

Linking Research and Teaching in Microbiology



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Curriculum Design and the Research-teaching Nexus

(Jenkins et al., 2007: HEA; Healey 2005)

- Research –tutored
 - Curriculum emphasises learning focused on students writing and discussing papers or essays
- Research-based
 - Curriculum emphasises students undertaking inquiry-based learning
- Research-led
 - Curriculum is structured around teaching subject content
- Research –orientated
 - Curriculum emphasises teaching processes of knowledge construction in the subject

Research

- Attachment of microorganisms to surfaces, and biofilm formation
 - Oral microbiology
 - Food hygiene
 - Surface modification
 - Different surfaces, different applications and perspectives
 - Cross-disciplines (chemistry, engineering, maths, art..)

Teaching


- Lectures
- Tutorials
- Undergraduate practical classes
- Undergraduate/taught postgraduate project work/research postgraduate (supervision)
- Assignments

Lectures

- Research topics
 - Oral microbiology
 - Biofilms
- Cross-disciplinary

Oral microbiology

- Overview lectures to second year undergraduates (biology/BMS): 60-200 students
- Microbiology module
- Applied microbiology/normal flora
 - Public health aspects – general interest
 - Students considering dentistry – final year projects
- Demonstrates research activities in School
- MCQ/Exam

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- Denture plaque
 - Denture fixatives
 - Microbial contamination of toothbrushes
 - Bad breath
 - Probiotics
 - Chewing gum, mints

Microbiology and Art

- Deterioration of cultural heritage
- Other links between microbiology and (the) art(s)
 - Beauty of microorganisms
 - Impact of microorganisms on content
 - Sci-art collaboration
 - Public understanding of science

Microbiology and art lecture

- Year one, first term, undergraduates: over 200
- Microbiology module
- Assignment
 - Product linking microbiology and art
 - Work alone or in group (up to 3)
 - Negotiate assessment criteria

Outcomes

- Memorable, interest in subject
- Students inspired for research projects
- Unpredicted
 - Publications, presentations
 - Dynamic - examples provided by colleagues
- Collaboration with researchers in other disciplines
 - Human geography
 - Ecological artist
 - North West Film Archive
- Exhibition, sponsorship
 - Leica, Yakult, DALY

Tutorials

- Biofilms
- Year three
undergraduates
- Medical microbiology
module

Biofilms tutorial

- Literature on biofilms in medicine (web, journals, reference books – text books less helpful).
 - What is a biofilm?
 - What particular features make biofilms important in medicine?
 - Consider the range of biofilm-associated infections.
- BIOFILMS: The Hypertextbook
www.erc.montana.edu/biofilmbook/
- Evaluation information and forms:
- www.erc.montana.edu/biofilmbook/forms/

Undergraduate practical classes

- Isolate microorganisms from oral cavity
- Identify
- Design experiment
 - Effect of essential oils, toothpastes
 - pH change when incubated with
 - Adhesion assays
- Write up

ASM Curriculum Resources

- Online (fee)
- www.asm.org
- Peer reviewed
- Very full information
- Suggestions for modifications
 - Different classes etc.

'Exploring oral biofilms and the contamination of toothbrushes'

- Week one:
 - Sample plaque
 - Cut head from toothbrush, place in test-tube, mix and plate out liquid
 - Use range of culture media
- Week two
 - Electron microscopy
 - Gram stain
 - Counts

Report (individual or group)

- Brief introduction, methods
- Results
- Discussion
 - Origin of brush contamination?
 - Survival of oral species?
 - Cross-infection hazard?
 - Variation between individuals?
 - Effectiveness of selective media?
 - Limitations of data, design etc.

'Chairside Diagnosis for plaque-associated oral infections'

- No overnight incubation
 - Darkground microscopy/gingival flora
 - Acidogenic properties of saliva
 - Plaque quantity (disclosed)
 - DMFT
 - Images and class data
- Extensive laboratory report with guidance.
- Include images, internet resources etc.
- Success of chairside demonstrations?
- Information available to public?
- Additional chairside procedures
- Minimum intervention strategies

Cross-contamination

- Mobile phones

Wash your hands, caller. Your mobile's dirtier than you think

YOUR mobile phone could be a major health hazard, research shows. The phones, an essential part of everyday life for 55million Britons, are crawling with potentially lethal bacteria.

With tens of thousands of microbes living on each square inch, they harbour more bacteria than a lavatory seat, the sole of a shoe or a door handle. Microbiologists say

By **Fiona MacRae**
Science Reporter

the combination of constant handling and the heat generated by the phones creates a prime breeding ground for all sorts of bugs that are normally found on our skin.

They include *Staphylococcus aureus*, which can cause illnesses from pimples and boils to

pneumonia and meningitis and is a close relative of the superbug MRSA.

Joanna Verran, professor of microbiology at Manchester Metropolitan University, said: 'Mobile phones are stored in bags or pockets, are handled frequently and held close to the face.

'In other words, they come into contact with more parts of our body and a wider range of bacteria than toilet seats. The

phones contained more skin bacteria than any other object. This could be due to the fact that this type of bacteria increase in high temperatures and our phones are perfect for breeding these germs as they are kept warm and cosy in pockets, handbags and briefcases.'

Mobile firm Dial-a-Phone advised owners to use anti-bacterial wipes to keep their handsets germ-free.

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Other projects

- Second year summer term, alternative to industrial placement/research experience
 - Prelude to final year project
 - Opportunity for interested student
 - Opportunity for preliminary work
 - Novel activities
 - DVD, outreach, lab work
 - External funding
 - Sfam, LTSN, DTI etc.

Undergraduate Projects

- Continuation/extension/repetition of specific research areas
 - Cross-contamination
 - Antimicrobial surfaces
 - Oral microbiology
- Peer reviewed abstracts
- Several full peer-reviewed papers
- Preliminary work for subsequent research projects (taught MSc, PhD)

Dental technology

- Hygiene - basic principles
- Cross-contamination
 - Dental technology labs
 - Ocular impressions
- Materials characterisation and interaction with microorganisms
- Links with Manchester University Dental Hospital

Final Comments (1):Students

- Knowledge of research activity within School
- Applied microbiology
 - Relevant
 - memorable
- Laboratory classes, research-led
- Real research experience
 - Literature
 - Laboratory
 - Problem solving
- Connecting across subjects: communication
 - Interesting

Final Comments (2) Staff

- Energising
- Useful for research
 - Research feeding into practicals: results informing projects
- Website 'In The Loop' www.sci-eng.mmu.ac.uk/intheloop
 - Research, consultancy , education and resources
- Publications,
 - Research
 - ' Education'
 - <http://resources.glos.ac.uk/ceal/resources/casestudiesactivelearning/undergraduate/casestudy10.cfm>
- Dissemination of practice within discipline
 - Society for General Microbiology www.sgm.ac.uk
 - Int Biodet Biodeg Soc. www.biodeterioration.org