A Short History of Food Research

With the help of current and former scientists, Science Historian, Dr Sarah Wilmot has been working on the archive of documents held at IFR, particularly those which relate to the Low Temperature Research Station in Cambridge. This short history of food research in the UK portrays a few of the key people and their contributions, concentrating on LTRS and the Food Research Institute in Norwich and bringing the story up to the present day. We have only scratched the surface here.

1903 Original building, National Fruit & Cider Institute (LARS)

1903: Long Ashton Research Station (LARS) founded

1912: LARS became publicly funded and the Research Institute in Dairying (later National Institute for Research in Dairying, NIRD) was established at University College, Reading - the start of state-aided food research in Britain

Very few research studies in food science prior to WWI other than chemical analyses

1916 - 1918: Food supplies reached perilously low levels due to gross wastage of imported perishable foods

1917: Wholesale freezing of food was becoming commercially viable

1918: Food Investigation Board (FIB) set up under Directorship of W.B. Hardy with early work through committees - Engineering, Meat Preservation, Fish Preservation, Fruit and Vegetables

1920: Partnership of Franklin Kidd and Cyril West at the University of Cambridge launched the first systematic studies of 'gas storage' of fruit in the world and the science of post-harvest physiology

1921: FIB established a 'committee of management' for a new 'Low Temperature Research Station for Biochemistry and Biophysics' (LTRS) in Cambridge

1922: LTRS opened, with two suites of accurately controlled (+/- 0.1°C) rooms - a unique facility that provided the focus for the early work on the preservation of food by refrigeration and controlled atmosphere storage

1923: NIRD moved to Shinfield Manor near Reading

1925: The first of a series of classic papers (1925-1949) by Franklin Kidd and Cyril West, now at LTRS, on the gas storage of fruit, using mixtures of CO_2, O_2, and N_2. Growers began to build refrigerated gas storage systems

1925: W. B. Hardy knighted in the New Year's Honours (and awarded the Royal Medal of the Royal Society of London in 1926)

1926: Covent Garden laboratory set up by FIB to study fruit passing through the market

1928: Ditton Laboratory established by FIB at East Malling, Kent. Ditton was the 'daughter' lab to LTRS - a 'ship on land', to enable experiments to be carried out on the bulk storage of fruit under conditions comparable to those in ships' holds

1928: Extension to LTRS brought the total number of constant temperature rooms up to 40

1929: First commercial gas store for apples was built by a grower near Canterbury, Kent based on Kidd and West's research. By 1938 there were 200 commercial gas stores for apples in the UK

1929: Torry Research Station (Aberdeen) founded by FIB for research to improve the preservation of fish

1933: Scientific partnership began between Robert McCance, Professor of Experimental Medicine at Cambridge University, and Dr Elsie Widdowson. Their work on the chemical composition of foods underpinned the formulation of wartime rations and laid the foundations of modern Western nutritional thinking

1930s-1940s: Ripening colour charts published to help fruit growers store their crops with minimum wastage

1934: R. Gane at LTRS proved that the volatile agent given off by ripening apples and pears is ethylene and it began to be considered as

a ripening hormone. Shipping companies stopped the loading and transport of apples and bananas in adjacent spaces

1934: Franklin Kidd became Superintendent of LTRS

1937: British merchant vessel *Port Jackson* completed its maiden voyage, arriving in Melbourne, Australia on 10th January. Ditton-influenced cargo spaces gave unprecedented rapid, uniform cooling of fruit and other refrigerated cargoes, and the 'Port Jackson' design remained influential into the 1960s

1937: LTRS began to concentrate on the novel field of food dehydration, vital in the context of ensuring food supplies e.g. dried egg which needed routine screening because of contamination with *Salmonella* spp. and, during 1939 -1945, intensive work on the drying of vegetables

1938: LTRS discovered that the use of storage atmospheres containing as low as 10% CO_2 could double the life of chilled meat which revolutionised the export industries of Australia and New Zealand

1939: Franklin Kidd at LTRS took out the first patent describing the freeze-drying of food

1940: 1st edition of McCance and Widdowson's landmark study *The Chemical Composition of Foods* published. In all six print editions were published between 1940 and 2002

1940s: A group of postharvest scientists assembled in New York decided to rename Franklin and Kidd's 'gas storage' as 'controlled atmosphere storage' (CA) by which name it is known today

1940s: LTRS helped resolve issues on dried egg nutritional qualities after processing and storage, as well as palatability, wholesomeness and baking qualities

1940s: Lightweight rations developed at LTRS for wartime use. Important field-test when Dr Maurice Ingram joined a wartime expedition in the Cairngorms with commandos, training to destroy a heavy-water plant in Norway. Post-war, Ingram was awarded the King Haakon VII medal for significant service to Norway

1944: Dr Franklin Kidd was elected a Fellow of the Royal Society for his work on the ripening of fruit, and the environmental factors that control it

1944-1947: A. T. R. Mattick and A. Hirsch at NIRD provided the first description of nisin and a medium for producing it on a large laboratory scale. This naturally-occurring antibiotic substance was approved for use as an antimicrobial food additive by FAO/WHO in 1969. Today it is a highly profitable, commercialised food preservative in use in over 50 countries worldwide. Nisin is the best-known member of a class of antibiotics called 'lantibiotics' which may in future offer a vital resource for new drugs

1947: E. C. Bate Smith became LTRS Superintendent

1947: A new Microbiology Section formed at LTRS

1948: 'Food Science' as a discipline launched with a summer course at LTRS - over the next few years four universities established degree courses in food science

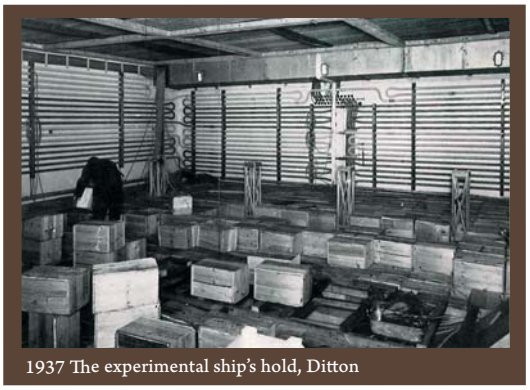
1948: First edition of *The Potato* by William Glynn Burton published. He worked on post-harvest and CA storage issues at LTRS and subsequently at Ditton Laboratory

1948-60: W. Hugh Smith, Ditton Laboratory, carried out surveys of wastage in the marketing of cauliflowers, carrots, celery, lettuce and watercress, and trials on pre-cooling and transport of soft fruit. This work was responsible for improving the storage and handling practice of fruit and vegetables and the more widespread adoption of refrigerated storage of vegetables, which began to expand rapidly from the late 1960s

1950: LTRS initiated research into the preservation of food by treatment with ionising radiation following reports of successful trials in the USA

1950s: Research on the microbiological safety of food became more significant, stimulated particularly by problems in the rapidly developing eggs and poultry processing industries and the increasing adoption of new packaging techniques for fresh foods at retail, e.g. vacuum packaging

1956: The University of Cambridge, hard-pressed for space, decided to terminate the lease of the LTRS. The Department for Scientific and Industrial Research (DSIR) was given 10 years notice to find new premises



1937 The experimental ship's hold, Ditton

1957: The ship's hold at Ditton Laboratory was dismantled and replaced by new constant temperature chambers

1958: FIB was abolished and its laboratories were transferred to DSIR. Fisheries work at Torry transferred to the Ministry of Agriculture, Fisheries and Food (MAFF)

1959: LTRS and Ditton transferred from DSIR to the Agricultural Research Council; their role to research the science involved in the loss of fresh quality of home-produced and imported foodstuffs during storage and transport

1950s Dr EM (Ella) Barnes (later OBE) samples a chicken for bacteriological examination (Cambridge Daily News Ltd)

1961: Work on the flavour of fruit and vegetables began at LTRS when the MAFF experimental factory in Aberdeen closed and its staff transferred to Cambridge

1962: The first International Congress of Food Science and Technology was held in London. LTRS took a leading part in organising the congress

1962: Plans were agreed for a Meat Research Institute (MRI) at Langford adjacent to the University of Bristol's Veterinary School and a Food Research Institute (FRI) on a site adjacent to the new University of East Anglia to extend research on food other than meat (but including poultry and eggs)

1962: Dr. J. K. Brooks at LTRS suggested an 'alpha-amylase test' to indicate the satisfactory pasteurisation of liquid whole egg – the test is still in use today

1964 Valerie Cann using a potato tenderometer at Recreation Road Lab, Norwich

1964: Temporary laboratory for Food Research Institute staff – the 'Earlham Laboratory' - set up in Recreation Road, Norwich

1964: The 'Food Irradiation Group' at LTRS/MRI established what was possible with ionising radiation and provided key advice for the Ministry of Health's *Report of the Working Party on Irradiation of Food* (1964)

1965: Sidney R. Elsden, Director of an ARC Unit and Professor of Microbiology at the University of Sheffield appointed Director-designate of FRI. FRI's role was to 'do the research necessary to ensure that both the consumer and processor receive from the farmer and grower first-class produce, i.e. vegetables, fruit, eggs and poultry, in first-class condition and with a minimum of wastage'

1964-5: Patrick Andrews at NIRD published two key papers in the *Biochemical Journal* on the introduction of gel-filtration (size-exclusion chromatography) as a reliable method for estimating proteins in solution. Together these articles have been cited more than 9000 times and they are both in the top 10 BJ papers of all time

1966: L. W. Mapson and J. E. Robinson at LTRS showed that unripe bananas can be stored at ambient temperatures for up to 30 days if oxygen is kept between 5 and 7.5% to inhibit the production of ethylene – the fruit can then ripen normally when returned to air. Old methods for transport and storage of unripe bananas became obsolete

1966: Work on the new FRI building completed including fifteen rooms used for experiments on storage, ten simple cold stores and nine cold laboratories. The temperatures ranged from - 40° to 20°C. The architect was D. J. F. Luckhurst, from Feilden and Mawson in Norwich

1966: W.G. Burton published 2nd edition of *The Potato*. He joined FRI as Deputy Director, continuing important work on dormancy, sprout suppression and low-temperature sweetening

1968: Ceremonial Opening of MRI by HM The Queen

1968: FRI staff, comprising former members of LTRS, Ditton, the ARC Microbiological Unit in Sheffield, and 1952 Nobel prize-winner, structural chemist Prof. Richard (Dick) Synge gathered under the same roof for the first time. Roy Markham and staff of the ARC Virus Research Unit from Cambridge were guests of FRI until their permanent building was completed at the newly-established, adjacent John Innes Institute site (in February 1971) and staff from the MAFF Food Science Laboratory were co-located for many years until they moved to premises in Norwich, more recently in the building which now houses the NRP Innovation Centre and finally at York (Sand Hutton, now FERA)

Late 1960s: A developing and major problem of off-odours in poultry stocks was resolved by FRI scientists, who demonstrated that chemicals used to treat timber were causing wood shavings used for bedding to become contaminated with chloranisoles

1969: Ditton Laboratory closed

1969: FRI's Leslie Mapson elected FRS for his distinguished work on the biochemistry of ascorbic acid

1960s: JR Bendall undertook important basic studies on structure and function of muscle at LTRS and later at MRI, working out that chilling has serious effects on meat texture if carried out too rapidly when meat is pre-rigor

1969: First Open Days at FRI with Guest of Honour, The Duke of Northumberland

Early 1970s: The Rothschild Report (1971) and the customer:contractor principle impacted on the food institutes, with the introduction of more practically-oriented problems into their research portfolios

1970s-1980s: Dr John Geeson and colleagues at FRI conducted major research on controlled atmosphere storage (eg. of winter white cabbage) and modified atmosphere packaging (eg. tomatoes and fruit)

1973: Dr Hal MacFie joined MRI as a statistician. In a 25-year career (later at IFR's Reading site and finally as Acting Director of IFR in 1998) he established an international reputation for the application of statistics to consumer sciences

1974: ARC/MRC committee on Food and Nutrition Research (Neuberger report) recommended expansion of nutrition research in Britain and recommended that ARC should become involved with nutrition research relevant to human health

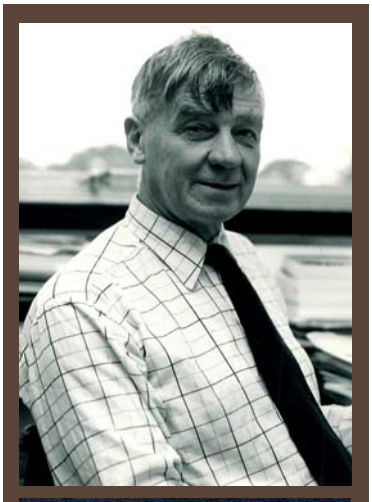
1976: Objectives of FRI re-defined including providing basic research to assist the food processing industry (short-term research was the responsibility of the industry-funded Research Associations); a new era of food products began (for example, prepared salads)

1977: Dr R. F. (Frank) Curtis appointed Director of the Food Research Institute

1977: Stamp issued to celebrate FRI scientist Prof. Richard (Dick) Synge's Nobel prize in Chemistry (1952) for his contribution to partition chromatography

1978: Nutrition and Food Quality Division at FRI started under Dr David Southgate (appointed from MRC Dunn Nutrition Unit, Cambridge where he had worked with Prof. Elsie Widdowson since 1950). He brought expertise on the composition of foods, the compilation of food tables and dietary carbohydrate analysis, especially dietary fibre

1978: Southgate, with Dr Alison Paul, published 4th ed. of McCance and Widdowson's *The Composition of Foods* with the Medical Research Council, MAFF and the Laboratory of the Government Chemist. First computer-readable version



1977 Prof Dick Synge FRS

1978-1982: FRI's Dave Phillips and Tony Wright identified and corrected a major flaw in the folic acid assay method, a landmark event in the history of folates necessitating the complete re-analysis of foods for food composition tables

1978: Dr Ella Barnes awarded OBE in the New Year's Honours List (and the Poultry Industry's BOCM-Silcock Trophy).
Her contributions included showing that antibiotic use in poultry feed led to the presence of antibiotic resistant streptococci and salmonella indicating that medically important antibiotics should only be used for treatment of disease in man and animals, and not be added to animal feed. Research by Dr. Barnes and Dr. Geoff Mead on poultry chilling systems led to the introduction of the counter-flow chiller and changes in EC regulations

1978: Dr Henry Chan and colleagues at FRI published research on light-induced flavour deterioration in crisps. The food industry changed the packaging of crisps (removing all transparent areas)

Late 1970s: FRI scientists developed a method for analysing total glucosinolate content in food that became an industry standard

Late 1970s: FRI, with Houghton Poultry Research Station, solved the poultry industry's problem of 'fishy taint' in eggs from chickens fed with rapeseed meal and showed that the problem could be solved by avoiding layers bred from Rhode Island Red stock

1978-1984: Dr Ella Barnes' group pioneered the principle of 'competitive exclusion' in the UK, a method that improved the safety of poultry products by encouraging the development of gut floras in chicks that inhibit growth of pathogenic *Salmonella*

1978-1985: FRI published a key contribution to the food storage technology of 'ice bank cooling', a system of cooling vegetables quickly to maintain freshness. Dr John Geeson and colleagues also completed trials of long-term ice-bank storage of UK-grown carrots, with subsequent commercial evaluation

1979-1981: Dr Will Waites and colleagues developed a novel approach to killing bacterial spores with combined UV light and hydrogen peroxide – one of the Agricultural Research Council's most financially lucrative patents and a concept used in machinery for sterilising packaging before filling with UHT liquids

1979-early 1980s: A shift in priorities for FRI moved the Institute away from post-harvest disease and spoilage research to areas of greater interest to the food processing industry. Investment in research on food structure and processing began which helped introduce a more molecular approach to food structure, together with a rapidly increasing interest in biotechnology and an increased focus on food-poisoning microorganisms – with a new work programme on *Clostridium botulinum*. A containment facility was constructed under the direction of Dr. Barbara Lund which substantially increased UK resources for the study of *C. botulinum*, and initiated research on the safe development of chilled ready meals; today IFR's *C. botulinum* research group, led by Prof. Mike Peck, is world-renowned

1980: The National Collection of Yeast Cultures (founded c. 1951) moved to FRI from its previous location with the Brewing Research Foundation

1981: FRI worked out protocols for storage of tomatoes harvested ¼ ripe to ¾ ripe and later designed an industry 'colour chart' (1988) to judge the ripeness of tomatoes which was in demand for 20 years

1981: Dr Roger Fenwick and colleagues developed methods for analysing individual glucosinolates, used to determine levels in raw and processed products - this led to the problem of excessive bitterness in Brussels sprouts being understood and minimised

1981 HM The Queen with Dr Ralph Riley (L) Secretary of ARC and Prof Curtis at the ARC Jubilee Soiree

1982: Dr Peter Richmond joined FRI (from Unilever) to head the new Process Physics Division with a remit to 'investigate the physical and engineering principles that underlie the processing of food'

1983: The Agricultural and Food Research Council (AFRC) was formed from its predecessor the ARC, marking the beginning of increased momentum for food research and recognising the strategic importance of the UK food manufacturing industry

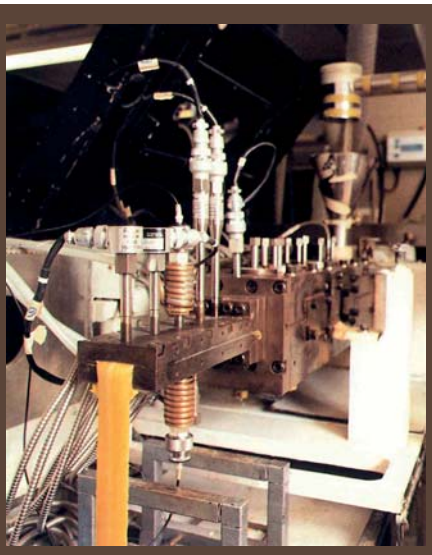
1980s: IFR began contributing to the *The Composition of Foods* series with analyses of the composition of potatoes and vegetables in the early 1980s, data that were included in the 5th edition (1991)

1984-87: Dr Mike Gasson (previously at NIRD) was awarded FRI's first European Union funding for work on the biotechnology of lactic acid bacteria and the lantibiotic, nisin

1985: The AFRC's three food research institutes became known as: the Food Research Institute, Bristol; Food Research Institute, Norwich; Food Research Institute, Reading. The AFRC Institute of Food Research (IFR) was formed with headquarters at Reading. Prof. Frank Curtis was appointed the first Director, and awarded CBE in the 1985 New Year's Honours List

1985: Dr Sue Fairweather-Tait and Ron Self at IFR, Norwich developed techniques for measuring the bioavailability of dietary iron in humans using stable isotopes analysed by mass-spectrometry. The group pioneered the use of foods intrinsically labelled with isotopes of iron, zinc, calcium and copper in nutrition studies, and were international leaders in this field

Archive documents on the composition of foods



1986 Instrumented twin screw extrusion cooker fitted with sensors for temperature and pressure measurements

1986 Swabbing rubber plucking 'fingers' inside defeathering equipment

1986: Long Ashton Research Station became part of the Institute of Arable Crops Research; some staff transferred to the IFR, Reading Lab, while some work, including the MAFF's Total Diet Study, transferred to IFR, Norwich

1987: Dr Mary Griffin at IFR, Reading, was awarded the Food Group Junior Medal of the Royal Society of Chemistry (the first ever awarded)

1987: Prof. Allen Bailey at IFR, Bristol, was awarded the Food Group Senior Medal of the Royal Society of Chemistry (the first ever awarded)

1987: Immunoassays initiated by Dr Mike Morgan and his team at IFR, Norwich were made available commercially – a total aflatoxin test kit, together with quantitative assay kits for total aflatoxin and ochratoxin A

1988: Dr Doug Georgala CBE (formerly Head of Unilever's Colworth Laboratory) appointed Director of the AFRC Institute of Food Research

1988: MAFF initiated a co-ordinated programme led by IFR, Bristol's Dr Terry Roberts (later at IFR, Reading) on the growth and death of bacterial pathogens, giving predictive microbiology a big impetus. Data were collected and computerised in a standardised way and the first validated, commercialised programme package, Food MicroModel™, was built. The data underpinned the web-based ComBase package launched in 2004 that contains predictive models and data on growth, survival and death of pathogens and food spoilage microbes. The Combase website has an average of ca. 200 visits per day, and has been estimated to deliver economic benefit to the UK food industry of more than £20 million per annum

1988: IFR, Norwich organised "Bioavailability '88", the first of a series of international conferences on nutrient bioavailability, dietary fibre and cancer, hosted at UEA, and organised under the auspices of the Royal Society of Chemistry. Nearly 300 scientists attended, from 44 countries. This series contributed significantly to building IFR's international reputation

1988: Dr Mike Morgan's group filed a patent describing a rapid method for the detection of agents in gluten which are associated with good bread-making quality

1989: Dr Gary Barker was part of one of the first AFRC Linked Groups, collaborating with Prof. Sir Sam Edwards and colleagues at the University of Cambridge Cavendish Laboratory, studying Food Physics. The IFR:Cavendish partnership was fruitful for almost 15 years and individual collaborations remain

1989: IFR, Norwich Liaison Officer, Mr Arnold 'Tommy' Tomalin was awarded an MBE in the New Year's Honours List in recognition of his pioneering work in communicating the results of research to industry and the general public

1989: Prof. David Southgate was awarded the Inaugural British Nutrition Foundation prize; Dr Dave Collins (IFR, Reading) was the first British scientist to be awarded the International Bergey Trust Award for research into microbial taxonomy

1989: The AFRC announced major restructuring following the UK Government's withdrawal from near-market research. IFR, Bristol Lab was closed. Some staff transferred to Reading and Norwich laboratories and the Institute now concentrated on food safety, biotechnology, and nutrition and food quality. The first *IFR News* was published (now Science+Innovation)

1990: Dr David Clark and Prof. David Southgate at IFR, Norwich were awarded the Food Group Junior and Senior Medals of the Royal Society of Chemistry respectively

1990: Dr. Barbara Lund at IFR, Norwich was awarded best paper in 1989-90 by the *British Food Journal* for her article on "Prevention of foodborne Listeriosis"

1990: Drs Gary Barker and Malcolm Grimson at IFR, Norwich documented the physics of muesli for a front cover story in *New Scientist* magazine

1990: Publication of the first edition of C. Brett and IFR's Keith Waldron's textbook *Physiology and Biochemistry of Plant Cell Walls* (second edition, 1996). This book showcased the new techniques of spectroscopy, biophysics and molecular biology and revealed the complexity of plant molecular architecture and its importance in the control of plant growth and development

Early 1990s: A re-assessment of dietary food folates at IFR, Norwich led to a re-evaluation of UK dietary folate recommendations by various expert/governmental bodies (COMA, SACN)

1990s-2010: IFR had significant input into various expert consultations on folic acid fortification of flour in the UK and the need for peri-conceptual folic acid supplementation for women of child-bearing age in the first 28 days following conception

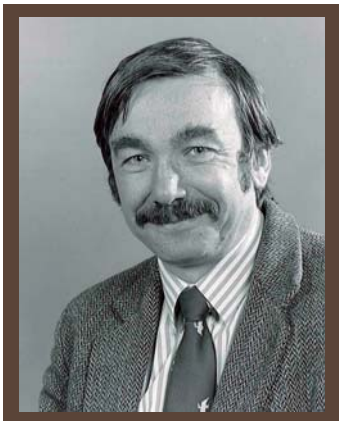
1991: Prof. Doug Georgala appointed to the Dept of Health/MAFF Microbiological Safety of Food Advisory Committee

1991: IFR staff made a substantial contribution to a book published by HMSO *Cooking and Kitchen Skills* – a handbook of food preparation, basic cooking techniques and recipes

1992: Dr Gary Barker, working with Dr Anita Mehta at the Cavendish Laboratory, published ideas which describe size segregation in granular materials in the premier science journal *Nature*. These concepts explained for the first time the behaviour of many food materials during processing

1992: Official opening of new IFR, Reading Laboratory on the Whiteknights campus of the University of Reading by HRH The Princess Royal

1992: Prof. Peter Belton appointed Head of IFR's Norwich Laboratory – previously as Head of Food Colloids and Biopolymer Science at IFR he had a distinguished record in developing understanding of the role of molecular dynamics in food quality and structure



1992 Prof Peter Belton

1992: Official launch of Norwich Research Park (UEA's Schools of Biological and Chemical Sciences, the John Innes Centre, IFR, Norwich, the MAFF Food Science Laboratory and the British Sugar Technical Centre were the original members)

1992: Prof. Mike Gasson appointed to Advisory Committee on Novel Foods and Processes (later Vice-Chair in 1998 and Chair in 2003). This appointment was to strengthen ACNFP's expertise on genetic modification issues. Profs. David Southgate and Bevan Moseley (IFR, Reading) were also members

1992-95: IFR, Norwich launched research programmes on the bioavailability and beneficial health effects of dietary phytochemicals, including isothiocyanates, polyphenols and carotenoids

1993: Dr Gary Williamson at IFR, Norwich was awarded the Food Group Junior Medal of the Royal Society of Chemistry

1993: Research Councils were reorganised following the Government White Paper *Realising our Potential*. The Biotechnology and Biological Sciences Research Council was established by Royal Charter in 1994

1993: Dr Roger Fenwick received the Royal Agricultural Society of England's Research Medal for 1993, an individual award that is made each year to honour research of benefit to agriculture

1993-1995: Drs József Baranyi and Terry Roberts published three papers that gave a good mathematical basis for mechanistic modelling of bacterial growth - the extensively-cited 'Baranyi-model' has become the most widely used primary growth model

Mid 1990s: The Norwich Legume Group, NORLEG, was established by IFR and JIC scientists to promote legume research and knowledge transfer in the UK

Mid 1990s: the focus of IFR's glucosinolate work shifted to take account of the anti-carcinogenic effects of their breakdown products

Mid-late 1990s: IFR provided underpinning science to the development of UK food policy in two key areas, on poly-unsaturated fatty acid consumption (the current UK recommendations were introduced in 1994) and on dietary fibre, which culminated in the launch of the Department of Health's 5-a-day advice and promotional campaign in 2003

1994: IFR became an Institute sponsored by the Biotechnology and Biological Sciences Research Council

1994: Dr Peter Aggett, Head of IFR's Nutrition, Diet and Health Division, was appointed to the Advisory Committee on Novel Foods and Processes (and in 1995 to the Department of Health Committees on the Medical Aspects of Food Policy and the Toxicity of Chemicals in Food, Consumer Products and the Environment)

1994: Dr Robbie Selvendran at IFR, Norwich, was awarded the Food Group Senior Medal of the Royal Society of Chemistry

1994: Dr Alan Malcolm, previously Director General of the Flour, Milling and Baking Research Association but with a background in academic biochemistry, especially medical applications, was appointed Director of IFR

1995: Official opening of the purpose-built six-bedded Human Nutrition Unit at Norwich

1995: Dr Jennifer Ames at IFR, Reading was awarded the Food Group Junior Medal of the Royal Society of Chemistry

1995: Physiologist Jenny Gee (PhD 2001), who transferred from NIRD to FRI in the 1960s, was awarded an MBE for her science, and her contribution to laboratory health and safety training. Dr Terry Roberts (MRI, and then at Reading) was awarded OBE for his recognition of the industrial potential of computer modelling of microbial growth responses. Prof. Bevan Moseley was also awarded an OBE on his retirement as Head of the Reading Laboratory

1995: Dr Glenn Gibson joined IFR, Reading as Head of Microbial Physiology

1996: Dr Reg Wilson at IFR, Norwich was awarded the Food Group Junior Medal of the Royal Society of Chemistry for pioneering work on food authentication

1996: Getting reliable and consistent delivery of drugs to the colon is difficult. IFR science led by Dr Steve Ring was the origin of Alizyme's COLAL™ technology which involves the incorporation of the drug behind a glassy amylose coat that is broken down by colonic bacterial amylases

1997: The first legitimised food-specific health claim was approved by the US Food & Drugs Administration. This allowed a new heart health claim to appear on the Quaker Oatmeal cereals that qualified. The evidence-base for the claim was supported by IFR studies by Prof. Ian Johnson and Dr Liz Lund on the effect of Oat beta-glucans on the physical properties of gastrointestinal contents

1997: Drs Mike Morgan and Clare Mills and colleagues published details of their rapid test for the detection of traces of peanut contamination in food. This ELISA assay for peanut had far higher sensitivity than previous tests, and was subsequently marketed by a leading diagnostic company for industry use

1997: Marked the first publication of IFR's Annual Report and newsletters on the website; the publications database became on-line only

1997: Dr Sue Fairweather-Tait was awarded the BNF Prize by the British Nutrition Foundation Council

1997: The UK Government's 'Prior Options' review concluded unequivocally that the function IFR provided was needed, and that IFR should remain in the public sector

1998: The Atkinson Report presented to BBSRC Council recommended rationalisation of IFR onto a single site; the consolidation was completed in September 2000. A BBSRC Strategy Review Group confirmed IFR's mission in food safety, diet and health and food materials science

1999: Prof. Peter Schroeder became the interim Director of IFR during the restructuring. He was formerly Director of Research and Development at the Nestlé R&D centre in York

1999: New mission statement: 'Our mission is to carry out independent basic and strategic research on food safety, quality, nutrition and health'

1999: Prof. Vic Morris, a world class pioneer in AFM, published the first textbook with Andrew Kirby and Patrick Gunning on *Atomic Force Microscopy for Biologists*

2000: Dr Alastair Robertson, plant biochemist and Technical Director of Safeway Stores plc, was appointed Director of IFR

2000: The Institute was designated a 'Marie Curie Training Site' for post-graduate training

2000: Dr. Barbara Lund in collaboration with Dr. Tony Baird-Parker and Prof. Grahame Gould (both of Unilever Research) published their classic two-volume reference book on *The Microbiological Safety and Quality of Food*. Prof. Mike Peck and Dr. József Baranyi contributed chapters

2001: Prof. Robertson appointed as Chair of UK Government's Foresight Panel on 'Food chain and crops for industry'

2001: The Food and Health Network was formed to lead the Institute's Knowledge Exchange activity with the food industry

2001: IFR's Gel Cassette system, developed by Tim Brocklehurst and colleagues, was made available to industry and research – the system allows the impact of immobilisation of bacteria to be studied

2001: Dr Roger Fenwick and Prof. Vic Morris received the 'Highly Cited Researcher' award from the Institute of Scientific Information (ISI), as two of the top 250 researchers worldwide in the field of agricultural science (a newly-launched category). Only four UK researchers qualified for this award (later IFR recipients included Prof. Ian Johnson, Dr Robert Selvendran, Keith Price and Dr Gary Williamson)

2002: IFR initiated the FOODforce network of Directors of leading EU food and nutrition research organisations (chaired by Prof. Alastair Robertson)

2002: Dr Clare Mills' expertise in plant food allergens as a Working Party member was vital to the Royal Society's important report on *GM plants for food use and human health – an update*

2002: 6th summary edition of McCance and Widdowson's *The Composition of Foods* published - the first produced under the Food Standards Agency (transferred from MAFF). Compiled by IFR's Mark Roe and Paul Finglas with Susan Church, FSA

2002: Prof. Alastair Robertson appointed to the FSA's new Advisory Committee on Research set up to guide their £30.8 million research programme

2003: Prof. Richard Mithen joined IFR to lead studies on the health benefits of high glucosinolate broccoli, focussing on people with enhanced risk of cardiovascular disease and prostate cancer. His research, which started at the John Innes Centre, was supported by IFR, BBSRC, Plant Bioscience Limited (PBL), and plant and seed development company Seminis

2003: The UK Food Standards Agency funded Dr Jòzsef Baranyi to develop a computer program Growth Predictor which, together with the international collaborative effort, ComBase, are offering huge benefits to assuring the safety of foods in international trade

2004: Dr Martin Wickham won a BBSRC Young Enterprise Scheme award and a BBSRC Enterprise Fellowship to explore the commercial potential of his *in vitro* model of human digestion which he developed during PhD studies at IFR

2004: Prof. David White appointed Director of IFR. He was previously Director of Science and Technology at BBSRC's Swindon Office and developed the IFR's 2005-10 strategy focussed on diet and health

2004: IFR was part of the core group that established the European Technology Platform *Food for Life*

2004: Prof. Richard Mithen appointed to the new Science Advisory Council for the Department of Environment and Rural Affairs

2005-10: Dr Clare Mills coordinated EuroPrevall, a €14M EU project bringing together 53 centres to investigate the prevalence, cost and basis of food allergy across Europe. A new website www.foodallergens.info was launched – offering credible food allergy information to stakeholders (funding from an earlier EU project InformAll)

2005: Prof. Vic Morris was awarded the first Food Hydrocolloids Trust Medal – this recognised his work on polysaccharides and proteins used by the food industry

2005: Dr Roger Fenwick awarded the Mikael Oczopowski Medal of the Polish Academy of Agricultural Sciences for services to UK:Polish cooperation

2006: Profs. Vic Morris and Mike Gasson elected as Fellows of the International Academy of Food Science and Technology (IAoFST). In 2006 there were 130 Fellows world-wide, of whom 13 were UK citizens

2006: Dr Clare Mills appointed to the Advisory Committee on Novel Foods & Processes

2007: A bacterial genus was named *Barnesiella* after Dr. Ella Barnes, to recognise her substantial contribution to our knowledge of intestinal bacteriology and anaerobic bacteriology. Members of the genus *Barnesiella* have been isolated from the chicken caecum and human faeces

2007: IFR's mission was refreshed to 'deliver fundamental and strategic research to understand the relationship between food, diet and the optimisation of individual health'. The Institute launched a new outreach programme 'IFR in the City' coordinated by Dr Dee Rawsthorne

2011 Dr Dee Rawsthorne, Big Bang Science Fair, London

2007: Dr Claudio Nicoletti's team discovered a vital molecule for resistance to food allergy, Interleukin-12, offering a potential target for therapy

2007: Dr Martin Wickham, lead scientist at IFR, and engineers from TWI in Cambridge launched the world's first biochemically and physiologically accurate human gut model, developed as a business unit of PBL

2007: Prof. Mike Peck's team in collaboration with colleagues at the Sanger Institute and University of Nottingham published the first genome sequence of *Clostridium botulinum*, providing important details of the organism's biology, and enabling whole genome and transcriptome studies at IFR and elsewhere. This complemented their applied work on the safe development of new chilled ready meals and other foods with respect to preventing foodborne botulism

2007: Prof. Ian Johnson received the JK Puri Memorial Lifetime Achievement Award for his work on glucosinolates and isothiocyanates

2008: Dr Roger Fenwick elected as a Fellow of IAoFST

2008: Prof. Simon Carding was the first joint UEA:IFR appointment at Norwich Research Park - Prof. of Mucosal Immunology at Norwich Medical School and leader of IFR's Gut Immunology research

2008: IFR launched 'IFR Extra' – a service to address short-term industry problems

2009: Prof. Vic Morris and colleagues showed that a fragment released from pectin binds to, and is believed to inhibit, Gal3, a protein that plays a key role in many aspects of cancer progression

2009: Prof. David White awarded a CBE for services to biological science in the Queen's Birthday Honours List

2009: IFR ranked 2nd in the world for the impact of its research in the area of agricultural and food sciences in an independent survey of published research papers for the last ten years using data from the Thomson Reuters' Essential Science Indicators database

2009: Prof. David Boxer, Dundee University's Vice-Principal for Research and Enterprise and Professor of Microbial Biochemistry, appointed Director of IFR

2010: Dr Paul Ó'Máille became the first joint IFR:John Innes Centre research leader appointment, in plant natural products and health

2010: IFR Extra developed an additional site – at Colworth Science Park, near Bedford

2011: Prof. Keith Waldron won BBSRC's 'Most Promising Innovator of the Year' award for his research and collaboration with industry partners to develop a novel peat replacement product from food chain wastes, produced by a novel composting process

2011: The Biorefinery Centre, funded by BBSRC and the East of England Development Agency, was formally launched and enables Waldron's team and industry partners to look at the potential of harnessing material such as straw and brewers' grain to produce bio-alcohol fuel

2011 Science Minister David Willetts presents Prof Keith Waldron with his BBSRC Most Promising Innovator Award

2011: IFR was part of the core team developing a Food and Innovation Community within the European Institute of Innovation and Technology

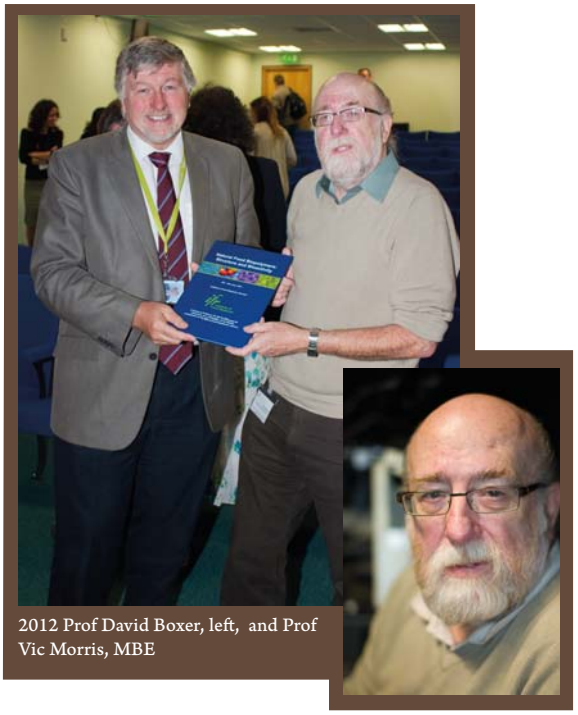
2011: A new variety of broccoli with higher levels of a key phytonutrient was launched in the UK. Known as Beneforté, it was developed from publicly-funded research at IFR and the John Innes Centre, led by Prof. Richard Mithen

2011 Launch of Beneforté broccoli

2011: IFR became an independent Institute, strategically funded by the BBSRC and with new governance structures

2012: Dr Arnoud van Vliet and his team discovered that the foodborne bacterium *Campylobacter* requires selenium for respiration of organic acids. Knowing how and why *Campylobacter* uses selenium could help in developing ways to control it, benefitting public health and the food industry

2012: Prof. Vic Morris was awarded an MBE in the Queen's Birthday Honours List recognising his distinguished career in food research



2012 Prof David Boxer, left, and Prof Vic Morris, MBE

2012-17: Award of £29M to IFR for research and innovation announced by BBSRC. Institute Strategic Programme Grants are focused on Gut health and food safety, and Food and Health. Additional investment funds research collaborations with Imperial College, London and the University of East Anglia. There is also funding to support three National Capabilities (the National Collection of Yeast Cultures, Food Databanks and Combase)

If you wish to add information and reminiscences, please contact IFR.