



IUPAC TOXICOLOGY FOUNDATION COURSE

ESSENTIAL TOXICOLOGY

An Educational Resource

Prepared by John H. Duffus^{1*} and Howard G.J. Worth²

¹The Edinburgh Centre for Toxicology, 43 Mansionhouse Road, Edinburgh EH9 2JD, Scotland, U.K.

²Clinical Chemistry Department, King's Mill Centre for Health Care Services, Mansfield Road, Sutton-in-Ashfield, NG17 4JL, England, U.K.

*Corresponding Author

READ ME FIRST

These presentations in Powerpoint format were prepared because the Committee on the Teaching of Chemistry of IUPAC and the Commission on Toxicology identified a need for some elementary toxicology to be taught to chemistry students, even at school. Thus the prime aim of the authors was to provide chemistry teachers with a teaching resource on the fundamentals of toxicology from which they could select material appropriate for their own local requirements, supplementing it with examples relevant to the students' own experience. It is hoped that other educators in areas other than chemistry may find this material of use by selecting those parts which are suitable for their students. In other words, from this resource, educators should select the most appropriate parts to explain fundamental ideas in toxicology so that their students can understand the hazards and risks associated with chemicals. It is expected that educators using this material will use their own expert judgment in modifying it to suit their own students and local conditions.

Although the material is prepared in the form of Powerpoint presentations, it is not necessary for it to be presented on computers in this form. The Powerpoint programme permits handouts to be printed, and overhead viewfoils to be prepared. In the absence of an overhead

projector, individual slides can be printed out on A4 paper and used as a means of presenting the material selected by the teacher.

The material is divided up into seven sections with an introductory presentation to be considered by the prospective user. This introductory presentation lists the educational objectives of each section and suggests some ways in which the material can be used. There is also a section on assessment and a section on ethics. While each section contains its own self-assessment questions of the true or false variety, the assessment section also contains questions which require an answer in the form of a short essay. For these questions which require longer answers, outline answers are given. Again the authors leave it entirely to users to select what they require and would expect each user to devise in addition their own questions suitable for their own students. The section on ethics is provided to provide a basis for discussion. Decisions on the production, marketing, use and disposal of chemicals are rarely simply matters of scientific judgment. Other factors with ethical implications must often be considered, for example the balance between protecting human health and protecting the natural environment in the use of pesticides such as DDT to prevent malaria.

The authors believe that it is important that the students should be given some relevant case studies to consider. If the educator knows of any good local examples these should be used. However, a brief case study of the DDT story is presented as an example which could be presented to the students to illustrate the problems that occur in real situations.

A list of further reading is given below for those who wish to take their knowledge of the subject further. A good starting point, specially designed for chemists, is the book already referred to above, "Fundamental Toxicology for Chemists" published by the Royal Society of Chemistry, Cambridge.

ACKNOWLEDGMENTS

We are grateful to our colleagues on the IUPAC Commission for Toxicology and the IUPAC Committee for the Teaching of Chemistry for their support and encouragement. The drawings illustrating acute and chronic toxicity were drawn by Victoria Duffus.

FURTHER READING

- Aitio, A., Aro, A., Jarvisalo, J. and Vainio, V. (1991). Trace Elements in Health and Disease. Royal Society of Chemistry, Cambridge.
- Anderson, D. and Conning, D.M. (1993). Experimental Toxicology, The Basic Issues, 2nd Edition. Royal Society of Chemistry, Cambridge.
- Ballantyne, B., Marrs, T.C. and Syverson, T. (1999). General and Applied Toxicology, 2nd Edition. Macmillan Reference, London.
- Balls, M. (1991). Animals and Alternatives in Toxicology. Macmillan, London.
- Budavari, S., O'Neil, M.J., Smith, A., Heckelman, P.E., and Kinneary, J.F. eds. (1996). The Merck Index - an encyclopaedia of chemicals, drugs and biologicals, 12th Edition. Merck, New Jersey.
- Calabrese, E.J. (1990). Multiple Chemical Interactions. Lewis Publishers, Boca Raton.
- Calabrese, E.J. and Kenyon, E. (1990). Air Toxics and Risk Assessment. Lewis Publishers, Boca Raton.
- Casarett and Doull's Toxicology - see Klaasen.
- D'Mello, J.P.F., Duffus, C.M. and Duffus, J.H. (1991). Toxic Substances in Crop Plants. Royal Society of Chemistry, London.
- Duffus, J.H. and Worth, H.G.J. (1996). Fundamental Toxicology for Chemists. Royal Society of Chemistry, Cambridge.
- Finney, D.J. (1971). Probit Analysis, 3rd Edition. Cambridge University Press, Cambridge.
- Gossell, T.A. and Bricker, J.D. (1994). Principles of Clinical Toxicology, 3rd Edition. Raven Press, New York.
- Harvey, A.L. (1991). Snake Toxins. Pergamon, Oxford.
- Harrison, R.M. (1996). Pollution: Causes, Effects and Control, 3rd Edition. Royal Society of Chemistry, Cambridge, 1996.

Hayes, A.W. (2001). Principles and Methods in Toxicology, 4th Edition. Taylor & Francis, London.

Hester, R.E. (1986). Understanding Our Environment. Royal Society of Chemistry, London.

Holdgate, M.W. (1979). A Perspective of Environmental Pollution. Cambridge University Press, Cambridge.

International Agency for Research on Cancer (IARC) (1972 onward). Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. IARC, Lyon.

International Labour Office (ILO) (1998). Encyclopaedia of Occupational Health and Safety, Fourth Edition. ILO, Geneva.

JECFA (1972 onwards). WHO Food Additives Series, multivolume series. WHO, Geneva.

Kirkland, D.J. (1990). Basic Mutagenicity Tests: UKEMS Recommended Procedures. Cambridge University Press, Cambridge.

Klaasen, C.D., ed. (1996). Casarett and Doull's Toxicology - The Basic Science of Poisons (5th Edition). McGraw-Hill, New York. 6th Edition expected 2001.

Krebs, C.J. (1993). Ecology. The Experimental Analysis of Distribution and Abundance. Harper and Row, New York.

Landis, W.G. and Yu, M.-H. (1995). Introduction to Environmental Toxicology. Lewis Publishers, Boca Raton.

Lu, F.C. (1996). Basic Toxicology, 3rd Edition. Taylor & Francis, Washington DC.

Mackay, D. (1991). Multimedia Environmental Models, The Fugacity Approach. Lewis Publishers, Boca Raton.

Merck Index - see Budavari, S.

Miller, K., Turk, J.L. and Nicklin, S. (1991). Principles and Practice of Immunotoxicology. Blackwell, Oxford.

OECD (1982 onward). Guidelines for Testing of Chemicals. Organization for Economic Cooperation and Development (OECD), Paris.

- OECD (1982). Good Laboratory Practice in the Testing of Chemicals. Organization for Economic Cooperation and Development (OECD), Paris.
- Rand, G.M. (1995). Fundamentals of Aquatic Toxicology, 2nd Edition. Taylor & Francis, Washington, DC.
- Gangolli, S.ed. (1999). Dictionary of Substances and Their Effects. Royal Society of Chemistry, Cambridge.
- Roitt, I., Brostoff, J. and Male, D. (1996). Immunology, 4th Edition. Mosby, London.
- Samiulla, Y. (1990). Prediction of Environmental Fate of Chemicals. Elsevier Applied Science, Barking.
- Timbrell, J.A. (2001). Introduction to Toxicology, 3rd Edition. Taylor and Francis, London.
- Tomlin, C.D.S. ed. (1997). The Pesticide Manual, Twelfth Edition. British Crop Protection Council, Farnham.
- Waldron, H.A. (1990). Lecture Notes on Occupational Medicine, 4th Edition. Blackwell, Oxford.
- Walker, C.H., Hopkin, S.P., Sibly, R.M. and Peakall, D.B. (2000). Principles of Ecotoxicology, 2nd Edition. Taylor and Francis, London.
- World Health Organization (1976 onward). IPCS Environmental Health Criteria Series. WHO, Geneva.
- Yang, R. (1994). Toxicology of Chemical Mixtures. Academic Press, New York.

BOOKS ON PATHOLOGY

- MacSween, R.N.M. and Whaley, K. (1992). Muir's Textbook of Pathology, 13th Edition. Edward Arnold, London.
- Turton, J. and Hooson, J. (1998). Target Organ Pathology. Taylor & Francis, London.