Nickel Toxicology

edited by
Stanley S. Brown
and
F. William Sunderman Jr

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Edited by

STANLEY S. BROWN

Division of Clinical Chemistry
M.R.C. Clinical Research Centre
Harrow, Middlesex, U.K.

and

F. WILLIAM SUNDERMAN Jr

Departments of Laboratory Medicine and Pharmacology
University of Connecticut School of Medicine
Farmington, Connecticut, U.S.A.

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CONTRIBUTORS

AASETH, J., Institute of Occupational Health, Oslo, Norway.
ABRAHAM, J.L., Department of Pathology, University of California, San Diego, La Jolla, California, USA.
ADAMS, D.B., INCO (Europe) Ltd., Clydach, Swansea, Wales.
ADAMSSON, E., Department of Environmental Hygiene, Karolinska Institute, Stockholm, Sweden.
ALBERT, D.M., Massachusetts Eye and Ear Infirmary, Harvard Medical School, Boston, Massachusetts, USA.
ALLPASS, P.R., University of Connecticut School of Medicine, Farmington, Connecticut, USA.
ANDERSEN, A., Cancer Registry of Norway, Montebello, Oslo, Norway.
ANDERSEN, I., Falconbridge Nikkelverk, Kristiansand, Norway.
ANKE, M., Karl-Marx Universitat Leipsig, Jena, East Germany.
BAGSCHIK, U., Institute of Chemistry, Nuclear Research Centre, Juelich, West Germany.
BARTON, R.T., UCLA Center for the Health Sciences, Los Angeles, California, USA.
BOYSEN, M., Department of Pathology, Norsk Hydro's Institute for Cancer Research, Oslo, Norway.
BROWN, S.S., MRC Clinical Research Centre, Harrow, Middlesex, England.
BRUNI, C., University of Virginia Medical Center, Charlottesville, Virginia, USA.
BURGES, D.C.L., Employment Medical Advisory Service, Queensway, Birmingham, England.
CECUTTI, A.G., Falconbridge Nickel Mines Ltd., Falconbridge, Ontario, Canada.
CHRISTENSEN, O.B., University of Lund General Hospital, Malmo, Sweden.
CLARK, G.C., Huntingdon Research Centre, Huntingdon, Cambridgeshire, England.
COSTA, M., Department of Pharmacology, University of Texas Medical School, Houston, Texas, USA.
CRAFT, J.L., Massachusetts Eye and Ear Infirmary, Harvard Medical School, Boston, Massachusetts, USA.

CRONIN, E., St John's Hospital for Diseases of the Skin, London, England.
CUCKLE, H., Nuffield Department of Clinical Medicine, University of Oxford, Oxford, England.
DEWALLY, D., Universite des Sciences et Techniques de Lille I, Villeneuve d'Ascq-Cedex, France.
DI MICHIEL, A.D., MRC Clinical Research Centre, Harrow, Middlesex, England.
DOHLMAN, H.G., Massachusetts Eye and Ear Infirmary, Harvard Medical School, Boston, Massachusetts, USA.
DOLL, R., Cancer Epidemiology and Clinical Trials Unit, University of Oxford, Oxford, England.
DORNEMANN, A., Bayer AG, Krefeld, West Germany.
ENTERLINE, P.E., Graduate School of Public Health, University of Pittsburgh, Pittsburgh, Pennsylvania, USA.
GABRYEL, P., Institute of Biostructure, Medical Academy, Poznan, Poland.
GARDNER, D.E., Health Effects Research Laboratory, Research Triangle Park, North Carolina, USA.
GONDER, J.R., Massachusetts Eye and Ear Infirmary, Harvard Medical School, Boston, Massachusetts, USA.
GRANDJEAN, P., Danish National Institute of Occupational Health, Hellerup, Denmark.
GROPPEL,B., Karl-Marx Universitat Leipzig, Jena, East Germany.
GRUN, M., Karl-Marx Universitat Leipzig, Jena, East Germany.
HIKADE, D.A., Chemistry Department, University of Michigan, Ann Arbor, Michigan, USA.
HILDEBRAND, H.F., Institut de Recherche sur le Cancer et Unite 124 INSERM, Lille-Cedex, France.
HOCHRAINER, D., Fraunhofer Institut fur Toxikologie und Aerosolforschung, Schmallenberg, West Germany.
HØGETVIET, A.C., Falconbridge Nikkelverk, Kristiansand, Norway.
JACKSON, G.C., Huntingdon Research Centre, Huntingdon, Cambridgeshire, England.
JARCZEWSKA, K., Institute of Biostructure, Medical Academy, Poznan, Poland.
JONES, D.C., Department of Chemistry, University of Wales, Cardiff, Wales.
JULIAN, J.A., McMaster University Medical Centre, Hamilton, Ontario, Canada.
KASPRZAK, K.S., Institute of General Chemistry, Technical University of Poznan, Poznan, Poland.
KEARNS, L.P., Cytology Unit, University of Manchester, Manchester, England.
KLEIST, H., Bayer AG, Krefeld, West Germany.

KOLLER, A., Experimental Research Department, Semmelweis Medical School, Budapest, Hungary.
KOVACH, A.G.B., Experimental Research Department, Semmelweis Medical School, Budapest, Hungary.
KRONEMANN, H., Karl-Marx Universitat Leipzig, Jena, East Germany.
LAGESSON, V., Department of Occupational Medicien, University Hospital, Linkoping, Sweden.
LAVOIE, P., Department of Chemistry, Laurentian University, Sudbury, Ontario, Canada.
LEWIS, D., Huntingdon Research Centre, Huntingdon, Cambridgeshire, England.
LIGETI, L., Experimental Research Department, Semmelweis Medical School, Budapest, Hungary.
LIND, B., National Institute of Environmental Medicine, Stockholm, Sweden.
LLOYD, G.K., Huntingdon Research Centre, Huntingdon, Cambridgeshire, England.
MAGNUS, K., Cancer Registry of Norway, Montebello, Oslo, Norway.
MARSH, G.M., Graduate School of Public Health, University of Pittsburgh, Pittsburgh, Pennsylvania, USA.
MAY, P.M., Department of Chemistry, University of Wales, Cardiff, Wales.
MOLLENHAUER, H.H., Science and Education Administration, US Department of Agriculture, College Station, Texas, USA.
MORGAN, L.G., INCO (Europe) Ltd., Clydach, Swansea, Wales.
MUIR, D.C.F., McMaster University Medical Centre, Hamilton, Ontario, Canada.
NIEBOER, E., Faculty of Health Sciences, McMaster University, Hamilton, Ontario, Canada.
NIEBUHR, E., Institute for Genetic Biology, Copenhagen University, Copenhagen, Denmark.
NILSSON, B., Department of Environmental Hygiene, Karolinska Institute, Stockholm, Sweden.
NOMOTO, S., School of Medical Technology, Shinshu University, Matsumoto, Japan.
NORSETH, T., Institute of Occupational Health, Oslo, Norway.
OBERDOERSTER, G., University of Rochester School of Medicine and Dentistry, Rochester, New York, USA.
OSKARSSON, A., University of Connecticut School of Medicine, Farmington, Connecticut, USA.
PADOVAN, D., Department of Chemistry, Laurentian University, Sudbury, Ontario, Canada.
PAPALE, J., Massachusetts Eye and Ear Infirmary, Harvard Medical School, Boston, Massachusetts, USA.
PISCATOR, M., Department of Environmental Hygiene, Karolinska Institute, Stockholm, Sweden.

PUNTERVOLD, R., Department of Pathology, Norsk Hydro's Institute for Cancer Research, Oslo, Norway.
REID, M.C., University of Connecticut School of Medicine, Farmington, Connecticut, USA.
RIEDEL, E., Karl-Marx Universitat Leipzig, Jena,East Germany.
REISS, A.-L.P., Institute of Occupational Health,Oslo,Norway.
REITH, A., Department of Pathology, Norsk Hydro's Institute for Cancer Research, Oslo, Norway.
ROBERTS, R.S., McMaster University Medical Centre, Hamilton, Ontario, Canada.
RUBANYI, G., Experimental Research Department, Semmeleveis Medical School, Budapest, Hungary.
SARKAR, B., Research Institute, Hospital for Sick Children, Toronto, Ontario, Canada.
SCHNEIDER, H.-J., Friedrich-Schiller Universitat Jena, Jena, East Germany.
SCHULER, B., Department of Pathology, Norsk Hydro's Institute for Cancer Research, Oslo, Norway.
SELIKOFF, I.J., Mount Sinai School of Medicine, City University of New York, New York, USA.
SHANNON, H.S., McMaster University Medical Centre, Hamilton, Ontario, Canada.
SHEN, S.K., University of Connecticut School of Medicine, Farmington, Connecticut, USA.
SIGEE, D.C., Cytology Unit, University of Manchester, Manchester, England.
SMITH, G., Department of Pathology, University of California, San Diego, La Jolla, California, USA.
SOLBERG, L.A., Department of Pathology, Ulleval Hospital, Oslo, Norway.
STEDMAN, D.H., Department of Atmospheric and Oceanic Science, University of Michigan, Ann Arbor, Michigan, USA.
STERN, R.M., Danish Welding Institute, Glostrup, Denmark.
STOEPPLER, M., Institute of Chemistry, Nuclear Research Centre, Juelich, West Germany.
SUNDERMAN, F.W.,Jr., University of Connecticut School of Medicine, Farmington, Connecticut, USA.
THOMSEN, E., Technological Institute, Tastrup, Denmark.
VENKATACHALAM, T.K.V., Department of Chemistry, Laurentian University, Sudbury, Ontario, Canada.
WAKSVIK, H., Department of Genetics, Norsk Hydro's Institute for Cancer Research, Oslo, Norway.
WILLIAMS, D.R., Department of Chemistry, University of Wales, Cardiff, Wales.
WULF, H.-C., Finsen Institute, Copenhagen, Denmark.

FOREWORD

F. William Sunderman Jr.

Chairman, Commission on Toxicology
Clinical Chemistry Division
International Union of Pure and Applied Chemistry (IUPAC)

1. INTRODUCTION

The Swansea Conference on Nickel Toxicology was held at the University College of Swansea in Swansea, Wales, UK, on September 3 to 6, 1980, under the joint sponsorship of the IUPAC Subcommittee on Environmental and Occupational Toxicology of Nickel and the Association of Clinical Scientists. The Swansea Conference continued the traditions of scientific excellence and interdisciplinary exchange that were established at four previous conferences (London, UK, 1975; Farmington, USA, 1976; Monte Carlo, Monaco, 1977; Kristiansand, Norway, 1978). Papers on several aspects of nickel toxicology were presented at both the Monte Carlo and Kristiansand Conferences (see Brown, 1977; Sunderman, 1978).

The Swansea Conference was attended by 118 participants from 19 countries, including many of the world's authorities on nickel in the areas of trace analysis, physiology, pharmacology, toxicology, pathology, industrial hygiene, occupational medicine, dermatology, and epidemiology. The Conference facilitated the exchange of new scientific data on biological effects of nickel, and it promoted international collaboration by workers in this field of endeavour. An important accomplishment of the Swansea Conference was critical evaluation and unanimous approval by the IUPAC Nickel Subcommittee of a Reference Method for analysis of nickel in serum and urine by electrothermal atomic absorption spectrometry (Brown *et al*, 1981). Synopses of the scientific papers that were presented at the Swansea Conference are published in this volume to facilitate rapid communication of advances in nickel toxicology to the scientific community throughout the world.

2. RECENT DEVELOPMENTS IN NICKEL BIOCHEMISTRY

Salient recent developments in nickel biochemistry are mentioned in this Foreword, as a background to the considerations of nickel toxicology in the body of this book. Mackay and Pateman (1980) demonstrated that nickel is required by a urease-deficient mutant of *Aspergillus nidulans*. Addition of nickel ions to the culture medium restored urease activity *in vivo* and enabled the strain of *A. nidulans* to utilize urea. This study indicated that nickel was necessary for the activity of microbial urease, just as nickel was previously shown to be essential for the activity of plant ureases (Dixon *et al.*, 1975, 1980; Polacco, 1977). Drake *et al.* (1980) found that carbon monoxide dehydrogenase from *Clostridium thermoaceticum* is a nickel-containing metalloenzyme. Whitman and Wolfe (1980) and Diekert *et al.* (1980) discovered that nickel is an essential constituent of coenzyme F430 isolated from methanogenic bacteria. Coenzyme F430 is the first specific nickel-containing organic compound of low molecular weight that has been identified in biological materials. The chemical structure of coenzyme F430 has not been elucidated, but its chemical properties are similar, in certain respects, to vitamin B_{12}. To date, no clear-cut biochemical role of nickel has been identified in animals, with the possible exception of *Octopus vulgaris*, which possesses chromatophores that contain pigment granules of nickel sulfides (Froesch and Packard, 1979). Metabolic functions of nickel in animals and man will probably be identified since nutritional essentiality of nickel has been demonstrated in rats, swine, and goats (Schnegg and Kirchgessner, 1975; Nielsen *et al.*, 1975; Anke *et al.*, 1977), and since pathological alterations of nickel metabolism have been observed in common diseases of man (McNeely *et al.*, 1971). For example, Howard (1980) has confirmed earlier reports (D'Alonzo and Pell, 1963; Sunderman *et al.*, 1970) that serum nickel concentrations become increased in patients following acute myocardial infarction.

3. RECENT SCIENTIFIC LITERATURE ON NICKEL

To illustrate the recent growth of interest and research on nickel in biology and medicine, the annual citations on nickel in Cumulative Index Medicus from 1960 to 1979 are plotted in Fig. 1. For comprehensive reviews of the scientific literature on nickel analysis, metabolism, toxicology, and health effects, readers may consult monographs and articles by Nriagu (1980), Nieboer and Cecutti (1980),

Norseth and Piscator (1979), and Sunderman (1980 a-d). Readers should be aware that another International Conference on Nickel was held in Jena, DDR, in July 1980, sponsored by Karl Marx University and Friedrich Schiller University. The Proceedings of the Jena Conference will soon be published (Anke and Schneider, 1981).

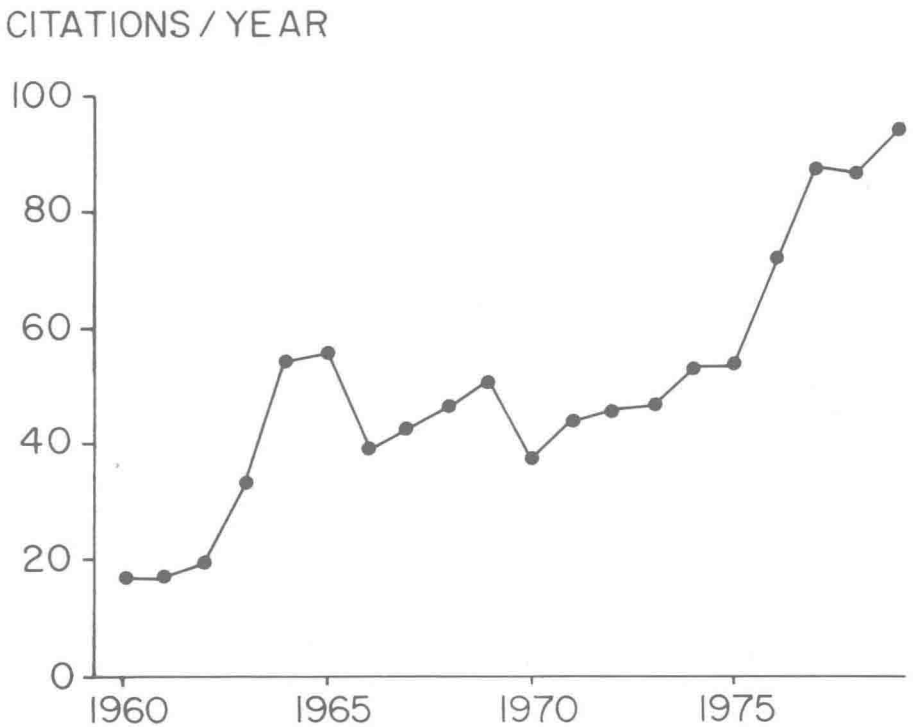

Fig. 1. Annual number of citations on nickel in the cumulative Index Medicus from 1960 to 1979

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