

BIOCHEMICAL SOCIETY TRANSACTIONS



J Med Gen 351 (12, 1

1984

Volume 12

1-560

Managing Editor D. C. WATTS

London: The Biochemical Society © 1984

Contents Volume 12, Part 1

DEVELOPMENTAL, GENETIC AND ENVIRONMENTAL ASPECT OF DRUG BIOTRANSFORMATION AND CONJUGATION

Acknowledgements		1
Introduction	B. BURCHELL & I. STEVENSON	1
Backword and forward	G. J. DUTTON	2
Intra- and extra-cellular formation of metabolites from chemically reactive species	J. R. GILLETTE, S. S. LAU & T. J. MONKS	4
Mechanism of metabolic activation of ronidazole, a 5-nitroimidazole	A. Y. H. LU, P. G. WISLOCKI, E. S. BAGAN, R. W. WANG, J. S. WALSH & G. T. MIWA	7
Xenobiotic acyl-coenzymes A: critical intermediates in the biochemical pharmacology and toxicology of carboxylic acids	J. CALDWELL	9
Effects of binding of amphipathic compounds to carrier proteins on their enzymic biotransformation by membrane-bound enzymes	K. P. M. HEIRWEGH	11
Glucuronidation and glucosidation reactions in aquatic species in boreal regions	O. HÄNNINEN, P. LINDSTRÖM-SEPPÄ, U. KOIVUSAARI, M. VÄISÄNEN, A. JULKUNEN & R. JUVONEN	13
Competition between sulphation and glucuronidation in the rat <i>in vivo</i> : enzyme kinetics and pharmacokinetics of conjugation	G. J. MULDER, J. R. DAWSON & K. S. PANG	17
Peroxidase-catalysed metabolism of drugs and carcinogens	P. MOLDÉUS, R. LARSSON, D. ROSS & B. ANDERSSON	20
Alterations in thiol and calcium-ion homeostasis during hydroperoxide and drug metabolism in hepatocytes	S. ORRENIUS, H. THOR & G. BELLOMO	23
Measurement of the oxidation rate of volatile alkanes: a new and non-invasive procedure for testing the drug-metabolizing capacity of the liver	H. REMMER & A. EL. M. GHARAIBEH	28
Interaction of aliphatic carbamates with hepatocytes (<i>by title only</i>)	J. W. BRIDGES	30
Multiple forms of mouse glutathione <i>S</i> -transferases	C.-Y. G. LEE	30
Cysteine conjugate β -lyase and the thiomethyl shunt	W. B. JAKOBY & J. STEVENS	33
Glucocorticoid sulphotransferases in rats and other animal species	S. S. SINGER	35
Nitroreduction of clonazepam in human foetal liver microsomes and hepatocyte cultures	D.-R. PENG, I. PETTERS & A. RANE	39
Enzymology and regulation of xenobiotic and steroid metabolism in placenta	O. PELKONEN & M. PASANEN	42
Influence of glucocorticoids and polycyclic aromatic hydrocarbons on hepatic drug-metabolizing enzyme development during the perinatal period	J. E. A. LEAKEY	44
Regulation of microsomal testosterone 15 α -hydroxylase activity in inbred mouse liver and kidney	A. H. NEIMS, R. L. HAWKE, L. RAYNOR & G. SINGH	45
Regulation of enzyme development: a commentary	A. M. NEMETH	48
The biosynthesis and induction of microsomal UDP-glucuronyltransferase in avian liver	B. BURCHELL, S. KENNEDY, M. JACKSON & L. MCCARTHY	50
Differential induction and glycosylation of UDP-glucuronosyltransferase	I. S. OWENS & P. I. MACKENZIE	54
Differential induction of UDP-glucuronosyltransferases and their 'permanent induction' in pre-neoplastic rat liver	K. W. BOCK, W. LILIENBLUM, D. ULLRICH & G. FISCHER	55
Induction of xenobiotic-metabolizing enzymes by <i>trans</i> -stilbene oxide and 2-acetylaminofluorene: observations on enzyme induction by drugs	J. W. DEPIERRE, J. SEIDEGÅRD, R. MORGENSTERN, L. BALK, J. MEIJER & A. ÅSTRÖM	58
Dynamics of the localization of drug metabolizing enzymes in tissues and cells	C. R. WOLF, A. BUCHMANN, T. FRIEDBERG, E. MOLL, W. D. KUHLMANN, H. W. KUNZ & F. OESCH	60
Apparent anomalies in the resolution of cytochrome <i>P</i> -450 isoenzymes by gel electrophoresis	W. LEVIN, J. E. SHIVELY, P.-M. YUAN & D. E. RYAN	62

Factors involved in the regulation of the levels and activities of rat liver cytochromes <i>P</i> -450	F. P. GUENGERICH	68
Cloning and characterization of NADPH-cytochrome <i>P</i> -450 oxidoreductase gene (<i>by title only</i>)	C. KASPER	71
Regulation of glutathione <i>S</i> -transferase mRNAs by phenobarbital and 3-methylcholanthrene: analysis using cDNA probes	C. B. PICKETT, C. A. TELAKOWSKI-HOPKINS, L. ARGENBRIGHT & A. Y. H. LU	71
A new polymorphism of hepatic drug oxidation in man: family studies on rates of formation of antipyrine metabolites	E. S. VESSELL & M. B. PENNO	74
Multiple forms of human cytochrome <i>P</i> -450	A. R. BOOBIS & D. S. DAVIES	78
UDP-glucuronosyltransferase deficiency in man and animals	J. ROY CHOWDHURY, N. ROY CHOWDHURY & I. M. ARIAS	81
Biliary excretion of the dimethyl ester of bilirubin in heterozygous (Jj) and normal (JJ) Gunn rats	G. B. ODELL, G. R. GOURLEY & W. MOGILEVSKY	83
Acetylation pharmacogenetics: profiles of arylamine pharmacology and toxicology in a genetic mouse model	W. W. WEBER, T. A. HULTIN & D. A. MORGOTT	87
Drug metabolism and tropical disease	A. BRECKENRIDGE, K. AWADZI, D. J. BACK, G. EDWARDS, H. GILLES, M. ORME & S. WARD	90
Drug conjugation in clinical toxicology	L. F. PRESCOTT	96
Cloning genes that encode inducible forms of <i>P</i> -450	D. W. NEBERT, M. NEGISHI, Y.-T. CHEN & R. H. TUKEY	99
Polymorphisms in drug metabolism: implications for drug utilization	F. SJÖQVIST	101
Cloning of cDNA coding for a rat liver protein whose expression is subject to gender-specific regulation by xenobiotics	I. R. PHILLIPS, E. A. SHEPHARD & A. ASHWORTH	103
Kinetic properties of rat liver UDP-glucuronosyltransferase during ontogenesis	L. KIFFEL, J. MAGDALOU & G. SIEST	105
BOOK REVIEWS		107

Contents Volume 12, Part 2

THE NINTH KEILIN MEMORIAL LECTURE		
The evolution and function of biological molecular assemblies: from catalase to viruses	M. G. ROSSMANN	115
THE TWENTIETH COLWORTH MEDAL LECTURE		
DNA: sequence, structure and supercoiling	D. M. J. LILLEY	127
604th MEETING, CAMBRIDGE		
Colloquium: Carbohydrate Transport in Micro-organisms		
Binding-protein-mediated transport systems in <i>Escherichia coli</i>	W. BOOS	141
Sugar-proton transport systems of <i>Escherichia coli</i>	P. J. F. HENDERSON, S. BRADLEY, A. J. S. MACPHERSON, P. HORNE, E. O. DAVIS, K. R. DARUWALLA & M. C. JONES-MORTIMER	146
Reconstitution of the lactose carrier from mutant and parent cells of <i>Escherichia coli</i>	T. H. WILSON, D. SETO-YOUNG & S. BEDU	148
Tightness of energy coupling during carbohydrate uptake in eukaryotic micro-organisms	A. A. EDDY	150
Relation between the protonmotive force and solute transport in bacteria	W. N. KONINGS, R. OTTO, B. TEN BRINK, G. T. ROBILLARD, M. G. L. ELFERINK & K. J. HELLINGWERF	152
Regulation of sugar transport by the bacterial phosphoenolpyruvate: glucose phosphotransferase system	D. FOX, M. KUKURUZINSKA, K. D.-F. LIU, N. D. MEADOW, D. SAFFEN & S. ROSEMAN	155
The role of the phosphoenolpyruvate-phosphotransferase system in inducer exclusion	H. L. KORNBERG, P. BRITTON, M. C. JONES-MORTIMER & L. G. LEE	157

Colloquium: Growth Factors

Studies on the structure and function of the epidermal-growth-factor receptor	M. GREGORIOU & A. R. REES	160
Uptake and intracellular processing of epidermal-growth-factor-receptor complexes	J. BEARDMORE & C. R. HOPKINS	165
Transforming growth factors: sources, properties and possible roles in normal and malignant cell growth control	K. D. BROWN & D. M. BLAKELEY	168
Nerve Growth Factor—an enigma still?	B. E. C. BANKS	173
Symposium: Enterotoxins and Anti-toxins		
Enterotoxins and ion transport	M. C. RAO & M. FIELD	177
The mechanism of action of <i>Escherichia coli</i> heat-stable toxin	H. R. DE JONGE	180
The ADP-ribosyltransferase activity of cholera toxin and <i>Escherichia coli</i> heat-labile toxin	C. J. COULSON, P. M. NASSAU & R. M. TAIT	184
Genetics of enterotoxin production in <i>Escherichia coli</i>	H. R. SMITH	187
Cellular location of enterotoxin in <i>Escherichia coli</i>	T. R. HIRST, L. L. RANDALL & S. J. S. HARDY	189
Enteric diseases in animals caused by <i>Escherichia coli</i> : their control and prevention	C. WRAY	191
<i>Clostridium difficile</i> enterotoxin (toxin A): new results	J. STEPHEN, S. C. REDMOND, T. J. MITCHELL, J. KETLEY, D. C. A. CANDY, D. W. BURDON & R. DANIEL	194
<i>Clostridium perfringens</i> enterotoxin: a brief review	B. A. BARTHOLOMEW & M. F. STRINGER	195
<i>Bacillus cereus</i> enterotoxins: present status	R. J. GILBERT & J. M. KRAMER	198
Present status of cholera vaccines	M. M. LEVINE, R. E. BLACK, M. L. CLEMENTS & J. B. KAPER	200
Antimotility drugs in the treatment of acute diarrhoea	S. HUGHES	202
Opiate agonists and enterotoxins	B. K. SANDHU, A. D. PHILLIPS & P. J. MILLA	205
α_2 -Adrenergic agonists and enterotoxins	P. M. NEWSOME, M. N. BURGESS, M. R. BURGESS, G. D. HOLMAN & S. R. NAHORSKI	208
Inhibition of cholera toxin-induced secretion by neuroleptics	J.-J. LARSEN, A. V. CHRISTENSEN & J. HYTTTEL	211
Colloquium: The Application of Recombinant DNA Technology to Enzymology and Membrane Transport Processes		
Cloning enzyme genes for overproduction	T. ATKINSON, D. A. BARSTOW, S. A. JONES, N. P. MINTON & R. F. SHERWOOD	215
Use of recombinant DNA techniques to study DNA repair in <i>Escherichia coli</i>	P. T. EMMERSON, I. D. HICKSON, H. M. ARTHUR, K. E. ATKINSON, D. BRAMHILL, P. FINCH & L. HUTTON	218
Cloning and sequence analysis of the pyruvate and 2-oxoglutarate dehydrogenase complex genes of <i>Escherichia coli</i>	J. R. GUEST, M. G. DARLISON, M. E. SPENCER & P. E. STEPHENS	220
Cloning and sequencing of the gene encoding NADP-specific glutamate dehydrogenase in <i>Neurospora crassa</i>	J. R. S. FINCHAM & J. A. KINNAIRD	223
Genetic dissection of tyrosyl-tRNA synthetase	G. WINTER, P. CARTER, M. M. Y. WAYE, D. M. BLOW, A. J. WILKINSON, J.-P. SHI & A. R. FERSHT	224
Directed mutagenesis as a technique to study protein function: application to β -lactamase	G. DALBADIE-MCFARLAND, A. D. RIGGS & J. H. RICHARDS	226
Probing the catalytic mechanism of yeast triose phosphate isomerase by site-specific mutagenesis	G. A. PETSKO, R. C. DAVENPORT, JR., D. FRANKEL & U. L. RAIBHANDARY	229
Molecular mechanisms of bacterial periplasmic transport systems	C. F. HIGGINS	232
Genes for bacterial and mitochondrial ATP synthase	J. E. WALKER, G. FALK, N. J. GAY & V. L. J. TYBULEWICZ	234
Potassium transport in <i>Escherichia coli</i> : genetic and biochemical characterization of the K^+ -transporting ATPase	W. EPSTEIN, L. WIECZOREK, A. SIEBERS & K. ALTENDORF	235
Isolation and manipulation of genes coding for energy-transducing enzymes from <i>Neurospora crassa</i> and <i>Escherichia coli</i>	W. SEBALD, H. ARENDS & J. E. G. MCCARTHY	236
Molecular and genetic aspects of the fumarate reductase of <i>Escherichia coli</i>	S. T. COLE	237

COMMUNICATIONS		239
605th MEETING, STRATHCLYDE COMMUNICATIONS		287
CHARING CROSS MEETING		
Symposium: Use of Liposomes in Medicine		
Brenda E. Ryman	W. J. WHELAN	331
Liposomes: bags of challenge	H. M. PATEL	333
Interaction of liposomes with hepatocytes and Kupffer cells <i>in vivo</i> and <i>in vitro</i>	F. H. ROERDINK, J. DIJKSTRA, H. H. SPANJER & G. L. SCHERPHOF	335
Targeting of small unilamellar liposomes to the galactose receptor <i>in vivo</i>	G. GREGORIADIS & J. SENIOR	337
Role of lipoproteins in stability and clearance of liposomes administered to mice	J. SENIOR & G. GREGORIADIS	339
Antibody-directed liposomes: the development of a cell-specific cytotoxic agent	T. D. HEATH, K. S. BRAGMAN, K. K. MATTHAY, N. G. LOPEZ-STRAUBINGER & D. PAPAHDJOPOULOS	340
Natural antibodies against phospholipids and liposomes in humans	C. R. ALVING	342
Liposomal drug delivery in chronic ischaemia	T. N. PALMER, M. A. CALDECOURT & R. O. KINGABY	344
Liposomes in diagnostic radiology	V. J. CARIDE	346
Liposomes as aids to tumour detection	G. M. BARRATT, B. E. RYMAN, K. A. CHESTER & R. H. J. BEGENT	348
Liposomes for gene transfer and expression <i>in vivo</i>	C. NICOLAU	349
BOOK REVIEWS		351

COMMUNICATIONS

604th MEETING, CAMBRIDGE		
Phosphotransferase system of <i>Clostridium pasteurianum</i>	W. J. MITCHELL & I. R. BOOTH	239
Regulation of hexose uptake in Chinese-hamster ovary cells	P. FAIK & M. J. MORGAN	240
Irreversible uptake of dihydrostreptomycin by <i>Escherichia coli</i> K12	S. N. YOUNG & W. W. NICHOLS	240
Epidermal growth factor receptors on porcine thyroid cell membranes: lack of receptor antibodies in Graves' disease	S. ATKINSON & P. KENDALL-TAYLOR	242
Distribution of epidermal-growth-factor receptors in rat skin during embryonic development: evidence for a specific inductive interaction between a mesenchyme and an epithelium	M. R. GREEN & J. R. COUCHMAN	243
Amidolytic activity of 7S nerve growth factor	W. F. LONG & F. B. WILLIAMSON	244
The purification by immuno-affinity chromatography of bacterial methionyl-(human somatotropin)	G. W. JACK & H. J. GILBERT	246
Characterization of mRNA sequences encoding sheep somatotropin (growth hormone) by cloning of pituitary complementary DNA	J. M. WARWICK & M. WALLIS	247
Monoclonal antibodies that inhibit somatomedin-like activity	D. C. WATKINS & M. WALLIS	249
The specificity of binding of somatotropin (growth hormone) and prolactin to purified plasma membranes from rabbit liver	C. F. LEAROYD, H. F. CADMAN & M. WALLIS	250
Plasma somatomedin activity and tri-iodothyronine and thyroxine concentrations in female rats treated with the growth promoter trenbolone acetate	P. A. SINNETT-SMITH, A. N. BROOKS, N. W. DUMELow, B. G. VERNON, N. B. HAYNES & P. J. BUTTERY	251
Posterior pituitary peptides in human foetal and neonatal tissues	A. SMITH, N. MCINTOSH & N. D. CARTER	252
The ontogeny of (arginine)vasotocin in the human foetus and newborn	N. MCINTOSH, A. SMITH & N. D. CARTER	253
The sympathetic control of brown-fat growth in animals and humans	G. MORY, D. RICQUIER, M. NECHAD, F. BOUILLAUD & J. THIBAUT	254

Is GTPase involved in the stimulation by human chorionadotropin of luteal adenylate cyclase?	G. J. MURPHY & D. A. STANSFIELD	255
Silica-released macrophage factor that stimulates protein synthesis in fibroblasts	E. KULONEN, M. AALTO & M. POTILA	256
Regulation of growth kinetics of endometrial cells in primary culture	R. P. FIELD & R. E. LEAKE	258
Growth potential of endometrial cells in primary culture	I. MUNIR & R. E. LEAKE	259
Low-molecular-mass tumour angiogenesis factor	J. B. WEISS, C. R. HILL & A. SCHOR	260
The partial purification of colony-stimulating factors from human placental-conditioned medium	W. S. GILMORE	261
The effect of mouse fibroblast interferon on proinsulin biosynthesis	C. J. RHODES & K. W. TAYLOR	262
Large-scale production and purification of <i>Clostridium perfringens</i> type A enterotoxin	D. REYNOLDS, H. S. TRANTER, B. J. CAPEL, B. A. BARTHOLOMEW & M. F. STRINGER	262
The effect of <i>Escherichia coli</i> enterotoxin and methotrexate on drug absorption	J. LYNCH & M. L. LUCAS	263
Development of an inhibition Magnetic Enzyme Immuno-Assay (MEIA) technique for determination of staphylococcal enterotoxin B	P. D. PATEL & P. A. GIBBS	264
Effect of <i>Clostridium botulinum</i> toxin on neuroblastoma cells	P. NEAVES, L. F. J. WOODS, P. D. PATEL & P. A. GIBBS	265
Development of a Magnetic Enzyme ImmunoAssay (MEIA) technique for determination of anti(staphylococcal enterotoxin) immunoglobulin G-type antibodies	P. D. PATEL, J. M. WOOD & P. A. GIBBS	266
The effect of chemical modification on the activity of heat stable enterotoxin from <i>Escherichia coli</i>	B. R. BOOTH, E. J. WOLFFE & M. A. SOWA	268
Effects on prostaglandin synthesis in WI-38 human lung fibroblasts following inhibition of acylation	S. A. HUNTER, S. BURSTEIN & C. SEDOR	269
Chloroplast genes for components of the ATP synthase complex	A. K. HUTTLY, C. J. HOWE, C. M. BOWMAN, T. A. DYER & J. C. GRAY	270
Chloroplast genes for components of the cytochrome <i>b-f</i> complex from pea	D. L. WILLEY, A. L. PHILLIPS & J. C. GRAY	271
Localization of the gene for the P700-chlorophyll <i>a</i> protein in chloroplast DNA from pea and wheat	A. G. SMITH & J. C. GRAY	272
cDNA cloning of rabbit fatty acid synthetase	I. R. CAMERON, R. DILS, R. A. FALLON & C. J. SKIDMORE	273
Subcloning of the <i>Escherichia coli</i> genes <i>aroA</i> (5-enolpyruvylshikimate 3-phosphate synthase) and <i>aroB</i> (3-dehydroquinate synthase)	K. DUNCAN & J. R. COGGINS	274
Subcloning of the <i>Escherichia coli</i> shikimate dehydrogenase gene (<i>aroE</i>) from the transducing bacteriophage <i>λspc1</i>	I. A. ANTON & J. R. COGGINS	275
The mercury-resistance genes of transposon Tn501: nucleotide sequence of the <i>mer</i> operon and a possible mechanism for mercury detoxification	N. L. BROWN, R. D. PRIDMORE & D. C. FRITZINGER	276
Cell-free translation of the uncoupling protein of brown-fat mitochondria	F. BOUILLAUD, D. RICQUIER & J. THIBAUT	277
Purification and expression of an Abelson-murine-leukemia-virus-encoded protein kinase from <i>Escherichia coli</i>	J. G. FOULKES, J. Y. J. WANG, N. C. ANDREWS & D. BALTIMORE	277
Investigation of the activity of yeast phosphoglycerate kinase by site-specific mutagenesis	C. A. B. WILSON, M. F. TUIITE, M. J. DOBSON, S. M. KINGSMAN, A. J. KINGSMAN, L. A. GLOVER, N. HARDMAN, H. C. WATSON & L. A. FOTHERGILL	278
Non-radioactive gene-specific probes	J. L. WOODHEAD & A. D. B. MALCOLM	279
The properties of immobilized horseradish peroxidase	N. SMALL, J. L. WOODHEAD & A. D. B. MALCOLM	280
Analysis of a retrovirus-like mouse gene family	A. T. CARTER, J. D. NORTON & R. J. AVERY	281
Studies on a human tRNA gene	J. P. GODDARD, M. BIENZ, M. SQUIRE & J. D. SMITH	282
Putative high-mobility-group (HMG) non-histone chromosomal proteins from wheat germ	E. L. V. MAYES & J. M. WALKER	283
Restriction-endonuclease digestion of topoisomer families	G. S. SNOUNOU & A. D. B. MALCOLM	284
Coloured computergraphic displays of subunit-subunit interfaces of oligomeric proteins	E. J. MILNER-WHITE	285
The human glutathione <i>S</i> -transferases: studies on the distribution of the GST1, GST2 and GST3 isoenzymes	R. C. STRANGE, C. G. FAULDER, B. A. DAVIS, J. A. H. BROWN, D. A. HOPKINSON & W. COTTON	285

605th MEETING, STRATHCLYDE

The effect of microtubule and microfilament disruption on the secretion of fucose- and mannose-containing glycoproteins from normal and cystic-fibrosis fibroblasts	V. GAVRIAS & C. J. DANPURE	287
Biochemical evidence for a case of canine fucosidosis	D. ABRAHAM, W. F. BLAKEMORE, A. DELL, M. E. HERRTAGE, J. JONES, J. D. LITTLEWOOD, J. OATES, A. C. PALMER, R. SIDEBOTHAM & B. G. WINCHESTER	288
The role of mannosyltransferase in cellulose synthesis in mung-bean hypocotyls	A. F. D. KENNEDY & C. T. BRETT	289
Changes in glucuronyltransferase activity during tissue development in pea epicotyls	K. W. WALDRON & C. T. BRETT	290
The use of concanavalin A as a probe for ADP-ribosylated glycoproteins	L. MINSHALL & W. J. D. WHISH	291
Partial purification of UDP- <i>N</i> -acetyl- β -D-glucosamine-L-asparagine sequon β -D-glucosaminyltransferase from human serum	O. M. P. SINGH & R. D. MARSHALL	292
Location of bi- and tri-antennary <i>N</i> -glycans among the heterogeneous forms of human serum transferrin: a topographical study	M. W. C. HATTON & L. R. BERRY	293
Incomplete blood-group substances in the metastases of gastro-intestinal tumours	D. A. R. SIMMONS	294
The formation of membrane-bound glycoproteins by explants of malignant human breast tissue	A. S. A. KASSAB, F. W. HEMMING & R. W. BLAMEY	296
Changes in transglutaminase activity during tumour growth and metastasis	R. N. BARNES, P. J. BUNGAY, B. M. ELLIOT, P. L. WALTON & M. GRIFFIN	297
A study of the pulmonary toxicity induced by the anti-tumour compound bleomycin	M. IQBAL, B. SCANLON, L. L. SMITH & M. GRIFFIN	298
Multiple antigenic determinants of the Epithelial Membrane Antigen	J. H. WESTWOOD, M. G. ORMEROD, K. STEELE & M. N. MAZZINI	299
Heparin sulphates of chemically transformed BHK cells in which the transformed growth trait is temperature-dependent	N. E. WOODHEAD, W. F. LONG, F. B. WILLIAMSON & W. J. HARRIS	300
Polarimetry as a technique for the study of glycosaminoglycan-metal-ion interactions	C. F. MOFFAT, D. GRANT, W. F. LONG & F. B. WILLIAMSON	301
Altered water structure in mixtures of heparin and metal ions	D. GRANT, C. F. MOFFAT, W. F. LONG & F. B. WILLIAMSON	302
Binding of the <i>Helix pomatia</i> lectin to the surfaces of normal and leukaemic lymphoid cells	M. J. HARDING & J. T. GALLAGHER	302
Sequence analysis of dermatan sulphate oligosaccharides	I. N. HAMPSON & J. T. GALLAGHER	303
Ascorbate increases the sulphation of glycosaminoglycans synthesized by human skin fibroblasts	M. EDWARD & R. F. OLIVER	304
Effect of phorbol esters on ADP-ribose transferase in cultured mouse lymphoma (L1210) cells	M. WRIGHTMAN, D. FURNISS & W. J. D. WHISH	305
Germination and protein ADP-ribosylation	N. ABED & W. J. D. WHISH	305
Solubilization from sheep erythrocyte membranes of the potassium-transport-associated antigens L_p , L_1 and M , and the molecular size determination of the L_p antigen by radiation inactivation	C. E. SMALLEY, E. M. TUCKER, I. SEPULVEDA & J. C. ELLORY	306
Isolation of a neurotensin-degrading enzyme from rat brain	J. R. MCDERMOTT	307
Enhancement of the neuritogenicity of peripheral-nervous-system myelin proteins of P_0 and P_2 by lysophosphatidylcholine	C. A. LOVELIDGE, P. MILNER, W. A. TAYLOR, A. K. MACPHERSON & R. A. C. HUGHES	308
L-Homocysteine enhances pyridoxal 5'-phosphate-induced seizures in the rat	I. C. ALLEN & R. GRIFFITHS	309
Thermal stability properties of immobilized creatine kinase	J. RUDGE & G. F. BICKERSTAFF	311
Activation of the Ca^{2+} -sensitive K^+ channel in erythrocytes at low temperature	A. C. HALL & J. S. WILLIS	312
Amino acids in the human placental intervillous space	N. MCINTOSH, C. H. RODECK & R. HEATH	314
Plasma amino acids in the mid-trimester human foetus	N. MCINTOSH, C. H. RODECK & R. HEATH	315
An electron-paramagnetic-resonance study of ferritin and haemosiderin	M. P. WEIR, J. F. GIBSON & T. J. PETERS	316
Human placental cell culture	D. M. L. MORGAN & V. J. TOOTHILL	317

Fluorescence-activated sorting of rat uterine decidual cells	K. N. MCCONNELL, B. D. YOUNG, J. E. O'GRADY & B. GREEN	318
Action of growth factors in rat uterine cells	R. P. FIELD & R. E. LEAKE	319
Attachment and growth of rat uterine cells <i>in vitro</i>	I. MUNIR & R. E. LEAKE	320
Factors regulating rat uterine oestrogen-receptor activation	L. MYATT, M. G. ELDER & J. O. WHITE	321
The interaction of oestrogen receptor with oligodeoxynucleotides	S. M. HYDER, M. G. ELDER, L. LIM & L. MYATT	322
Comparison of the activation of the rat uterine cytosol oestrogen receptor by oestradiol and anti-oestrogens	J. O. WHITE, M. G. ELDER & L. MYATT	323
Effect of oestrogen administration in fatty acid synthetase activity in male chick liver	S. COURTNEY & R. MANNING	324
Formation of free and sulphated oestrogens in porcine testicular microsomes: effects of aminoglutethimide on the pathway from 19-hydroxyandrost-4-enedione	R. M. AYLING, C. LYNE & D. B. GOWER	325
The involvement of calcium ions in phosphatidylinositol hydrolysis in the anterior pituitary	J. G. BAIRD, R. J. H. WOJCIKIEWICZ, P. R. M. DOBSON & B. L. BROWN	327
O-Glycosylation of herpes simplex virus glycoproteins carrying high-mannose glycans	F. SERAFINA-CESSI, F. DALL'OLIO & G. CAMPADELLI-FIUME	328

Contents Volume 12, Part 3

606th MEETING, CORK

Colloquium: Molecular Aspects of Malignant Hyperthermia and Muscular Dystrophy

A biochemical abnormality found in muscle from unstressed malignant-hyperpyrexia-susceptible humans	F. R. ELLIS, P. J. HALSALL, P. ALLAM & E. HAY	357
Skeletal-muscle mitochondria and phospholipase A ₂ in malignant hyperthermia	K. S. CHEAH	358
Mitochondrial and plasma membrane changes in skeletal muscle in the malignant hyperthermia syndrome	J. J. A. HEFFRON	360
Duchenne muscular dystrophy	S. V. PERRY	362
Problems in the prenatal diagnosis of Duchenne muscular dystrophy	D. C. WATTS	366
X-Chromosome-coded antigens in Duchenne muscular dystrophy	F. S. WALSH	368
X-Chromosome-specific polymorphisms in Duchenne muscular dystrophy: clinical applications	T. O'BRIEN	371

Symposium: Transport of Proteins, Ions and Electrons Through Mitochondrial Membranes

Import of mitochondrial proteins	M. A. HARMEY & W. NEUPERT	373
Transport of nuclear-coded proteins into mitochondria	G. A. REID	374
Transport and processing of the precursors of mitochondrial carbamoyl phosphate synthetase I and ornithine transcarbamoylase	P. P. COHEN	377
Large amplitude protein movement. What functions?	A. WAKSMAN, G. CREMEL, P. HUBERT, C. MUTET & C. BURGEN	378
Transport of mature proteins into isolated mitochondria: a model system to investigate mitochondrial biogenesis	S. PASSARELLA, E. MARRA, S. DOONAN, C. SACCONI & E. QUAGLIARIELLO	381
Energy transduction, ion transport and protonmotive force: are they linked?	M. L. CAMPO, C.-J. ZHANG & H. TEDESCHI	384
Proton translocation coupled to mitochondrial electron transport	A. L. LEHNINGER	386
Proton and calcium circuits across the mitochondrial inner membrane	D. G. NICHOLLS, R. SNELLING & E. RIAL	388
Characteristics of the uncoupling protein from brown-fat mitochondria	M. KLINGENBERG	390
A possible physiological role of the Na ⁺ /Ca ²⁺ exchange mechanism of brown-fat mitochondria in the mediation of α ₁ -adrenergic signals	J. NEDERGAARD, E. CONNOLLY, E. NÅNBERG & N. MOHELL	393

Electron flow in membranes	R. J. P. WILLIAMS	396
Some implications of fixed-charge formation during electron-transport-chain activity	F. H. MALPRESS	399
A structural basis for mosaic protonic energy coupling	K. VAN DAM, H. WOELDERS, A. COLEN & H. V. WESTERHOFF	401
Lateral diffusion, collision and efficiency of oxidation-reduction components in mitochondrial electron transport	C. R. HACKENBROCK, S. GUPTA, E.-S. WU & K. JACOBSON	402
Effects of physical exercise and/or vitamin E on tissue oxidative metabolism	A. T. QUINTANILHA	403
Carboxyl groups and the proton pump of bacteriorhodopsin	J. M. HERZ & L. PACKER	405
Colloquium: Current Problems in the Understanding of Protonmotive Systems		
Properties and physiology of energy-coupled mutants of <i>Escherichia coli</i>	I. R. BOOTH, R. G. KROLL, M. J. FINDLAY, L. M. D. STEWART & G. C. ROWLAND	409
Bioenergetic problems of alkalophilic bacteria	A. A. GUFFANTI & T. A. KRULWICH	411
Proton-transfer pathways during bacterial electron-transport phosphorylation	D. B. KELL & G. D. HITCHENS	413
'Cross-talk' between redox- and ATP-driven H ⁺ pumps	G. F. AZZONE, V. PETRONILLI & M. ZORATTI	414
Analysis of relationships between the protonmotive force and rates and extents of ATP synthesis	S. J. FERGUSON & D. PARSONAGE	416
Colloquium: Structures and Catalysis by Aspartate Aminotransferase Isoenzymes		
On the catalytic factors involved in the mechanism of aspartate aminotransferase: Chairman's remarks	C. A. VERNON	420
Primary structures of aspartate aminotransferases	F. BOSSA, D. BARRA & S. DOONAN	421
Three-dimensional structure of mitochondrial aspartate aminotransferase and some functional derivatives: implications for its mode of action	J. N. JANSONIUS, G. EICHELE, G. C. FORD, J. F. KIRSCH, D. PICOT, C. THALLER, M. G. VINCENT, H. GEHRING & P. CHRISTEN	424
Correlation of structure and catalysis by aspartate aminotransferase isoenzymes	P. CHRISTEN, H. GEHRING, E. SANDMEIER, H. KIRSTEN, K. PFISTER & J. N. JANSONIUS	427
Comparison of aspartate aminotransferase with other aminotransferases by absorption-spectrum analysis	R. A. JOHN, P. H. MORGAN & L. J. FOWLER	430
COMMUNICATIONS		433
605th MEETING, STRATHCLYDE		
Colloquium: Genetic Aspects of Glycoproteins		
Genetic aspects of glycoproteins: Chairman's introduction	R. D. MARSHALL	513
Model studies on <i>N</i> -glycosylation of proteins	E. BAUSE	514
The role of three-dimensional structure in the control of <i>N</i> -linked oligosaccharide biosynthesis	J. P. CARVER	517
Studies of membrane glycoproteins in the rough endoplasmic reticulum	P. H. ATKINSON & A. K. KABCENELL	519
Role of α -D-mannosidases in the biosynthesis and catabolism of glycoproteins	B. WINCHESTER	522
Exchange of lysosomal enzymes between cells	M. F. DEAN & S. DIMENT	524
Non-specific adsorptive pinocytosis	J. B. LLOYD & K. E. WILLIAMS	527
Intracellular turnover and secretion of lysosomal enzymes	W. JESSUP, J. L. BODMER, R. T. DEAN, V. A. GREENAWAY & P. LEONI	529
Colloquium: Glycoconjugates and Tumour-Cell Surfaces		
Regulation of cell-surface structures in malignancy, differentiation and proliferation	M. F. GREAVES	532
A variant of Tamm-Horsfall glycoprotein produced by transformed (BHK 21/C13) cells: implications in the biosynthesis of carbohydrate moieties	R. D. MARSHALL	533
Surface glycoproteins in chronic lymphocytic leukaemias	S. K. SMITH & A. H. MADDY	535
The structure of the Ca-antigen	G. WISEMAN, M. E. BRAMWELL, V. P. BHAVANANDAN & H. HARRIS	537
Cell interactions: some critical reappraisals	A. S. G. CURTIS & J. V. FORRESTER	538
Heparan sulphate alterations in tumour cells	D. J. WINTERBOURNE & Z. KHAN	540

Proteoglycans in cellular differentiation and neoplasia	J. T. GALLAGHER & I. N. HAMPSON	541
Carbohydrate differentiation and cancer-associated antigens detected by monoclonal antibodies	J. L. MAGNANI	543
Monoclonal antibodies reveal saccharide structures of glycoproteins and glycolipids as differentiation and tumour-associated antigens	T. FEIZI	545
Surface glycoprotein changes during normal and malignant haematopoietic differentiation	C. G. GAHMBERG, L. C. ANDERSSON, K. K. KARHI & H. RODT	549
Mutants, revertants and variants of metastasis	M. M. BURGER, J. FINNE & J.-P. PRIEELS	553
BOOK REVIEWS		557

COMMUNICATIONS

Purification of NAD ⁺ -dependent dehydrogenases by affinity precipitation with adipo- <i>N</i> ² , <i>N</i> ^{2'} -dihydrazidobis-(<i>N</i> ⁶ -carboxymethyl-NAD ⁺)(bis-NAD ⁺)	R. BEATTIE, L. D. GRAHAM, T. O. GRIFFIN & K. F. TIPTON	433
Mitochondrial transplantation in hepatocytes and HTC cells: studies of subsequent protein destruction	S. M. RUSSELL, P. J. EVANS & R. J. MAYER	434
Stimulation by feeder layers of human tumour-cell colony formation in agar	V. MCMANUS & M. CLYNES	435
Inhibition of fibroblast contamination in cultures of human epithelial cells	S. MCDONNELL, M. MORIARTY & M. CLYNES	435
The non-identity of protein phosphatase deinhibitor and protein kinase inhibitor	E. WAELKENS, J. GORIS, D. A. WALSH & W. MERLEVEDE	436
The effects of pulsed electromagnetic fields on membrane transport, protein and ATP synthesis in rat skin	P. H. DELPORT, N. CHENG, J. C. MULIER, W. M. SANSEN & W. DE LOECKER	437
Differential gene expression in rapidly dividing cells of <i>Schizosaccharomyces pombe</i>	G. M. WALKER & B. KRAMHØFT	438
Magnesium and control of mitochondrial morphology in fission yeast	G. M. WALKER & A. BIRCH-ANDERSEN	439
Multiple forms of calf prochymosin and chymosin	W. J. DONNELLY, D. M. O'CALLAGHAN, D. P. CARROLL, D. J. MCCONNELL & F. GANNON	440
Changes in the surface of mouse spermatozoa during their passage through the epididymis	K. M. DEVINE & J. CARROLL	441
Immunofluorescence studies on spermatozoa from the mouse epididymis	G. J. P. MURPHY & J. CARROLL	442
Cytosolic and mitochondrial fumarases	M. C. O'HARE & S. DOONAN	443
Import of aspartate aminotransferase into mitochondria	K. M. C. O'DONOVAN, S. DOONAN, E. MARRA & S. PASSARELLA	444
Comparative studies of the primary structures of aspartate aminotransferase	F. MARTINI, S. ANGELACCIO, D. BARRA, F. BOSSA & S. DOONAN	445
Biliary excretion of [¹⁴ C]androstenedione metabolites in control and clofibrate-treated male rats	M. E. BEARY & V. O'SHEA	446
The effects of surgery and hepatic dysfunction on alanine metabolism in man	G. M. HALL, M. FLANNIGAN, J. L. PATERSON & S. M. SAPSED	447
Insulin suppression is the primary mediator of changes in circulating metabolites during surgery in man	G. M. HALL, E. S. WALSH, J. L. PATERSON & K. MASHITER	448
The effect of inhibitors of ADP-ribose transferase on the concentration of (ADP-ribose) _n <i>in vitro</i>	W. H. MULLEN, L. MINSHALL & W. J. D. WHISH	449
Effect of dimethyl sulphate on ADP-ribosylation in mouse L1210 cells	W. H. MULLEN & W. J. D. WHISH	449
Loss of nicotinamide from cells treated with dimethyl sulphate	S. AL-MUHTASEB & W. J. D. WHISH	451
Monoclonal-antibody-mediated delivery of deacetylcolchicine to human peripheral blood neutrophils	T. G. COTTER, T. D. FECYCZ & K. O'MALLEY	452
Mitochondrial functions in mutants of <i>Drosophila melanogaster</i>	N. O'BYRNE-RING, H. QAZZAZ, A. BEHAN & E. J. DUKE	453
The antigenic region of the coat protein of the O subtypes of foot and mouth disease virus	F. BROWN, A. CARROLL, B. E. CLARKE, B. H. NICHOLSON & D. J. ROWLANDS	454
Effect of allopurinol (4-hydroxypyrazolo [3,4- <i>d</i>]pyrimidine on purine metabolism in rat skeletal muscle	J. M. MURPHY & E. R. TULLY	455

The puzzle of high phosphorylation potential and low protonmotive force generated by oxidative phosphorylation in <i>Paracoccus denitrificans</i> membrane vesicles in the presence of nitrate	D. PARSONAGE & S. J. FERGUSON	456
Complementation studies in fibroblast cultures from patients with abnormal cystathionine β -synthase activity (homocystinuria)	J. S. FOX, N. A. J. CARSON & M. H. R. LEWIS	457
Prenatal diagnosis of non-ketotic hyperglycinaemia	J. S. FOX, N. A. J. CARSON & M. H. R. LEWIS	458
The analysis, metabolism and encapsulation of coumarin	E. MORAN, R. O'KENNEDY & R. D. THORNES	459
Purification of pig gastric-mucosal <i>N</i> -acetyl- β -D-glucosaminidase	R. DEVERY, P. B. COLLINS, A. H. JOHNSON & G. WATSON	460
Suppressor T-lymphocytes in malignancy	B. M. HANNIGAN, A. H. JOHNSON, P. B. COLLINS, M. MORIARTY & P. KEELING	461
Ascorbic acid content of plasma and cellular components of blood	A. M. B. KEATINGE, B. M. HANNIGAN, A. H. JOHNSON, P. B. COLLINS, M. MORIARTY & P. KEELING	462
Effect of varied membrane protein density on the lateral diffusion of lipids in the mitochondrial inner membrane	B. CHAZOTTE, E.-S. WU & C. R. HACKENBROCK	463
The pyruvate-oxidation system of the lipoamide dehydrogenase-containing anaerobe <i>Peptococcus glycinophilus</i>	S. G. MAYHEW, G. DOHERTY, D. MCGRATH & C. H. WILLIAMS, JR.	464
Dimethyl sulphoxide inhibits electron transfer to haem a_3 from haem a and its associated copper in cytochrome c oxidase	N. S. DAHABRAH & J. M. WRIGGLESWORTH	465
Hydrogen peroxide as a substrate for cytochrome c oxidase	J. M. WRIGGLESWORTH, J. ELSDEN & H. BAUM	466
Investigation of the nature of inhibition of the mitochondrial F_1 -ATPase by 4-chloro-7-nitrobenzofurazan	R. SUTTON & S. J. FERGUSON	467
The effect of pH on the slow kinetic transients of arylsulphatase A	B. M. BUTLER & T. J. MANTLE	468
Purification and structural analysis of aromatic-amino-acid-accepting tRNA species from the green alga <i>Scenedesmus obliquus</i>	G. A. GREEN & D. S. JONES	468
The effect of Na^+ on growth and intracellular pH of a facultative alkalophile	D. MCLAGGAN, M. J. SELWYN, B. M. LUND & A. P. DAWSON	470
Effect of acetylcholine and tetraethylammonium on the contractile response produced in the rat ileum	F. A. WALI	471
Does glycerol facilitate neuromuscular transmission?	F. A. WALI	472
Multiple forms of calmodulin on sodium dodecyl sulphate/polyacrylamide-gel electrophoresis	D. C. WILLIAMS, C. O'RIORDAN, R. E. BEATTIE & C. O'NEILL	472
Purification of the mitochondrial phosphate-hydroxyl ion antiporter from rat liver	G. M. GIBB, G. P. REID & J. G. LINDSAY	474
Organization and distribution of carbohydrate on mitochondrial membranes	J. G. LINDSAY, G. P. REID & W. DARLINGTON	475
Prostaglandin synthase activity in tissues from guinea pigs fed fatty acid- and aspirin-supplemented diets	C. HADJIAGAPIOU, C. TRITSCHLER & M. G. HARRINGTON	476
Relationships between forms of deoxyribonuclease I from several mammals	C. SMYTHE & F. G. WINDER	477
An inhibited form of deoxyribonuclease 1b in extracts of <i>Aspergillus nidulans</i>	F. G. WINDER & D. SHEILS	478
Relationship between products and mechanism of action of deoxyribonuclease 1b of <i>Aspergillus nidulans</i>	F. G. WINDER & M. SHIKARA	479
Calcium uptake and retention by skeletal-muscle mitochondria	A. P. ALLSHIRE & J. J. A. HEFFRON	480
Effects of denervation on calcium uptake and release pathways of rabbit skeletal-muscle mitochondria	L. A. BURKE & J. J. A. HEFFRON	481
Second-derivative fluorescence spectroscopy in the study of membrane protein conformational changes	J. J. BIRMINGHAM & J. J. A. HEFFRON	482
Possible biochemical basis for bilirubin neurotoxicity	A. O'CALLAGHAN & P. F. DUGGAN	483
Calcium fluxes in synaptosomes from rat cerebral cortex	M. CAPLICE & P. F. DUGGAN	484
Comparison of the degree of non-biospecific binding of ^{125}I -labelled insulin to Sepharose CL-6B conjugates prepared with different activating agents	J. G. MAXWELL & G. B. IRVINE	485
A strategy for the cloning of the human oestrogen-receptor gene: optimization of an immunodetection system for use in the screening of a cDNA library	P. GILNA, D. COLLINS, G. L. GREENE & F. GANNON	486

Towards the cloning of the calf prochymosin gene	D. J. MCCONNELL, D. HUGHES, Y.-F. CHEN, D. P. CARROLL, W. J. DONNELLY, J. F. OLLINGTON, D. QUINN, T. BARRY & F. GANNON	487
Replacement of anticodon-loop nucleotides to produce functional tRNAs	A. G. BRUCE, J. F. ATKINS, N. WILLS, L. BARE, O. UHLENBECK & R. F. GESTELAND	488
Molecular studies on the DNA-repair genes of the cyanobacterium <i>Gloeocapsa alpicola</i>	D. NUTTALL, C. GEOGHEGAN & J. A. HOUGHTON	488
Expression of phosphoglucose isomerase and glucose 6-phosphate dehydrogenase from <i>Leuconostoc mesenteroides</i> in <i>Escherichia coli</i>	T. SCHWARZ, N. B. MURPHY & D. MCCONNELL	489
Characterization of complex genetic rearrangements in recombinant plasmids	N. B. MURPHY, T. SCHWARZ & D. MCCONNELL	490
Host selection of <i>Rhizobium trifolii</i> on <i>Trifolium repens</i> (clover)	J. NEILAN, D. N. DOWLING & L. K. DUNICAN	492
Generation of multiple-host <i>Rhizobium</i> strains by plasmid transfer	L. K. DUNICAN, D. N. DOWLING, J. NEILAN & M. O'CONNELL	492
An improved spectrophotometric assay for monoamine oxidase in mitochondria	C. H. WILLIAMS	493
Characterization of mRNA from mumps-virus-infected cells	J. A. CURRAN, E. M. HOEY & B. K. RIMA	494
Molecular cloning of bovine enterovirus	E. M. HOEY, R. O. CAMPBELL, J. A. P. EARLE & S. J. MARTIN	495
Purification and characterization of canine-distemper-virus mRNA	S. E. H. RUSSELL, E. M. HOEY, B. K. RIMA & S. J. MARTIN	496
Neurovirulence of canine-distemper virus for hamsters	S. L. COSBY, C. LYONS & S. J. MARTIN	497
The effect of digitonin on the fluorescence anisotropy depolarization of cholesterol-containing liposomes	P. GREER & N. M. RYAN	498
Cloning and identification of promoters from temperate phage $\Phi 105$ in <i>Bacillus subtilis</i> , using a versatile 'promoter-probe' vector	P. DHAESE, C. HUSSEY & M. VAN MONTAGU	499
An electron paramagnetic resonance study of <i>Escherichia coli</i> fumarate reductase: its iron-sulphur centres and their organization	D. SIMPKIN & W. J. INGLEDEW	500
The iron-sulphur centres of the <i>Escherichia coli</i> electron transport chain: changes in response to aerobic growth on different carbon sources	M. C. KIRBY & W. J. INGLEDEW	501
A kinetic and electron spin resonance study of the blue copper protein rusticyanin from <i>Thiobacillus ferro-oxidans</i>	C. A. LEWIS, A. G. LAPPIN & W. J. INGLEDEW	503
The physiology of <i>unc</i> mutants of <i>Escherichia coli</i>	R. G. KROLL, C. V. SALMOND & I. R. BOOTH	504
D-Alanine transport in <i>Escherichia coli</i>	G. C. ROWLAND & I. R. BOOTH	505
Energy coupling to K ⁺ transport via the Trk system of <i>Escherichia coli</i>	L. M. D. STEWART, E. P. BAKKER & I. R. BOOTH	506
Direct interactions between electron transfer chains and solute transport systems in bacteria	K. J. HELLINGWERF, M. G. L. ELFERINK & W. N. KONINGS	507
Kinetic studies on the ATP synthesis reaction in liposomes containing bacteriorhodopsin and ATPase-complex	R. L. VAN DER BEND, J. PETERSEN & J. A. BERDEN	508
Direct interaction between ATP synthase and the respiratory chain in beef heart submitochondrial particles	M. A. HERWEIJER, J. A. BERDEN & A. KEMP	509
Free and total tri-iodothyronine and thyroxine in malnourished Jamaican infants	H. M. PAYNE ROBINSON, H. BETTON & A. A. JACKSON	511

Contents Volume 12, Part 4

THE FIFTH THUDICHUM LECTURE

The structure and function of cholinergic synaptic vesicles	V. P. WHITTAKER	561
---	-----------------	-----

607th MEETING, LONDON

Colloquium: Advances in the Biochemistry and Genetics of Antibiotic-Producing Organisms

Genetic studies in micro-organisms producing β -lactam antibiotics	G. HOLT, M. W. ADLARD, E. LISBOA, M. E. ROGERS, S. D. ROGERS, G. SAUNDERS & T. M. SMITH	577
--	--	-----

Aspects of the biosynthesis of β -lactam antibiotics	E. P. ABRAHAM	580
β -Lactamases and their inhibition	G. W. ROSS	582
Dissecting the <i>Streptomyces</i> genome	K. CHATER, M. BIBB, C. BRUTON, D. HOPWOOD, G. JANSSEN, F. MALPARTIDA & C. SMITH	584
Recombinant DNA methods for the oxytetracycline producer <i>Streptomyces rimosus</i>	P. M. RHODES, I. S. HUNTER, E. J. FRIEND & M. WARREN	586
Optimization of streptomycete strains producing polyether and macrolide antibiotics	Z. VANĚK, S. POSPÍŠIL, P. SEDMERA, P. TICHÝ, T. ŘEZANKA & V. KRUMPHANZL	587
Colloquium: Mucin-Type Glycoproteins		
Tumour-associated and differentiation antigens on the carbohydrate moieties of mucin-type glycoproteins	T. FEIZI, H. C. GOOI, R. A. CHILDS, J. K. PICARD, K. UEMURA, L. M. LOOMES, S. J. THORPE & E. F. HOUNSELL	591
The human blood-group-Sd ^a determinant: a terminal non-reducing carbohydrate structure in N-linked and mucin-type glycoproteins	A. S. R. DONALD, A. D. YATES, C. P. C. SOH, W. T. J. MORGAN & W. M. WATKINS	596
Carbohydrate chains from human bronchial mucus glycoproteins: a wide spectrum of oligosaccharide structure	G. LAMBLIN, M. LHERMITTE, A. KLEIN, P. ROUSSEL, H. VAN HALBEEK & J. F. G. VLIAGENTHART	599
Structural analysis of the carbohydrate chains of mucin-type glycoproteins by high-resolution ¹ H-n.m.r. spectroscopy	H. VAN HALBEEK	601
Mucin sialidase in the rat large intestine	A. P. CORFIELD & J. R. CLAMP	605
The effect of mild alkali and alkaline borohydride on the carbohydrate and peptide moieties of fetuin	E. F. HOUNSELL, N. J. PICKERING, M. S. STOLL, A. M. LAWSON & T. FEIZI	607
Effect of alkalis on N-glycosidic linkages of glycoproteins	H. DEBRAY, G. STRECKER & J. MONTREUIL	611
Structure and gel formation in pig gastric mucus	A. ALLEN, D. A. HUTTON, D. MANTLE & R. H. PAIN	612
Is the macromolecular architecture of cervical, respiratory and gastric mucins the same?	I. CARLSTEDT & J. K. SHEEHAN	615
Confirmation of human mucus glycoproteins observed by electron microscopy	P. ROUSSEL, G. LAMBLIN, N. HOUDRET, M. LHERMITTE & H. S. SLAYTER	617
Studies on the molecular weight distributions of two mucins	J. M. CREETH & B. COOPER	618
Colloquium: Lasers in Biochemistry		
Light scattering and correlation measurement	P. JOHNSON	623
Low-angle laser light scattering from surfactant solubilized biological macromolecules	M. N. JONES & P. J. W. MIDGLEY	625
The measurement of motility in micro-organisms and its biochemical significance	R. A. KLEIN	627
Picosecond spectroscopy: applications in biochemistry. Part I: techniques	T. A. M. DOUST, D. PHILLIPS & G. PORTER	630
Picosecond spectroscopy: applications in biochemistry. Part II: applications	T. A. M. DOUST, D. PHILLIPS & G. PORTER	633
Laser Doppler microscopy	R. P. C. JOHNSON	635
COMMUNICATIONS		
606th MEETING, CORK		
Colloquium: Applications of Gene Cloning and Monoclonal Antibodies in the Study and Production of Viral Proteins		
Alternative vaccines	S. J. MARTIN	703
Hepatitis B virus (<i>By title only</i>)	K. MURRAY	705
Chemical basis of antigenic variation in foot-and-mouth-disease virus	F. BROWN	705
The use of monoclonal antibodies for selection of a low-abundance mRNA: p53	S. BENCHIMOL, G. AMTLASHEWSKI & L. CRAWFORD	708
Organization of poliovirus genome and the sites for proteolytic processing (<i>By title only</i>)	C. W. ANDERSON, A. J. DORNER, R. HANECAK, B. L. SEMLER & E. WIMMER	711
Bovine enteroviruses	E. M. HOEY	711
BIOCHEMICAL REVIEW		
Models of the interactions between membranes and intracellular protein structures	P. S. AGUTTER & K. E. SUCKLING	713
BOOK REVIEWS		

COMMUNICATIONS

607th MEETING, LONDON

Identification of the amidase regulator gene sequence of <i>Pseudomonas aeruginosa</i>	D. COUSENS & R. DREW	639
High-performance liquid-chromatographic determination of β -lactam antibiotics using pre-column and post-column derivatization techniques	M. E. ROGERS, M. W. ADLARD, G. SAUNDERS & G. HOLT	640
The effects of chemicals in the presence of cellophane on X-ray-induced point mutation and gene conversion in <i>Aspergillus nidulans</i>	C. N. IGWE & P. COHN	641
Use of [³ H]tetrahydrocerulenin to assay condensing enzyme activity in <i>Streptomyces erythreus</i>	G. ROBERTS & P. F. LEADLAY	642
'Restriction-deficient' mutants of industrial <i>Streptomyces</i>	I. S. HUNTER & E. J. FRIEND	643
Construction and use of a bifunctional streptomycete cosmid	A. E. CHAMBERS & I. S. HUNTER	644
Cloning DNA from <i>Penicillium chrysogenum</i>	T. M. SMITH & G. HOLT	645
DNA repair and mutagenesis in <i>Penicillium chrysogenum</i>	S. D. ROGERS & G. HOLT	646
Gel-forming interactions in pig gastric mucous glycoprotein	A. E. BELL, A. ALLEN, E. MORRIS & S. ROSS-MURPHY	648
Observation of the adherent mucus gel on the rat gastroduodenal mucosa <i>in situ</i>	A. ALLEN, A. GARNER, D. A. HUTTON & S. MCQUEEN	649
Studies on pig and sheep salivary mucins	L. SELLERS & A. ALLEN	650
Preliminary characterization of mucous glycoprotein component of rabbit ocular mucus	R. KAURA & J. M. TIFFANY	651
Control of secretion of mucin-type glycoproteins from human and rat submandibular acini	M. A. MCPHERSON & R. L. DORMER	652
Carbohydrate antigens on glycoproteins of the neoplastic and uninvolved mucosae of patients with carcinoma of the stomach and colon	J. K. PICARD & T. FEIZI	653
Structural analysis of cell-free glycopeptides which bind to wheat germ agglutinin	J. T. GALLAGHER, A. MORRIS & M. DEXTER	655
Purification and properties of acetyl-CoA: glucosamine 6-phosphate <i>N</i> -acetyltransferase from rat liver	A. P. CORFIELD, D. T. MORTIMER & P. J. WINTERBURN	656
The structure of the major oligosaccharide unit of bovine testicular hyaluronidase	J.-C. MICHALSKI, A. H. OLAVESSEN, P. J. WINTERBURN, D. J. POPE & G. STRECKER	657
The regulation of androgen-receptor turnover in human genital skin fibroblasts by 5 α -dihydrotestosterone	D. RING & M. B. HODGINS	658
Structures and ligand-binding properties of human serum albumins	H. N. AU, S. BRAND, D. W. HUTCHINSON & P. MATEJTSCHUK	659
Modification of the age-dependent increase of plasma fibronectin in cancer patients	J. LABAT-ROBERT, J.-P. POTAZMAN & L. ROBERT	660
Studies on a human transferrin variant	R. W. EVANS, A. BOMFORD, A. D. CLARK, R. C. GARRATT, A. D. MADDEN & S. P. YOUNG	661
A low-molecular-weight iron-binding fragment from duck ovotransferrin	R. W. EVANS & A. D. MADDEN	661
Monoclonal antibodies against muscle-cell proteins	N. THI MAN, L. P. HEAD & G. E. MORRIS	662
Human uroporphyrinogen decarboxylase. Do tissue-specific isoenzymes exist?	G. H. ELDER & A. J. URQUHART	663
The use of immunological methods to investigate evolutionary relationships between hexokinase isoenzymes	G. M. LAWRENCE & I. P. TRAYER	664
Immunohistochemical localization of hexokinase isoenzymes in rat tissues	G. M. LAWRENCE, I. P. TRAYER & D. G. WALKER	665
An immunoradiometric assay specific for the MM-dimer of creatine kinase, with the use of monoclonal antibodies	G. E. MORRIS & L. P. HEAD	666
Phosphate distribution in mammalian epidermal keratin proteins	N. F. COOPER, P. T. BLADON, E. J. WOOD & W. J. CUNLIFFE	667
Microheterogeneity in a cytochrome <i>P</i> -450 multigene family	A. ASHWORTH, E. SHEPHARD, B. RABIN & I. PHILLIPS	669
Biochemical analyses of human class II histocompatibility (HLA-D region) antigen-associated invariant polypeptides	C. E. RUDD, J. G. BODMER, W. F. BODMER & M. J. CRUMPTON	670

The use of synthetic oligonucleotides in the detection of the Z variant of α_1 -antitrypsin (α_1 -AT)	N. KALSHEKER, G. L. WATKINS, A. F. MARKHAM, D. CHISWELL, S. E. HUMPHRIES & R. WILLIAMSON	671
Analysis of plasma protein variants by i.e.f./p.a. (isoelectric focusing in polyacrylamide gels) and immunoblotting techniques	M. DALY AND F. HALLINAN	672
Increased biosynthesis of dermal fibronectin in experimental and human diabetes	J. LABAT-ROBERT, L. PHAN THANH, M. LEUTENEGGER & L. ROBERT	673
Paracetamol toxicity in isolated rat hepatocytes	S. FAIRHURST & A. A. HORTON	675
Heterogeneous distribution of phase I xenobiotic metabolism in subpopulations of isolated hepatocytes	I. G. SUMNER, R. B. FREEDMAN & A. LODOLA	676
Enterohepatic circulation of benzo[<i>a</i>]pyrene-4,5-oxide in the rat	T. R. D. ELMHIRST, J. K. CHIPMAN, P. C. HIROM & P. MILLBURN	677
Relationship of ricin and modeccin hepatotoxicity to accumulation rates by parenchymal and non-parenchymal liver cells	D. N. SKILLETER & F. STIRPE	678
An injurious effect of chlorpromazine in the murine S180 sarcoma (var. CB) and its relevance to cancer treatment	G. R. N. JONES & M. J. N. FROHN	679
Cryosensitization and cryoprotection of hepatic microsomal membranes	D. BROWN & T. HALLINAN	680
Anthraquinone free-radical formation by mouse liver subcellular fractions	M. A. OLDCORNE, J. R. BROWN & L. H. PATTERSON	681
Metabolic evidence for the presence of different forms of cytochrome <i>P</i> -450 in human liver	S. THOMPSON, J. C. PETRIE, J. ENGESET, C. R. ELCOMBE, R. T. MAYER, C. VON BAHR & M. D. BURKE	682
Effect of cytochrome <i>P</i> -450 inducers on the efficacy and nephrotoxicity of cyclosporin A	C. CUNNINGHAM, P. H. WHITING, J. G. SIMPSON, D. N. WHEATLEY & M. D. BURKE	684
Denaturation of hepatic microsomal cytochrome <i>P</i> -450 by non-steroidal anti-inflammatory drugs <i>in vitro</i>	M. FALZON, J. HOGG, A. S. MILTON & M. D. BURKE	685
Ethanol induces an aniline hydroxylase in chick embryo liver without inducing cytochrome <i>P</i> -450	F. BURNET & N. DARBY	686
2-Acetamidofluorene as an inducer of cytochrome <i>P</i> -450 in the chick embryo	N. DARBY, F. BURNET & A. LODOLA	687
Inhibition of hepatic and skeletal muscle carnitine palmitoyltransferase I by 2[5(4-chlorophenyl)pentyl-oxirane-2-carbonyl-CoA	K. BARTLETT, H. S. A. SHERRATT & D. M. TURNBALL	688
Hydrolysis of 1- <i>O</i> -alkyl-2-acetyl- <i>sn</i> -glyceryl-3-phosphorylcholine (AGEPC) by mouse serum	C. VAKIRTZI-LEMONIAS	689
Iodination of the ω -side of a thromboxane-receptor antagonist for radioligand binding	P. V. HALUSHKA, D. R. KNAPP, I. A. BLAIR & J. MACDERMOT	690
Inhibition of glutamate binding by trifluoperazine and calmidazolium	M. E. BARDLSEY & P. J. ROBERTS	690
Low concentrations of glucose precipitate a rapid dephosphorylation of ATP in ram spermatozoa exposed to α -chlorohydrin	W. C. L. FORD & A. HARRISON	691
Simian-virus-40 DNA transfection of synchronized CV-1 cells	A. J. STRAIN, W. A. H. WALLACE & A. H. WYLLIE	692
Magnetic DNA	J. A. LANGDALE & A. D. B. MALCOLM	693
Chromatographic resolution of nucleic acids: application to organisms of industrial importance	G. SAUNDERS, M. E. ROGERS, M. W. ADLARD & G. HOLT	694
Doubly resistant variants of hypoxanthine: guanine phosphoribosyltransferase in Chinese-hamster cells	R. J. CHAMBERS & P. COHN	695
Responses of Chinese-hamster and human foetal lung cells to α -particle irradiation	T. MIN, P. COHN & J. A. SIMMONS	696
Control of the initiation of protein synthesis in CHO cells (tsH ₁) with a temperature-sensitive leucyl-tRNA synthetase	S. A. AUSTIN, M. J. CLEMENS & J. W. POLLARD	696
Processing and disulphide-bond formation in proteins biosynthesized from isolated human pancreatic mRNA	M. A. KADERBHAI, J. HERMON-TAYLOR & B. M. AUSTEN	697
An analysis of the changes in rat hepatocyte intermediate filaments during primary culture	C. M. ALEXANDER, A. LODOLA & K. GULL	699
Reduced rates of muscle protein synthesis during tail-vein infusion of rats	V. R. PREEDY & P. J. GARLICK	700

Contents Volume 12, Part 5

ELEVENTH JUBILEE LECTURE

- The discovery and the biological role of fructose 2,6-bisphosphate H. G. HERS 729

607th MEETING, LONDON**Colloquium: Effector Functions of the Constant Region of Immunoglobulin Molecules**

- Isotype switching in myeloma and hybridoma cells compared with LPS blasts A. RADBRUCH, F. SABLITZKY & K. RAJEWSKY 737
- Antigenicity and effector functions of human immunoglobulin G1 proteins having C γ 2 or C γ 3 deletions R. JEFFERIS, M. I. NIK JAAFAR, R. MCADAM & M. WALKER 737
- C1 activation by immunoglobulin and immunoglobulin antibodies N. C. HUGHES-JONES, A. FEINSTEIN, N. E. RICHARDSON, B. D. GORICK & J. C. HOWARD 738
- Fc receptors on lymphocytes and K cells J. GERGELY, M. SÁNDOR, G. SÁRMAY & F. UHER 739
- Immunoglobulin and soluble immune complex binding to phagocyte Fc receptors R. G. Q. LESLIE 743
- The monocyte binding domain(s) on human immunoglobulin G J. M. WOOF & D. R. BURTON 746
- Isotope specificity in the binding of mouse immunoglobulins to brush borders isolated from the neonatal mouse small intestine N. M. MACKENZIE & K. D. KEELER 747
- Use of synthetic peptides with immunoglobulin-heavy-chain sequences in the delineation of Fc effector function D. R. STANWORTH 747
- The relationship between the immune system and mucus in the protection of mucous membranes J. R. CLAMP 754

Colloquium: Phosphorylation of Membrane Proteins

- Tyrosine protein kinases, viral transformation and the control of cell proliferation T. HUNTER, K. L. GOULD & J. A. COOPER 757
- Stimulation of tyrosine phosphorylation by platelet-derived growth factor B. EK, L. RÖNNSTRAND & C.-H. HELDIN 759
- The insulin receptor-kinase complex: an integrated system for transmembrane hormone signalling E. VAN OBBERGHEN, H. GAZZANO, A. KOWALSKI, M. FEHLMANN, B. ROSSI & G. PONZIO 762
- Does insulin exert certain of its actions through a distinct species of guanine nucleotide regulatory protein? M. D. HOUSLAY, A. V. WALLACE, M. E. COOPER, N. J. PYNE, S. R. WILSON & C. M. HEYWORTH 766
- Protein kinases and insulin action in fat cells R. M. DENTON, R. W. BROWNSEY, T. J. HOPKIRK & G. J. BELSHAM 768
- Thylakoid protein phosphorylation: *in vitro* and *in vivo* J. BENNETT 771
- Protein phosphorylation and optimal production of ATP in photosynthesis J. F. ALLEN 774
- Control of excitation energy distribution in photosynthetic systems *in vivo* W. P. WILLIAMS 776

COMMUNICATIONS

779

BOOK REVIEWS

881

COMMUNICATIONS

- Recovery of polymorphonuclear leucocytes from complement attack B. P. MORGAN, A. K. CAMPBELL, J. P. LUZIO & M. B. HALLET 779
- Role of complement receptor CR1 in the breakdown of soluble and zymosan-bound C3b V. MALHOTRA & R. B. SIM 781
- Is the stepwise methylation of phosphatidylethanolamine relevant to the release of histamine from the mast cell? D. S. W. BOAM, D. R. STANWORTH, S. G. SPANNER & G. B. ANSELL 782
- Transiently phosphorylated M_r -70000 protein of rat mammary-gland Golgi-vesicle membrane is not an intermediate in casein phosphorylation R. A. CLEGG & D. W. WEST 783
- The possible existence of phosphoproteins as complexes on the synaptic plasma membrane L. C. MAHADEVAN & L. LIM 784

Regulation of multiple forms of L-serine dehydratase in mammalian liver	M. S. EDWARDS, M. D. HITCHEN & K. SNELL	786
The effect of experimental diabetes on the level of fructose 2,6-bisphosphate in different tissues of the rat: relationship to glycolytic flux	M. SOCHOR, A.-M. GONZALEZ & P. MCLEAN	786
D-3-Hydroxybutyrate dehydrogenase and metabolism of ketone bodies by rat stomach	A. K. MACGILL, N. G. ANDERSON, C. N. A. TROTMAN, J. M. CARRINGTON & P. J. HANSON	788
Phosphoenolpyruvate carboxylase activity in the kidney of pregnant rats during late gestation	C. VALCARCE, J. M. CUEZVA & J. M. MEDINA	789
Effects of exogenous and endogenous gastric inhibitory polypeptide in obese hyperglycaemic (<i>ob/ob</i>) mice	P. R. FLATT, C. J. BAILEY, P. KWASOWSKI, T. PAGE & V. MARKS	790
Short-term effects of wheat bran supplementation on glucose and lipid metabolism in man	D. J. MOORE, F. J. WHITE, P. R. FLATT & D. V. PARKE	791
Studies of chick kidney alkaline phosphatase	M. JAHAN & P. J. BUTTERWORTH	792
Increased phosphate incorporation into phospholipids accompanying the substrate-mediated stimulation of phosphate uptake in chick-kidney proximal-tubule cells	R. PARVEEN, M. F. GRAHN & P. J. BUTTERWORTH	793
Effects of cadmium on hepatic gluconeogenesis <i>in vivo</i> and <i>in vitro</i>	I. N. ROBINSON & K. SNELL	794
Use of liver snips for studies on gluconeogenesis	K. PHILIPSON & K. SNELL	795
Regulation of cyclic AMP production in rat Leydig cells by LHRH agonist under basal and LH-stimulated conditions	M. H. F. SULLIVAN & B. A. COOKE	796
Ribosomal protein S3, and not ribosomal protein S3a, is phosphorylated in Krebs II ascites cells incubated under certain conditions	M. J. MCGARVEY & D. P. LEADER	797
The role of phosphagens in the survival of hypoxic stress by polychaete annelids	B. BESTWICK & L. WARREN	799
Anaerobiosis in <i>Terebella lapidaria</i> L.	I. ROBBINS & L. WARREN	799
Immunochemical analysis of membrane-bound antigens from <i>Escherichia coli</i> which have succinate dehydrogenase activity	R. W. JONES, J. H. WEINER & R. B. GENNIS	800
Identification of a putative 5-hydroxytryptamine receptor in insect nervous tissue	C. S. OSBORNE, R. H. OSBORNE & K. J. CATTELL	801
Benzodiazepines modulate the A2 adenosine receptor on 108CC15 neuroblastoma × glioma hybrid cells	C. R. SNELL & P. H. SNELL	802
Rat brain membranes have specific high-affinity binding sites for NAD	P. H. SNELL, C. R. SNELL & C. D. RICHARDS	804
Comparison between induction of glutamine synthetase by removal of glutamine and by addition of glucocorticoids in normal astrocytes and in astroglioma cells	M. D. WEIR, A. HUNT, A. J. PATEL & D. G. T. THOMAS	805
Measurement of free calcium in synaptosomes and the effects of depolarization by potassium and glutamate	R. D. BURGOYNE, R. CUMMING & M. J. GEISOW	806
Interaction of nicotinic acetylcholine receptor from locust (<i>Schistocerca gregaria</i>) central nervous system with concanavalin A: comparison with vertebrate receptor	T. ROBINSON, O. AGUILAR & G. G. LUNT	807
Susceptibility of muscarinic acetylcholine receptor from locust (<i>Schistocerca gregaria</i>) central nervous system to perturbation by ethanol and by sulphhydryl reagents	O. AGUILAR, M. FONSECA & G. G. LUNT	809
Muscarinic receptor inactivation by butane-2,3-dione	D. MILLAN, J. V. SANCHEZ-ANDRES, C. RIPOLL & B. SORIA	810
Inhibition of muscarinic binding by pyridoxal-5'-phosphate	J. V. SANCHEZ-ANDRES, I. PALAFOX, C. RIPOLL, D. MILLAN & B. SORIA	811
Pyridoxal-5'-phosphate content of synaptic membrane	C. RIPOLL, D. MILLAN, J. V. SANCHEZ-ANDRES & B. SORIA	812
Radiolabelling of α -bungarotoxin to high specific radioactivity with complete retention of biological activity	T. BARKAS & B. W. FULPIUS	813
Antigenic sites of the nicotinic acetylcholine receptor characterized by stability to acid denaturation	T. BARKAS, R. W. JAMES, L. EDER & B. W. FULPIUS	814
Iodination of the nicotinic acetylcholine receptor from <i>Torpedo marmorata</i> to high specific radioactivity with complete retention of antigenicity	M. I. VELAZCO, T. BARKAS & B. FULPIUS	815

γ -Glutamyl transpeptidase from kidney and brain: a rapid purification method yields useful immunogens	S. MURPHY, C. MORROW & V. LISY	816
Immunological distribution of cysteine sulphinate decarboxylase (EC 4.1.1.29) in rat tissues	P.-F. URBAN & P. REICHERT	817
[³ H]Galactose incorporation into bovine rods and cones	W. A. KEEGAN, N. M. MCKECHNIE & C. A. CONVERSE	818
Analytical subcellular fractionation of insect central-nervous-system tissue	A. K. DWIVEDY & D. B. SATTELLE	819
Isolation of postsynaptic densities from chick brain: morphology and protein/glycoprotein composition	K. MURAKAMI, P. R. GORDON-WEEKS & S. P. R. ROSE	820
An output of adenine derivatives from neocortical tissues modified by L-homocysteine thiolactone	H. MCILWAIN & J. D. POLL	822
Enhancement of neuromuscular transmission and contraction by angiotensin II at a skeletal muscle (rat diaphragm)	F. A. WALI	823
Contractures produced by angiotensin II and acetylcholine at the rat ileum (autonomic nerve-muscle preparation)	F. A. WALI	823
Non-stoichiometry of ovomucoid inhibition of sperm-bound acrosin	F. S. STEVEN & M. M. GRIFFIN	824
Correlation of myosin heavy chains with ATPase staining of skeletal- and cardiac-muscle fibres	W. T. PERRIE & S. J. BUMFORD	825
Purification and partial characterization of arginine aminopeptidases from human skeletal muscle	D. MANTLE, B. LAUFFART & R. J. T. PENNINGTON	826
On the mechanism of action of the protein phosphatase de-inhibitor	E. WAELKENS, J. GORIS & W. MERLEVEDE	827
Virus and pathogenesis-related protein accumulation after tobacco-mosaic-virus infection of tobacco	J. F. ANTONIW, R. F. WHITE, D. J. BARBARA & A. LONGLEY	828
Binding and degradation of insulin by renal-cortical tubules	J. H. THOMAS, P. G. DAVEY, N. V. CLARK & J. JAMES	829
The identification of enterokinase activity in endocytotic vesicles after its clearance by hepatocytes	D. GRANT, S. SIDDIQUI & J. GRAHAM	829
Preliminary studies on the characterization of a modulatory protein in the rat tapeworm <i>Hymenolepis diminuta</i>	J. B. HIPKISS & C. J. BRANFORD WHITE	831
Comparison between the enzymic and the immunological demonstration of prostatic acid phosphatase immobilized on agarose beads	T. C. RICHARDSON & E. HEYDERMAN	832
Prostaglandins, leucocytic endogenous mediator and the acute-phase protein response to trauma	J. W. KEYSER, G. L. WATKINS & C. G. CURTIS	833
Improved sample preparation and rapid extraction of prostacyclin and thromboxane metabolites from biological samples by using reversed-phase octadecylsilyl-silica cartridges	I. DAS	834
The arachidonic acid cascade in rat liver	S. HEWERTSON, R. G. McDONALD-GIBSON & T. F. SLATER	835
Arachidonic acid metabolism by rat uterus	A. MORGAN, R. G. McDONALD-GIBSON & T. F. SLATER	837
Δ^9 - and Δ^6 -long-chain-fatty-acid desaturase activity and fatty acid composition of the chick embryo during development	J. H. SHAND & R. C. NOBLE	838
Inhibition of platelet 12-lipoxygenase by hydroxy-fatty acids	P. D. MITCHELL, C. HALLAM, P. E. HEMSLEY, G. H. LORD & D. WILKINSON	839
Intermediates in the formation of 5,16-androstadien-3 β -ol from pregnenolone in neonatal porcine testis microsomes	T. K. KWAN, N. F. TAYLOR & D. B. GOWER	841
Kinetic studies of 3 α - and 3 β -hydroxysteroid dehydrogenases in neonatal porcine testis subcellular fractions	T. K. KWAN & D. B. GOWER	842
High-density-lipoprotein (HDL) subfractions in interstitial fluid from human aortic intima and atherosclerotic lesions	E. B. SMITH, C. ASHALL & J. E. WALKER	843
The effect of peroxidized lipids on thromboplastin activity	G. P. CROPPER & R. M. HOWELL	845
Histidine-rich glycoprotein alleviates the inhibition by heparin of thrombin-induced platelet aggregation	G. KINDNESS, E. A. VIGROW, W. F. LONG, F. B. WILLIAMSON, W. T. MORGAN & J. CHANG	846
Possible plasmid involvement in the virulence of <i>Salmonella dublin</i>	E. J. MANNING, G. D. BAIRD & P. W. JONES	847
Rapid screening of iodinated peptides for radioimmunoassay	P. R. FLATT	848
H ⁺ /O stoichiometry in plant mitochondria	J. A. MITCHELL & A. L. MOORE	849

Intracellular-volume measurements of wheat-leaf mesophyll cells and protoplasts	K. L. M. VALLES, M. O. PROUDLOVE, F. A. WILLIAMSON, R. B. BEECHEY & A. L. MOORE	850
Membrane potential measurements in wheat-leaf mesophyll protoplasts	K. L. M. VALLES, M. O. PROUDLOVE, R. B. BEECHEY & A. L. MOORE	851
Glycine decarboxylation by renal cortical mitochondria in relation to renal serine synthesis	M. LOWRY, M. HALL, B. HALL, D. HALL & J. BROSNAN	852
Excretion of β -aminoisobutyric acid in relation to lead load in humans	D. F. EVERED, E. C. CRUTCHER, D. BARLTROP & C. D. STREHLOW	853
Effects of copper overload on hepatic intracellular organelles in Bedlington terriers	C. A. SEYMOUR & G. M. SMALL	854
Erythrocyte cation transport in essential hypertension	B. L. WALSH, J. B. FERRIS, J. O'HARE & J. J. A. HEFFRON	856
Mechanism of uptake and intracellular translocation of [35 S]cystine in cystinotic fibroblasts	C. J. DANPURE, P. R. JENNINGS, S. HALSALL & T. J. PETERS	857
The plasma amino acid flux across the placenta	N. MCINTOSH, C. H. RODECK & R. HEATH	857
Electron spin resonance studies of iron uptake by intestinal brush-border membrane vesicles	R. J. SIMPSON, M. P. WEIR, J. F. GIBSON & T. J. PETERS	859
The effect of wheat-bran fibre on the anaerobic metabolism of cholic acid by mixed faecal bacteria	K. FADDEN, R. W. OWEN, M. J. HILL & A. N. MASON	860
The faecal ration of lithocholic acid to deoxycholic acid may be an important aetiological factor in colo-rectal cancer	R. W. OWEN, M. DODO, M. H. THOMPSON & M. J. HILL	861
A comparison of the effects of chenodeoxycholic acid and ursodeoxycholic acid treatment on faecal bile acid profiles in healthy subjects	M. DODO, R. W. OWEN, M. H. THOMPSON & M. J. HILL	862
Potential Z-DNA between exons of human secreted and membrane immunoglobulin heavy-chain μ -gene	C. P. MILSTEIN, E. V. DEVERSON & T. H. RABBITTS	863
Regulation of the biosynthesis of cephamycin C by <i>Streptomyces lactamdurans</i>	J. CORTÉS, P. LIRAS, J. M. CASTRO, J. ROMERO & J. F. MARTÍN	863
Cloning and expression of two <i>pab</i> genes coding for <i>p</i> -aminobenzoic acid synthase, an enzyme involved in candidicin biosynthesis	J. A. GIL, A. REBOLLO, T. ALEGRE, P. LIRAS & J. F. MARTÍN	865
Carbon catabolite regulation of penicillin biosynthesis at the α -amino adipic acid and α -amino adipyl-cyteinyl-valine levels	J. F. MARTÍN, G. REVILLA, M. J. LÓPEZ-NIETO, F. R. RAMOS & J. M. CANTORAL	866
Proteinase activity in human brain ontogeny	R. G. MAHAJAN, S. MANDAL, S. K. MUKHERJEE, R. BANERJEE, M. DOHADWALA, K. L. MUKHERJEE & A. K. SINHA	867
Substrate metabolism in developing human brain	A. K. SINHÁ, S. MANDAL, R. G. MAHAJAN, S. MUKHOPADHYAYA, R. BANERJEE, M. DOHADWALA & K. L. MUKHERJEE	868
Fluorescence measurements of intrasynaptosomal free calcium by using a Quin dye	R. H. ASHLEY, M. J. BRAMMER & R. M. MARCHBANKS	869
The incorporation of glucose into lipids of oligodendroglia isolated from developing rat brain	U. AYLIFFE, N. MELIHY, S. MULHALL, C. HUGHES, K. WEAVER, A. GIBSON & M. J. BRAMMER	871
Incorporation of [14 C]glucose into lipids of isolated bovine oligodendroglia: effects of normal and multiple-sclerosis sera	A. GIBSON & M. J. BRAMMER	872
Placental transfer and metabolic dynamics of thyroid hormones in foetus and maternal tissues in rats	R. J. WOODS, A. K. SINHA & R. P. EKINS	872
A comparison of glycosaminoglycans content of human synovial fluid in different disease states	S. C. MALIK, J. P. PEARSON & C. W. DICK	874
The enhanced mucolytic activity of human pepsin 1 compared with pepsin 3: implications in peptic ulceration	J. P. PEARSON, N. B. ROBERTS & W. H. TAYLOR	875
Smooth muscle cell elastase: effect of <i>in vitro</i> ageing and lipoproteins	M. C. BOURDILLON, W. HORNEBECK, J. M. SOLEILHAC & L. ROBERT	876
Bifunctional inhibitors as potential agents against elastolysis	L. ROBERT, W. HORNEBECK & E. MOCZAR	876
Interaction of rat monoclonal antibodies with human killer cells (K cells)	G. HALE, M. CLARK & H. WALDMANN	877
A highly expanded spheroidal conformation for a mucin from a cystic fibrosis patient: new evidence from electron microscopy	P. HALLETT, A. J. ROWE & S. E. HARDING	878
Electrogenic reactions of the chloroplast cytochrome <i>b/f</i> complex	R. W. JONES, M. A. SELAK & J. WHITMARSH	879

Contents Volume 12, Part 6

SIXTH BDH LECTURE

- Quantitative cytochemistry: a precise form of cellular biochemistry J. CHAYEN 887

608th MEETING, KEELE**Colloquium: The Lysosome and its Membrane**

- Proteolytic and other metabolic pathways in lysosomes A. J. BARRETT 899
 Metabolic consequences of genetic defects in lysosomes J. M. TAGER, L. V. M. JONSSON, J. M. F. G. AERTS, R. P. J. OUDE ELFERINK, A. W. SCHRAM, A. H. ERICKSON & J. A. BARRANGER 902
- Penetration of small molecules across the lysosome membrane: the 'classical' view J. B. LLOYD 906
- The lysosomal proton pump P. HARIKUMAR & J. P. REEVES 906
- Lysosomal transport of cystine and other small molecules J. A. SCHNEIDER, A. J. JONAS, M. L. SMITH & A. A. GREENE 908
- Modes of access of macromolecules to the lysosomal interior R. T. DEAN 911
- Drug targeting to lysosomes R. DUNCAN, J. KOPEČEK & J. B. LLOYD 913

Colloquium: Post-Translational Modifications of Proteins: Mechanisms and Functions

- Analysis of microsomal polypeptides involved in the co-translational translocation of secretory proteins M. A. KADERBHAI, D. H. RIDD, A. ROBINSON & B. M. AUSTEN 917
- Processing of precursors of mitochondrial proteins B. SCHMIDT & W. NEUPERT 920
- The vitamin K-dependent carboxylation of proteins C. VERMEER, B. A. M. SOUTE, M. ULRICH, K. HAMULYAK & M. A. G. DE BOER-VAN DEN BERG 922
- Processed and non-processed forms of procollagens R. TIMPL 924
- Influence of dopaminergic agents on β -endorphin processing in rat pars intermedia J. HAM, K. G. MCFARTHING, C. I. A. TOOGOOD & D. G. SMYTH 927
- Protein disulphide-isomerase and the formation of native disulphide bonds R. B. FREEDMAN, B. E. BROCKWAY & N. LAMBERT 929
- Post-translational modification of exogenous proteins in *Xenopus laevis* oocytes A. COLMAN, S. BHAMRA & G. VALLE 932

Colloquium: Biochemical Approaches to the Control of Hypertension

- Localized Determinants of Vascular Smooth-Muscle Contractility
- Regulation of Ca^{2+} levels in smooth-muscle cells C. CAUVIN & C. VAN BREEMEN 939
- The identification of cytoplasmic membrane calcium-entry channels by ligand-binding studies H. GLOSSMANN, A. GOLL, D. R. FERRY & M. ROMBUSCH 941
- The role of the Na^+, K^+ -ATPase in the regulation of vascular smooth-muscle contractility, and its relationship to essential hypertension J. K. ARONSON 943
- Mechanisms of the regulation of myofibrillar function in vascular smooth muscle S. B. MARSTON, C. MOODY & C. SMITH 945
- The Renin-Angiotensin Converting Enzyme Cascade
- Renin and blood pressure M. TREE, J. J. BROWN, B. J. LECKIE, A. F. LEVER, P. MANHEM, J. J. MORTON, J. I. S. ROBERTSON, M. SZELKE & D. WEBB 948
- Biochemistry of renin T. INAGAMI, K. S. MISONO, J.-J. CHANG & Y. TAKII 951
- Computer graphics modelling and specificity of renins B. L. SIBANDA 953
- Renin inhibitors containing 2-substituted statine D. F. VEBER, M. G. BOCK, S. F. BRADY, E. H. ULM, D. W. COCHRAN, G. M. SMITH, B. I. LAMONT, R. M. DIPARDO, M. POE, R. M. FREIDINGER, B. E. EVANS & J. BOGER 956

Colloquium: Exocytosis and Endocytosis		
Exocytosis involves highly localized membrane fusions	D. E. CHANDLER	961
The role of contractile filaments in secretion	J. P. BENNETT	963
A possible role for endogenous protease in secretory events	D. ALLAN	965
Contrasting roles for receptor-stimulated inositol lipid metabolism in secretory cells	S. COCKCROFT	966
The relationship between intracellular second messengers and platelet secretion	D. E. KNIGHT & M. C. SCRUTTON	969
The calelectrins: new and ubiquitous Ca ²⁺ -regulated proteins with a possible role in cytotic processes	T. C. SÜDHOF	972
Processing of secretory proteins	J. A. TAYLOR, R. C. FOREMAN & J. D. JUDAH	974
Substrate selection and processing in endocytosis	J. B. LLOYD, M. K. PRATTEN, R. DUNCAN, T. KOOISTRA & S. A. CARTLIDGE	977
Characterization of clathrin and clathrin-associated proteins	E. UNGEWICKELL	978
Semliki forest virus entry and the endocytic pathway	M. MARSH, M. C. KIELIAN & A. HELENIUS	981
Involvement of the cortical actin filament network of neutrophil leucocytes during phagocytosis	P. SHETERLINE, J. E. RICKARD & R. C. RICHARDS	983
Colloquium: Microcomputers in Biochemistry		
The work of the microcomputer	A. THOMSON	989
A low-cost chromatograph data-collection system	J. S. LITTLER & C. J. P. SCOTT	991
Microcomputers to control the pH of growing microorganisms	J. A. BANGHAM & M. SYMMONS	993
The role of the microcomputer in the computing facilities of a large research establishment	M. M. JORDAN, J. E. LEWIN & J. SATCHELL	997
Towards an automated two-dimensional gel analysis system	N. V. MCFERRAN & T. P. QUIGLEY	1000
Computer methods to aid the determination and analysis of DNA sequences	R. STADEN	1005
Computer graphics in the study of drug-nucleic acid interactions	S. NEIDLE	1008
The EMBL nucleotide sequence data library	G. G. KNEALE & O. KENNARD	1011
ZSEQ: an interactive DNA sequence analysis program designed for microcomputers	M. J. BISHOP	1015
ZPEP: an interactive protein sequence analysis program designed for microcomputers	M. J. BISHOP	1017
DNA sequence analysis and the computer	M. D. JONES	1018
COMMUNICATIONS		1021
LONDON MEETING		
Colloquium: Biochemistry of Mixed Microbial Cultures		
Mixed microbial culture technology	A. T. BULL	1137
Redox interactions in mixed cultures	J. W. T. WIMPENNY	1138
Competition between plasmid-positive and plasmid-negative cells	C. A. CAULCOTT	1140
Biochemistry of cellulose breakdown by mixed cultures	D. A. VEAL & J. M. LYNCH	1142
Biochemistry of methanogenesis by mixed cultures	D. B. ARCHER	1144
Xenobiotic breakdown by mixed cultures	R. B. CAIN	1146
Mixed cultures in the manufacture of cheese	B. A. LAW	1148
Fermented milks: new developments in the biochemistry of the starter cultures	V. M. E. MARSHALL	1150
BOOK REVIEWS		1153
INDEXES		
Author Index		1159
Keyword Index		1177
COMMUNICATIONS		
Enzymes of the lysosomal membrane	M. DOBROTA & R. H. HINTON	1021
Increased latency of acid hydrolases in the kidney cortex of proteinuric rats	H. J. HAGA, K. J. ANDERSEN, M. DOBROTA & B. M. IVERSEN	1022

The effect of food restriction on the latency of acid β -glycerophosphatase in the kidney cortex of nephritic rats	H. J. HAGA, K. J. ANDERSEN, M. DOBROTA, B. M. IVERSEN & J. OFSTAD	1023
Incorporation of 'acid' β -glucosidase into phosphatidylcholine membranes	M. CARROLL	1024
Uptake of ^{125}I -labelled percoll by rat visceral yolk sac cultured <i>in vitro</i>	M. K. PRATTEN, L. SCARLETT & J. B. LLOYD	1025
Degradation of microinjected cytosolic proteins in 3T3-L1 pre-adipocytes	F. J. DOHERTY & R. J. MAYER	1026
Immunological properties of urinary sphingomyelinase	A. W. SCHRAM, G. WEITZ, M. DRIESSEN, E. M. BROUWER-KELDER, K. SANDHOFF, J. A. BARRANGER & J. M. TAGER	1027
Differential effects of leupeptin on the maturation of lysosomal α -glucosidase	R. P. J. OUDE ELFERINK, T. HENDRIKS, A. STRIJLAND, E. M. BROUWER-KELDER, O. DAMSMA, J. HILKENS, J. HILGERS & J. M. TAGER	1028
Gentamicin stabilization of the rat kidney lysosome	S. F. BRADLEY, S. NOORAZAR & D. T. PLUMMER	1030
Effects of gentamicin and cefuroxime on the rat kidney lysosome	S. F. BRADLEY, S. NOORAZAR & D. T. PLUMMER	1031
Latent 5'-nucleotidase in rat liver lysosomes	G. A. MAGUIRE	1032
The molecular form of gold in the human synovial membrane after administration of gold thiomalate	M. TAYLOR, A. TAYLOR & R. H. HINTON	1033
Changes in the colloid and lysosomes of the thyroid of rats treated with clofibrate	S. C. PRICE, D. CHESCOE & R. H. HINTON	1034
Studies on the mechanism of action of a drug-carrier-antibody conjugate	M. C. GARNETT, E. JACOBS, M. J. EMBLETON & R. W. BALDWIN	1035
Direct transfer of lymphocyte α -D-mannosidase to enzyme-deficient human fibroblasts	D. ABRAHAM, B. WINCHESTER & I. OLSEN	1036
Mechanism of chloroquine-induced inhibition and stimulation of the labelling of the intralysosomal cystine pool in cystinotic fibroblasts	C. J. DANPURE, P. R. JENNINGS, D. A. FYFE, S. HALSALL & T. J. PETERS	1037
The effect of chymostatin on protein degradation in 3T3 cells	A. ANASTASI & R. T. DEAN	1039
Expression of sphingomyelinase in normal and Niemann-Pick disease tissues	S. J. FREEMAN, D. J. DAVIDSON, P. SHANKARAN & J. W. CALLAHAN	1040
Protein disulphide-isomerase activity of preparations used in the study of protein synthesis <i>in vitro</i>	B. E. BROCKWAY & R. B. FREEDMAN	1041
Chemical modification of essential residues in purified rat liver protein disulphide-isomerase	N. LAMBERT & R. B. FREEDMAN	1042
Protein disulphide-isomerase of mature and developing wheat	G. M. V. DE AZEVEDO, B. E. BROCKWAY, R. B. FREEDMAN, P. GREENWELL & L. T. RODEN	1043
Protein primary sequence studies of plasmin-derived peptides from rabbit haemopexin	C. F. A. BRYCE, M. G. CORD, G. KINDNESS, A. SMITH & W. T. MORGAN	1043
Phosphorylation of the myelin-specific enzyme 2',3'-cyclic nucleotide 3'-phosphodiesterase	J. M. BRADBURY & R. J. THOMPSON	1044
Inactivation of hepatic microsomal glucose-6-phosphatase by diethylpyrocarbonate	W. J. ARION, B. BURCHELL & A. BURCHELL	1045
Polyamine stimulation of casein phosphorylation: differential effects on the three major rat caseins	D. W. WEST & R. A. CLEGG	1046
Meprin deficiency: a fault in post-translational processing?	R. J. BEYNON, G. C. MACADAM & J. S. BOND	1047
Protein synthesis by isolated rat hepatocytes: effects of diamide and hydroperoxides	A. J. WHATMORE & A. J. DICKSON	1048
Pyridoxal phosphate as a turnover label for glycogen phosphorylase	P. E. BUTLER & R. J. BEYNON	1050
The early stages in the biosynthesis of prothrombin	M. R. EVANS, M. W. P. SUNG & M. P. ESNOUF	1051
Isolation of a type VI collagen precursor from bovine elastic tissues	S. AYAD, C. A. SHUTTLEWORTH & M. E. GRANT	1052
Studies on the basement membrane of bovine retinal microvessels	A. E. CANFIELD & M. E. GRANT	1053
Synthesis of basement membrane precursor collagen and its incorporation into the extracellular matrix by isolated rat renal glomeruli	R. P. BOOT-HANDFORD & M. E. GRANT	1054
Identification and partial characterization of small-procollagen-like cartilage collagens	C. M. KIELTY, D. J. S. HULMES, S. L. SCHOR & M. E. GRANT	1055

A new carboxypeptidase responsible for the modification <i>in vitro</i> of MM-creatine kinase in human plasma	R. J. EDWARDS & D. C. WATTS	1056
The role of peptidyl dipeptidase (angiotensin converting enzyme) in the hydrolysis <i>in vitro</i> of gliadin by human intestinal brush-borders	G. BRUCE & J. F. WOODLEY	1057
Renin and kallikrein concentrations in renal tissue from spontaneously hypertensive rats during acute reduction of perfusion pressure	K. J. ANDERSEN, B. M. IVERSEN, M. DOBROTA, L. JOHANSEN & J. OFSTAD	1058
Determination of captopril by an improved high-performance liquid chromatography-electrochemical assay	D. PERRETT, S. R. RUDGE & P. L. DRURY	1059
The stability of structures containing endocytosed horseradish peroxidase in the presence of glycyl-phenylalanine-2-naphthylamide	M. JADOT, S. WATTIAUX-DE CONINCK & R. WATTIAUX	1060
Endocytosis of sucrose by monolayers of rat hepatocytes	J. THIRION & R. WATTIAUX	1060
Exocytosis of proteases by I-cell fibroblasts	H. A. KHALFAN & D. ROBINSON	1062
Fabry's disease. Identification of carrier status by fluorescent lectin binding	D. ROBINSON & H. A. KHALFAN	1063
Enhancement of adsorptive pinocytosis of a polyaspartamide by incorporation of tyramine residues	R. DUNÇAN, H. C. CABLE, F. RYPAČEK, J. DROBNÍK & J. B. LLOYD	1064
Targeting of soluble cross-linked <i>N</i> -(2-hydroxypropyl)-methacrylamide copolymers <i>in vivo</i> . A potential drug delivery system	S. A. CARTLIDGE, P. REJMANOVÁ, R. DUNÇAN, J. KOPEČEK & J. B. LLOYD	1064
Inhibition of pancreatic enzyme secretion by intracellular EGTA	R. L. DORMER	1065
Calcium translocation in the rough endoplasmic reticulum during stimulation of pancreatic enzyme secretion	A. E. RICHARDSON, G. R. BROWN & R. L. DORMER	1066
Regulation of insulin secretion by human and rat islet-cell tumours	P. R. FLATT & S. K. SWANSTON-FLATT	1067
Preliminary studies on the binding of D-galactosyl- and L-fucosyl- β -bovine serum albumins to rat hepatocytes	R. SHARMA, N. KADERBHAI & D. GRANT	1068
The identification of enterokinase activity in the Golgi complex after its clearance by hepatocytes	D. GRANT, S. SIDDIQUI & J. GRAHAM	1070
Fibroblast β -glucuronidase: receptor-mediated endocytosis of secreted enzyme by other types of cell	M. F. DEAN, B. M. JENNE, S. DIMENT & A. MCNAMARA	1071
Hepatic endosomes contain β -adrenergic receptors but lack adenylate cyclase activity	W. H. EVANS, N. FLINT, N. HADJIIVANOVA, C. DIX & B. COOKE	1072
⁺ H-ATPase is a functional marker for hepatic endosomal membrane vesicles	T. SAERMARK, N. FLINT & W. H. EVANS	1073
Effects of calf serum on pinocytosis and proteolysis in rat yolk sacs	S. FORSTER & K. E. WILLIAMS	1074
The mode of penetration of leupeptin into intact cells	S. A. CLARK & K. E. WILLIAMS	1075
Comparative studies on the endocytosis of proteins in kidney-tubule cells	G. S. VINCE & R. T. DEAN	1076
Relationship between neurotransmitter release and cytosolic free calcium in PC12 cells	T. POZZAN, F. DI VIRGILIO, G. GATTI, N. DOZIO & J. MELDOLESI	1077
Dependence of exocytosis on cytosolic Ca ²⁺ and protein kinase <i>c</i> activation in human neutrophils	F. DI VIRGILIO, P. D. LEW & T. POZZAN	1078
Recycling of NADH pyrophosphatase in rat hepatoma cells	R. J. PEASE, N. D. COOK, G. D. SMITH & T. J. PETERS	1079
The involvement of transglutaminase and polyamines in insulin release from islets of Langerhans	P. J. BUNGAY, J. M. POTTER & M. GRIFFIN	1080
Site of transport of immunoglobulin A in rat salivary glands	C. SANDERSON, C. POWELL, J. PEPPARD, R. H. HINTON & B. M. MULLOCK	1081
Endocytosis of insulin in rat liver leads to non-lysosomal degradation of the hormone	G. D. SMITH, J. R. CHRISTENSEN & T. J. PETERS	1082
The roles of endocytosis and exocytosis in oxygen-radical production by polymorphonuclear leucocytes	M. B. HALLETT & A. K. CAMPBELL	1083
Modification of human erythrocytes by <i>t</i> -butyl hydroperoxide alters their partition behaviour in two-polymer phase systems	P. S. GASCOINE, D. P. PASHBY, C. RICE-EVANS & D. FISHER	1084
The dependence of cell partition in two-polymer aqueous phase systems on the electrostatic potential between the phases	P. S. GASCOINE & D. FISHER	1085

The effect of oral immunization on the uptake of macromolecules by adult rat intestinal columnar epithelium and Peyer's patch tissue <i>in vitro</i>	S. J. BEAHON & J. F. WOODLEY	1087
The uptake of macromolecules by adult rat intestinal columnar epithelium and Peyer's patch tissue <i>in vitro</i>	S. J. BEAHON & J. F. WOODLEY	1088
A cytoskeleton from synaptosomes which is rich in a spectrin-like protein	J. E. HESKETH	1089
Substrate dependency of gastric acid secretion: effect of metabolic substrates on aminopyrine accumulation by rat parietal cells	N. G. ANDERSON, G. P. SHAW & P. J. HANSON	1090
Is mucin secretion from rat submandibular acini triggered by a rise in intracellular Ca ²⁺ concentration	M. A. MCPHERSON & R. L. DORMER	1091
Neurotensin modulation of the plasma insulin response to glucose in obese hyperglycaemic (<i>ob/ob</i>) mice	C. J. BAILEY & P. R. FLATT	1092
Metabolic maps for the Apple II	M. R. WATSON	1093
Microcomputer-controlled collection of haemoglobin-oxygen binding curves	R. A. PENNY & D. A. FELL	1094
Three-dimensional computer graphics on a Sinclair Spectrum	M. J. C. CRABBE	1095
Computer graphic display of a large multisubunit protein: <i>Escherichia coli</i> aspartate transcarbamoylase	E. J. MILNER-WHITE & S. MCLEOD	1097
Microcomputer control of liquid chromatography	C. D. MCFARLAND, S. PRICE, R. A. BROWN & M. J. HARVEY	1098
A microcomputer system for the detection, integration and area apportionment of g.l.c. elution profiles	I. G. GILES	1099
A graphics-based teaching program	N. V. MCFERRAN	1100
A microcomputer implementation of the DIAGON sequence comparison and alignment program	I. G. GILES	1101
Nucleic acid sequencing package for the BBC microcomputer	R. W. WESTLAKE & D. S. ROE	1102
Quantification of cholesteryl sulphate in human faeces	R. W. OWEN & M. H. THOMPSON	1102
Diet and steroid composition in ileostomy fluid	F. FERNANDEZ, H. KENNEDY, E. TODD, S. TRUELOVE & M. HILL	1103
Site of cholesterol degradation in the human gut	J. A. BOYER, D. W. DAY & M. J. HILL	1104
Steroid degradation along the gastrointestinal tract: the use of the cannulated pig as a model system	K. FADDEN, R. W. OWEN, M. J. HILL, E. LATYMER, A. G. LOW & A. N. MASON	1105
The characterization of calpains and calpain inhibitors from chicken gizzard smooth muscle	P. JOHNSON, C. PARKES & A. J. BARRETT	1106
The human glutathione S-transferases: developmental aspects of the GST1 and GST3 loci	B. A. DAVIS, C. G. FAULDER, W. COTTON, A. D. BAIN, R. HUME & R. C. STRANGE	1108
The metabolism of lithocholic acid-3 α -sulphate by <i>Pseudomonas</i> sp. NC18 10590 under anaerobic conditions	R. W. OWEN & R. F. BILTON	1109
Glutathione and glutathione S-transferase levels in mouse bone marrow after cyclophosphamide administration	D. J. ADAMS, J. CARMICHAEL, J. F. SMYTH & C. R. WOLF	1110
Purification and properties of human liver cathepsin L	R. W. MASON & A. J. BARRETT	1111
Comparison of human low-molecular-weight RNA from normal and Crohn's disease derived blood and mesenteric lymph node leucocytes	P. D. BUTCHER, C. M. STRANGE, J. MCFADDEN & J. HERMON-TAYLOR	1112
Metabolism of testosterone by human gingival fibroblasts in culture	M. SOORIYAMOORTHY, W. HARVEY & D. B. GOWER	1113
Steroid metabolism by human axillary bacteria	A. NIXON, P. J. H. JACKMAN, A. I. MALLET & D. B. GOWER	1114
A study of bile salt binding by human liver cytosol	A. J. SCRIVEN, I. A. NIMMO, R. HUME & R. C. STRANGE	1115
The breakdown of gliadin peptides by rat intestinal brush-borders <i>in vitro</i>	G. BRUCE & J. F. WOODLEY	1116
Characterization of the human thyroid microsomal antigen involved in the thyroid autoimmunity	J. P. BANGA, G. PRYCE, L. HAMMOND & I. M. ROITT	1118
Activation of carbonic anhydrase III by active-site modification	W. R. CHEGWIDDEN, D. HEWETT-EMMETT & R. E. TASHIAN	1119
An enzyme-linked immuno-adsorbent assay for the quantification of neurofilament protein levels in cell cultures initiated from human foetal nervous tissue	P. DOHERTY, J. G. DICKSON & F. S. WALSH	1120

Development of choline acetyltransferase activity in motor neuron-enriched primary cultures of chick embryo spinal cord	T. P. FLANIGAN, J. G. DICKSON & F. S. WALSH	1122
Subcellular localization of esterase, lipase and sulphatase activities in human neutrophils	N. J. HACK, G. P. SMITH & T. J. PETERS	1123
Ca ²⁺ -mobilizing hormones increase Ca ²⁺ influx in isolated rat hepatocytes	J.-P. MAUGER, J. POGGIOLI, F. GUESDON & M. CLARET	1123
Cytosolic Ca ²⁺ variations induced by specific receptor-mediated stimulation in male and female rat hepatocytes	A. BINET, B. BERTHON & M. CLARET	1124
Inhibition of phospholipase A ₂ by serum albumin	S. FORSTER, E. ILDERTON, R. SUMMERLY & H. J. YARDLEY	1125
Inosine-induced vasoconstriction and glucose secretion in the perfused rat liver	R. J. SHARMA & J. R. GRIFFITHS	1126
Maternofetal transmission of immunoglobulin G: an approach <i>in vitro</i>	L. C. W. SEYMOUR & K. E. WILLIAMS	1128
Influence of proliferation of cultivated endothelial and smooth-muscle cells on activities and expression of glycosyltransferase	P. VISCHER & E. BUDDECKE	1129
Analysis of keto compounds in blood by high-performance liquid chromatography	T. G. VICKERS & R. A. OWEN	1130
Azurin from <i>Pseudomonas putida</i> : an electron acceptor for <i>p</i> -cresol methylhydroxylase	M. J. CAUSER, D. J. HOPPER, W. S. McINTIRE & T. P. SINGER	1131
Effect of toxaphene on photosynthetic electron flow in susceptible cereals	S. AKBAR & L. J. ROGERS	1132
Amino acid sequence of <i>Rhodymenia palmata</i> ferredoxin	K. INOUE, T. HASE, H. MATSUBARA, M. P. FITZGERALD & L. J. ROGERS	1133
Minor faecal bile acids and large-bowel cancer	R. WAIT & M. H. THOMPSON	1134

Transport of Proteins, Ions and Electrons Through Mitochondrial Membranes

Biochemical Society/International Union of Biochemistry Joint Symposium organized and edited by S. Doonan and J. J. A. Heffron (Cork) and L. Packer (University of California)

Import of mitochondrial proteins

MATTHEW A. HARMEY* and
WALTER NEUPERT†

**Department of Botany, University College, Dublin, Ireland,*
and †*Institut für Biochemie, Georg-August Universität,*
Göttingen, West Germany

Most mitochondrial proteins are encoded in the nuclear genome and are translated on the cytoplasmic ribosomes in the form of precursors (Neupert & Schatz, 1981). These precursors are synthesized mainly on free ribosomes and run off to form a cytosolic pool, from which they are transferred into the mitochondria (Zimmermann *et al.*, 1979; Freitag *et al.*, 1982a; Schatz & Butow, 1983). The pool sizes for individual precursors are characteristically very small and are quite difficult to detect. Recent studies using uncouplers have, however, made possible the demonstration of cytosolic pools for quite a number of mitochondrial proteins (Reid & Schatz, 1982; Schmidt *et al.*, 1983a). In yeast cells, in particular, it has been possible to accumulate substantial quantities of precursor (Reid & Schatz, 1982).

The overall process of import may be dissected into a number of distinct but concatenated steps: (I) mitochondrial recognition of precursors; (II) translocation of the precursor across the mitochondrial membranes; (III) processing of precursor protein; (IV) assembly to multimeric complexes.

Recognition of precursor is mediated by receptors in the mitochondrial outer surface. The recognition is specific in that it discriminates between precursor and mature forms of individual proteins. When mitochondria are treated with trypsin, they no longer bind precursors, an observation which suggests that the recognition factors are surface proteins of the outer membrane. When *Neurospora* mitochondria were incubated in the presence of apocytochrome *c* and holocytochrome *c*, the apo form was selectively imported. The presence of a large excess of the holocytochrome did not decrease the import of the apoprotein (Korb & Neupert, 1978). The binding of the precursor can only be effectively demonstrated when the further progress of the precursor is inhibited. With apocytochrome *c*, addition of deuterohaemin prevents import, but does not hinder binding (Hennig & Neupert, 1981). For the ADP/ATP carrier and subunit 9 of ATPase, depletion of the membrane potential may be used to achieve arrest at the binding stage (Schleyer *et al.*, 1982; Schmidt *et al.*, 1983a). The bound precursor can be exchanged for precursor, but not for the mature protein (Hennig & Neupert, 1981). The precursors bind in a saturable manner, and for apocytochrome *c* Scatchard plots have indicated the presence of high-affinity receptors with a frequency of 90 pmol/mg of mitochondrial protein (Hennig *et*

al., 1983). It is not known, however, whether each individual protein has a specific receptor protein. The electrophoretic profiles of the outer membrane would not support such a view, and further, there is evidence from competition studies that a number of precursors compete for both binding and import. On the other hand, the receptor for apocytochrome *c* is highly specific. A partially purified receptor has been isolated and inserted into liposomes, where it shows the same high affinity and specificity as in the intact mitochondria (H. Koehler, B. Hennig & W. Neupert, unpublished work). When inhibition of import was removed from mitochondria to which precursors had been bound, the bound precursors were directly imported without intermediate displacement (Zwizinski *et al.*, 1983). It appears that the receptors not only sort the precursors but also steer them to the next stage of the import process.

In general the transfer of precursor from the bound state, in which it is accessible to added proteinases, into the mitochondria, where it becomes inaccessible to added proteinase, requires an electrical transmembrane potential (Schleyer *et al.*, 1982). The electrical potential may be generated by the addition of ATP, but it has been convincingly demonstrated that it is the membrane potential and not the ATP, in itself, which is the requirement. The exact role of the membrane potential is unclear. It is not known whether the potential is needed to provide energy for the transport, or if it triggers the transmembrane movement with attendant conformational changes in the incoming proteins. The transport of all precursors does not require a membrane potential; notable exceptions are apocytochrome *c* and the precursor to the outer-membrane protein porin (Freitag *et al.*, 1982b; Zimmermann *et al.*, 1981). Neither of these precursors has to insert into, or cross, the inner membrane, which is the site of the membrane potential; hence they have no need of an energy source.

The transfer of many precursors is accompanied by a proteolytic processing step (Daum *et al.*, 1982). The processing is carried out by a matrix-located metalloenzyme which cleaves the precursor to the mature size. The proteinase can be inhibited by chelators without inhibiting the import process, so that one can differentiate between transport and proteolysis, although these processes are linked *in vivo* (C. Zwizinski & W. Neupert, unpublished work). A matrix-located enzyme which is not synthesized as a higher-molecular-weight precursor has recently been described, an observation which reinforces the separateness of transport and proteolytic processing (Hampsey *et al.*, 1983). This observation also is in accord with the observed behaviour of proteins such as the ADP/ATP carrier, which is not synthesized as a larger precursor, but which requires a mem-

brane potential for transfer and insertion into the inner membrane.

A few precursor proteins are processed in two steps; cytochrome c_1 is such a case (Gasser *et al.*, 1982; Teintze *et al.*, 1982). The first step is by the matrix proteinase. The second, haeme-dependent, cleavage is effected by a proteinase which is apparently independent of a membrane potential, is not inhibited by chelators, and appears to be located at or near the outer face of the inner membrane. The intermediate form can be seen in cells pulse labelled at 8°C. The conversion of the intermediate into mature form can also be followed in mitochondria from cells labelled at 8°C. The proteolytic processing and its requirements for a membrane potential in intact mitochondria can be attributed to the location of the proteinase in the mitochondrial matrix. All polypeptides requiring proteolytic cleavage must therefore traverse the inner membrane, in part at least, and thus require a membrane potential to do so.

The final step in the transport process, i.e. assembly of the imported subunits into functional complexes, and the factors controlling this step have not been extensively studied. There is evidence of an interaction between availability of subunits in mitochondria and those supplied by the cytosolic system (von Rucker & Neupert, 1976; Lustig *et al.*, 1982). On the other hand there is evidence to show the absence of a close coupling between the supply of subunits from cytosol and mitochondria in the assembly of the cytochrome bc_1 complex in *Neurospora* (Weiss & Kolb, 1979). In this context it has been shown that *in vitro* imported ADP/ATP carrier displays the characteristics of the assembled mature complex (M. Schleyer & W. Neupert, unpublished work). Import of subunit 9 of the ATPase results in incorporation of precursor into an immunoprecipitable ATPase complex (Schmidt *et al.*, 1983a). These latter two proteins may provide models to study the assembly process further.

The import mechanism is specific for recognition and import of mitochondrial precursors. When mRNA from *Neurospora crassa* is translated in rabbit reticulocyte lysates, the post-ribosomal supernatant contains a mixture of proteins. Mitochondria will selectively import mitochondrial-specific proteins from this heterogeneous protein mixture. The recognition system is, however, also capable of recognizing precursor proteins from unrelated species, as shown by import studies with subunit 9 of the ATPase. *Neurospora* subunit 9 is imported by yeast mitochondria from a reticulocyte lysate supernatant, programmed with *Neurospora* message, and furthermore is correctly processed by a matrix protease (Schmidt *et al.*, 1983b). In yeast this subunit

is coded in the mitochondrial DNA and is translated on mitochondrial ribosomes (Tzagoloff & Meagher, 1972). A similar situation has been described for mammalian tissues, where mitochondria from tissues which do not produce ornithine transcarbamoylase can nonetheless import and correctly process the precursor (Morita *et al.*, 1982). It appears therefore that the recognition, translocation and proteolytic processing mechanisms are highly conserved during eukaryotic evolution.

- Daum, G., Gasser, S. & Schatz, G. (1982) *J. Biol. Chem.* **257**, 13075–13080
- Freitag, H., Janes, M. & Neupert, W. (1982a) *Eur. J. Biochem.* **126**, 197–202
- Freitag, H., Neupert, W. & Benz, R. (1982b) *Eur. J. Biochem.* **123**, 629–636
- Gasser, S., Ohashi, A., Daum, G., Böhni, P., Gibson, J., Reid, G., Yonetani, T. & Schatz, G. (1982) *Proc. Natl. Acad. Sci. U.S.A.* **79**, 267–271
- Hampsey, M., Levin, A. & Kolnow, G. (1983) *Proc. Natl. Acad. Sci. U.S.A.* **80**, 1270–1274
- Hennig, B. & Neupert, W. (1981) *Eur. J. Biochem.* **121**, 203–212
- Hennig, B., Koehler, H. & Neupert, W. (1983) *Proc. Natl. Acad. Sci. U.S.A.* **80**, 4963–4967
- Korb, H. & Neupert, W. (1978) *Eur. J. Biochem.* **91**, 609–620
- Lustig, A., Padmanaban, G. & Rabinowitz, M. (1982) *Biochemistry* **21**, 309–316
- Morita, T., Miura, S., Mori, M. & Tatibana, M. (1982) *Eur. J. Biochem.* **122**, 501–509
- Neupert, W. & Schatz, G. (1981) *Trends Biochem. Sci.* **6**, 1–4
- Reid, G. & Schatz, G. (1982) *J. Biol. Chem.* **257**, 13056–13061
- Schatz, G. & Butow, R. (1983) *Cell* **32**, 316–318
- Schleyer, M., Schmidt, B. & Neupert, W. (1982) *Eur. J. Biochem.* **125**, 109–116
- Schmidt, B., Hennig, B., Zimmermann, R. & Neupert, W. (1983a) *J. Cell Biol.* **96**, 248–255
- Schmidt, B., Hennig, B., Koehler, H. & Neupert, W. (1983b) *J. Biol. Chem.* **258**, 4687–4689
- Teintze, M., Slaughter, M., Weiss, H. & Neupert, W. (1982) *J. Biol. Chem.* **257**, 10364–10371
- Tzagoloff, A. & Meagher, P. (1972) *J. Biol. Chem.* **247**, 594–603
- von Rucker, A. & Neupert, W. (1976) in *Genetics and Biogenesis of Chloroplasts and Mitochondria* (Bücher, Th., Neupert, W., Sebald, W. & Werner, S., eds.), pp. 231–238, North-Holland, Amsterdam
- Weiss, H. & Kolb, H. (1979) *Eur. J. Biochem.* **99**, 139–149
- Zimmermann, R., Paluch, U. & Neupert, W. (1979) *Eur. J. Biochem.* **99**, 247–252
- Zimmermann, R., Hennig, B. & Neupert, W. (1981) *Eur. J. Biochem.* **116**, 455–460
- Zwizinski, C., Schleyer, M. & Neupert, W. (1983) *J. Biol. Chem.* **258**, 4071–4074