeting, agreed to hold additional combined meetings of INA and ICOH SCNP when these can be arranged.

7. International neurotoxicology meetings

Two other major influences on the development of neurotoxicology have paralleled the ICOH and INA meetings deserve mention as the themes and integration of animal and human research overlap with the ICOH and INA meetings and attest to the size and robustness of the field of neurotoxicology. Begun in 1982, a series of neurotoxicology conferences organized by Dr. Joan Cranmer (see Fig. 7 from the third conference) has contributed significantly to the development of the field of neurotoxicology as it has often focused on cutting edge developments and research integration in the field. The first of this series was the International Conference on Neurotoxicity of Selected Chemicals: Lead, Tin, Manganese and Kepone that was held in Chicago, Illinois in September 1982. The conference series has continued approximately annually since that time and has featured a wide variety of timely topics. The conference proceedings have been published regularly in the journal NeuroToxicology.

In addition to the INA and ICOH meetings dedicated specifically to neurotoxicology, there was a parallel growth within the Society of Toxicology (SOT) that was expressly manifest in the formation in 1983 of a Neurotoxicology Specialty Section to serve as a focal point for the interaction of members of SOT that were interested in neurotoxicology. The Neurotoxicology Specialty Section conducts symposia, workshops and training courses within the annual meetings of the SOT.

8. *ICOH SCNP* accomplishments

The ICOH SNCP group initiated their symposia in 1982 with a major emphasis on guidance to the scientists conducting neurotoxicity assessments in human populations, who were often clinicians drawn into the field to conduct a field assessment of an apparent problem in their home area. As a result, methods had

Fig. 7. Dr. Joan Cranmer from the second Neurotoxicology conference in 1983, in Chicago, Illinois, USA.

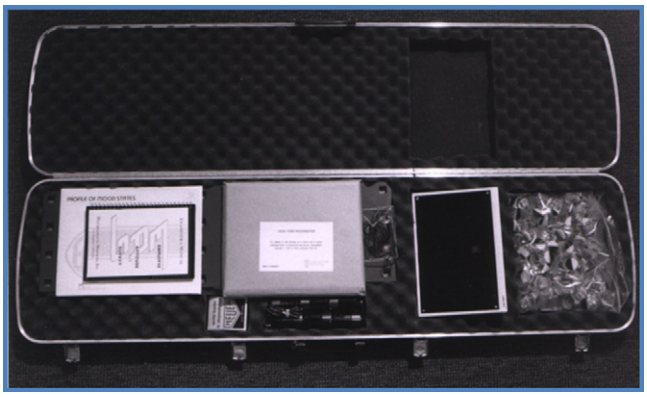


Fig. 8. The WHO Neurobehavioral Core Test Battery (NCTB) kit shipped to various countries as part of the cross-cultural comparison (Anger et al., 1993).

proliferated and it seemed that every new study used a new and unique set of tests, leaving little basis to compare the results across studies. The ability to replicate effects was compromised by the lack of comparable methodologies. In addition, it was not possible to build a common database that would allow quantitative comparisons between studies; what would today be thought of as meta-analysis. The same group came together in a special meeting hosted by NIOSH in Cincinnati, Ohio, USA, in 1984 with the express purpose of recommending a small set of tests for detecting and characterizing neurotoxic effects in human populations. That meeting led to the recommendation of a specific testing system and tier II and III tests named the WHO Neurobehavioral Core Test Battery (NCTB) (Fig. 8). The goal was to provide a consensus expert recommendation for a test battery to detect neurotoxic effects in [all] humans (Johnson et al., 1987). The tests are:

- Digit Symbol
- Digit Span
- Benton visual memory
- Santa Ana (pegboard)
- Simple reaction time
- Pursuit Aiming II
- Profile of Moods Scale (POMS) (symptoms)

In 1986, an Operational Guide was developed at WHO, led by Kent Anger, Helena Hanninen and Maria Cassitto, to provide detailed implementation guidance and specific instructions. This was developed to ensure that scientists had a step-by-step guide to conduct well-designed and adequately powered epidemiological studies of neurotoxic exposures, and to support a 10-country cross-cultural feasibility study to be conducted according to the Operational Guide (Anger et al., 1993). The development of the NCTB has been a theme through the ICOH meetings, with major presentations about this battery of tests in the fourth, seventh and ninth ICOH meetings. In the seventh meeting, Iregren and Letz (1993, 1991) proposed the minimum core test battery (MCCTB), a set of three NCTB tests: The symbol digit, simple reaction time and finger tapping tests. To this day, many publications report basing the test selection for their research on the NCTB. A push of the development of new computer-based technology is shared by INA and ICOH. In ICOH it has taken the form of behavioral tests for human populations.

The ICOH Scientific Committee of Neurotoxicology and Psychophysiology that holds the International Symposia consists of about 45 members from 25 countries. Meeting attendance is always over 300 participants, however, drawing especially on scientists from the host country and developing countries located geographically near the meeting venue. The extensive collaborations that have developed by people who first met at one of these meetings constitute among the most enduring accomplishments of the ICOH SCNP meetings.

9. INA accomplishments

The major accomplishments of the INA are not focused on a specific set of methodologies or approaches, but rather include the creation and fostering of an international cross-disciplinary community of neurotoxicologists. The original goal of the

Fig. 9. Participants in the INA soccer (football) match (2003).

organization was to bring together investigators across different scientific disciplines using a variety of techniques that were involved in neurotoxicology research. The combination of multiple approaches to study common problems has continuously been a feature of the meetings. There are currently over 200 members of INA from more than 36 countries. The INA meetings provide a venue to share and discuss the most current scientific information, to meet potential collaborators, share ideas and discuss a variety of neurotoxicology issues. Importantly, an effort is made at every meeting to foster development of students and young investigators. Opportunities for informal interactions including social outings and a traditional football (soccer) match are a favorite part of the meetings (Fig. 9). Another major accomplishment of the INA is the series of publications currently comprising 13 special issues to date that reflect the depth and breadth of neurotoxicology research, and also document the development of neurotoxicology as a scientific discipline over 2 and a half decades (Table 2).

The INA meetings also have provided a venue for the members who have contributed substantially to the neurobehavioral testing methodologies that have since been incorporated into neurotoxicity screening batteries (including the functional observational battery, motor activity, and neuropathology testing) that have become incorporated into harmonized animal testing batteries for the US and Europe (OECD, 2004). Thus, although not a direct product of the INA as the human testing batteries have been for ICOH, the INA and INA members played a substantial role in development of neurotoxicity screening methods for laboratory animals. Recently, the publication entitled "Toxicity testing in the 21st century: A vision and a strategy" (NRC, 2007) advocated the eventual replacement of whole animal testing with high throughput screening methods and computational modeling based on the ability of compounds to perturb critical toxicity pathways. The INA meetings have become one of the important venues for those attempting to develop such testing and computational capacity for predicting neurotoxicity, in particular for developmental neurotoxicity. Recent INA meetings have featured multiple sessions considering these important topics.

10. Conclusion

In sum, the INA and ICOH/SNCP meetings have helped stimulate the development of the field of neurotoxicology and provided leadership for the field. With the 2011 meeting in Xi'an, China, these two organizations joined together to find common ground for future research that addresses mechanisms in a context relevant to the real-world. One of the best things about the joint meeting of these two societies was the ability to structure numerous scientific sessions that spanned the range of investigations from laboratory bench research to field evaluations of exposed human populations, thus better fostering translational use of scientific information and encouraging the formation of potentially powerful future collaborations. For those interested in this field, you can join one or both of these organizations by contacting the following:

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SNCP website: http://sites.google.com/site/scnp09/

ICOH SNCP website: http://www.icohweb.org/site_new/ico_homepage.asp

INA

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INA website: http://www.neurotoxicology.org/

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