

# **ICRP**

## **1999 Annual Report of the International Commission on Radiological Protection**





ICRP Annual Report on 1999  
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*Cover photo: The Main Commission meeting in St Petersburg, Russia, September 1999.  
The famous armoured cruiser, Aurora, is visible in the background.*

## ***Our Mission Statement***

**The International Commission on Radiological Protection, ICRP,  
is an independent Registered Charity,  
established to advance for the public benefit  
the science of radiological protection,  
in particular by providing recommendations and guidance  
on all aspects of protection against ionising radiation.**

### ***Progress in 1999 in a Nutshell***

The present report begins with a brief description of ICRP and its procedures, serving as a platform providing a logical structure for the report.

Two reports were printed in the *Annals of the ICRP* in 1999: *Publication 79* on 'Genetic Susceptibility to Cancer'; and *Publication 80* on 'Radiation Dose to Patients from Radiopharmaceuticals'.

A report in CD ROM format on 'The ICRP Database of Dose Coefficients: Workers and Members of the Public' is being distributed through the same channels as the *Annals of the ICRP*. It extends the collection of dose coefficients given in *ICRP Publications 68* and *72*.

A booklet on the 'History, Policy, Procedures' of ICRP was also produced.

The Main Commission approved three reports for publication, one on

Radiation Protection Recommendations as Applied to the Disposal of Long-lived Solid Radioactive Waste, one on Principles for Protection of the Public in Situations of Prolonged Exposure, and one on Pregnancy and Medical Radiation. The two former reports had been subjected to extensive international consultation before ICRP approval.

The Commission also reviewed draft reports from Task Groups, on Interventional radiology and on Accident prevention in radiotherapy. Drafting continued on numerous further reports, some of them intended to be produced partly or entirely in CD ROM format.

Meetings were held in 1999 with the Main Commission, with each one of the four Committees, and with each one of 13 Task Groups; and the Secretariat undertook various actions to support these activities.



## ***The International Commission on Radiological Protection***

The primary body in radiological protection is ICRP. It was formed in 1928 as the 'International X-ray and Radium Committee', but adopted its present name in 1950 to reflect its growing involvement in areas outside that of occupational exposure in medicine, where it originated.

ICRP consists of the Main Commission, Committee 1 (Radiation Effects), Committee 2 (Doses from Radiation Exposure), Committee 3 (Protection in Medicine), Committee 4 (Application of ICRP Recommendations), *ad hoc* Task Groups and Working Parties, and the Scientific Secretariat.

The Main Commission consists of twelve members and a Chairman, while the Committees contain between 15 and 20 members each. The Commission and its Committees run for four-year periods, from 1 July. On each occasion of a new period, at least three, and not more than five, members of the Commission must be changed. A similar rate of renewal is sought for the Committees. Such a new period began 1 July 1997.

The Commission meets once or twice a year. Each Committee meets once a year. Twice in each four-year period, the annual meeting of the Committees is conducted jointly and together with the Commission. These meetings are funded as necessary from monies available to ICRP.

The activities of ICRP are financed mainly by voluntary contributions from national and international bodies with an interest in radiological protection. (A list of the bodies providing such contributions in 1999 is appended at the end of this report). Some additional funds accrue from royalties on ICRP *Publications*. Members' institutions also provide

support to ICRP by making the members' time available without charge and, in many cases, contributing to their costs of attending meetings.

The Commission uses Task Groups and Working Parties to deal with specific areas. Task Groups are formally appointed by the Commission to perform a defined task, usually the preparation of a draft report. A Task Group usually contains a majority of specialists from outside the Commission's structure. It is funded as necessary from monies available to ICRP.

Working Parties are set up by Committees to develop ideas, sometimes leading to the establishment of a Task Group. The membership of a Working Party is usually limited to Committee members. Working Parties receive no funding of their own, *i.e.* they operate primarily by correspondence and by meetings in direct conjunction with meetings of the Committee concerned.

These activities are co-ordinated with a minimum of bureaucracy by a Scientific Secretary, ensuring that ICRP recommendations are promulgated.

Thus, ICRP is an independent international network of specialists in various fields of radiological protection. At any one time, about one hundred eminent scientists are actively involved in the work of ICRP. The four-tier structure described provides a rigorous Quality Management system of peer review for the production of ICRP Publications.

In preparing its recommendations, the Commission considers the fundamental principles and quantitative bases on which appropriate radiation protection measures can be established,

while leaving to the various national protection bodies the responsibility of formulating the specific advice, codes of practice, or regulations that are best suited to the needs of their individual countries. The aim of the recommendations of ICRP is to

- *provide an appropriate standard of protection for mankind from sources of ionising radiation, without unduly limiting beneficial practices that give rise to exposure to radiation.*

## **The Main Commission:**

*Genetic Susceptibility to Cancer; Radiopharmaceuticals; CD ROM Database; Multifactorial Diseases; Embryo/Foetus Doses; Long-lived Solid Radioactive Waste; Prolonged Exposures of the Public; Pregnancy and Medical Radiation*

*The Commission is an independent Registered Charity, established to advance for the public benefit the science of radiological protection, in particular by providing recommendations and guidance on all aspects of protection against ionising radiation.*

Two Reports were published in the Annals of the ICRP in 1999. The first of these, *Publication 79*, is the report from Committee 1 on **Genetic Susceptibility to Cancer**. It was adopted with a concluding section on implications for radiological protection drafted by the Main Commission. The report reviews mechanisms of radiation oncogenesis with respect to gene mutations in man and animals; the spontaneous frequencies of relevant germline mutations in human populations; and the role of genetic factors in radiation-induced cancer. The text adopted contains reviews and judgements on mechanisms of DNA damage and repair; on gene involvement in the development of cancers, leukaemia and lymphomas; and the modelling of genetically imposed cancer risk. In respect of the implications for radiological protection, the report concludes that the prevalence of familial cancers in the population is too low to distort current estimates of population risk. Radiation-induced cancer risks at low doses in genetically susceptible individuals are considered small when compared with background rates; but that these individual risks will become important following high dose exposure such as would occur after radiotherapy.

The second report, *Publication 80*, is from a Task Group of members of Committees 2 and 3 on **Radiation Doses to Patients from Radiopharmaceuticals (Addendum 2 to ICRP Publication 53)**. This will contain biokinetic models and

effective doses, using ICRP 60 dosimetry for C-11 methylthymidine and 2-thymidine C-14 urea including CO<sub>2</sub> and bicarbonate, O-15 water, Tc-99m HIG, Pertechnegas, Technegas, Tetrofosmin In-111 HIG and Octreotide. Dose data for the 19 most frequently used radiopharmaceuticals from *Publication 53* have been recalculated using ICRP 60 dosimetry and include, F-18 FDG, Cr-51 EDTA, Ga-67 citrate, Se-75 SeHCAT, Tc-99m DMSA, DTPA, RBC, IDA derivatives, large colloids, WBC, MAA, non-absorbable markers, pertechnetate, and phosphates/phosphonates, I-123 Hippuran, I-131 Hippuran, I-123 MIBG, I-131 NP 59, Tl-201 thallous ion and some printing corrections to *Publication 53*. Finally dose data are reproduced unchanged from *Addendum 1*, i.e., H<sub>3</sub> neutral fat and free fatty acids, C-14 neutral fat and free fatty acids, Ga-68 EDTA, and Tc-99m HMPAO, MAG3, and MIBI.

New electronic media pose special challenges. In 1999, the Commission also published a CD ROM, **The ICRP Database of Dose Coefficients: Workers and Members of the Public**. The CD ROM essentially expands the lookup tables of *ICRP Publications 68 and 72* by adding organ doses including Remainder Tissues to the effective doses given in the printed versions. It also provides more detail in some further respects. This CD ROM is distributed through the Commission's publisher, Elsevier Science.

A booklet on the History, policies, and procedures of ICRP, which was issued in 1998, was in brisk demand also during 1999.

Two reports which had been approved for publication by the Commission already in 1998 were the subject of final preparation for printing during all of 1999, in both cases due to painstaking QA procedures. One of these reports is **Risk Estimation for Multifactorial Diseases**, which will become *Publication 83*. The main conclusion is that the risk of hereditary radiation-induced disease is less than had been previously estimated. The report will give details of computer simulation studies to estimate the risk of those multifactorial diseases that commonly occur and where both mutation and environmental factors are known to be involved. It will indicate the limitations of the model and the impact of mutational changes on gene interactions in non-equilibrium populations. The preliminary conclusion is that radiation-induced mutations at low doses are not likely to significantly influence the incidence of the commonly-occurring multifactorial diseases.

Another report, on **Age-dependent Doses to Members of the Public from Intakes of Radionuclides, Part 6. Embryo and Foetus** covers intakes by the mother before and during pregnancy for selected radioisotopes of the 31 elements for which age-dependent biokinetic models have been given in recent publications.

The Main Commission met in September 1999 in St Petersburg, Russia. The major agenda items were the approval of two related draft reports. One of these concerns **Radiological Protection Recommendations as Applied to Disposal of Long-lived Solid Radioactive Waste**. This report supplements ICRP *Publication 46* on the same topic, particularly on potential exposures from long-lived wastes,

protection objectives in the long-term, the weight to be given to future doses, and the application of optimisation of protection. That report was subjected to final preparation for printing after the Commission meeting, and has appeared in print in 2000 as ICRP *Publication 81*.

The companion draft report addresses **Protection of the Public in Situations of Prolonged Exposure to Radiation** ('chronic' exposures). This includes such topics as when to suspend intervention countermeasures, advice on decontamination and reclamation of land after contamination from past practices or accidents, and unexpected exposure to high doses from natural sources. Final preparation for printing of this long and typographically rather complicated report continued well into 2000, and the report will appear late in the summer of 2000 as ICRP *Publication 82*.

Furthermore, the Commission reviewed a draft report on **Pregnancy and Medical Radiation**, aimed at a wider readership within the medical community than many of the Commission's more technical documents. That report was later approved by postal ballot, and it is now being finally prepared for printing.

The Commission also briefly reviewed two draft reports on protection in interventional radiology and on prevention of accidents in radiotherapy. Both of these drafts are also intended for a wider readership than some of the more technical ICRP reports. In 2000, these two drafts have been circulated for public consultation via the Commission's Internet site.

In addition to these reviews of specific reports, the Commission reviewed current progress and plans in each of its four Committees. The Commission also made its annual formal survey of its financial and administrative matters.



The most recent fundamental recommendations of ICRP, *Publication 60*, date from 1990 (published in 1991). The Commission plans to recapitulate and consolidate these ICRP recommendations, aiming at publishing an updated set of recommendations around the year 2005. To this end, the Commission has recruited the assistance of IRPA, the International Radiation Protection Association, in circulating world-wide a conceptual

overview of possible ways forward suggested by the Chairman of ICRP. This initial consultation has generated considerable interest, and the Commission plans to thoroughly discuss the results of the consultation at its October 2000 meeting.

Finally, the Commission undertook initial discussions concerning the membership for the next period, 2001-2005.



## **Committee 1 (Radiation Effects):**

### *Low Dose Risks; Effects on Embryo/Foetus; Radiation Quality Effects*

*Committee 1 considers the risk of induction of cancer and heritable disease (stochastic effects) together with the underlying mechanisms of radiation action; also, the risks, severity, and mechanism of induction of tissue/organ damage and developmental defects (deterministic effects).*

Committee 1 of the International Commission on Radiological Protection met in Leiden, the Netherlands, in August 1999.

At the meeting, the Committee reviewed progress of its three Task Groups. The first one of these addresses 'Estimates of radiation-induced cancer risks at low doses'. There are two main objectives of this Task Group: First, to review the information in ICRP *Publication 60* regarding stochastic effects. Second, to examine what has been learnt subsequently with respect to: the value of low dose studies for risk estimation; the possibility of a dose threshold; linearity at low doses including the implication of genomic instability; the standard general dose-response model; the Dose-Dose Rate Effectiveness Factor; and variations in radiation-induced risk by age at exposure and time since exposure.

A second Task Group deals with 'Radiation effects on the embryo/foetus'. The Task Group's aims are to address the pre-implantation period (including whether malformations can be induced in this period), teratogenesis (including brain development), and stochastic effects.

The third Task Group is working on 'Radiation quality effects in radiological protection'. The Task Group will collate and evaluate data from alpha particles, neutrons, and protons, considering deterministic and stochastic effects and effects after both acute and prolonged exposure. The methods of handling difference and uncertainties in radiation quality effects for radiological protection purposes will be examined.

In addition, Working Parties will continue:

- to review published epidemiological studies,
- to survey developments in cell/molecular biology and biophysics relevant to the effects of ionising radiation,
- to identify cells at risk,
- to provide evidence of dose and dose-rate effects from animal studies,
- to consider genetic risks in relation to both mendelian and multifactorial disorders, and
- to survey the evidence of interaction between the effects of ionising radiations and chemical carcinogens and to consider the differences in systems of protection.



## **Committee 2 (Doses from Radiation Exposures):**

*Embryo/Foetus Doses; CD ROM Database; Reliability and Application of Dose Coefficients; Basic Anatomy/Physiology*

*Committee 2 is concerned with the development of dose coefficients for the assessment of internal and external radiation exposure, development of reference biokinetic and dosimetric models, and reference data for workers and members of the public.*

ICRP Committee 2 met in Braunschweig, Germany, in July 1999. The meeting reviewed the progress of QA of the approved but not finally completed report on dose coefficients for the embryo and foetus after intakes of radionuclides by the mother (see also Main Commission results above).

The Committee also reviewed the progress of its Task Groups. One of these, the standing 'INDOS' group (for INTERNAL DOSimetry), is working on aspects of Reliability of dose coefficients for intake of radionuclides, (to be published as scientific reports in the open literature by the individual experts involved). The group also addresses Application of the ICRP human respiratory tract model (a supporting technical document), and on a longer term, revision of ICRP *Publication 30* on Limits for intakes of radionuclides by workers.

Another Task Group, 'HAT', addresses the Human Alimentary Tract. It aims to produce a dosimetric model to replace the current 1966 gastro-intestinal tract model.

A Task Group on REference Man, 'REM', is working on the revision of information relevant for dosimetry in ICRP *Publication 23* which is a catalogue of data

on man. ICRP *Publication 70* constituted a first part dealing with the skeleton. A new report on Anatomical and physiological data is due next.

The 'DOCAL' (DOSe CALculations) standing Task Group is working on the development of realistic human phantoms for dose calculation, based on medical imaging. This Task Group is also generally involved in Quality Assurance for dose coefficient tabulations.

There is also a Task Group, 'EXDOS', that is concerned with dose coefficients for EXternal DOSimetry. However, the work of this group is currently on hold, pending development of new phantoms as well as a more specific plan for the 2005 updated fundamental recommendations of ICRP.

In collaboration with Committee 1, the Committee also critically appraises the dosimetry of radon between the model of the respiratory tract and the epidemiological data.

A standing Task Group on 'Radiation doses to patients from radiopharmaceuticals' is operated jointly with Committee 3 and will be discussed under that heading below.



### **Committee 3 (Protection in Medicine):**

*Radiopharmaceuticals; Pregnancy and Medical Radiation, Accident Prevention in Radiotherapy; Radiation Injuries in Interventional Procedures*

*Committee 3 is concerned with protection of persons and unborn children when ionising radiation is used for medical diagnosis, therapy, or for biomedical research; also, assessment of the medical consequences of accidental exposures.*

As indicated in the section on the Main Commission, ICRP *Publication 80* on radiation doses to patients from radiopharmaceuticals was printed in 1999. This report was drafted by the joint Committee 2 – Committee 3 Task Group on ‘Radiation doses to patients from radiopharmaceuticals’.

ICRP Committee 3 met in Paris, France, in August 1999. During this meeting, the progress of the Task Groups of the Committee were reviewed.

One of these Task Groups addresses ‘Pregnancy and medical radiation’. It takes account of both medical exposures of pregnant patients, and occupational exposures of pregnant medical staff. As mentioned in the Main Commission Section, that draft report was later approved for publication .

Another Task Group deals with ‘Accident prevention and safety in radiotherapy’. The task includes a discussion of what constitutes an accident in radiotherapy, as well as material intended to provide learning from experience. This draft report was updated and has been circulated for public consultation in 2000.

A third Task Group is working on ‘Radiation injuries in interventional procedures’. Again, the document is intended to cover both medical exposures of patients and occupational exposures of medical staff. This report has also been circulated for public consultation in 2000.

A common feature of the reports being drafted by these three Task Groups is that they are aimed very much at the practising physician and nurses and other medical staff concerned, in addition to health physicists and managers. Thus, the primary target group is somewhat different than the traditional readership of the Commission’s journal, *Annals of the ICRP*. Special efforts are being planned to ensure adequate distribution of these reports when they are ready.

The standing joint Committee 2-Committee 3 Task Group on radiopharmaceuticals had produced dose tables for several new drugs, and the Committee also reviewed this information. These dose tables will be made available at the Commission’s Internet site, pending the accumulation of enough new material to warrant a full printed publication.

In addition, Working Parties of Committee 3 will consider:

- radiation protection in paediatrics,
- aspects of medical radioactive waste disposal,
- the principles of radiological protection for general practitioners and medical students,
- radiation safety in nuclear medicine,
- radiation protection in computed tomography: recommendations for dose reduction,
- implications of genetic susceptibility for radiation exposure in medical practice.





## **Committee 4 (Application of the Commission's Recommendations): Prolonged Exposure Situations; Solid Radioactive Waste; New Tasks**

*Committee 4 is concerned with providing advice on the application of the recommended system of protection in all its facets for occupational and public exposure. It also acts as the major point of contact with other international organisations and professional societies concerned with protection against ionising radiation.*

ICRP Committee 4 met on Kiawah Island, SC, USA, in April 1999. A main item on the agenda was to review in detail a draft report from the Task Group on 'Protection of the public in situations of prolonged exposure to radiation' ('chronic' exposure). The draft was then subjected to public consultation on the Internet. As indicated above, the draft was approved for publication in September, and is currently being printed as ICRP *Publication 82*.

Similarly, a draft report on 'Radiation protection principles for the disposal of long-lived solid radioactive waste' was also scrutinised in detail. Again, the draft was then subjected to public consultation. Thereafter, it was approved for publication, and has now appeared as ICRP *Publication 81*.

Committee 4 also has several Working Parties in operation. These are addressing the following questions:

- consideration of requirements on new fundamental protection recommendations, particularly as regards the use of collective dose and coherence between dose levels used for the public in practices and intervention;
- surveying the literature on protection of the environment;
- contact with Committee 1 on their studies on genetic susceptibility to cancer;
- consideration of cosmic ray exposures in aircraft and space flight; and
- doses to man from radionuclide releases into the environment.



## ***The Scientific Secretariat***

The Scientific Secretariat is currently situated in Stockholm, Sweden. The seat of ICRP remains in the United Kingdom where ICRP is a Registered Independent Charity.

Tasks of the Secretariat include preparations for and organisation of meetings, final editing of reports for publication in the *Annals of the ICRP*, maintenance of contacts with all collaborating organisations, and administrative issues.

In 1999, 264 different new matters were filed for action in the Commission's computerised document filing system, and 14 matters that had been filed but not completed in 1998 were also handled. Of the 264 new

matters, 10 concerned the Main Commission, 49 concerned the four Committees and their Task Groups, and the remaining 205 concerned the Scientific Secretariat. Of the latter, 37 were to do with ICRP Publications (mostly, requests for permission to publish ICRP material). 127 were general enquiries to ICRP including 10 draft documents sent to us for consultation, and 41 concerned economical matters. 232 of these 264 1999 actions were completed in 1999.

The Secretariat also devoted part of its efforts to arranging an Internet Web Site that came into operation in the spring of 1999. Apart from providing general information about ICRP, this Home Page proved particularly useful when ICRP wants to consult on its own draft documents.

## ***Contacts, Meetings, etc.***

Numerous different contacts were maintained, formally and informally, during the year. The Chairman, Professor R H Clarke, was invited to give the inaugural Lindell Lecture by the Swedish Risk Academy in April 1999 where he discussed evolution of radiation protection standards. He was invited to give the annual nuclear safety lecture to the Council for Nuclear Safety in Johannesburg in May and was further invited to participate in their Autumn school lecturing on Protection Policy and in a conference on radiation waste where he again presented a summary of ICRP reports.

In June he was invited to the meeting of the World Council for Nuclear Workers and was invited to address the congress on Effects of Low and Very Low Doses of Ionising Radiation on Human Health. In September 1999 he gave a seminar on Management of Radiation Risks at Chilton, UK, for professional bodies and government

departments in the UK. In November he participated in a conference in Seattle on The Basis for Risk Factors and their use in setting standards: Past, Present and Future. While later in that month he was invited by the IAEA to give a paper on Restoration Principles and Criteria – recommendations of the ICRP. At a symposium on Restoration of environments with radioactive residues in December, he was invited to participate in a workshop devoted to Bridging Radiation and Science in the USA.

The Chairman held specific discussions on technical issues with officials of the European Commission and with US NRC Commissioners and representatives of EPA and DOE. He had also participated in several IAEA and WHO meetings.

In addition, the Vice-Chairman, Professor Meinhold, the Scientific Secretary, Dr Valentin, and members of the

Commission represented ICRP in meetings of various kinds with IAEA, the International Radiation Protection Association (IRPA), the Nuclear Energy Agency of the Organization for Economic Co-operation and Development (OECD/NEA), the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the US National Council on Radiation Protection and Measurements (NCRP), and WHO, as well as meetings of professional societies in different countries. Several of these meetings

also provided an opportunity for the officers of the Commission to make formal presentations, sometimes including published reports. On a number of occasions when formal representation was not called for, ICRP arranged to obtain observers' reports so as to keep abreast with developments.

There was also a brisk demand for informal enlightenment and information via telephone, e-mail, and regular mail to the Secretariat.

### ***ICRP Publications, etc., 1999***

ICRP (1999). Genetic susceptibility to cancer. ICRP Publication 79. *Annals of the ICRP* 28 (1-2), Pergamon Press, Oxford, UK.

ICRP (1999). Radiation dose to patients from radiopharmaceuticals. ICRP Publication 80. *Annals of the ICRP* 28 (3), Pergamon Press, Oxford, UK.

ICRP (1999). The ICRP database of dose coefficients: Workers and members of the public. CD ROM (distributed by Elsevier Science).

## **Contact Information**

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ICRP Publications are available from reputable booksellers or directly from the Commission's publishers, Elsevier Science:

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E-mail: usinfo-f@elsevier.com  
Web site: www.elsevier.com

For customers outside the Americas, the Regional Sales Office in Amsterdam,

Telefax: +31 20 485 34 32  
E-mail: nlinfo-f@elsevier.nl  
Web site: www.elsevier.nl

## ***Organisations providing grants to ICRP in 1999***

Unrestricted funds totalling about 239 000 US dollars were received from:

CEC;  
IAEA;  
IRPA;  
ISR;  
OECD/NEA;  
Australia: High Commission;  
Canada: AECB, and Health Canada;  
Denmark: NBH;  
Finland: STUK;  
France: SFRP;  
Germany: Bundesmin UNR;  
Iceland: GR;  
Japan: JAERI, PNC;  
Norway: NRPA;  
Sweden: Min Environment;  
Switzerland: Fed Off Energy;  
UK: HSE;  
USA: NRC.

Restricted funds, USD 19 000, in support of the 1999 C4 meeting, were received from US DoE, US EPA, US NRC, and Colorado DPHE.

## ***Composition of the International Commission on Radiological Protection and Committees, 1997 - 2001***

### MAIN COMMISSION

#### Chairman:

Professor R H Clarke

#### Vice-Chairman:

Professor C B Meinhold

#### Members:

Dr D Beninson  
Dr J D Boice Jr.  
Dr R Cox  
Dr L-E Holm  
Professor L A Ilyin  
Professor Dr A Kaul  
Dr Matsudaira H  
Professor F Mettler  
Dr J-C Nenot  
Dr Pan Z  
Mr B C Winkler

#### Emeritus Members: (as of January 1998)

Mr H J Dunster  
Professor B Lindell  
Professor K Z Morgan  
Dr W K Sinclair  
Dr L S Taylor

#### Scientific Secretary

Dr J Valentin

### COMMITTEE 1

#### Chairman:

Dr R Cox

#### Members:

Dr A V Akleyev  
Dr R J M Fry  
Dr J H Hendry  
Professor Dr A M Kellerer  
Dr C E Land  
Professor J B Little  
Dr Mabuchi K  
Dr R Masse  
Dr C R Muirhead  
Dr R J Preston  
Professor K Sankaranarayanan  
Professor R E Shore  
Professor Dr C Streffer  
Professor W Ullrich (*from Oct. 1998*)  
Professor Wei K  
Dr H R Withers

### COMMITTEE 2

#### Chairman:

Professor Dr A Kaul

#### Members

Dr B B Boecker  
Dr A Bouville  
Professor Dr Chen X  
Professor Dr G Dietze  
Dr K F Eckerman  
Miss F A Fry  
Dr Inaba J  
Professor Dr I A Likhtarev  
Professor J L Lipsztein  
Dr H Métivier  
Dr H Paretzke  
Dr A R Reddy  
Dr M Roy  
Dr J W Stather  
Professor D M Taylor  
Professor T Wøhni (*ret. Oct. 1998*)

COMMITTEE 3

Chairman:

Professor F Mettler

Members:

Professor J M Cosset  
Dr M J Guiberteau  
Dr L K Harding  
Professor Dr J Liniecki  
Professor S Mattsson  
Professor Nakamura H  
Dr P Ortiz  
Dr L V Pinillos-Ashton  
Professor M M Rehani  
Professor H Ringertz  
Dr M Rosenstein  
Dr Sasaki Y  
Dr C Sharp  
Professor Yin W  
Professor W Y Ussov

COMMITTEE 4

Chairman:

Mr B C Winkler

Members:

Dr R M Alexakhin  
Dr E D'Amato  
Dr D Cancio  
Mr T Godås  
Dr A J González  
Dr K R Kase  
Dr Kosako T  
Professor Dr W Kraus  
Mr J Lochard  
Dr A C McEwan  
Dr R V Osborne  
Dr K C Pillai  
Dr A Sugier  
Dr J E Till  
Dr A D Wrixon  
Dr Xia Y  
Dr C Zuur