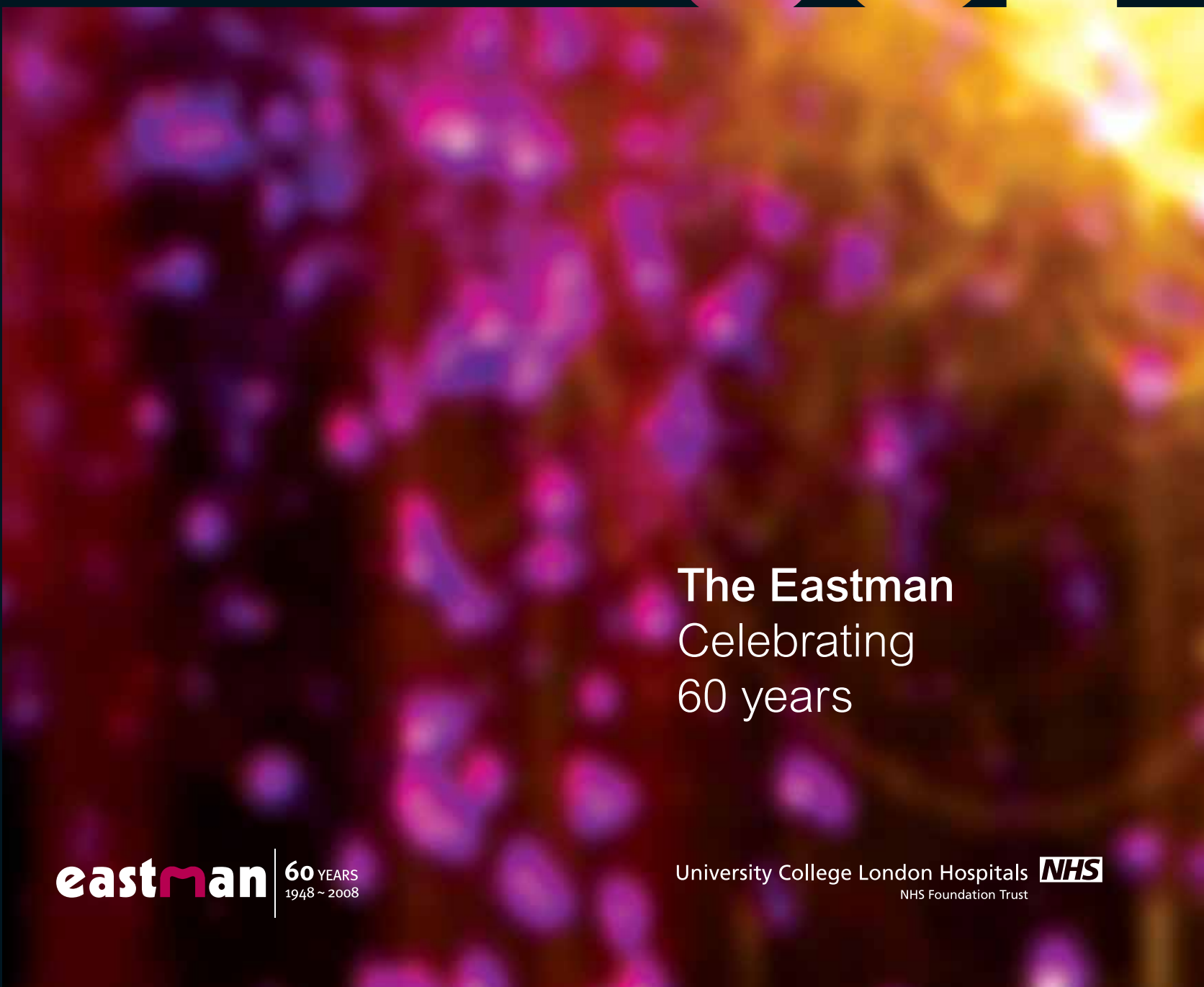
UCL EASTMAN DENTAL INSTITUTE

UCL



The Eastman
Celebrating
60 years

eastman 60 YEARS 1948 ~ 2008

University College London Hospitals NHS
NHS Foundation Trust

Contents

Welcome to the celebration of the Eastman's 60th Anniversary

The Eastman, a partnership between the Dental Institute and Dental Hospital, is recognised internationally as one of the pre-eminent institutions in the field, with an ever-increasing influence.

On the occasion of the Eastman's 60th Anniversary, we are delighted to take this opportunity to showcase some of the latest achievements of our staff. This review will give you an insight into the breadth and quality of our activities in research, education and clinical care.

The Eastman's mission is 'to promote oral health and wellbeing by advancing knowledge of the causes of orofacial disease and the prevention, repair and regeneration of resultant tissue abnormalities, and to translate such findings into clinical practice'. This review provides a snapshot of the latest research outcomes from Eastman scientists in the fields of Biomaterials & Tissue Engineering and Microbial Diseases – the Eastman's two research themes. These brief articles are intended to offer a flavour of the spectrum of our research activities from initial discovery through to clinical translation and the evaluation of health services.

On this prestigious occasion, in view of the Eastman's roots and its ongoing commitment to supporting the development of the dental team, we would also like to share with you some of our advances in clinical care and education.

We hope you find it thought-provoking and we look forward to continued successful collaborations with our friends and colleagues, new and old, both near to home and further afield, in the years to come.

Professor Crispian Scully CBE *left*
Dean and Director of Studies and Research
UCL Eastman Dental Institute

Ms Ulpee Darbar *right*
Clinical Director
Eastman Dental Hospital
UCLH NHS Foundation Trust

UCL was founded

180 years ago in a pioneering spirit

Introduction from the President and Provost, UCL

At the outset, it challenged discrimination and was the first university in England to admit students of any race, class or religion, and the first to welcome women on equal terms with men. UCL introduced academic disciplines required by the emerging industrial and commercial society, and was the first English university to offer the systematic teaching of law, architecture and medicine. Today, UCL is London's global university and its influential research and teaching continue to enrich and benefit society.

Like all leading university departments, the Eastman has an active research portfolio. Since his appointment as Dean in 1993, Professor Crispian Scully CBE has led the development of the Eastman's research activities with great success, reflected by top scores of 5 in successive Research Assessment Exercises in 1996 and 2001. The merger with UCL (1999) has been particularly productive, enabling the Eastman to build upon these achievements.

Today its research programmes are funded by the *Medical Research Council, Engineering & Physical Sciences Research Council, Biotechnology & Biological Sciences Research Council and Wellcome Trust*. Publications appear in the leading science, medical and dental journals (such as *Cell, Nature Genetics, Science, New England Journal of Medicine, The Lancet* and the *Journal of Dental Research*, among others) and findings have been widely reported in the national and international dental press. Several research programmes have culminated in patented inventions which have been licensed and are now used in everyday clinical practice. The Eastman research programme was reviewed by the Department of Health in 2006 and is one of only two oral themes to achieve national funding as an NHS Comprehensive Biomedical Research Centre.

The Eastman has always been a pioneer within the dental profession, and its leadership and innovation are evident in its training programmes for specialist dental practitioners and consultants.

In 1968, the Eastman launched Master of Science (MSc) programmes providing evidence-based specialist training, and soon taught graduates from over 50 countries around the world.

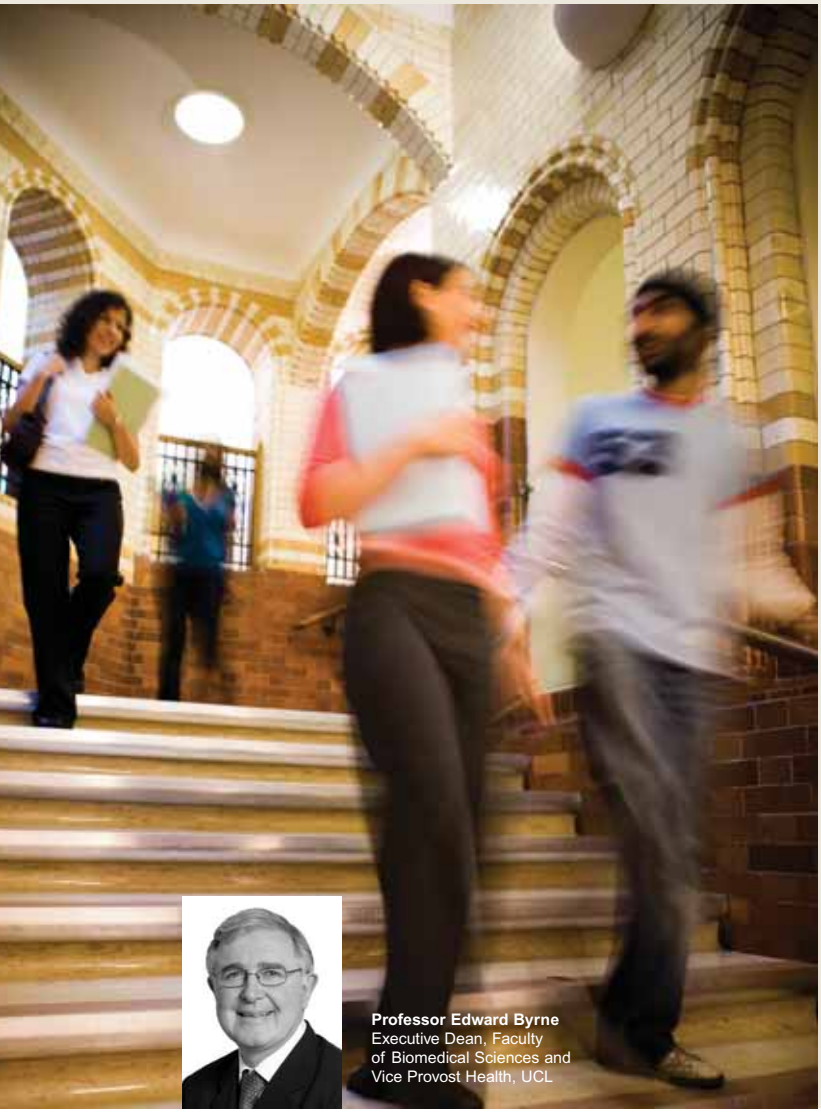
In 1997 the General Dental Council (GDC) established lists to recognise dentists with specialist skills, practising either as consultants or high-street dental specialists, and Masters courses make up a significant portion of this specialist training. Sensitive to such educational developments, in the early 1990s the Eastman again set the trend by becoming the first UK dental school to establish an academic department and education centre dedicated to Continuing Professional Development (CPD). By 2002 the GDC had made CPD compulsory for dentists, and now for all dental care professionals. Over 1,750 dental professionals now access Eastman CPD courses every year, updating and enhancing their skills and knowledge.

This commitment to learning was recognised in 2002 when the Eastman became the first dental school to receive the Queen's Anniversary Prize for Higher and Further Education.

I share the pleasure of my colleagues at the Eastman in knowing that their research and education results in real improvements to patient care – and I'm certain that the rich legacy from those early pioneers will flourish into the future.

Professor Malcolm Grant CBE
President and Provost
UCL

Message from the Executive Dean, UCL Faculty of Biomedical Sciences



Professor Edward Byrne
Executive Dean, Faculty of Biomedical Sciences and Vice Provost Health, UCL

Professor Edward Byrne, Executive Dean of the Faculty of Biomedical Sciences and Vice Provost Health UCL believes the Eastman has made a significant contribution to academic life, dental research and teaching internationally, especially since becoming part of UCL.

Biomedicine at UCL has a long and proud tradition. This has been enhanced by the coming together of some of the most prestigious postgraduate health research institutions in the UK.

The Eastman was, for many years, run independently until it joined UCL nearly a decade ago. Today, the Institute includes outstanding research teams across a series of specific areas. In recent years, noteworthy advances have been made in the fields of tissue regeneration and biomaterials relevant to dental and other problems, and the microbiology of oral diseases.

As one of the most prestigious dental research and teaching institutes in the world, the Eastman has played an enormous role in postgraduate education for the UK's dental profession. It also leads the way in taught degrees in the health sciences at UCL, and staff from the Eastman make considerable contributions to academic life.

I believe the Eastman will continue to go from strength to strength in the years ahead. It is with much sincerity that I and all my colleagues in the health sciences at UCL pass on our congratulations to our colleagues at the Eastman at this important time – the 60th Anniversary of the Institute.

A bustling student community: The Cruciform Building, Gower Street (left)

Message from the UCLH NHS Foundation Trust

UCLH NHS Foundation Trust is proud of the contribution made by the Eastman during the last 60 years – especially since it became part of the Trust in 1996 – to world class research, top quality clinical care and excellent teaching. We are strongly committed to its continuing development and look forward to the next 60 years of its pre-eminence.

Celebrating the success of the Eastman reflects the outstanding quality and dedication of the staff across all grades and the tremendous teamwork in support of its work.

The recently published strategy for London health care, which looks forward over the next two decades, sees the Eastman continuing to play an important role.

We are planning to provide new accommodation for clinical services fit for the 21st century. These plans see the Eastman at the heart of the joint UCL-UCLH Bloomsbury biomedical campus – the largest academic clinical facility in Europe. The strategy looking ahead for the Eastman over the next several years is to move to new facilities within the Bloomsbury biomedical campus on Euston Road-Gower Street. This will help us achieve increased clinical and academic synergies, new teaching and research facilities and better patient access. At the same time we expect to take a greater role at outreach sites across London so that the benefits of an excellent specialist centre are combined with the opportunity for care closer to home when possible.

In conclusion, we commend the many achievements of the Eastman over the last 60 years and look forward to a bright and sustained next 60 years – underpinned by the excellence of the current staff, the trainees developing for the future, and new resources.

Sir Robert Naylor *left*
Chief Executive
UCLH NHS Foundation Trust

Professor David Fish *right*
Medical Director
of Specialist Hospitals
UCLH NHS Foundation Trust

Putting patients first: the UCLH NHS Foundation Trust Tower, Euston Road (above)

Eastman 60th Anniversary

celebration programme

A wide range of activities for all members of the dental team to mark the occasion of our 60th Anniversary

Thursday 3rd and Friday 4th April, 2008 at the Eastman in Central London

Presentations from senior members of the Eastman faculty and alumni about our past, present and future.

On the research front

The latest and newsworthy findings in Biomaterials & Tissue Engineering and Microbial Diseases.

The clinical perspective

The Eastman's role in the delivery of high quality patient care and the provision of specialist services.

For dentists

An educational clinical programme including an evidence-based review of the advantages and disadvantages of natural teeth versus dental implants.

For nurses, hygienists, therapists and technicians

A dedicated parallel programme including the following topics: dental implants, smoking cessation, restoration design, evidence-based dentistry, General Dental Council registration and infection control.

Joint sessions

Oral health and systemic health interactions.

Developments in implantology.

A truly inspirational event. Celebrating the Eastman's 60th Anniversary.

www.eastman60.org.uk

A proud heritage

In 1948, the Eastman became the Institute of Dental Surgery of the British Postgraduate Medical Federation, paving the way for the Eastman we recognise today.

60 years, 6 deans

1948-1950

Professor Alan Deverell

Instigated a department of Pathology and Microbiology, the development of courses for technicians and the first civilian oral hygiene school in the UK.

1950-1959

Professor Frank Wilkinson CBE

Forged international connections enabling the Eastman to blossom into an international centre of excellence in higher training, with graduates hailing from many countries.

1959-1970

Professor Sir Robert Bradlaw CBE

Re-modelled the Eastman's teaching concept in response to the introduction of University-recognised MSc courses.

The story of the Eastman began when entrepreneur George Eastman (of Eastman Kodak fame) donated £200,000 to fund a dental clinic to provide treatment for children from London's poorest districts.

Following the Second World War, the Institute of Dental Surgery was established to train consultants, specialists and teachers, to give members of staff and students access to clinical and laboratory facilities and research, and to provide short educational courses for the dental team.

The Eastman has since grown into an internationally-renowned centre for postgraduate research and training.

Outstanding leadership

While the success of the Eastman can be attributed to every one of its teachers, clinicians, scientists and postgraduates, the role of its Deans must not be overlooked. Throughout history, the inspiration and dedication of these individuals has shaped the Eastman we see today to create a world-famous centre of clinical and research excellence.

A bright outlook

Today, the Eastman is assured of a thriving and dynamic future within both UCL and UCLH NHS Foundation Trust.

A vision of the future: demonstrating clinical techniques using the Varioscope® (left)
Early steps: some of the first children to benefit from care at the Eastman (above)

1970-1983

Professor Ivor Kramer OBE

Was instrumental in securing funding for expansion into the adjacent vacated Royal Free Hospital site on Gray's Inn Road.

1983-1993

Professor Gerald Winter

Oversaw the development of the Dental Practice Centre for general practitioner courses and Institute expansion with new departments, including Oral Biology and Biomaterials Science.

1993-present

Professor Crispian Scully CBE

Guided the Eastman to two successive Research Assessment Exercise top scores of 5 (in 1996 and 2001), and successful merger into UCL and UCLH. Led the Eastman to become the first dental school to receive the Queen's Anniversary Prize for Higher and Further Education.

Understanding microbial communities

Biofilms account for over 80% of microbial infections in the human body and dental plaque is just one example. At the Eastman, researchers are working to further the understanding of the ecology of what are actually highly complex microbial communities and how they link to infections and disease.

The oral cavity – inhabited by up to 800 species of microbes – contains one of the most complex microbial communities in humans. This community is present on the large number of diverse surfaces, each of which has a characteristic microbial population.

Plaque is a biofilm, which we try to remove when we brush our teeth, and is essentially micro-organisms embedded in a self-derived polysaccharide matrix. Interesting features of these biofilms include a reduced susceptibility to being killed by the host immune system and to antimicrobial agents.

The root of disease

The major dental examples of diseases caused by biofilms are caries, periodontal diseases (gingivitis, periodontitis) – the two most common chronic infectious diseases in humans – and root canal (endodontal) infections.

The specific shifts in the microbial community structure that lead to the inception and progression of disease are poorly understood for most oral infections. Which is why, at the Eastman, we are looking into what shifts in the populations occur in polymicrobial biofilm-mediated infections.

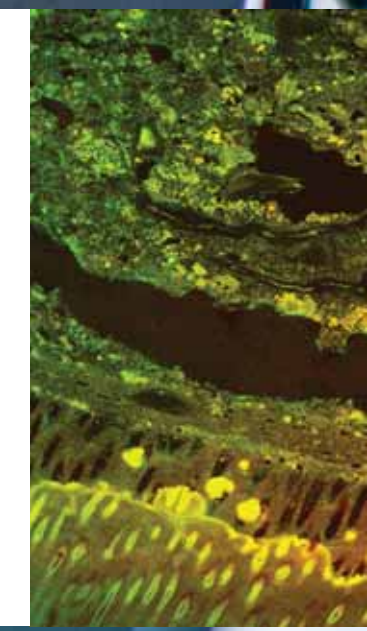
However, a major difficulty with these studies is that most of the microbes implicated are always present in the mouth – even in healthy patients – with changes in numbers and proportions leading to disease states in susceptible individuals.

It is not possible to grow around half of the microbes present, and it can be difficult and time consuming to accurately identify them. So new approaches have been called for.

New techniques, new advances

To overcome these difficulties, we are developing a number of techniques that do not require the isolation of micro-organisms; instead, they are aimed at measuring the genetic, structural, or functional properties of the whole community. We use a range of culture-independent techniques, including metagenomic, metabolomic and community finger-printing approaches, which help us to understand how the community associated with healthy mouths shifts towards the development of disease.

These studies of microbial communities at the Eastman are providing valuable insights into those changes associated with oral health and disease.



We are developing a number of techniques that do not require the isolation of micro-organisms.

Illuminating microbial communities: examining the intricate structure of biofilms (main image)
The root of the problem: bacteria in the dentinal tubules (inset)

Overcoming bacterial resistance

In all areas of health care, bacteria are becoming increasingly resistant to antibiotics. At the Eastman, new methods are being developed to fight antibiotic-resistant bacteria and reduce the risk of life-threatening illnesses.

The Eastman's research has shown that the mouth harbours very high levels of bacteria, many of which are resistant to antimicrobials. We have shown that the genes responsible for antimicrobial resistance are easily passed from one organism to the next, which may explain the rapid spread of resistance.

The main worry is that high levels of antimicrobial-resistant organisms are found in individuals – including children – who have not taken antimicrobials recently, which means that such resistant species can remain active in the mouth for more than 18 months. These bacteria are prolific in a number of areas, including root canals, and could cause local and systemic infections.

Our researchers have also discovered that these bacteria are resistant to the mercury found in dental restorations. This could promote colonisation of the mouth by bacteria resistant to mercury and antibiotics, which could also lead to systemic infections – especially in immunocompromised individuals.

Stopping the spread

To deal effectively with these antibiotic-resistant bacteria, we have developed innovative approaches such as the use of light-activated agents that selectively target and kill specific organisms such as meticillin-resistant *Staphylococcus aureus* (MRSA).

Moving forwards

We are working to develop other measures to counter antibiotic-resistant bacteria, such as light-activated antimicrobial coatings and new photosensitisers that can inactivate potentially drug-resistant bacteria in wounds and on surfaces in clinics and hospitals.

Techniques such as metagenomics are being developed and used in a number of areas, such as to help identify the genes responsible for spreading antibiotic resistance among oral bacteria and beyond.

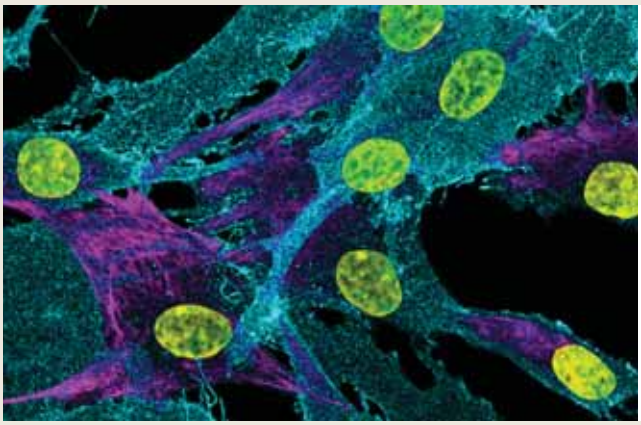
We are also investigating compounds found in common foods and beverages and developing specific functional foods, which are able to reduce the build up of bacteria on tooth surfaces thereby reducing the risk of developing caries and gingivitis.

It is possible that one day, cleaning teeth with an agent derived from food or beverages will safely reduce the risk of dental decay and gum disease, and help prevent infections likely to cause problems elsewhere in the body.

A growing problem: antibiotic-resistant bacteria (left and above right)

The reality of regeneration

Imagine a world where organs can be made or repaired to order. With tissue engineering, a small piece of tissue from the patient can be harvested, the cells collected, cultivated and expanded, and returned to the donor.



Put simply, this research follows two main themes: repair and regeneration.

Researchers at the Eastman have long been associated with exciting developments in science. Cell regeneration is just one such area in which we have been making considerable advances.

We have been concentrating on the biology behind the repair and regeneration of oral/craniofacial soft tissues, which has involved the cellular response of muscle cells and their interactions with their environment.

This has also included other cells and highly topical, bioactive, biodegradable and biocompatible scaffolds for tissue engineering applications. Put simply, our research follows two main themes: repair and regeneration.

The building blocks of research: separating cells from their suspending medium (left)
New for old: human muscle cells grown in the laboratory (above)

Focus on repair

Wounds in the human mouth heal more rapidly and with less obvious scarring than elsewhere in the human body. While the differing physiological environment – such as the presence of saliva – has some role to play, we have shown that there are also fundamental differences in the healing capacity of the cells in the mouth.

Drawing on this knowledge, we are carrying out research to see if these cells can be used to repair skin elsewhere. After all, the required number of cells can be generated more rapidly than with other tissues, which means new tissue could also be generated more quickly.

Applying logic

Using the same theories, we have also been looking at the possibility of deriving cells from human jaw muscle. Again, these muscles appear to be more adaptable than other muscles – we have started to identify the biology behind this and how it might be exploited.

The essential 'ingredient' within the oral/craniofacial tissues that is most likely to be the source of this beneficial cellular biology is a component from the embryological layer known as the neural crest. Once we have unlocked its potential, the possibilities are truly extraordinary.

From concept to reality – advancing tissue engineering

Tissue engineering – developing a biological substitute to regenerate or improve tissue function, or even whole organs – has slowly become a reality across many disciplines. Today, drawing on new techniques and materials, the Eastman is advancing cross-clinical research with exciting discoveries.

Once the realm of myth and legend, the theory of tissue engineering has become a very real possibility thanks to the development of new technologies. However, one of the main problems in this interdisciplinary field is the large amount of tissue needed for most surgical procedures.

In oral health care, however, the tissue volumes needed are relatively small. At the Eastman, we have been able to exploit existing technology and develop new ways to treat tissue defects in the oral and craniofacial environment.

New ideas

Our work is like that of cell biologists in its duality. We have to understand the fundamentals of oral cell function, as these cells can behave very differently from those in other parts of the body. And we also investigate how the cells interact with new biomaterials being synthesised.

We have used engineering technology to develop innovative implant materials. The chemistry used in light-cured polymers has helped us develop degradable composites that can be positioned and cured *in situ*. When used with bioactive fillers, the material breaks down over time and stimulates bone growth.

We have also developed a range of soluble phosphate-based glasses for hard and soft tissue surgery, which we have exploited in fibre form for regenerating muscles and ligaments.

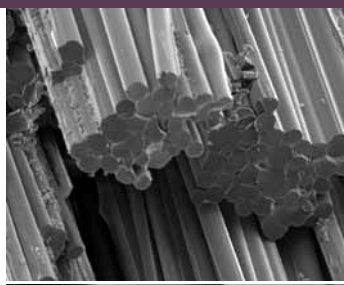
Research and collaboration

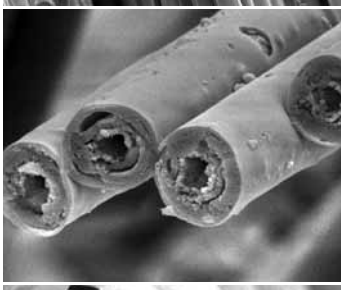
Our research ranges from *in vitro* tests of biocompatibility to larger, longer-term experiments that use tissue bioreactors to grow and maintain cell viability in three-dimensional cultures.

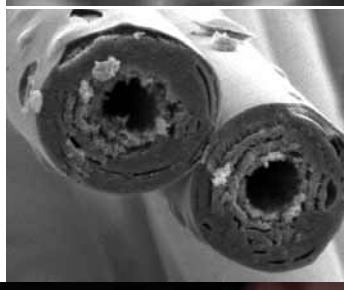
To gain new and wider contextual insights, we pool knowledge with specialists from a variety of disciplines. These help us understand the responses to the application of loads to cells in culture, and how innovative imaging methods like ultrasound can be used to investigate tissue constructs three-dimensionally without damaging them.

We have developed new patented and licensed materials that are now undergoing clinical trials. And our work has even influenced clinical research in other disciplines, opening up the possibility of using mouth stem cells to regenerate a variety of tissues throughout the body.

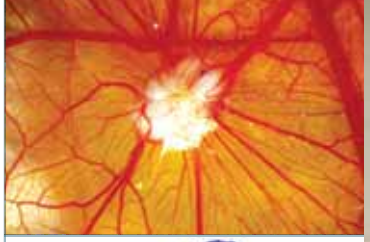
Today, drawing on new techniques and materials, the Eastman is advancing cross-clinical research with exciting discoveries.

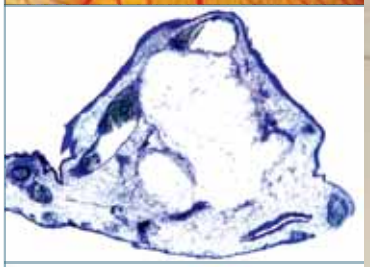


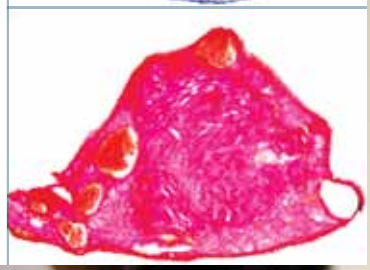




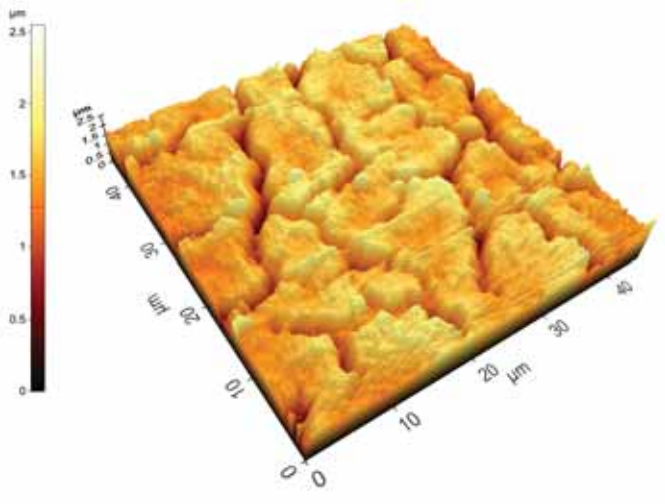
Revealing structures: probing the chemical properties of potential implant materials using x-ray diffraction (main image)
Microscopic fibres – huge potential: microtube formation in phosphate glass fibres (inset)







The Eastman is building on its international reputation of expertise in translational research. Its scientists and clinicians are working together to develop innovative new treatments. A good example of this is in the field of tissue engineering.



Applying regenerative theory to practice

Our researchers have extensive experience conducting preclinical and clinical studies on the effect of active biologic peptides, such as enamel matrix proteins and bone grafts, in periodontal and bone regeneration.

To further research in this area, we have developed a series of experimental models to measure bone healing. Using both established and innovative treatment approaches, the information is correlated to the molecular mechanisms and to the relevant gene expression during healing.

From theory to application: translating research into clinical practice (left)
Regenerating bone: engineered tissues produced by rapid prototyping technology (inset left)
Intimately bound: three-dimensional atomic force microscope image of an implant surface covered with tissue (35 months after implantation) (above right)

New possibilities

We have discovered – through a programme of translational research from basic *in vitro* studies through to preclinical and, ultimately, randomised controlled clinical trials – how and where to evaluate the effects of different implant surfaces and biomaterials in terms of molecular, histological and clinical healing. The research team is also developing stem cells for use in both periodontology and implantology.

By virtue of our strategic partnerships with industry we are able to evaluate new products and develop randomised controlled clinical trials for interventions to re-build and regenerate damaged or diseased oral tissues.

The Eastman has always been at the forefront of dental research and care. Its revolutionary method for treating periodontitis is set to change dental practice around the world.

Shedding new light on oral disease

Periodontal diseases – among the most common diseases of humanity – are caused by bacteria known as periodontopathogens that can trigger damage in the mouth, producing enzymes and toxins which destroy the tissues supporting the tooth (the periodontium). If left untreated, teeth may loosen and eventually fall out.

But these bacteria may also pose a wider threat. They can increase the risk of systemic diseases and, because some bacterial strains are now resistant to antibiotics and antiseptics, it is vital that new approaches are developed against them.

A bright idea: the use of Periowave™ for treating periodontal diseases (main image) The perfect solution: applying the photosensitizer to the treatment area (inset)

New techniques

We have developed a revolutionary new procedure which uses light-activated antimicrobial agents to achieve lethal photosensitisation of the periodontopathogens.

These agents are drugs that have no antibacterial activity in themselves. However, when activated by light of a specific wavelength, they produce toxic chemicals (singlet oxygen and free radicals) which kill bacteria. The Eastman's research has shown these agents can be used to destroy many oral, and other, bacteria without damaging human tissues.

Our approach has been used successfully to treat patients with periodontitis. The light-activated antimicrobial agent is painlessly syringed into the gingival crevice where the disease-causing bacteria live, and irradiated with low-power laser light through an optical fibre. The whole procedure is painless and the bacteria are destroyed within a minute.

Revolutionising health care

Patented by the Eastman, and licensed to Ondine Biopharma Inc, the treatment system is known as Periowave™ and is widely used in Canada by Dental Care Professionals. It has been granted a CE mark, so it will soon be available for use throughout Europe. Periowave™ is a good example of research being carried from the laboratory to the patient.

There are other exciting possibilities for this technique: light-activated antimicrobial agents may soon be used to eliminate antibiotic-resistant bacteria such as MRSA from the nostrils of carriers. And they could also be used to treat and prevent wound infections – benefiting patients and health care professionals globally.

Oral health care

for people with serious medical problems

Good oral health is central to the wellbeing of people with serious medical problems such as cancer, diabetes, haemophilia, heart disease and HIV/AIDS. The Eastman has achieved international recognition for its pioneering work in Special Care Dentistry, taking a leading role in research and patient care.

We have established a World Health Organization (WHO) Collaborating Centre for Research, Education and Service in Oral Health, Disability and Culture at the Eastman and appointed the only professor in Special Care Dentistry in the UK, along with the first consultants in this field. We offer innovative postgraduate courses and, as well as publishing research papers and monographs, our staff authored the first UK books dedicated to the discipline.

Infections of the mouth in immunocompromised groups

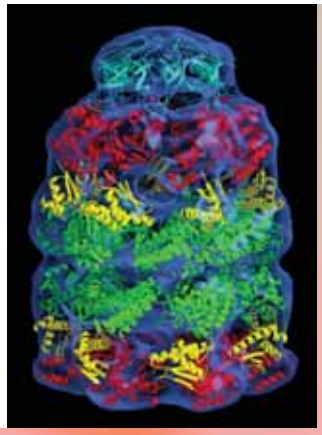
Fungal diseases of the mouth are common, increasingly diverse and/or drug-resistant and have the potential to give rise to systemic infections, particularly in immunocompromised individuals. Eastman researchers have established that the risk of oral infection by fungi in people with diabetes and bone marrow allograft recipients may be influenced by local factors in the mouth, such as the presence of dentures. In collaboration with colleagues in Italy and Australia, Eastman researchers are exploring the development of novel agents that may potentially destroy drug-resistant fungal infections of the mouth.

Kaposi's sarcoma is caused by a virus and is a common mouth tumour in people with HIV/AIDS and those on immunosuppressive therapies, such as patients following kidney transplants. This tumour is caused by Human Herpesvirus 8 (HHV-8). Research at the Eastman has established that the mouth is a common site of this virus and that the amounts detected may predict future risk of developing Kaposi's sarcoma.

Eastman researchers have found that HHV-8 is easily transmitted in saliva, highlighting the need for good infection control measures, particularly in clinics that manage immunocompromised patients such as renal units.

Artificial mouth – real results: replicating the oral environment for the study of fungal disease (right)

The Eastman has achieved international recognition for its pioneering work in Special Care Dentistry.



The impact of oral health on systemic health

The Eastman is renowned for pioneering innovative treatments in oral health care. But its latest findings show how treating periodontal disease could actually have far-reaching medical benefits.

Cultivating innovation: growing human tissues (main image)
Heat shock proteins: a novel treatment for inflammatory diseases (inset)

Around the time that bacteria were discovered at the end of the 19th century, physicians started to question whether distant 'foci' of tissue infections (e.g. mouth infections) might be harmful to other organs. In light of this 'focal infection' theory they often carried out tooth extractions indiscriminately. But they failed to reduce diseases like rheumatism, and arthritis and so the theory collapsed.

However, over the past decade, new evidence has emerged that links periodontal disease with general illnesses such as diabetes, heart disease, stroke, lung infections and even adverse pregnancy outcomes.

New evidence

At the Eastman, our research has indicated a causal relationship between periodontal disease and blood vessel function. The evidence suggests that bacteria invading periodontal tissues may enter the bloodstream and damage arteries or trigger a low-grade inflammatory response in the body.

We hypothesise that intensive treatment for periodontitis could lead to a significant improvement in circulatory function, which in turn could help prevent some of the UK's biggest killers – heart attacks and strokes. A recent pilot study by the Eastman showed that treating periodontitis led to improved glycaemic control in people with diabetes.

Taken together, these findings, if confirmed, could have a real impact on public health.

Further studies

Studies of patients with periodontitis revealed lowered levels of cell stress proteins (CSPs) in their blood, proteins that prevent changes to cells under the stress of disease. When the patients received periodontal treatment, the levels of one of these CSPs – known to be immunosuppressive – increased in circulation. It is the first evidence to suggest that this CSP, termed heat shock protein (Hsp)10, could be used to treat inflammatory diseases.

There is still much research to be done in the field of mouth/systemic microbial interactions, but there are indications that the results could help in preventing some common, and serious, illnesses.

Local treatment – far-reaching benefits: periodontal surgery (above)

Vital research into facial abnormalities

Understanding the causes of abnormal facial growth is the first step to any corrective treatment approach. Having spent years closely studying what occurs in the process, the Eastman is putting research into practice – and achieving some spectacular results.

Facial deformity can happen for many reasons – from abnormal facial growth, to acquired disease or pathology, or direct physical trauma. Most of these abnormalities are coupled with severe malalignment and malocclusion of the teeth. This combination of facial and dental problems can lead to major functional and aesthetic difficulties and, in some cases, severe psychological distress for the affected individuals and their families.

A clearer understanding

The Eastman has been at the centre of an internationally-renowned research programme, which has enabled us to build in-depth knowledge of the interaction of muscle and bone in both normal and abnormal growth, as well as in development of the face and jaws. We now have a much clearer understanding about how well this interaction can adapt to different clinical treatment approaches – whether in a growing child through techniques such as myofunctional orthodontic appliances and osteogenic distraction techniques, or in a mature adult through orthognathic surgical procedures.

From research to results

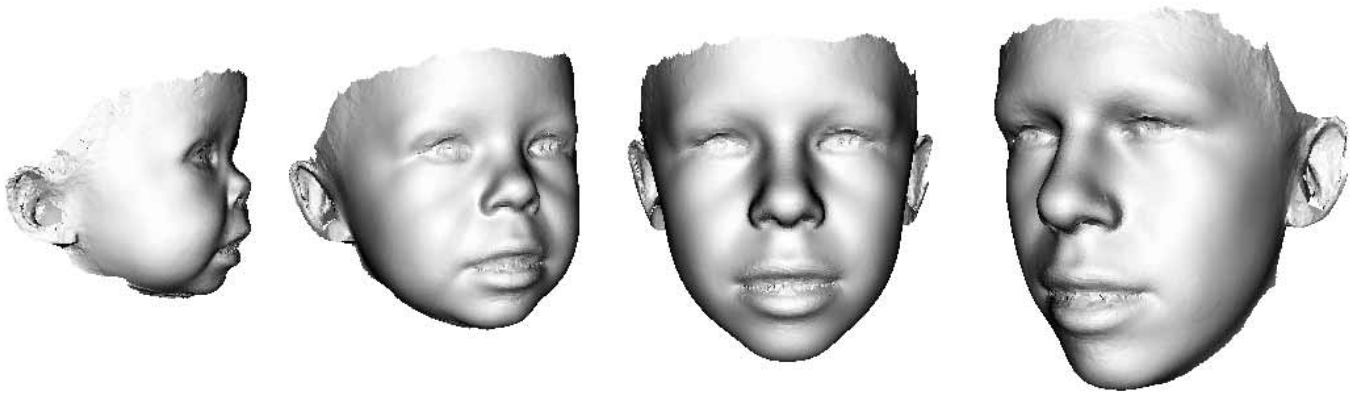
Even more importantly, we are seeing this scientific research being put into effective clinical practice. The Eastman has become a national referral centre for muscle-related disorders which directly affect the face and jaws. The opening of our state-of-the-art Craniofacial Centre has provided ideal facilities for both clinical developments and many other health care research projects – all aimed at improving the quality of care provided and the long-term success of treatment.

Recognised the world over

Our fundamental goals for treatment have always been total patient satisfaction and improved quality of life. We are proud of our reputation as one of the world leaders in research in these important areas. Our experienced, multidisciplinary approach has seen us achieve extremely high patient satisfaction scores. As a local, national and international referral centre, we look forward to staying at the forefront of developments in research and patient care in this important area.

Facial asymmetry: a major functional and aesthetic challenge (inset)
Before and after: examining the results of orthognathic treatment (main image)

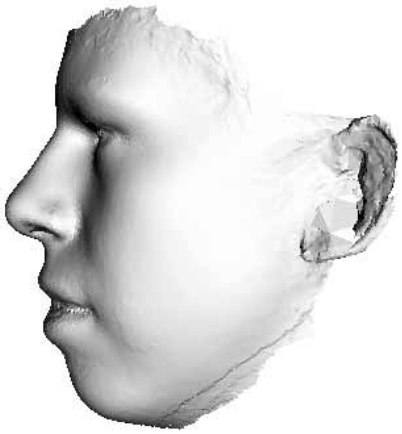
Our experienced, multidisciplinary approach has seen us achieve extremely high patient satisfaction scores.

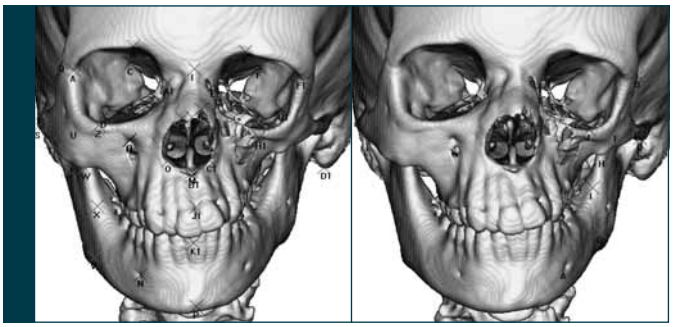


Genetic clues

– scanning the face for abnormalities

There are over 700 genetic disorders that can affect facial appearance and the functioning of the mouth but, due to their subtle differences, the clinical diagnosis of these abnormalities is often difficult. At the Eastman, researchers are making significant advances in the recognition of these genetic defects.





Without an understanding of the range of facial appearances it is impossible to determine the exact genes responsible for normal facial development. Which is why our researchers, in collaboration with colleagues from around the globe, have made significant advances both in the recognition of facial anomalies of important craniofacial disorders and the genetic defects that underlie such conditions.

Detailed research

Over the past five years, we have captured three-dimensional images of thousands of children and adults from many countries around the world. Each image contains details of over 25,000 points on the facial surface, thereby allowing us to record the most subtle contours of the face.

A model diagnosis: facial growth in Williams Syndrome (above left)
Pinpoint accuracy: the use of three-dimensional CT scans in treatment planning (above right)

From the library of images, we developed computation models called Dense Surface Models (DSMs) that allow recognition of facial abnormalities likely to have a genetic basis. The power and potential application of DSMs in the diagnosis and research of facial anomalies is immense. We have already been able to demonstrate that it may be possible to diagnose with 90% to 95% accuracy disorders such as Williams, Noonan, velo-cardio-facial, Smith-Magenis and chromosome 22q11 deletion syndromes. In addition, this research has helped determine the genes responsible for some of these facial anomalies.

In the future it is likely that this work, which involves the Institute of Child Health, will be central to our understanding of the genetic regulation of growth of the face; early, non-invasive diagnosis of facial anomalies of children and young adults; and aid facial reconstruction following trauma or malignancy.

A brighter future

– improving the outlook for oral cancer care

Eastman researchers have made significant strides in developing methods of potentially reducing the risk of oral cancer arising and/or becoming advanced.

The incidence of oral cancer is rising in the developed world but the prognosis has yet to improve – over 50% of patients still die within five years of diagnosis. However early diagnosis of cancer, or stages prior to cancer (precancer) can greatly improve the outlook for those affected and minimise the adverse sequelae of treatment which can impair aesthetics, speech and swallowing.

Eastman researchers have established the exact risk of tobacco and alcohol in carcinogenesis, identified human papillomaviruses as a cause in some cases, and have established that conventional biopsy remains the most effective means of confirming the diagnosis. Eastman researchers have made significant strides in developing methods of potentially reducing the risk of oral cancer arising and/or becoming advanced. A collaborative research group from the Eastman, the University of Sheffield and the Centre for Health Economics, University of York published a Health Technology Assessment report that showed that dentists and doctors who take advantage of routine check-ups to screen their high-risk patients for oral cancer may be the most cost-effective guard against the disease.

Eastman researchers have developed new methods to treat precancer and early oral cancer using photodynamic therapy (PDT). This technique employs light-sensitive agents that concentrate in the cancer or precancer. Application of a cold laser activates a photosensitiser releasing oxidizing agents that kill the cancer cell. The researchers have established that this PDT may offer a new means of treating early cancer and precancer. Researchers have also been developing imaging methods by which the margins of cancers can be more clearly identified than was previously possible, also potentially reducing the need for extensive surgery, and improving patients' quality of life.

Molecular biology: central to the understanding of the pathogenisis of oral cancer and precancer (left)

From research to best practice

In just five years since its inception, the Eastman's International Centre for Evidence-Based Oral Health (ICEBOH) now leads in evidence-based oral health research and provides world-class training to clinicians, policy makers and academics. The focus of its work is to bridge the gap between research findings and effective oral health care.

Since its inception, the Eastman's ICEBOH has gone from strength to strength, building a reputation for excellence through award-winning clinical research, research synthesis, training and collaboration on a wide range of projects.

Our collaborative projects have received two awards from the International Association of Dental Research (IADR), while the Royal Society of Medicine awarded us the Colyer Prize for 'best research portfolio in the UK'.

A centre for learning

From the European Federation of Periodontology and Nordic Research Council, to the American Academy of Periodontology and Swiss Dental Association, we have trained many individuals and groups who have gone on to base state-of-the-art workshops and clinical recommendations on our evidence-based methods.

Our work has wider implications for associated health care.

Cutting edge research

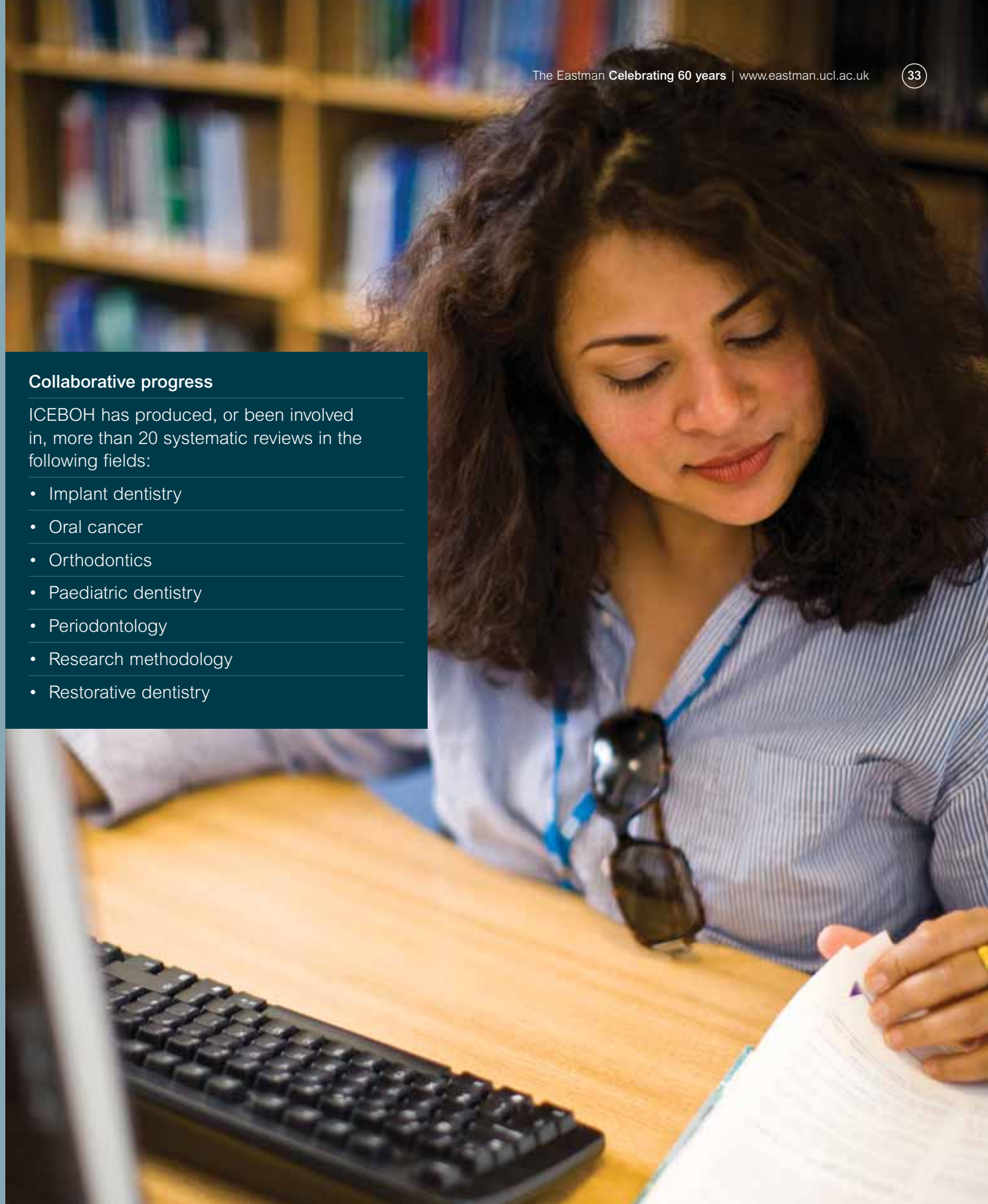
Our work has wider implications for associated health care. We use research synthesis to design and conduct clinical trials to address important health issues, such as preventing pneumonia in critically ill patients, or investigating quality of life after periodontal therapy.

Through established national guidelines and assessments, we have encouraged organisations to use research to inform their clinical practice. We recently worked with the Health Technology Assessment programme to investigate the cost effectiveness of oral cancer screening, and helped develop the Dental Recall Guideline for the National Institute for Health and Clinical Excellence (NICE). We also helped create an Oral Health Assessment for the Department of Health.

Fostering partnerships

Our partnership with other organisations underpins much of the success and scope of our work. Our commitments include acting as an editor and statistical advisor for the Cochrane Collaboration's Oral Health Group and Chair for the International Association for Dental Research Evidence-Based Dentistry Network. We are also a member of the UK Virtual Centre for Improving Oral Health and the European Union Dentaid working group on Evidence-Based Dentistry. These roles put the Eastman's ICEBOH in a position of leadership and responsibility in evidence-based health care.

Uncovering the evidence: consulting source materials in the Information Centre (right)



Collaborative progress

ICEBOH has produced, or been involved in, more than 20 systematic reviews in the following fields:

- Implant dentistry
- Oral cancer
- Orthodontics
- Paediatric dentistry
- Periodontology
- Research methodology
- Restorative dentistry

Essential support

effort
EASTMAN FOUNDATION
FOR ORAL RESEARCH & TRAINING

The Eastman Foundation for Oral Research and Training (EFFORT) is a registered charity set up to support both the Institute and Hospital.

Keeping up-to-date: studying in the newly refurbished Information Centre (left)
State-of-the-art equipment: supporting teaching and learning (below right)

From Eastman
to San Francisco
My research on a
poster to show
It's a prestigious event
But my budget is spent
Oh please can you
help me to go?

The charity's main work involves promoting the prevention of oral disease. It does this by raising the standards of education to improve knowledge of the means and possibilities to prevent, diagnose, treat and cure diseases.

Promoting learning and understanding

The charity is involved in a number of projects, providing essential financial and educational support. Its diverse work includes establishing an EFFORT PhD Fellowship and co-funding the refurbishment of three laboratories at the Eastman and equipment for a number of the Eastman's units and divisions. Additionally, it has contributed to the furnishing of the Eastman Information Centre.

EFFORT believes that research is crucial to the development of oral health care. Which is why it provided matching funding with the Engineering & Physical Sciences Research Council for a PhD Fellowship, and supports two research projects with targeted funding from commercial companies.

Academic life

EFFORT offers exciting and unique opportunities to both staff and students. The Limerick/EFFORT travel awards in 2005 and 2006, funded by Lady Limerick (a previous Chairman of EFFORT), allowed 13 junior staff members and fellows to travel to scientific meetings around the world to present their research findings.

Applicants for a travel award had to write a limerick outlining their area of interest and the reasons they were applying – which certainly added a unique twist to the proceedings!

For more information about EFFORT's work visit ***www.eastman.ucl.ac.uk***
or to make a donation email ***effort@eastman.ucl.ac.uk***

Putting patients first

With internationally-renowned staff and extensive expertise, the Hospital works closely with the Institute to provide the highest quality oral health care.

The Eastman has one of the highest concentrations of oral health care specialists in Europe; many are leaders in their fields. Their dedication to first-class patient care is underpinned by a culture of rigorous clinical research coupled with an environment that promotes excellence in academic endeavour.

Key strengths of the Eastman's clinical teams are the breadth of expertise among staff and a passion for working together across disciplines. These qualities enable us to solve complex clinical problems and seek ways to enhance patient care and improve clinical outcomes for possibly the largest and most diverse group of patients in Europe.

The Eastman is home to a number of internationally-renowned units dedicated to areas such as hypodontia, special care dentistry, orofacial pain and craniofacial anomalies. These were developed in response to an ever-widening range of oral health challenges to ensure the seamless care of patients with complex needs.

Leading the way

The Eastman is committed to 'putting patients first' and is at the forefront of reform, helping to develop new models of care in the NHS.

The Eastman's focus on innovation has led to initiatives that promote the role of oral health care in the management of patients with cardiovascular disease and other systemic disorders in response to the latest evidence linking oral health with systemic disease. We have also pioneered the first smoking cessation clinic based exclusively in a dental hospital.

The Eastman is central to oral health care provision for both the local and national population. Investment in a new building with state-of-the-art facilities, relocation within the heart of the expanded UCLH NHS Foundation Trust and UCL Bloomsbury biomedical campus, and enhanced outreach clinical services, will ensure that the Eastman is perfectly placed to continue to promote the highest standards in oral health care.

An expert opinion: initial assessment in the Craniofacial Centre (main image)
Teamwork: the Orthognathic Team review progress (inset)

Unrivalled educational expertise

What sets the Eastman apart in education is its focus on specialist education and training. With the most comprehensive portfolio of postgraduate courses in Europe and renowned teaching staff, it is superbly placed to meet the demands of today's dental health care professionals.

At the Eastman, we work hard to ensure we maintain our reputation and success as a centre for learning excellence. We pride ourselves in first-class, innovative education, training and Continuing Professional Development (CPD) delivered from state-of-the-art facilities.

Our prestigious portfolio of Masters programmes is one of the largest at UCL, with programmes attracting substantial numbers of applicants from home and abroad. Our online CPD programme with the British Dental Journal is one of the largest of its type with over 11,700 dental care professionals enrolled.

World-renowned academics

Our teaching staff are acclaimed leaders in their field. They regularly appear as invited keynote speakers at international conferences and are involved as editorial and advisory board members of over 40 leading dental and other publications and are widely published in clinical research journals such as the *Journal of Dental Research*, the *New England Journal of Medicine*, *The Lancet*, the *Journal of the American Dental Association* and the *British Medical Journal*. This level of expertise is highly regarded both nationally and internationally.

Our clinical teaching extends beyond oral health care. Postgraduates also learn how to manage problems affecting the head and neck, from treatment of the disfigured face and implant reconstruction, to photodynamic therapy and management of the patient with oral cancer.

Modern methods

We respond to changing patterns in disease and health care, so our training always retains its professional relevance. With flexible study modes, busy practitioners can work at their own pace towards UCL programmes, such as the Certificate, Diploma or Masters in Restorative Dental Practice, whilst maintaining their professional commitments in practice.

To make sure all dental professionals keep pace with developments in oral health care, we offer a diverse variety of part-time opportunities, ranging from Certificates in Dental Sedation and Pain Management, Endodontics and Paediatric Dentistry to Diplomas in Clinical Dental Sciences, Implant Dentistry and Special Care Dentistry. We even offer holistic subjects such as Dental Hypnosis or management classes including Dental Practice Finance.

Above all, our aim is to make sure every member of the dental team has access to the very best clinical teaching in Europe and beyond.

Hands-on experience: at work in the endodontic skills laboratory (right)
Learning in a positive environment: small-group teaching at Eastman CPD (inset)

Key facts

First dental school to receive the Queen's Anniversary Prize for Higher and Further Education.

Dentists from 18 countries registered for online CPD.

Over 1,750 dentists and dental care professionals contribute to almost 6,000 attendances on 300 flexible courses annually.

Over 350 postgraduates from 30 countries enrolled on UCL programmes on site.

Eastman staff have authored more than 55 textbooks – amongst the largest number per head of staff at dental institutes worldwide.

The true reach of the Eastman

The work of the Eastman extends far beyond the Institute and Hospital. Its staff are involved in a wide range of professional activities and public service commitments.

From public service to charity work, Eastman staff lend their years of experience and expertise to help government health care policy makers devise guidelines for the care of patients suffering from conditions such as cancer of the head and neck, haemophilia and HIV/AIDS. They also contribute to international policy processes such as the USA Surgeon General's Report, and serve on national committees within the NHS, the various Royal Colleges and independent charitable organisations. Many are on the editorial boards or act as advisors to peer-reviewed journals.

As part of our 60th Anniversary, we are honoured to acknowledge and celebrate these wider contributions to society.

Reaching the pinnacle of success: climbing Mont Blanc

The Eastman hosts the only World Health Organization (WHO) Collaborating Centre for Research, Education and Service in Oral Health, Disability and Culture. Apart from many research and teaching activities, this centre has published the first book on culturally-sensitive oral health care.

To further raise the profile of oral health issues, our staff have supported a number of charitable causes. Examples include the Oral Medicine Unit who actively promote the awareness of oral cancer by providing mouth screening services at annual events organised by the Mouth Cancer Foundation.

Leading the profession

In academia, we have provided expertise for the national assessments of teaching, learning and research by the Higher Education Funding Council for England. We have also acted in an advisory capacity to help other universities across the world develop their research or masters training for dentists.

Many of our staff hold key roles in professional societies and, in this capacity, have been instrumental in bringing together colleagues from around the world for the exchange of ideas at scientific meetings and symposia.

Eastman Alumni have gone on to become high profile figures within the dental profession, in roles including Chief Dental Officers, Deans, and Vice Chancellors and a number have received honours in their respective countries.

The energy and enthusiasm of Eastman staff does not stop there. Some also find the time to lend their individual support to charitable organisations through events such as running the London and New York marathons.

As part of our 60th Anniversary, we are honoured to acknowledge and celebrate these wider contributions to society.

Going the extra mile: raising funds for charity by running the London Marathon (left)
Raising awareness: oral cancer screening at the Mouth Cancer Foundation Walk (top right)
Safe to drink: Cellopore™, an Eastman invention for purifying water (bottom right)

Dedications from international colleagues

"In the past forty years I have seen the Eastman Dental Institute developing into a highly respected institute. Truly the best dental institute in the world!"

Isaäc van der Waal
ACTA (Academic Centre for Dentistry of Amsterdam), Amsterdam, The Netherlands

"It was the greatest opportunity of my life to be accepted to study at the world's most splendid institute, the Eastman, where I not only gained tremendous knowledge of my specialty, but learnt many other invaluable things about life there."

Kobkan Thongprasom
Knight Grand Cordon (Special Class) of the Most Exalted Order of the White Elephant, Professor, Chulalongkorn University, Thailand

"Eastman's excellence in oral health care education has been an inspiring beacon for those of us from Asia attempting to emulate its success in a regional context. We wish to congratulate Eastman – no doubt the grandest old dame of dental education worldwide – for reaching 60 years. Here's to its continued success!"

Lakshman Samaranayake
Dean, Faculty of Dentistry, The University of Hong Kong, and Director, Prince Philip Dental Hospital, Hong Kong, China

"The Eastman has a long tradition of discovery, development and translation of science to the clinic that is unparalleled in dentistry. The diversity of activities in clinical practice, clinical and basic research, and the diversity of faculty and staff at the Eastman today ensure that this tradition will continue for another 60 years and beyond."

Thomas E. Van Dyke
Director, Clinical Research Center, Boston University, USA

"The Eastman Dental Institute in London has become a world-class dental institution. It is one of the few truly global dental institutions providing leadership in oral health research, education and clinical care."

Cyril Meyerowitz
Director, Eastman Dental Center, Professor and Chair of Dentistry, School of Medicine and Dentistry, University of Rochester Medical Center, USA

"The Eastman Dental Institute is a place of light, liberty and learning, with a prestigious, renowned faculty. Throughout the years, all my postgraduates who studied at the Eastman thought that it was a worthwhile experience and have gone on to take up leading roles at other universities. The Institute educates the postgraduates perfectly in each special area of dentistry and enables them future success wherever they go and in whatever they choose to do. I wish the Eastman Dental Institute continued success for the future."

Selcuk Yilmaz
Head and Chair of Periodontology, Director of the EFP Accredited Graduate Programme, Consultant/ Specialist in Periodontics, Yeditepe University, Dental Faculty, Istanbul, Turkey

"The Eastman Dental Institute in London is one of the leading international centers for research and postgraduate education."

Jan-Ivan Smedberg
Head of Eastman Dental Institute, Stockholm, Sweden

"There was a time when young men were advised to go West. Now we know better. Young people go East and become Eastman!"

Heikki Murtomaa
Head and Chair, Department of Oral Public Health, Institute of Dentistry, University of Helsinki, Finland

"On its 60th birthday the Eastman Dental Institute turned into the world's capital establishment of oral health care, education and research. Its students are present in all corners of the globe, many of whom are distinguished academics and clinicians in their own countries. This would not have been possible without the relentless efforts of its keepers. We are proud to be affiliated with it and we will keep practising and preaching its scientific values."

Zaid Baqain
Chairman of the Oral Surgery, Oral Medicine and Periodontolgy Department, University of Jordan, Amman, Jordan

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Credits

Page 17, inset images
Ensanya Ali Abou Neel, Anne Margaret Young,
Showan Najdat Nazhat, Jonathan Campbell Knowles.
A Facile Synthesis Route to Prepare Microtubes from
Phosphate Glass Fibres.
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Neil A Ranson, George W Farr, Alan M Roseman,
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ATP-Bound States of GroEL Captured by
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