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UNIDO WORKSHOP

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**"THE DEVELOPMENT OF ADVANCED
PHARMACEUTICAL FORMULATIONS"**

22nd - 27th November 1992

FINAL REPORT

by Professor Neil B. Graham

UNIDO Contract No. 92/239

Ref: XP/RLA/92/109

A course on "The Development of Advanced Pharmaceutical Formulations" was organised by Professor Neil B. Graham (Team Leader) and Dr. Tony L. Whateley. The course took place in the University of Strathclyde, Glasgow, G1 1XL, Scotland and was held in the Strathclyde Graduate Business School, 199 Cathedral Street, Glasgow, G4 OG2. The Business School is new executive standard accommodation with top quality bedrooms with en-suite bathroom, telephone, TV, etc. and an excellent silver-service restaurant with full bar and cocktail lounge. These comfortable facilities were almost next door to the fully equipped seminar room used for the workshop lectures and discussions. All 11 participants from Latin America arrived on schedule (Sunday 22nd November) by air at Glasgow Airport and were met at the plane then taken directly to the Business School. An extra attendee from Cuba joined the Group in Glasgow with the agreement of Dr. Rudolfo Quintero. The attendees are listed in Appendix 1.

Surprise was expressed that their flights from both New York and Chicago brought them directly to Glasgow without the necessity of travelling via London. The participants were generous in their praise of the course, accommodation and meals.

Each of the first four days comprised lectures (usually three), a group discussion to take best advantage of visiting experts, and a two hour laboratory session in which a combination of demonstration and hands-on experience was provided. All of the attendees spoke excellent English and had very little trouble in understanding the English spoken by the lecturers.

The participating experts providing the lectures were as listed below:-

Professor Neil B. Graham	Department of Pure & Applied Chemistry University of Strathclyde, Glasgow
Dr. Tony L. Whateley	Department of Pharmaceutical Sciences University of Strathclyde, Glasgow
Professor Jonathan Hadgraft	The Welsh School of Pharmacy University of Wales College of Cardiff, Cardiff, Wales
Professor Ian W. Kellaway	Welsh School of Pharmacy University of Wales College of Cardiff, Cardiff, Wales
Dr. Russell Paterson	Department of Chemistry University of Glasgow, Glasgow
Professor Eric Tomlinson	GeneMedicine Inc, Houston, Texas
Mr. Robert F. Weir	Controlled Therapeutics (Scotland) Ltd East Kilbride, Glasgow
Professor Clive G. Wilson	Department of Pharmaceutical Sciences University of Strathclyde, Glasgow

Each of these experts have considerable international stature and short CVs on each of them are provided in Appendix 2.

The first day of the course introduced the subject and taught the underlying fundamentals necessary for the understanding of drug delivery. The mathematics of diffusion and its modelling on computer and in practice was illustrated in both lectures and laboratory. Special considerations for peptides and proteins were discussed. In spite of jet-lag all of the attendees seemed awake, attentive and joined actively in discussions.

The second day covered transdermal delivery by passive and iontophoretic methods and biodegradable polymers which are very relevant to peptide formulations. The group by this time were feeling at home in the laboratory, getting to know one another and gave every appearance of enthusiasm and understanding.

The third day covered the encapsulation of drugs in liposomes and the fundamentals of "Nasal and Lung" delivery followed by a lecture on "Regulatory Considerations". Practical work for Wednesday and Thursday involved the preparation and sizing of various microcapsules along with a computer modelling exercise - Thursday and Friday's lectures covered microspheres, microencapsulation, multiple emulsions, GI Tract Transport and Delivery, Site Specific Drug Delivery and Molecular Approaches to Drug Delivery. The detailed programme is attached as Appendix 3.

All participants were provided with two volumes of papers, lectures and practical course information as a permanent record. Visiting lecturers and course leaders mixed socially with the Group at all times.

The course finished with a trip to the famous Loch Lomond where in ancient "Ross Priory" on the waterside a final summarising discussion was held followed by a "Scottish Fare" closing dinner introduced by music on the "Scottish Pipes". The course was a high level intensive but enjoyable learning experience which fully met its objective of providing a significant instruction in the "Development of Advanced Pharmaceutical Formulations" to a group of very mixed backgrounds in pharmacy, chemical engineering, biochemistry, industry and academia. Useful contacts were made between the participants in Latin America and the lecturing staff.

APPENDIX 1

UNIDO WORKSHOP

"THE DEVELOPMENT OF ADVANCED PHARMACEUTICAL FORMULATIONS"

22nd - 27th November 1992

List of Participants

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Facultad de Farmacia
San Jose, Costa Rica, A.C. 1000
Instituto de Investigaciones Farmaceuticas (INIFAR)
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Fax: (506)-253574

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Vice Director of Quality Control
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Ramon INFANTE

Instituto de Biomedicina, Fac. de Medicina
Caracas, Apartado 4043, Venezuela
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Fax: (58-2)-861-12-58

Julio PADRON

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Fax: (53-7)-336471

Centro de Quimica Farmaceutica (CQF)
Centro de Ingenieria Genetica y Biotecnologia
PO Box 6162, 10600 Havana, Cuba

Rodolfo QUINTERO

Director General
Programa Regional de Biotecnologia
PNUD/RLA/83/003-009
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11570 Mexico, D.F.
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Jefe de Departamento
Departamento de Bioingenieria
Instituto de Biotecnologia, UNAM
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Maria del Carmen SELEME

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Fac. Ciencias Puras y Naturales
Univesidad Mayor de San Andres
Bolivia
Tel: 591-2-327592/328851
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La Paz, Bolivia
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Victoria ZABALA

Director of Pharmaceutical Development
Prater Laboratorios - BIOS - Chile, S.A.
Box 54, Los Cerrillos, Santiago, Chile
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Fax: (56-2)-5574336/5571687

Jaime Carrcon ZEPEDA

Executive Director of Science & Technology
Laboratorios Columbia S.A. de C.V.
670 Del Hueso Ave, Mexico City,
04940, Mexico
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Fax: (525) 684-76-13

APPENDIX 2

CURRICULUM VITAE

Name: Neil Bonnette GRAHAM
Date of Birth: 23rd May 1933 in Liverpool, England
Nationality: British by Birth and Canadian by Naturalisation
Marital Status: Married Marjorie (Royden)
Four children
Degrees and Qualifications: ALCM (1947), BSc (1953), PhD (1956), FCIC (1966),
FPRI (1973), CChem FRSC (1974) and FRSE (1989)

Appointments:

1956-67 Research Chemist/Research Scientist, Central Research
Laboratories of Canadian Industries Ltd., McMasterville,
P.Q., Canada

1967-73 Associate Group Head/Group Head, Polymer Chemistry
Group, Petrochemical and Polymer Research Laboratories,
ICI, Runcorn, Cheshire, England

1969-73 Visiting Lecturer in Polymer and Fibre Science,
University of Manchester Institute of Science and Technology,
Manchester, England

1973-83 "Young" Professor of Chemical Technology, University
of Strathclyde, Glasgow, Scotland

1975-77 Chairman, Department of Pure and Applied Chemistry,
University of Strathclyde

1979-86 Consultant and Member of the British Government
Medicines Commission Advisory Committee on Dental
and Surgical Materials (CDSM)

1983 - present Research Professor of Chemical Technology,
Department of Pure and Applied Chemistry,
University of Strathclyde

1980 Founded Polysystems Ltd.

1980 - 90 Director of Polysystems Ltd., Clydebank, Scotland

Major Consultancies:

ICI, Metal Box Co., Roche, Smith Kline Beckman Consumer Products Division (USA), Controlled Therapeutics Corp. (USA), Polysystems Ltd., Kelvin Lenses, British Technology Group, Reckitt and Coleman, Greater Glasgow Health Board.

Publications and Patents:

Many publications and over 50 patents in the field of polymer chemistry and its applications.

Trustee

1. James Clerk Maxwell Trust 2. McKinnon-McNeill Trust

Hobbies

Walking, Sailing and Music

SUMMARY CURRICULUM VITAE

NAME : TONY L. WHATELEY

QUALIFICATIONS : BA Class 1 Hons., Chemistry, Oxford, 1962
MA Oxford, 1966
MSc University of NSW, Australia, 1967
PhD Cambridge, 1972
CChem., 1976
FRSC, 1985

PRESENT APPOINTMENT : SENIOR LECTURER, Department of Pharmaceutical Sciences
Strathclyde (since 1987). Previously lecturer since 1972.

PhD's SUPERVISED : 10

RESEARCH INTERESTS :

1. Microencapsulation of Drugs especially cytotoxic agents for Targeting to Liver and Brain Tumours
2. Biocompatibility of biomaterials esp. protein/enzyme adsorption and conformation at interfaces
3. Drug Delivery using Multiple Emulsions

MAIN RESEARCH COLLABORATIONS : Department of Surgery, Glasgow Royal Infirmary
Beatson Oncology Centre, Glasgow
IUPAC Working Party Member 'Interaction of Polymers with Living Systems'

PUBLICATIONS & PRESENTATIONS :

Books	1
Book Chapters and Reviews	4
Refereed Articles	51
Communications & Abstracts	61

RESEARCH SUPPORT : SERC, Cancer Research Campaign, Amersham Int., plc., SHERT
Total 1977-1992 £291,000

OTHER : Editorial Board of *Journal of Microencapsulation*
Committee Member UK Association of Pharmaceutical Scientists
Visiting Professor, Universite Paris - Nord, 1991

SELECTED RECENT PUBLICATIONS

BOOKS

Whateley, T.L. (ed.) 'Microencapsulation of Drugs' Harwood Academic Publishers, U.K., 1992

BOOK CHAPTERS & REVIEWS

Whateley, T.L., 'Radiopharmaceuticals and Radiochemistry' chapter in Beckett, A.H. and Stenlake, J.B. 'Practical Pharmaceutical Chemistry, Pt. II, 4th Edn., p501-534.

Florence, A.T., Whateley, T.L., Omotosho, J.A. 'Multiple w/o/w Emulsions as Drug vehicles in 'Controlled Release of Drugs' ed. Rosoff, M., VCH Pub., N.Y., 1989.

Kerr, D.J., Goldberg, J.A., Anderson, J.R., Willmott, N., Whateley, T.L., McArdle, C.S. and McKillop, J. 'The Effect of Angiotensin II on Tumour Blood Flow and the Delivery of Microparticulate Cytotoxic Drugs' in 'Angiogenesis: Key Principles'. Ed. Steiner, R., Weisz, P.B. and Langer, R. Birkhauser-Verlag, Basel, 1992, pp. 339-345.

Whateley, T.L., Eley, J.H., Kerr, D.J., McArdle, J.G., Goldberg, J.A. and Anderson, J. 'Microencapsulation of Mityomycin C' in 'Microencapsulation of Drugs' (Ed) Whateley, T.L., Harwood Acad.Publ., UK., 1992, pp293-303.

INVITED LECTURES

Whateley, T.L. 'Biodegradable Microspheres: Preparation & Application' Plenary Lecture at 8th Int.Symp. on Microencapsulation, Dublin, Sept. 1992.

Whateley, T.L., Eley, J.G., Kerr, D.J., McArdle, C.S. and Anderson, J. 'Biodegradable Microspheres for Delivery of Mitomycin C' presented at ACS Meeting on Polymeric Drug Delivery Systems, San Francisco, Apr. 1992.

Whateley, T.L. 'Microencapsulation of Drugs' invited lecture at BACS/RSC meeting on Controlled Release & Microencapsulation, Manchester, Sept., 1992.

REFEREED JOURNAL ARTICLES

Omotosho, J.A. Whateley, T.L. and Florence, A.T. 'Absorption and Lymphatic Uptake of 5-Fluorouracil in the Rat following Oral Administration of w/o/w Multiple Emulsions'. Int.J.Pharm., **61**, 1990, 51-56.

Ping, Q., Law, T.K., Whateley, T.L. and Florence, A.T. 'Aggregation and gelation of a polymerisable diacryloyl derivative of poloxamer 407' Int.J.Pharm., **61**, 1990, 79-84.

Goldberg, J.A., Kerr, D.J., Blackie, R., Whateley, T.L., Pettit, L., Kato, T. and McArdle, C.S. 'Mitomycin C loaded microcapsules in the treatment of colorectal liver metastases'. Cancer, **67**, 952-956 (1991).

Anderson, J.H., Goldberg, J.A., Eley, J.E., Whateley, T.L., Kerr, D.J., Cooke, T.G. and McArdle, C.S. 'A Phase I study of regionally administered Mitomycin C microcapsules for patients with colorectal liver metastases'. Eur.J.Cancer, **27**, 1189-1190 (1991).

Jonathan Hadgraft D.Sc. FRSC

Date of Birth 13.12.50.

Qualifications

1969-1973	BA Chemistry, University of Oxford.
1973-1975	D.Phil in physical chemistry, University of Oxford.
1984	Fellow of the Royal Society of Chemistry.
1991	D.Sc University of Oxford.

Professional experience

1975-1977	Teaching fellow, The School of Pharmacy, University of London.
1977-1979	Lecturer, Department of Pharmaceutical Chemistry, University of Strathclyde.
1979-1985	Lecturer, Department of Pharmacy, University of Nottingham.
1985	Professor of Pharmaceutical Chemistry, University of Wales, Cardiff.

Part time positions

Act as a consultant to and on scientific advisory boards to a number of US and European Pharmaceutical Companies.
Visiting professor at University of Minnesota and University of California, San Francisco. Invited professor University of Lyon. Past chairman and founder member of ukaps.

Editorial experience

Board member, International Journal of Pharmaceutics, Pharmaceutical Research, Journal of Skin Pharmacology.

Act as referee to above journals and: J. Chem. Soc., J. Pharm. Pharmacol., J. Invest. Dermatol., J. Pharm. Sci., Brit. J. Derm., J. Membr. Sci., etc.

Scholastic honours

1984	British Pharmaceutical Conference Science Award.
1987	Pfizer award for the pharmaceutical sciences.

Invited presentations

I give approximately 10 invited external lectures per year and have addressed pharmaceutical companies in the US, Germany, France, The Netherlands, Switzerland, Ireland, Japan. Invited lectures to Universities: Nottingham, Aston, Kent, London, Manchester, Amsterdam, Leiden, La Laguna (Tenerife), California, Minnesota, Toronto, Otago (New Zealand). Plenary lectures to conferences: Controlled Release Society, American Association of Pharmaceutical Sciences, American Chemical Society, American Electrochemical Society, British Pharmaceutical Society, FIP, Swedish Academy of Pharmaceutical Sciences, Portuguese Association of Pharmaceutical Sciences etc.

Patents

UK patent with W. J. Albery on the rotating diffusion cell.
3 world-wide patent applications with 1, Whitby Research on penetration retarders, 2, Dow Corning, silicone penetration enhancers, 3, Schering AG, use of Rolipram in transdermal drug delivery

Publications

Over 200 in the field of the application of physical chemistry to drug delivery particularly concentrating on delivery of drugs to the skin.

196. Heather A. E. Benson, James C. McElnay, Robin Harland and Jonathan Hadgraft
Influence of Ultrasound on the Percutaneous Absorption of Nicotinate Esters
Pharm. Res. (1991) 8, (2), 204 - 209
197. M. Walker, L. A. Chambers, D. A. Hollingsbee and J. Hadgraft
Significance of vehicle thickness to skin penetration of Halcinonide
Int. J. Pharm. (1991) 70, 167-172
198. M. Walker and J. Hadgraft
Oleic acid - a membrane 'fluidiser' or fluid within the membrane?
Int. J. Pharm. (1991) 71, R1 - R4
199. Keith R. Brain, Jonathan Hadgraft, Derek Lewis and Geoffrey Allan
The influence of Azone[®] on the percutaneous absorption of methotrexate
Int. J. Pharm. (1991) 71, R9 - R11
200. J. Hadgraft
Structure activity relationships and percutaneous absorption
J. Controlled Release (1991) 15, 221 - 226
201. Jonathan Hadgraft, Derek Lewis, Dieter Beutner and H. Michael Wolff
In vitro assessments of transdermal devices containing nitroglycerin
Int. J. Pharm. (1991) 73, 125 - 130
202. Michael J. Rathbone and Jonathan Hadgraft
Absorption of drugs from the human oral cavity
Int. J. Pharm. (1991) 74, 9 - 24
203. Nigel M. Davies, Stephen J. Farr, Jonathan Hadgraft and Ian W. Kellaway
Evaluation of Mucoadhesive Polymers in Ocular Drug Delivery
Pharm. Res. (1991) 8 (8) 1039 -1043
204. Adam C. Watkinson, Jonathan Hadgraft and Alan Bye
Aspects of the transdermal delivery of prostaglandins
Int. J. Pharm. (1991) 74, 229 - 236
205. A. F. Davies and J. Hadgraft
Effect of supersaturation on membrane transport: 1. Hydrocortisone acetate
Int. J. Pharm. (1991) 76, 1 - 8

206. Helena M. Cabral Marques, Jonathan Hadgraft, Ian W. Kellaway and Glyn Taylor
Studies of cyclodextrin inclusion complexes. III. The pulmonary absorption of β -, DM- β - and HP- β -cyclodextrins in rabbits
Int. J. Pharm. (1991) 77, 297 - 302
207. Helena M. Cabral Marques, Jonathan Hadgraft, Ian W. Kellaway and Glyn Taylor
Studies of cyclodextrin inclusion complexes. IV. The pulmonary absorption of salbutamol from a complex with 2-hydroxypropyl- β -cyclodextrin in rabbits
Int. J. Pharm. (1991) 77, 303 - 307
208. H. M. Cabral Marques, J. Hadgraft, I. W. Kellaway and G. Taylor
The absorption of salbutamol (SA) from the rabbit lung following intratracheal instillation of salbutamol complexed with 2-hydroxypropyl- β -cyclodextrin (HP- β -CYD)
J.Pharm. Pharmacol. (1991) 43, Supplement 65P
209. R. D. Green, J. Hadgraft and K. R. Brain
Enhanced Penetration of Peptides Through the Skin
J.Pharm. Pharmacol. (1991) 43, Supplement 113P
210. Richard H. Guy and Jonathan Hadgraft
Principles of Skin Permeability Relevant to Chemical Exposure
In Dermal and Ocular Toxicology Fundamentals and Methods: CRC Press, Inc., Ed. David W. Hobson (1991) 221 - 246
211. V. L. C. Moffat, R. D. Green, J. Hadgraft, F. Renauld, A. Etienne & J. A. Bouwstra
Functional Siloxanes as Skin Penetration Enhancers
Proceed. Intern. Symp. Control. Rel. Bioact. Mater. 18 (1991) Controlled Release Society, Inc. 536 -539
212. J. Hadgraft and R. H. Guy
Synthetic Membranes as Biological Models
Advances in Pharmaceutical Sciences, Academic Press, London (1992) 43 - 64
213. R. D. Green and J. Hadgraft
The transdermal delivery of peptides
Pharmacocinetique: de la recherche a las clinique. Ed. J. Brés, G. Panis. John Libbey Eurotext (1992) pp 3-10

214. Richard H. Guy and Jonathan Hadgraft
Percutaneous Penetration Enhancement: Physicochemical Considerations and Implications for Prodrug Design
In Prodrugs, Topical and Ocular Drug Delivery, Ed Kenneth B. Sloan, Marcel Dekker, Inc., New York (1992) pp 1 - 16
215. Jonathan Hadgraft and Keith R. Brain
Xenobiotic experimentation: predicting percutaneous penetration
In The Environmental Treat to the Skin. Eds. R Marks and G Plewig
Martin Dunitz Ltd., London (1992) pp 179 - 184
216. R. D. Green and J. Hadgraft
Enhanced Transdermal Delivery of Peptides
In Proceedings of the 1st Annual UKaps Conference (1992)
STS Publishing, Cardiff (1992) 7P
217. Paul R. Street and Jonathan Hadgraft
The Squeeze-Out of Oleic Acid Esters from DPPC Monolayers
In Proceedings of the 1st Annual UKaps Conference (1992)
STS Publishing, Cardiff (1992) 12P
218. A. C. Watkinson and J. Hadgraft
Small Angle Neutron Scattering (SANS) Studies on DPPC/Azone® Multilamellar Systems
In Proceedings of the 1st Annual UKaps Conference (1992)
STS Publishing, Cardiff (1992) 16P
219. Charles M. Heard, Keith R. Brain and Jonathan Hadgraft
Differential Facilitated Transfer of Propranolol and Bupranolol Enantiomers Across A Liquid Membrane
In Proceedings of the 1st Annual UKaps Conference (1992)
STS Publishing, Cardiff (1992) 28P
220. E. D. S. Kerslake, J. Hadgraft and K. R. Brain
Interaction of Oxygenated Sterols with Lipid Model Monolayers
In Proceedings of the 1st Annual UKaps Conference (1992)
STS Publishing, Cardiff (1992) 54P
221. E. D. S. Kerslake and J. Hadgraft
Alkyl Esters as Potential Skin Permeability Enhancers
In Proceedings of the 1st Annual UKaps Conference (1992)
STS Publishing, Cardiff (1992) 55P

222. C. M. Heard and J. Hadgraft
Blood Protein Binding Studies of Some Cationic ^{99m}Tc -Based
Myocardial Imaging Agents
In Proceedings of the 1st Annual UKaps Conference (1992)
STS Publishing, Cardiff (1992) 60P
223. M. Walker, D. A. Hollingsbee, J. Hadgraft, L. Monger, G. Martin, C.
Marriott
Influence of oleic acid on the physical and chemical properties of the
human epidermal barrier
In Prediction of Percutaneous Penetration: IBC Technical Services Ltd.,
Eds. R.C.Scott, R.H.Guy, J.Hadgraft and H.E.Boddé (1991) 86 - 96
224. A. F. Davis, J. Hadgraft
The use of supersaturation in topical drug delivery
In Prediction of Percutaneous Penetration: IBC Technical Services Ltd.,
Eds. R.C.Scott, R.H.Guy, J.Hadgraft and H.E.Boddé (1991) 279 - 287
225. J. Hadgraft, D. Lewis, D. Beutner, H. M. Wolff
In vitro-in vivo correlations in transdermal nitroglycerin delivery
In Prediction of Percutaneous Penetration: IBC Technical Services Ltd.,
Eds. R.C.Scott, R.H.Guy, J.Hadgraft and H.E.Boddé (1991) 315 - 322
226. D. Lewis, J. Hadgraft, H. E. Boddé
Mixed monolayer studies of DPPC with N-alkyl-aza-cycloheptanones at
the air-water interface
In Prediction of Percutaneous Penetration: IBC Technical Services Ltd.,
Eds. R.C.Scott, R.H.Guy, J.Hadgraft and H.E.Boddé (1991) 355 - 364
227. A. C. Watkinson, P. R. Street, R. W. Richards, J. Hadgraft
Evidence for phase separation of oleic acid in DPPC liposomes and
excised stratum corneum from a small angle neutron scattering
(SANS) study
In Prediction of Percutaneous Penetration: IBC Technical Services Ltd.,
Eds. R.C.Scott, R.H.Guy, J.Hadgraft and H.E.Boddé (1991) 380 - 385
228. W. Bialik, K. A. Walters, K. R. Brain, J. Hadgraft
The effect of vehicles on the skin penetration of ibuprofen
In Prediction of Percutaneous Penetration: IBC Technical Services Ltd.,
Eds. R.C.Scott, R.H.Guy, J.Hadgraft and H.E.Boddé (1991) 458 - 464
229. L. Jack, B. D. Cameron, R. C. Scott, J. Hadgraft
In vitro percutaneous absorption of salicylic acid; effect of vehicle pH
In Prediction of Percutaneous Penetration: IBC Technical Services Ltd.,
Eds. R.C.Scott, R.H.Guy, J.Hadgraft and H.E.Boddé (1991) 515 - 518

230. M. Walker, L. A. Chambers, D. A. Hollingsbee, J. Hadgraft
In vitro delivery of halcinonide: significance of applied vehicle
quantity of skin penetration
In Prediction of Percutaneous Penetration: IBC Technical Services Ltd.,
Eds. R.C.Scott, R.H.Guy, J.Hadgraft and H.E.Boddé (1991) 527 - 532
231. S. E. Way, J. Hadgraft
In vitro investigation of the permeation and metabolism of
hydrocortisone and hydrocortison-21-esters
In Prediction of Percutaneous Penetration: IBC Technical Services Ltd.,
Eds. R.C.Scott, R.H.Guy, J.Hadgraft and H.E.Boddé (1991) 554 - 557
232. Jonathan Hadgraft, Kenneth A. Walters and Richard H. Guy
Epidermal Lipids and Topical Drug Delivery
Seminars in Dermatology, Vol. 11, No 2 (June 1992) 139 - 144
233. J. Hadgraft
Pharmacokinetic modelling of penetration through the skin
Acta Pharm. Nord, Vol. 4, No. 2 (1992) 118 - 119
234. Richard H. Guy and Jonathan Hadgraft
Rate control in transdermal drug delivery?
Int. J. Pharm. (1992) 82, R1-R6
235. A. C. Watkinson, A. L. Bunge and J. Hadgraft
Aspects of the transdermal delivery of prostaglandins II
Int. J. Pharm. (1992) 83, 171 - 175
236. Nigel M. Davies, Stephen J. Farr, Jonathan Hadgraft and Ian W.
Kellaway
Evaluation of Mucoadhesive Polymers in Ocular Drug Delivery. II.
Polymer-Coated Vesicles
Pharm. Res. Vol. 9, No. 9 (1992) 1137 -1144

CURRICULUM VITAE.

NAME: KELLAWAY, Ian Walter.
POSITION: PROFESSOR OF PHARMACEUTICS.
Welsh School of Pharmacy,
University of Wales College of Cardiff,
Cardiff,
CF1 3XF.

DATE OF BIRTH: 10th March, 1944.

NATIONALITY: British.

MARITAL STATUS: Married with two children.

EDUCATION:

1962 - 1965 B.Pharm. [2(i)], The School of Pharmacy,
University of London.
1965 - 1968 Ph.D., Department of Pharmaceutical Chemistry,
School of Pharmacy, University of London.
1990 D.Sc., University of London.

CAREER:

1969 - 1969 Lecturer in Pharmaceutics, Leicester Polytechnic.
1969 - 1979 Lecturer in Pharmaceutics, Department of
Pharmacy, University of Nottingham.
1979 - date Professor of Pharmaceutics, UWCC.

PROFESSIONAL QUALIFICATIONS:

1969 M.R.Pharm.S.
1990 F.R.Pharm.S.

FIELD OF SCHOLARSHIP:

1. Drug delivery to the respiratory tract.
2. Drug targeting to inflamed tissues.
3. Mucoadhesive drug delivery systems.

- [7/4/1] N.M.DAVIES, S.J.FARR, J.HADGRAFT & I.W.KELLAWAY.
Assessment of precorneal clearance of mucoadhesive polymer coated liposomes in the rabbit. *J Pharm Pharmacol* 41 (1989) 48P. ISSN 0022-3573
- [7/4/1] H.M.CABRAL-MARQUES, W.J.PUGH, J.HADGRAFT & I.W.KELLAWAY. The β -cyclodextrin-salbutamol complex. *J Pharm Pharmacol* 41 (1989) 62P. ISSN 0022-3573
- [7/4/0.5] J.D.SMART & I.W.KELLAWAY. An assessment of some mucosa-adhesive granule formulations. *J Pharm Pharmacol* 41 (1989) 142P. ISSN 0022-3573
- [7/4/0.67] L.J.KERR, I.W.KELLAWAY & G.D.PARR. The interaction of bioadhesive polymers with gastric glycoprotein. *J Pharm Pharmacol* 41 (1989) 143P. ISSN 0022-3573
- [7/4/0.5] W.G.LOVE, N.AMOS, I.W.KELLAWAY & B.D.WILLIAMS.
Liposome accumulation in inflammatory tissue: effect of liposome size, stability and dose. *J Pharm Pharmacol* 41 (1989) 150P. ISSN 0022-3573
- [7/11/0.5] W.G.LOVE, N.AMOS, B.D.WILLIAMS & I.W.KELLAWAY. High performance liquid chromatographic analysis of liposome stability. *J. Microencapsulation*. 7 (1990) 105 - 112. ISSN 0265-2048
- [7/11/0.67] K.M.G.TAYLOR, G.TAYLOR, I.W.KELLAWAY & J.STEVENS.
Drug entrapment and release from multilamellar and reverse-phase evaporation liposomes. *Int J Pharm*, 58 (1990) 49 - 55. ISSN 0378-5173.
- [7/11/0.67] K.M.G.TAYLOR, G.TAYLOR, I.W.KELLAWAY & J.STEVENS.
The stability of liposomes to nebulisation. *Int J Pharm* 58 (1990) 57 - 61. ISSN 0378-5173.
- [7/7/1] I.W.KELLAWAY. In vitro test methods for the measurement of mucoadhesion. In: R.Gurny, H.E.Junginger (Eds) Bioadhesion-

Possibilities and Future Trends. Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart. (1990) pp86 - 92. ISBN 3-8047-1074-3

[7/11/1] H.M.CABRAL-MARQUES, J.HADGRAFT & I.W.KELLAWAY. Studies of cyclodextrin inclusion complexes. I. The salbutamol-cyclodextrin complex as studied by phase solubility and DSC. *Int J Pharm*, 63 (1990) 259 - 266. ISSN 0378-5173.

[7/11/1] H.M.CABRAL-MARQUES, J.HADGRAFT, I.W.KELLAWAY & W.J.PUGH. Studies of cyclodextrin inclusion complexes. II. Molecular modelling and ¹H-NMR evidence for the salbutamol-β-cyclodextrin complex. *Int J Pharm* 63 (1990) 267 - 274. ISSN 0378-5173.

[7/15/1] I.W.KELLAWAY & S.J.FARR. Liposomes as drug delivery systems to the lung. *Adv. Drug Del. Rev.*, 5 (1990) 149 - 161. ISSN 0169-409X

[7/11/0.5] W.G.LOVE, N.AMOS, I.W.KELLAWAY & B.D.WILLIAMS. Specific accumulation of cholesterol-rich liposomes in the inflammatory tissue of rats with adjuvant arthritis. *Ann Rheum Dis* 49 (1990) 611 - 614. ISSN 0003-4967.

[7/12/1] I.W.KELLAWAY. Small can be beautiful. *Pharm J* (1990) 339 - 343. ISSN 0031-6873

[7/4/1] H.M.CABRAL-MARQUES, J.HADGRAFT, G.TAYLOR, K.R.BRAIN, I.W.KELLAWAY, A.WILLIAMS, & S.J.FARR. The absorption of β-, DM-β- and HP-β-cyclodextrins from the rabbit lung. *J Pharm Pharmacol* 42 (1990) 13P. ISSN 0022-3573

[7/4/0.75] W.G.LOVE, S.J.FARR, I.W.KELLAWAY & B.D.WILLIAMS. Gamma scintigraphic study of accumulation of 99m technetium radiolabelled liposomes within inflammatory tissue. *J Pharm Pharmacol* 42 (1990) 55P. ISSN 0022-3573

- [7/4/0.67] S.J.WARREN, I.W.KELLAWAY & P. TIMMINS. The in-vitro characterisation of mucoadhesive hydrogel materials for the buccal delivery of peptides. *J Pharm Pharmacol* 42 (1990) 140P. ISSN 0022-3573
- [7/4/1] H.J.LEWIS & I.W.KELLAWAY. In-vitro investigation of the potential of mucoadhesive microspheres for the controlled nasal delivery of oxytocin. *J Pharm Pharmacol* 42 (1990) 142P. ISSN 0022-3573
- [7/4/1] J.G.P.LIM, I.W.KELLAWAY, S.J.FARR. The hydrolysis and incorporation of cromoglycate esters into liposomes. *J Pharm Pharmacol* 42 (1990) 145P. ISSN 0022-3573
- [7/4/0.8] A.B.DENNIS, S.J.FARR, I.W.KELLAWAY, G.TAYLOR, R.DAVIDSON. Gamma scintigraphic evaluation and simultaneous plasma analysis of rapid release ketoprofen semi-solid matrix capsules. *J Pharm Pharmacol* 42 (1990) 149P. ISSN 0022-3573
- [7/4/0.75] L.SEALE, W.G.LOVE, B.D.WILLIAMS & I.W.KELLAWAY. The effect of molecular mass of polyvinylpyrrolidone on its accumulation in inflammatory tissue in the rat. *J Pharm Pharmacol* 42 (1990) 178P. ISSN 0022-3573
- [7/4/0.5] L.J.KERR, I.W.KELLAWAY, C.ROWLANDS & G.D.PARR. The influence of poly(acrylic) acids on the rheology of glycoprotein gels. *Proceed Intern Symp Control Rel Bioact Mater* 17 (1990) 122-123.
- [7/4/1] H.J.LEWIS & I.W.KELLAWAY. Nasal peptide delivery by mucoadhesive polymers. *Proceed Intern Symp Control Rel Bioact Mater* 17 (1990) 289-290.
- [7/4/1] W.G.LOVE, A.EVANS & I.W.KELLAWAY. In vitro release of liposome encapsulated indomethacin. *Proceed Intern Symp Control Rel Bioact Mater* 17 (1990) 329-330.
- [7/4/0.75] W.G.LOVE, S.J.FARR, I.W.KELLAWAY & B.D.WILLIAMS. Liposome accumulation within inflamed tissue: gamma scintigraphic evidence. *Proceed Intern Symp Control Rel Bioact Mater* 17 (1990) 377-378.

- [7/7/1] I.W.KELLAWAY. The influence of formulation on drug availability. In Introduction to the Principles of Drug Design (ed. H.J.Smith), 2nd Ed., Butterworth & Co., (1988) 32 - 45. ISBN 0-7236-1211-0
- [7/7/1] I.W.KELLAWAY, S.J.FARR & G.TAYLOR. Drug delivery to the respiratory tract. In Topics in Pharmacy. Routes of Drug Administration (Eds. A.T.Florence and E.G.Salole). Butterworth & Co., (1990) 48 - 77. ISBN 0-7236-0922-5.
- [7/4/0.75] W.G.LOVE, S.J.FARR, I.W.KELLAWAY & B.D.WILLIAMS. Scintigraphic imaging of inflamed tissue using serum-stable ^{99m}Tc liposomes. *Brit J Rheumatol* 29 (1990). 109P. ISSN. 0263-7103.
- [7/11/1] H M CABRAL MARQUES, J HADGRAFT, I W KELLAWAY AND G TAYLOR - Studies of cyclodextrin inclusion complexes: III The pulmonary absorption of β -, DM- β - and HP- β -cyclodextrins in rabbits, *Int J Pharm* 77 (1991) 297-302 ISSN 0378-5173
- [7/11/1] H M CABRAL MARQUES, J HADGRAFT, I W KELLAWAY AND G TAYLOR - Studies of cyclodextrin inclusion complexes: IV The pulmonary absorption of salbutamol from a complex with 2-hydroxypropyl- β -cyclodextrin in rabbits, *Int J Pharm* 77 (1991) 303-307 ISSN 0378-5173
- [7/11/1] N M DAVIES, S J FARR, J HADGRAFT AND I W KELLAWAY - Evaluation of mucoadhesive polymers in ocular drug delivery: I Viscous solutions, *Pharm Res* 8 (1991) 1039 ISSN 0724-8741
- [7/11/0.67] M THOMAS, I W KELLAWAY AND B E JONES - Gelatin film formation at the air/water interface, *Int J Pharm* 71 (1991) 147-152 ISSN 0378-5173
- [7/11/0.67] M Thomas, I W Kellaway and B E Jones - Gelatin film formation at the solid/aqueous interface, *Int J Pharm* 73 (1991) 185-190 ISSN 0378-5173
- [7/4/1] H M Cabral Marques, J Hadgraft, I W Kellaway and G Taylor - The absorption of salbutamol (SA) from the rabbit lung following intratracheal instillation of salbutamol complexed with 2-

hydroxypropyl-B-cyclodextrin (HP-B-CYD), *J Pharm Pharmacol* 43 (Suppl) (1991) 65P ISSN 0022-3573

[7/4/1] S J Clements, W G Love and I W Kellaway - In vitro release of a collagenase inhibitor from liposomes, *Proceed Intern Symp Control Rel Bioact Mater* 18 (1991) Controlled Release Society Inc 385-386

[7/4/1] N M Davies, S J Farr, I W Kellaway and M Thomas - Comparison of the gastric emptying of tablet formulations containing alginate with and without the inclusion of calcium as an excipient, *J Pharm Pharmacol* 43 (Suppl) (1991) 79P ISSN 0022-3573

[7/4/1] A M Durrani, N M Davies, M Thomas and I W Kellaway - Pilocarpine bioavailability from a mucoadhesive liposomal ophthalmic drug delivery system, *J Pharm Pharmacol* 43 (Suppl) (1991) 30P ISSN 0022-3573

[7/4/1] I W Kellaway and S J Warren - Mucoadhesive hydrogels, *Proceed Intern Symp Control Rel Bioact Mater* 18 (1991) Controlled Release Society Inc 73-74

[7/4/1] M A Khattab, S J Farr, W G Love, I W Kellaway - The influence of some non-ionic polymers on liposome biodistribution in the rabbit, *J Pharm Pharmacol* 43 (Suppl) (1991) 96P ISSN 0022-3573

[7/4/1] S M Jones, W G Love and I W Kellaway - Liposomal incorporation and in vitro release of a NSAID, *Proceed Intern Symp Control Rel Bioact Mater* 18 (1991) Controlled Release Society Inc 383-384

[7/4/0.75] W G Love, S J Farr, B D Williams and I W Kellaway - Preliminary study of the kinetics of liposome association with inflammatory tissue, *Proceed Intern Symp Control Rel Bioact Mater* 18 (1991) Controlled Release Society Inc 389-390

[7/4/0.75] L Seale, W G Love, B D Williams and I W Kellaway - Accumulation of polymers within inflammatory tissue, *Proceed Intern Symp Control Rel Bioact Mater* 18 (1991) Controlled Release Society Inc 387-388

- [7/5/1] I W Kellaway - Liposomal targeting of the respiratory tract and regions of inflammation, *2nd Anglo-Egyptian Conference of Pharmaceutical Sciences* (1991)
- [7/5/1] I W Kellaway - Pulmonary administration by means of liposomes, *GTRV* (1991) Montpellier, France, p27.
- [7/11/0.6] L Seale, W G Love, N Amos, B D Williams & I W Kellaway - Accumulation of polyvinylpyrrolidone within the inflamed paws of adjuvant-induced arthritic rats. *J Pharm Pharmacol* (1992) 44: 10 - 14. ISSN 0022-3573.
- [7/11/1] N M Davies, S J Farr, J Hadgraft & I W Kellaway - Evaluation of mucoadhesive polymers in ocular drug delivery. II: Polymer coated vesicles. *Pharm Res* (in press). ISSN 0724-8741.
- [7/15/0.67] W G Love, I W Kellaway & B D Williams - Liposome association with inflammatory tissue. In *Liposomes in Drug Design* (Ed. G.Gregoriadis, A.T.Florence & H.M.Patel). Harwood Acad. Pub. Reading, (1992).
- [7/15/0.5] N M Davies, J L Greaves, I W Kellaway & C G Wilson. Advanced corneal delivery systems III. *Liposomes in Ophthalmic Drug Delivery Systems*. Ed. MITRA, Marcel Dekker Inc., New York (1992)
- [7/4/1] J Lane, S J Farr & I W Kellaway - Biodistribution of Gallium labelled liposomes following oral dosing to rats. *Proceedings of the 1st Annual UKAPS Conference*. (Eds. Hadgraft, Kellaway & Parr) (1992) p.61. ISBN 0948917 024
- [7/4/0.67] M Thomas, I W Kellaway & B E Jones - A study of the mutual diffusion coefficient in gelatin solutions by photon correlation spectroscopy (pcs). *Proceedings of the 1st Annual UKAPS Conference* (Eds. Hadgraft, Kellaway & Parr) (1992) p.61. ISBN 0948917 024.
- [7/4/1] J Lane, S J Farr & I W Kellaway - Biodistribution of Gallium labelled liposomes following oral dosing to rats. *Proceed. Intern. Symp. Control. Rel. Bioact. Mater.*, 19 (1992) Controlled Release Society Inc.
- [7/5/0.67] I W Kellaway, S J Warren & P Timmins. Hydrogels for buccal administration. *Proceedings of the APGI Conference on Nasal and Buccal Drug Delivery*, Paris, (1991), pp. 9.
- [7/5/1] I W Kellaway. Liposomal drug delivery to the lung. *Proceedings of '2nd Liposome Research Days'*. 17 - 19 June 1992, Leiden, The Netherlands, pp.1.

- [7/5/1] I W Kellaway. Liposomal systems for pulmonary delivery. Proceedings of Nasal and pulmonary delivery of peptide and protein drugs. 7 - 9 April, 1992. Donaueshingen, Germany. pp. 2.
- [7/4/1] M B Delgado-Charro, I W Kellaway. Influence of cross-linking agent concentration, pH and swelling time on mucoadhesion of PAA hydrogels. Proc. 19th Int. Symp. Cont. Rel. Bioact. Mater. 26 - 31 June, 1992, Orlando, Florida, USA. (1992)
- [7/4/1] J Lane, S J Farr, I W Kellaway. Biodistribution of gallium labelled liposomes following oral dosing to rats. Proc. 19th Int. Symp. Cont. Rel. Bioact. Mater. 26 - 31 June, 1992, Orlando, Florida, USA. (1992)
- [7/11/0.67] J Hadgraft, I W Kellaway and G D Parr (Editors) Proc. of 1st Annual UKAPS Conference (1992) STS Publishing Cardiff (1992) ISBN 0 948917 02 4 (in press)
- [7/ /0.67] M Thomas, I W Kellaway and B E Jones. A study by photon correlation spectroscopy of the influence of gelatin source, ionic strength and temperature on the gelation process. Int. J. Pharm. 83 (1992) 139 - 145.

Eric Tomlinson

Eric Tomlinson is the President and Chief Executive Officer of GENEMEDICINE, INC, a Houston, Texas early-stage biotechnology company developing *in vivo* gene therapies. He was formerly President and CEO of Somatix Corporation, a private gene therapy company. In that position, Dr. Tomlinson led Somatix's second-round financing and merger to form Somatix Therapy Corporation, a public company.

From January 1984 to February 1990 he was worldwide Head of Advanced Drug Delivery Research for Ciba-Geigy Pharmaceuticals with responsibility for creating and leading its multidisciplinary research and development program in site-specific (protein) drug delivery. He was also a member of the International Research Board of Ciba-Geigy Pharmaceuticals.

Dr. Tomlinson has held previous appointments at the University of Bath as lecturer (1975-1979); at Ohio State University as visiting associate professor (1978-1979); at the University of Amsterdam as professor in the Department of Pharmacy (1979-1983); and at the University of Nottingham as special professor in pharmaceuticals (1984-1990). Since March 1992 he has been visiting professor of pharmacy at the University of Strathclyde.

He was the first Chairman of the UK LINK Programme in Selective Drug Delivery and Targeting, and is a member of the Science Committee of the Royal Pharmaceutical Society of Great Britain. In 1991 he was the Chairman of Science for the British Pharmaceutical Conference.

Eric Tomlinson has authored or co-authored more than 210 scientific publications and articles in the pharmaceutical sciences (solution thermodynamics, drug design and drug delivery). He received his Bachelor of Pharmacy (1968), Doctor of Philosophy (1971) and Doctor of Science (1988) degrees from the University of London. He is a Fellow of the Royal Pharmaceutical Society of Great Britain awarded for distinction in the science of pharmacy. In 1991 he was admitted as a Fellow of the Royal Society of Chemistry. He is the recipient of the British Pharmaceutical Conference Science Award 1980. In 1991 he was conferred an Honorary Higher Doctorate *cum laude* (Hon DSc) of the United Kingdom Council for National Academic Awards by Liverpool Polytechnic for achievements in the development of pharmaceutical sciences both nationally and internationally.

Some Recent Relevant Publications

Colonic delivery of therapeutic peptides and proteins

M Mackay and E Tomlinson (1991)

In "*Colonic Drug Absorption and Metabolism*" Editor P R Bieck; Marcel Dekker, New York,

Site-specific proteins

E Tomlinson (1991)

In "*Polypeptide and Protein Drugs: Production, Characterisation and Formulation*" Editors R C Hider and D Barlow; Ellis Horwood, Chichester, pp 251-264

Design of site specific protein drugs

E Tomlinson (1991)

QSAR in Environmental Toxicology," Editors J Hermens and A Oppenheim, Elsevier Science Publishers, Amsterdam, 1991, pp 9-16

Gene therapy using cellular protein delivery systems

E Tomlinson (1991)

Proceedings of the Controlled Release Society International Symposium of Controlled Release of Bioactive Materials, 18, 91-92

Impact of the modern biologies on the medical and pharmaceutical sciences

E Tomlinson (1992)

Journal of Pharmacy and Pharmacology, Special Edition, 44 (Supplement 1), 147-159

Control of the biological dispersion of therapeutic proteins

E Tomlinson (1990)

In "*Protein Design and the Development of New Therapeutics and Vaccines*" Editors J B Hook and G Poste; Plenum Press, New York, Chapter 16, pp 331-357

Selective delivery and targeting of therapeutic proteins

E Tomlinson (1990)

In "*Protein Production by Biotechnology*" Editor T J R Harris; Elsevier Applied Science, pp 207-225

Biological dispersion and the design of site-specific protein therapeutic systems

E Tomlinson (1990)

In "*Targeting of Drugs 2: Optimization Strategies*" Editor G Gregoriadis; Plenum, New York, pp 1-19

The effect of adsorbed coats of poloxamers 237 and 338 on the in vitro aggregation and in vivo distribution of polystyrene latex (PSL) particles

J E O'Mullane, K Petrak, L E F Hutchinson, and E Tomlinson (1990)

International Journal of Pharmaceutics, 63, 177-180

Site-specific drugs and delivery systems: toxicological and regulatory implications

E Tomlinson (1990)

In *"Topics in Pharmaceutical Sciences 1989"* Editors D D Breimer, D J A Crommelin and K K Midha; Fédération Internationale Pharmaceutique, The Hague, pp 661-671

Considerations in the physiological delivery of therapeutic proteins

E Tomlinson (1989)

In *"Novel Drug Delivery and Its Therapeutic Applications"* Editors L F Prescott and W S Nimmo; John Wiley, Chichester, Chapter 23, pp 245-262

Adsorption of fibrinogen onto polystyrene latex coated with non-ionic surfactant, poloxamer 338

J E O'Mullane, C J Davison, K Petrak and E Tomlinson (1988)

Biomaterials, **9**, 203-204

Biopharmaceutics of microparticulate drug carriers

J E O'Mullane, P Artursson and E Tomlinson (1987)

Annals of the New York Academy of Science, **507**, 120-140

Theory and practice of site-specific drug delivery

E Tomlinson (1987)

Advanced Drug Delivery Reviews, **1**, 87-198

SUMMARY CURRICULUM VITAE

Name: Clive George WILSON

Date of Birth: 13th December 1946

Qualifications (1970) BSc. Applied Biology (First Class Hons) CNA Hatfield Polytechnic
Ph.D. Biochemistry, University of Surrey, 1973

Present Appointment: Professor (J P Todd Chair of Pharmaceutics), Department of Pharmaceutical Sciences, University of Strathclyde

Previous Appointments:

Lecturer in Biochemical Pharmacology (1973), University of London.
Lecturer (1975), Senior Lecturer (1984), Reader (1988), University of Nottingham.

Membership of Professional Bodies:

British Pharmacological Society	Member 1978
The Society for Drug Research	Member 1981
Association for Research in Vision and Ophthalmology	Member 1988
British Society of Gastroenterology	Member 1988

Ph.D. s Supervised 13

Research Interests Behaviour of drug dosage forms in the body. Physiological and pathophysiological effects on drug absorption.

Main Research Achievements

1. Utilisation of gamma scintigraphy in drug delivery research (Amersham International Prize 1982 for Radiopharmaceutical Innovation)
2. Demonstration of the utilisation of gamma scintigraphy to study the relationship between drug release from pharmaceutical formulations and absorption in the human gastrointestinal tract (Pfizer Award For Meritorious Research In the Pharmaceutical Sciences, 1985).

Main research Collaborations

Medical School & University Hospital, Nottingham,
Department of Ophthalmology, University of Oxford
Extensive Industrial Collaboration in Europe & USA

Publications and Presentations

Books	4
Book chapters and reviews	15
Refereed Scientific articles:	72
Communications and abstracts	60
Reports to Industry	41
Invited Lectures	130
Patents	1 in progress

Member of Editorial Board of S.T.P. Pharma.Sciences (France)

Research Support Medical Research Council, Science and Engineering Research Council, Wellcome Trust, Reckitt & Colman, Abbott Laboratories, Johnson & Johnson (USA), Proctor & Gamble (USA) Allergan (USA), Merck Sharpe & Dohme-Chibret (France), Valpharma (Italy)

Research Support 1986-1991 £550,170

76. J Saunders, S S Davis, C G Wilson and A Smith
 'Effect of uptake of albumin microsphere: on cellular activity of mouse peritoneal macrophages'.
Int. J. Pharm. 68, 1991, 265-270
77. H L Ashworth, C G Wilson, E E Sims, P. Wotton And J G Hardy
 'Delivery of propellant soluble drug from a metered dose inhaler'
Thorax 46, 1991, 245-247
78. A H Batts, C Marriott, G P Martin, S W Bond, J L Greaves and C G Wilson
 "The use of a radiolabelled saccharin solution to monitor the effect of the preservatives thiomersil, benzylconium chloride and EDTA on human nasal clearance.
J. Pharm. Pharmacol. 43, 1991, 180-185
79. C G Wilson, N Washington, J L Greaves, C Washington, I R Wilding, T Hoadley and E E Sims.
 'Predictive modelling of the behaviour of of a controlled release Buflomedil HCl formulation using scintigraphic and pharmacokinetic data.'
Int J Pharm. 72, 1991, 79-86
80. C G Wilson, N Washington, J L Greaves, P E Blackshaw, A C Perkins, M F Barkworth and K D Rehm
 The effect of pretreatment with ranitidine on the pharmacokinetics and gastrointestinal transit of a sustained release theophylline preparation.
Arznei-nittelforschung. 11, 1991, 1154-1159
81. J L Greaves, C G Wilson, N R Galloway, A T Birmingham and O Olejnik
 A comparison of the precorneal residence of an artificial tear preparation in patients with keratoconjunctivitis sicca andf in normal volunteer subjects using gamma scintigraphy.
Acta Ophthal. 69, 1991, 432-436
82. P J Watts, B P Atkin, C G Wilson, M C Davis and C D Melia
 Radiolabelling of polymer microspheres for scintigraphic investigations by neutron activation. 1. Incorporaion of samarium oxide and its effects on the properties of Eudragit R S: sulphasalazine microspheres.
Int. J. Pharm. 76, 1991, 55-59
83. L. Barrow, R.C. Spiller and C.G. Wilson. (1991) Pathological influences on colonic motility: implications for drug delivery. *Advanced Drug Delivery Reviews*, 7, 201-218.
 1992
84. J.L. Greaves, C. G. Wilson, A. T. Birmingham, M.C. Richardson & P.H. Bentley. (1992). Scintigraphic studies on the corneal residence of a New Ophthalmic Delivery System (NODS): rate of clearance of a soluble marker in relation to duration of pharmacological action of pilocarpine. *Br. J. Clin. Pharmac.* 33, 603-609.
85. P. Fitzgerald, C.G. Wilson, J.L. Greaves, M. Frier, D. Hollingsbee, D. Gilbert and M. Richardson. (1992). Scintigraphic assessment of the precorneal residence of a new ophthalmic delivery system (NODS) in man. *International Journal of Pharmaceutics*, 83, 177-185.
86. C. G. Wilson. (1992). New Drugs Delivery Systems. In: "The Health Science Handbook" (ed D. Ashton and M. Paul, Kogan Page London) pp. 139-150.

87. C. G. Wilson and A. C. Perkins. (1992). Gamma scintigraphy and the study of drug deposition. *Advances in Pharmaceutical Sciences*, Academic Press, London. pp 1-42.
88. N. Washington, K.P. Steed and C. G. Wilson. (1992). Evaluation of a sustained release formulation of antacid almagate. *European Journal of Gastroenterology*, Vol.4, pp. 495-500.
89. J.L. Greaves, O. Olejnik and C.G. Wilson. (1992). Polymers and the precorneal tear film. *S.T.P. Pharma Sciences* 2 (1) pp. 13-33.
90. L. Barrow, K.P. Steed, R. C. Spiller, P.J. Watts, C.D. Melia, M.C. Davies and C.G. Wilson. Scintigraphic demonstration of accelerated proximal colon transit by lactulose and its modification by gelling agents. *Gastroenterology*. (in press).

APPENDIX 3

UNIDO WORKSHOP - FINAL PROGRAMME

"THE DEVELOPMENT OF ADVANCED PHARMACEUTICAL FORMULATIONS"

6 Nights 5 Days

22nd - 27th November 1992

Venue

Strathclyde Graduate Business School

199 Cathedral Street, Glasgow, G4 0G2, Scotland

Leaders: Professor Neil B. Graham Department of Pure and Applied Chemistry
Dr. Tony L. Whateley Department of Pharmaceutical Sciences
Secretary: Mrs. Carole Britton Department of Pure and Applied Chemistry

Sunday 22nd November

18.30 - 20.00pm

Arrival - Cocktails + Buffet Supper

Monday 23rd November

09.00 - 09.15

Fundamental Principles of Controlled Drug Delivery
Professor Neil B. Graham. Welcome

09.15 - 10.15

Professor Neil B. Graham
"An Introduction to Controlled Release"

10.15 - 10.45

Tea Break

10.45 - 11.45

Dr. Russell Paterson
"Principles of Diffusion and Molecular Transport I"

11.45 - 12.30

Professor Neil B. Graham
"The Applications of the Dosage of Practical Programmed Delivery Systems"

12.30 - 13.30

Lunch

14.00 - 15.00

Dr. Russell Paterson
"Principles of Diffusion and Molecular Transport II"

15.30 - 17.30

Practical Laboratories - C27 Chemistry Dept
Thomas Graham Building, 295 Cathedral Street

17.30 - 18.30

Group Discussion with Course Staff

Tuesday 24th November

09.00 - 10.00

Transdermal Delivery and Biodegradables
Professor Jonathan Hadgraft
"Transdermal Delivery I"

10.00 - 11.00

Professor Jonathan Hadgraft
"Transdermal Delivery II"

11.00 - 11.30

Tea Break

11.30 - 12.30

Dr. Tony L. Whateley
"Biodegradables"

12.30 - 13.30

Lunch

14.00 - 15.30

Group Discussion with Course Staff

15.30 - 17.30

Practical Laboratories - C27 Chemistry Dept
Thomas Graham Building, 295 Cathedral Street

Wednesday 25th November

09.00 - 10.00	Professor Ian W. Kellaway "Liposomes"
10.00 - 11.00	Professor Ian W. Kellaway "Nasal and Lung Delivery"
11.00 - 11.30	Tea Break
11.30 - 12.30	Mr. R. F. Weir "Regulatory Considerations"
12.30 - 13.30	Lunch
14.00 - 15.30	Group Discussion with Course Staff
15.30 - 17.30	Practical Laboratories - R120 and R121, Dept of Pharmaceutical Sciences Royal College Building, 204 George Street

Thursday 26th November

09.00 - 10.00	Dr. Tony L. Whateley "Microspheres and Microencapsulation"
10.00 - 10.30	Tea Break
10.30 - 11.30	Dr. Tony L. Whateley "Multiple Emulsions"
11.30 - 12.30	Professor Clive G. Wilson "GI Tract Transport and Delivery"
12.30 - 13.30	Lunch
14.00 - 15.00	Group Discussion with Course Staff
15.00 - 17.00	Practical Laboratories - R120 and R121, Dept of Pharmaceutical Sciences Royal College Building, 204 George Street

Friday 27th November

09.00 - 10.00	Professor Eric Tomlinson "Site Specific Drug Delivery"
10.00 - 10.30	Tea Break
10.30 - 11.30	Professor Eric Tomlinson "Molecular Biological Approaches to Drug Delivery"
11.30 - 13.00	Forum to discuss specific problems of delegates
13.00	Lunch
14.30	Coach to Ross Priory on Loch Lomondside and Workshop Closing Dinner
16.00	Afternoon tea
16.30 - 18.30	Group Discussion
19.00	Workshop Closing Dinner (Scottish Fare)
21.15	Coach departure to Glasgow