

Appendix 1

Locations of UK biotechnology companies, public centres of research excellence and pharmaceutical industry R&D and manufacturing sites

Location of UK specialist biotechnology companies



Source: Based on Ernst & Young 1999

Appendix 1

Locations of UK biotechnology companies, public centres of research excellence and pharmaceutical industry R&D and manufacturing sites

Public centres of research excellence relating to biotechnology

i) RAE rating of disciplines impacting on biotechnology⁽¹⁾

Institution	1996 Rating	Flagged Research Groups
Clinical Laboratory Sciences⁽²⁾		
Institute of Cancer Research	5*	
Royal Postgraduate Medical School	5*	
University of Oxford – Dunn School of Pathology	5*	
Institute of Cancer Research	5	
London School of Hygiene & Tropical Medicine	5	Parasite Chemotherapy and Molecular Diversity (Biochemistry and mode of drug action); Clinical Epidemiology and Control (Entomology – control of malaria vectors)
University of Birmingham	5	
University of Cambridge	5	
University of Oxford – Clinical Laboratory Sciences	5	
Imperial College of Science, Technology and Medicine	4	Immunology; Bacterial Pathogenicity
Royal Free Hospital School of Medicine	4	
University College London	4	Magnetic Resonance; Near Infrared Spectroscopy
University of Bristol	4	Immunology
University of Dundee	4	Molecular and Environmental Toxicology
University of Edinburgh	4	Human Genetics Group; Human Cancer Biology Group; Cell and Tissue Injury Group
University of Glasgow	4	Parasite Immunology; FC Receptors Group
University of Southampton	4	Human Genetics
University of Wales School of Medicine	4	Biochemical Immunology; Medical Genetics
University Aberdeen	3a	Medical Genetics; Biomedical Physics and Bio-Engineering
University of Leeds	3a	Molecular Medicine (inc Histopathology)
University of Leicester	3a	Microbial Pathogenicity

⁽¹⁾ Centres of excellence as those departments rated 5*, 5, or 4

⁽²⁾ 3a rated departments included as centres of excellence

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Institution	1996 Rating	Flagged Research Groups
University of Liverpool	3a	Microbiology (snake venom); Parasitology and Entomology (insect immunity and molecular genetics); Reproductive Immunology Group
University of Newcastle	3a	Human Genetics; Clinical Genetics 5* rated
University of Nottingham	3a	Haematology

Pre-clinical studies

Imperial College of Science, Technology and Medicine	5	
King's College London	4	Developmental Biology; Allergy and Asthma
St George's Hospital Medical School	4	
United Medical and Dental Schools	4	Developmental Neurobiology; Cardiovascular Research Group
University of Manchester	4	Cell-Cell Interactions

Physiology

University of Liverpool	5*	
University of Bristol	5	
University of Cambridge	5	
University of Newcastle upon Tyne	5	
University of Oxford	5	
University College London / Royal Free Hospital School of Medicine	4	Exocytosis and Cell Signalling; Transmitter Transport Processes
University of Birmingham	4	

Pharmacology

University College London / Royal Free Hospital School of Medicine	5*	
University of Leicester	5*	
University of Bristol	5	
University of Cambridge	5	
University of Liverpool	5	
University of Oxford	5	
Queen Mary and Westfield College	4	
University of Dundee	4	

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Institution	1996 Rating	Flagged Research Groups
University of Edinburgh	4	Systems Neuroscience
University of Nottingham	4	

Pharmacy

University of Nottingham	5*	
Institute of Cancer Research	5	
School of Pharmacy	5	
University of Bath	5	
University of Manchester	5	
University of Wales, Cardiff	5	
King's College London	4	
University of Strathclyde	4	

Other studies and professions allied to medicine

University of Southampton – Nutrition	5*	
University of Strathclyde	5*	
University of Ulster – Biomedical Sciences	5*	
Loughborough University	5	
University of Surrey – Toxicology	5	
University of Wales, Cardiff	5	
Aston University	4	
King's College London – Gerontology	4	
King's College London – Nutrition	4	
Napier University	4	
Sheffield Hallam University – Biomedical Sciences	4	
UMIST	4	
University of Bradford – Biomedical Sciences	4	
University of Bradford – Optometry	4	
University of Glasgow	4	
University of Greenwich	4	
University of Portsmouth	4	
University of Surrey – Nutrition	4	

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Institution	1996 Rating	Flagged Research Groups
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Biochemistry⁽²⁾

University of Cambridge	5*	
University of Dundee	5*	
University of Oxford	5*	
Imperial College of Science, Technology and Medicine	5	
University College London/Royal Free Hospital School of Medicine	5	
University of Birmingham	5	
University of Bristol	5	
University of Glasgow	5	
University of Leeds	5	
University of Leicester	5	
University of Manchester	5	
University of Newcastle upon Tyne	4	
University of Nottingham	3a	

Biological sciences⁽²⁾

Institute of Cancer Research	5*	
University of Cambridge – Genetics	5*	
University of Cambridge – Zoology	5*	
University of Nottingham – Genetics	5*	
Birkbeck College – Crystallography	5	
Imperial College of Science, Technology and Medicine	5	
UMIST	5	
University College London	5	
University of Bath	5	
University of Cambridge – Biotechnology	5	
University of East Anglia	5	
University of Edinburgh	5	
University of Glasgow – Molecular Genetics	5	

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Institution	1996 Rating	Flagged Research Groups
University of Leicester – Genetics	5	
University of Oxford – Zoology	5	
University of Sussex	5	
University of Warwick	5	
University of York	5	
Cranfield University	4	
Institute of Zoology	4	
Lancaster University	4	
Queen Mary and Westfield College	4	
University of Birmingham	4	
University of Bristol	4	
University of Cambridge – Plant Sciences	4	
University of Essex	4	
University of Glasgow – Functional Ecology	4	
University of Glasgow – Infection and Immunity	4	
University of Kent at Canterbury	4	
University of Leeds	4	
University of Leicester – Botany and Zoology	4	
University of Liverpool	4	
University of Manchester	4	
University of Nottingham – Life Science	4	
University of Oxford – Plant Sciences	4	
University of Sheffield	4	
University of Southampton	4	
University of St Andrews	4	
Brunel University	3a	
Keele University	3a	
King's College London	3a	
Open University	3a	
Oxford Brookes University	3a	
The Queen's University of Belfast	3a	
University College of North Wales	3a	

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Institution	1996 Rating	Flagged Research Groups
University College of Swansea	3a	
University of Aberdeen	3a	
University of Dundee	3a	
University of Durham	3a	
University of Exeter	3a	
University of Portsmouth	3a	
University of Reading	3a	
University of Stirling	3a	
University of Surrey	3a	
University of Wales, Cardiff	3a	
University of Wales, Aberystwyth ⁽³⁾	2	Microbial Physiology; Analytical Biotechnology

Agriculture

University of Reading – Plant Science	5*	
The Queen's University of Belfast	5	
University of Edinburgh	5	
University of Newcastle upon Tyne	5	
University of Nottingham	5	Animal Science
Natural Resources Institute	4	
University College of North Wales	4	
University of Aberdeen	4	
University of Leeds	4	
University of Reading – Agriculture, Soil Science, Agricultural Economics and Management	4	Centre for Dairy Research
University of Stirling	4	
Cranfield University ⁽³⁾	3a	
University of Exeter ⁽³⁾	3a	
Wye College, University of London ⁽³⁾	3a	Plant Molecular Biology

⁽³⁾ Included because department contains groups of excellence impacting on biotechnology

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Institution	1996 Rating	Flagged Research Groups
Food science and technology		
University of Leeds	5*	
University of Nottingham	5*	
Heriot-Watt University	4	
The Queen's University of Belfast	4	
University of Reading	4	
University of Surrey	4	
Veterinary Science		
Royal Veterinary College	4	Reproduction; Musculoskeletal Pathobiology
University of Bristol	4	Muscle and Connective Tissue Biology
University of Cambridge	4	Neurology: Infection and Immunity
University of Edinburgh	4	Physiology; Clinical and Molecular Immunology
University of Glasgow	4	Parasitology; Pathology
University of Liverpool	4	Cell Physiology
Environmental sciences		
University of East Anglia	5*	
University of Reading	5*	
Lancaster University	5	
University of Southampton	5	
Imperial College of Science, Technology and Medicine	4	
University College of North Wales	4	
University of Edinburgh	4	

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Locations of UK biotechnology companies, public centres of research excellence and pharmaceutical industry R&D and manufacturing sites

ii) RAE ratings of disciplines interfacing with biotechnology⁽¹⁾

Institution	1996 Rating	Flagged Research Groups
Chemistry		
University of Cambridge	5*	
University of Oxford	5*	Small molecules
University of Edinburgh	5	
University of Exeter	4	
University of St Andrews	4	
University of Strathclyde	4	
University of York	4	
Computer science departments with bioinformatics capability		
University of York	5*	
University of Manchester	5	
University of Edinburgh	5	
University of Nottingham	5	
University of Aberdeen	4	
University of East Anglia	4	
University of Reading	4	
University of Sheffield	4	
University of Wales, Aberystwyth	4	
University of Wales, Cardiff	4	
University of York	4	
Chemical engineering		
Imperial College of Science, Technology and Medicine	5*	Biochemical engineering
University College London	5	Biochemical engineering
University of Bath	5	Biochemical engineering
University of Birmingham	5	Biochemical engineering

⁽¹⁾ Departments with groups interfacing with biotechnology

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Locations of UK biotechnology companies, public centres of research excellence and pharmaceutical industry R&D and manufacturing sites

iii) UK centres of research excellence in biotechnology not included in RAE

Institution	Region	Area
BBSRC institutes		
Babraham Institute	Cambridge	Animal models
Roslin Institute	Roslin, Edinburgh	Animal models, transgenics, applied genomics
Institute of Animal Health	Newbury	Animal Biology; infectious disease, pathogenesis
John Innes Centre	Norwich	Plant genomics and disease
Institute of Grassland & Environmental Research	Aberystwyth, Brecon and Okehampton	Grassland-related agriculture
Institute of Food Research	Norwich	Food safety, quality, nutrition and health
Institute of Arable Crop Research	Rothamsted, Long Ashton and Broom's Barn	Plant genomics
MAFF institutes		
Central Science Laboratory (CSL)	York and Norwich	Advice, technical & enforcement support, underpinned by appropriate R&D to underpin food safety
Horticulture Research Institute	Warwick and East Malling	R&D and transfer to horticultural industry
Royal Botanic Gardens	Kew and Edinburgh	
Scottish Executive institutes		
Hannah Research Institute	Ayr	
Moredun Research Institute	Moredun, Edinburgh	Animal health/welfare
Rowett Research Institute	Rowett, Aberdeen	Nutrition
Scottish Crop Research Institute	Dundee	
NERC institutes		
Institute of Freshwater Ecology	Ambleside	
Institute of Terrestrial Ecology	Huntingdon	
Institute of Virology and Environmental Microbiology	Oxford	

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Institution	Region	Area
MRC institutes/units		
MRC/BBSRC Neuropathogenesis Unit	Edinburgh	TSE
MRC Biostatistics Unit	Cambridge	
MRC Cell Mutation Unit	Brighton	
MRC Centre for Molecular Medicine	Oxford	
MRC Clinical Sciences Centre, Hammersmith Hospital	London	Genetics
MRC Environmental Epidemiology Unit	Southampton	
MRC Functional Genetics Unit	Oxford	
MRC Human Biochemical Genetics Unit	London	
MRC Human Genetics Unit	Edinburgh	Genetics
MRC Human Genome Mapping Resource Centre and Gene Function Unit	Cambridge	Sequencing /functional studies
MRC Laboratory of Molecular Biology	Cambridge	
MRC Mammalian Genetics Unit	Harwell	
MRC Molecular Haematology Unit	Oxford	
MRC Mouse Genome Centre	Harwell	
MRC National Institute for Medical Research	London	
MRC Protein Phosphorylation Unit	Dundee	
MRC Toxicology Unit	Leicester	
Other Government research centres		
Centre for Applied Microbiology & Research	Porton Down, Salisbury	Infectious diseases/vaccines
Chemical & Biological Defence Establishment (DERA)	Porton Down, Salisbury	
Multi-funded research centres		
International Centre for Life (Millennium Commission/Tyne & Wear Development Corporation/EC/the Wellcome Trust)	Newcastle	Genetics
The Edward Jenner Institute for Vaccine Research (MRC/BBSRC/DH/Glaxo Wellcome)	Newbury	Vaccines

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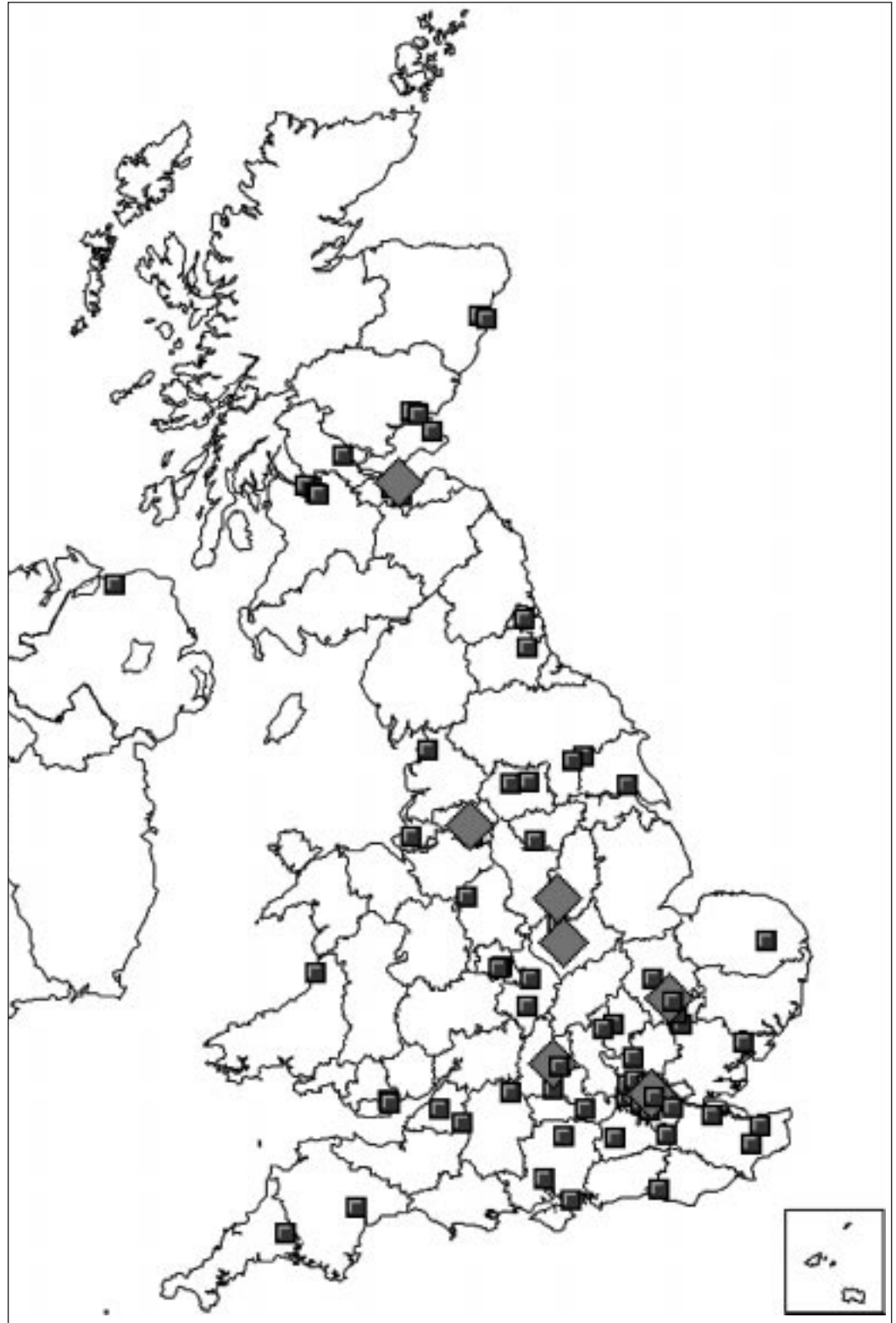
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Institution	Region	Area
Charities		
Arthritis Rheumatism Council		
Beatson Institute	Glasgow	Cancer research
British Diabetic Association		
British Heart Foundation		
Gray Laboratory	London	Cancer research
Imperial Cancer Research Fund	London	Cancer research
Institute of Cancer Research/ Royal Marsden	London	Cancer research
Leukaemia Research Trust	London	
Lister Research Institute	London	Infectious disease
Ludwig Institute	London	Cancer research
Marie Curie	Surrey	
Paterson Institute	Manchester	Cancer research
Wellcome Research Trust	London	Infectious disease
Genomic centres		
European Bioinformatics Institute	Cambridge	
Nottingham Arabdopsis Stock Centre	Nottingham	Plants
Sanger Centre	Cambridge	Prokaryotic genomes (include M tuberculosis) Eukaryotic genomics Human Chromosome X, 1,6,20,22
UMDS Guy's & St Thomas'	London	Human genetics
Wellcome Trust Human Genetics Centre	Oxford	

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Public centres of research excellence relating to biotechnology



- = All centres
- ◆ = University with 3 or more 5 or 5* departments in disciplines relating to biotechnology

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Locations of UK biotechnology companies, public centres of research excellence and pharmaceutical industry R&D and manufacturing sites

Principal pharmaceutical industry R&D and manufacturing (M) sites in the UK

SmithKline Beecham:

Harlow, Essex – R&D
Worthing, W.Sussex – M
Irvine, Ayrshire – M
Crawley, W.Sussex – M

Glaxo Wellcome:

Stevenage, Herts – R&D
Greenford, Middlesex – R&D + M
Beckenham, Kent – R&D
Ware, Herts – M
Dartford, Kent – M
Barnard Castle, Co. Durham – M
Ulverston, Cumbria – M
Montrose, Angus – M
Speke, Merseyside – M

AstraZeneca:

Alderley Park, Macclesfield – R&D + M
Brixham, Devon – R&D
Avlon Works – Severnside, Bristol – M
Grangemouth, Scotland – M
Charnwood, Loughborough – R&D
Corby, Cambridgeshire – M

Eli Lilly & Co.:

Basingstoke, Hants – M
Windlesham, Surrey – R&D
Speke, Merseyside – M

Roche:

Welwyn Garden City, Herts – R&D + M

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Locations of UK biotechnology companies, public centres of research excellence and pharmaceutical industry R&D and manufacturing sites

Merck Sharp & Dohme:

Hoddesdon, Herts – R&D (*Development*)

Terlings Park, Essex – R&D (*Research*)

Cramlington, Northumberland – M

Ponders End, Middlesex – M

Hoechst (Hoechst Marion Roussel) (*discounting imminent merger with Rhone-Poulenc to create Aventis*)

Swindon, Wilts – M

Milton Keynes – M

Novartis:

Institute for Medical Sciences, University College London – R&D

Horsham, W.Sussex – R&D + M

Bristol-Myers Squibb:

Moreton, Merseyside – R&D

Bayer plc:

Stoke Court, Stoke Poges, Slough – R&D

Abbott Laboratories:

Queenborough, Kent – M (*plus small R&D facility*)

Rhone-Poulenc: (*discounting imminent merger with Hoechst to create Aventis*)

West Malling, Kent – R&D + M

Dagenham, Kent – R&D

Holmes Chapel, Cheshire – R&D (*Development*)

Pfizer:

Sandwich, Kent – R&D + M

American Home Products (Wyeth-Ayerst/Whitehall Laboratories):

Havant, Hants (Wyeth-Ayerst) – M

Havant, Hants (Whitehall Laboratories) – R&D

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Locations of UK biotechnology companies, public centres of research excellence and pharmaceutical industry R&D and manufacturing sites

Monsanto (Searle):

Morpeth, Northumberland – M

BASF (Knoll):

Beeston, Notts – R&D + M

Cramlington, Northumberland – M

Medeva:

Ashton-under-Lyne, Manchester – M

Speke, Merseyside – M

Organon:

Newhouse, Scotland – R&D

Boehringer Ingelheim:

Bracknell, Berks – M

Sanofi-Synthelabo:

Fawdon, Newcastle – M

Alnwick, Northumberland – R&D + M

Yoshitomi:

Glasgow – R&D

Eisai:

University College London – R&D

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Locations of UK biotechnology companies, public centres of research excellence and pharmaceutical industry R&D and manufacturing sites

Principal pharmaceutical industry R&D and manufacturing sites



- Manufacturing site
- R&D site

Appendix 2

Contributors to the report

DTI would like to thank all those who took part in specific discussion groups to develop our thinking (listed below) and also very many others whose presentations at conferences and seminars inspired and informed this work. We also want to thank those who submitted papers to us.

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Appendix 3

Acronyms

BBSRC	Biotechnology and Biological Sciences Research Council
BIA	BioIndustry Association
BIVDA	British In Vitro Diagnostics Association
CAP	Common Agricultural Policy
CGT	Capital Gains Tax
DNA	Deoxyribonucleic Acid
DTI	Department of Trade and Industry
EMEA	European Medicines Evaluation Agency
EU	European Union
FDA	Food and Drug Administration (US)
GAV	Gross Added Value
GCSE	General Certificate of Secondary Education
GDP	Gross Domestic Product
GM	Genetically Modified
GMP	Good Manufacturing Practice
GPs	General Practitioners
HEIs	Higher Education Institutes
IP	Intellectual Property
IPO	Initial Public Offering
IT	Information Technology
LREC	Local Research Ethics Committee
MCA	Medicines Control Agency
MRC	Medical Research Council
MREC	Multi-Centre Research Ethics Committee
NERC	National Environment Research Council

Appendix 3

Acronyms

NGOs	Non-Governmental Organisations
NHS	National Health Service
NICE	National Institute for Clinical Excellence
OECD	Organisation for Economic Co-operation and Development
R&D	Research and Development
S&T	Science and Technology
SMART	Small Firms Merit Award for Research and Technology
SMEs	Small & Medium sized Enterprises
SNP	Single Nucleotide Polymorphisms
VCTs	Venture Capital Trusts
WTO	World Trade Organisation

Appendix 4

Glossary

Antibodies – These are part of the immune system, and are produced to help fight against infection. Antibodies are made by a type of blood cell called a lymphocyte, and are tailor-made in response to foreign material entering the body; this means that a new and specific antibody is made for each new antigen, the part of the foreign protein which provokes the immune response. Blood contains many different antibodies.

Antigen – A protein or part of a protein which provokes an immune response.

Assay – A chemical test to 'look for', and measure the amount of, a specific chemical in a mixture of ingredients.

Bioassay – A test to measure something using a living system – for example the metabolism of bacteria can be used to measure the levels of oxygen in water.

Bioinformatics – The organisation and use of information on biological and molecular subjects. This includes: organising biomolecular databases; managing the quality of data input; getting useful information out of such databases; and integrating information from disparate sources. One application of bioinformatics is to bring together gene-sequence data with that about the physiological functions of the proteins whose production they stimulate. Investigations of three dimensional protein structures and high throughput screening in drug discovery are creating demands for huge databases.

Biopharmaceuticals – Medicines made by biological processes rather than by chemical synthesis. Many medicines developed using recombinant DNA techniques are termed biopharmaceuticals.

Bioremediation – The use of biological systems, usually micro-organisms, to clean up a contaminated site.

Biosensors – Devices which use a biological component as an essential part of a sensor.

Chromosome – Structures into which DNA is packaged.

Cloning – A clone is a group of genetically identical organisms. Many plants are easily cloned; they can be grown from cuttings. Higher animals are more difficult to clone; the only cells in mammals which are capable of growing naturally into a new mammal are fertilised egg cells or cells from very early embryos – up to the stage where the embryo consists of just eight cells. ('Dolly' represented such a major breakthrough because a sheep was 'cloned' by making an ordinary body cell reproduce itself, by injecting the nucleus of the cell into a fertilised egg from which the nucleus had been removed).

Culture collections – Storage facilities for samples of micro-organisms and cell lines. They provide access to research groups to obtain and use the same organism. They also provide a depository for patented organisms, e.g. American Type Culture Collection (ATCC) which collects all types (i.e. definitive specimens) of micro-organisms and cell lines. The European Central Animal Cell Culture facility (ECACC) is at Porton Down.

DNA – Deoxyribonucleic acid, the chemical which in most organisms contains the genetic code. DNA is made up of four sub-units (referred to as bases) called adenine, guanine, cytosine and thymine – A, G, C, T. The DNA molecule is made up of two strands winding round each other – the double helix. A always pairs with T, and C with G.

DNA sequencing – see *Gene sequencing*.

Enzyme – A catalytic protein which is necessary for a particular chemical process to take place in a living cell. Many different types of enzyme can be extracted and used in manufacturing and production, including those used in detergents (proteases and lipases – enzymes which break down proteins and fats), in the dairy industry (e.g. chymosin, in cheese making) and in food processing.

Fermentation – Strictly speaking, this refers to the growth of micro-organisms in the absence of air, traditionally used for the production of beer, wine and leavened products such as bread. The term is now used to cover the growth of micro-organisms in liquid under a wide range of conditions.

Functional genomics – The use of biological experiments and database searches to establish what the different sequences in a gene actually do, e.g. what protein/enzyme is produced and what it does in the body when a particular gene sequence is activated. Some gene sequences have a controlling function – switching on and off other parts of the DNA.

Gene – A section of DNA which codes for a defined biochemical function (such as the production of a particular protein). The number of genes varies from species to species; humans contain about 100,000 genes.

Genetic modification – The production of new combinations of genetic material, usually by transferring a specific sequence of DNA into an organism in which it does not naturally occur.

Gene sequencing – Finding out the order of the four sub-units of DNA (adenine, guanine, cytosine and thymine), to determine its primary structure.

Gene therapy – Changing either the ‘germ cells’ (i.e. the sperm or eggs) which will have a permanent effect on the individual and any resultant offspring, or changing processes in the cells of an adult by introducing new DNA into the cells (somatic cell gene therapy), which only affects the individual. Bone marrow therapy, through which cells reproduce in the bone marrow to create changed blood cells (without disease) is an example of somatic gene therapy. Treatments designed to destroy tumours using gene therapy are under development.

Genome – The total set of genes in an organism or species. The human genome consists of about 3 billion DNA bases coding for about 100,000 genes, packaged in 23 pairs of chromosomes.

GMO – see *Recombinant DNA technology*.

High throughput screening – An approach for finding new drugs which looks for chemicals which act on a particular enzyme or other molecule. For example, if a chemical inactivates an enzyme, it might prove to be effective in preventing a process in a cell which causes a disease. High throughput methods enable researchers to try out thousands of different chemicals against each 'target' very quickly, using robotic handling systems and automated analysis of results.

In vitro – Literally 'in glass' this means living processes outside a living system (e.g. in vitro fertilisation).

In vivo – In the living system, for example in a living animal.

Lipases – Enzymes which break down fats (lipids) into their components.

Metabolism – The chemistry inside all living organisms, which turns inputs (food, water, oxygen, sunlight, etc.) into new cells or parts of the body, and enables it to grow and stay healthy.

Micro-organisms – Usually single-celled organisms which are so small that they can only be seen under a microscope. They include bacteria, yeasts, moulds and simple animals and plants.

Monoclonal antibodies – Made by growing large numbers of a single lymphocyte producing a specific antibody. The antibodies produced are therefore all the same, and they will bind to just one specific antigen. This makes them very useful as a means of identifying proteins. Monoclonal antibodies are used in diagnostics and in purifying useful proteins from mixtures. They are being developed to deliver medicines to specific cells in the body (e.g. for cancer treatment).

Mutation – A mutation is a change in the basic primary structure of the DNA of an organism (e.g. where one or more sub-units is changed, deleted or added). The effect of a mutation depends on where it takes place.

Orphan drug – A drug to treat a relatively rare disease, where the small numbers of patients involved mean that it will not be possible to recover the development and registration costs normally associated with bringing a new medicine to market.

Polymerase chain reaction – A method to produce sufficient DNA for analysis from a very small amount of DNA. The method was invented by Kary Mullis in 1985 and he was awarded the Nobel Prize for Chemistry for this work in 1993.

Proteins – Proteins are one of the products that genes code for. They are made of chains of amino acids folded into complex three dimensional structures. It is this structure that helps determine their function.

Proteomics – The study of gene activity by looking for the entire range of proteins which are produced by a particular gene, genome or cell.

Recombinant DNA technology – The set of techniques which enables DNA from different sources to be identified, isolated, and recombined, so that new characteristics can be introduced into an organism. An organism which has been changed by the introduction of recombinant DNA is known as a genetically modified organism (GMO).

Single nucleotide polymorphism (SNP) – A difference of a single base in the sequence of a gene, which alters the structure and function of the gene product. These differences occur naturally in any population, and help to account for differences between individuals (e.g. a SNP can mean a minor change in the primary structure of a protein, but this in turn can have a more significant effect on the protein's three dimensional structure, leading to possible changes in the protein's function). SNPs are being investigated to gain greater insights into the basis for disease, and to help develop more effective, tailor made treatments.

Streptomycetes – A type of bacteria which is used to produce a range of chemicals, especially antibiotics.

Transgenic – A transgenic organism is one where one or more genes, usually from another species, have been introduced using recombinant DNA technology. A transgenic organism is said to have been genetically modified.



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