

Departmental Teaching Enhancement Scheme Final Report

Project Leader: Dr Kay Yeoman

Project Title: The Development of a Science Communication Course for Undergraduates in the Science Faculty at the University of East Anglia.

Project Completed: December 2009

Abstract

Science communication is a rapidly expanding area. It is recognised that for meaningful engagement between scientists and citizens there needs to be effective two way communication, understanding and learning. This course focussed specifically on science communication and aimed to bring an understanding of how science is disseminated to the public. Students on the course were made aware of the theories surrounding communication and investigated science as a culture and how this culture interfaces with the public. Students also examined case studies in a variety of different scientific areas. They looked at how information is released in the scientific literature and how this is subsequently picked up by the public press. They gained an appreciation of how science information can be used to change public perception and how it can sometimes be misinterpreted. Students also learned practical skills related to designing, running and evaluating a public outreach event at a school or in a public area.

Tangible outcomes

The module was designed to reflect the growing discipline of science communication and included specific case studies given by research active staff in the field. There were three strands to the module design, the lecture programme, a project and the evaluation, which included self-reflection and action learning (see table 1).

Table 1. The Level 3 science communication module has a three stranded pedagogy:

Lecture programme	Project	Evaluation
History of modern science Theories of learning and communication How the public culture and science culture interface Specific case studies e.g. Stem cell research, GM food, Bird Flu.	A public or school engagement event	Questionnaires Participant observation Self reflection Action Learning

The module has been updated each year academic year to reflect student feedback and to update the case study seminars. The current module guide is attached in appendix 1.

Project Strand

Following the success of the public engagement event '*Totally Amazing me*' (detailed below, 2007-8 academic year), a variety of projects were offered for the 2008-9 academic year:

- Public event at the Castle Museum - 'Norfolk Science Past and Present'
- Science club for year 6 at Avenue Junior School (with pupils working towards a BA Bronze Crest Award)
- Helping to design an interactive area for the newly refurbished Natural History gallery at the Castle Museum.

- Video clips of research in our Biomedical Research Centre, for the Big C (local cancer charity).*
- DNA mutation event at Hethersett High School
- Turning research generated images into postcards
- Documentary production of climate change and the Norfolk Coast.*

*Students involved in the video projects were given a day's training at BBC Voices at The Forum in Norwich.

The 2009-10 academic year the following projects were offered:

- Public event on 'colours' at the Norwich Inspire Science Centre
- Public event 'Norfolk Rocks' at the Norwich Castle Museum.
- Science club at Avenue Junior school
- Human senses day at Heartease Primary school
- Cells day at Heartease Primary school
- Gifted and Talented day 'Living or Lifeless' at the Norwich castle Museum and BBC voices
- Mini-beasts at Chapel Break Infants school
- Widening participation in medicine event
- Design of an 'in house' biology gossip magazine

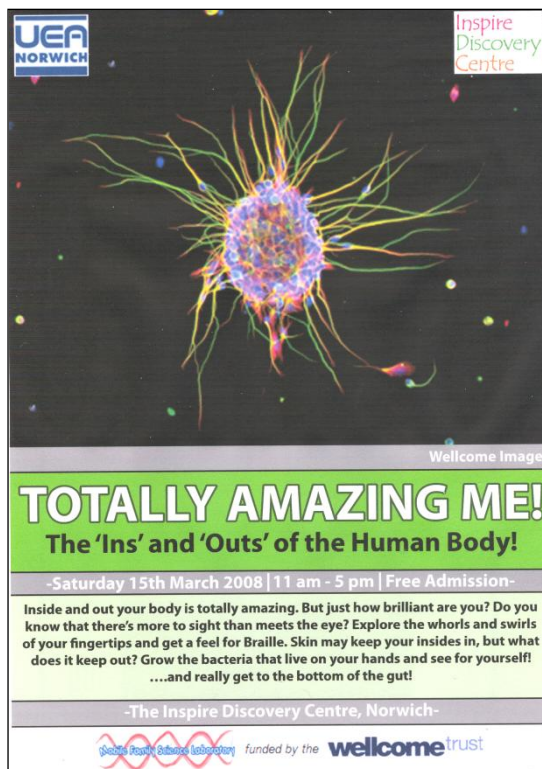
In the three year period there have been seventeen different engagement projects, 81 students have been involved in the design and delivery of projects and several thousand people have attended our events.

Science Communication event

The science communication event, called "Totally Amazing Me" was held at the Inspire Science Discovery Centre during Science Week (March 2008) and featured nine separate activities centred on the human body. Each student designed and developed their own activity in the following areas:

1. Brain waves
2. Digging for bones
3. The poo factory
4. Optical illusions
5. Touch
6. Nasty germs and friendly cells
7. Fingerprints
8. The Cell
9. Human ageing and the skin

Individually, each student had to think creatively and carefully about their activity to ensure it would appeal to a wide age range and also cater for the different learning styles of their audience. Their activities had to go through a process of development, from the initial concept, through to sourcing the materials, keeping to budget and designing posters and other display material. The students used self-reflection in order to develop their ideas. As a group, the students designed a marketing leaflet and also an evaluation postcard which was then used to ask the public for their feedback. One of the students was also given an opportunity to market the event on a local radio station. Each student also had to write a risk-assessment for their activity, which was then compiled to form the final risk assessment document. Each individual student produced an evaluation report, based on the public feedback and also a



portfolio, which included the self-reflection process on the development of their activity, as well as all the display materials.

The event was a real success with 400 visitors from across Norfolk. The visitors were asked to evaluate the event and they all said they had really enjoyed the experience and would take their children to a similar event again. Interestingly, 85% of the children said that it had made them think about science differently. The students themselves really enjoyed the experience of development and also the actual delivery:

'Science isn't just something that takes place in a laboratory. It is happening all around us, all of the time. Totally Amazing Me gave me a chance to show children and their families just how fascinating science can be. The look of delight on a child's face when they realise that they can 'do' science really motivates me.'

Student Cohort 2008-9 and 2009-10

In 2008-9, thirty four students enrolled from a variety of degree programmes across the Science Faculty; Environmental sciences, Environmental Earth sciences, Biology with management Biological Sciences, Ecology, Microbiology, Molecular Biology and Genetics, Biomedicine and Natural Sciences. In this current academic year, 38 students enrolled on the module, again from a variety of degree programmes across the Science Faculty.

Evaluation

Evaluation method using for the 2008-9 cohort

At the start of the module all the students were given a questionnaire to fill out (see appendix 2), in order to uncover their expectations of the module. The questionnaire was repeated at the end of the academic year and combined with the usual UEA evaluative procedure.

When asked why they chose the module, 74% said that it sounded interesting, 84% said because they wanted to gain experience. Only 7% said it was because they couldn't think of anything else to do. This indicates that the module was chosen for the right reasons, i.e. for interest and experience.

Student Distribution

Of the students taking the module in the 2008-9 academic year, 41% were female and 59% were male. This is in marked contrast to this current academic year where 8% are male and 92% female. Students come into the module from a variety of backgrounds, although the majority are biological sciences (C100) students.

Skills development

Table 2. When asked what skills they would/did develop, the students responded with the following percentage distribution pre and post module.

Skill	Percentage (%) pre-module	Percentage (%) post-module
Writing	44	69
Speaking in groups	81	44
Oral Presentations	67	38
Designing display materials	70	69
Constructing an argument	59	31
Working in a team	81	63
Independent learning	25	56
Working with outside organisations	88	56

From the data in table 2, it's interesting to note that only 25% of the students felt that they would develop independent learning, although 88% felt they would develop skills in dealing with outside

organisations. Post module 56% felt that had learnt independent learning skills. The skills development was associated with the project undertaken by individual students. Not all the projects involved working with outside organisations, but all projects involved some form of writing.

Figure 1 shows the results of what they expected to learn pre-module and what they did actually learn.

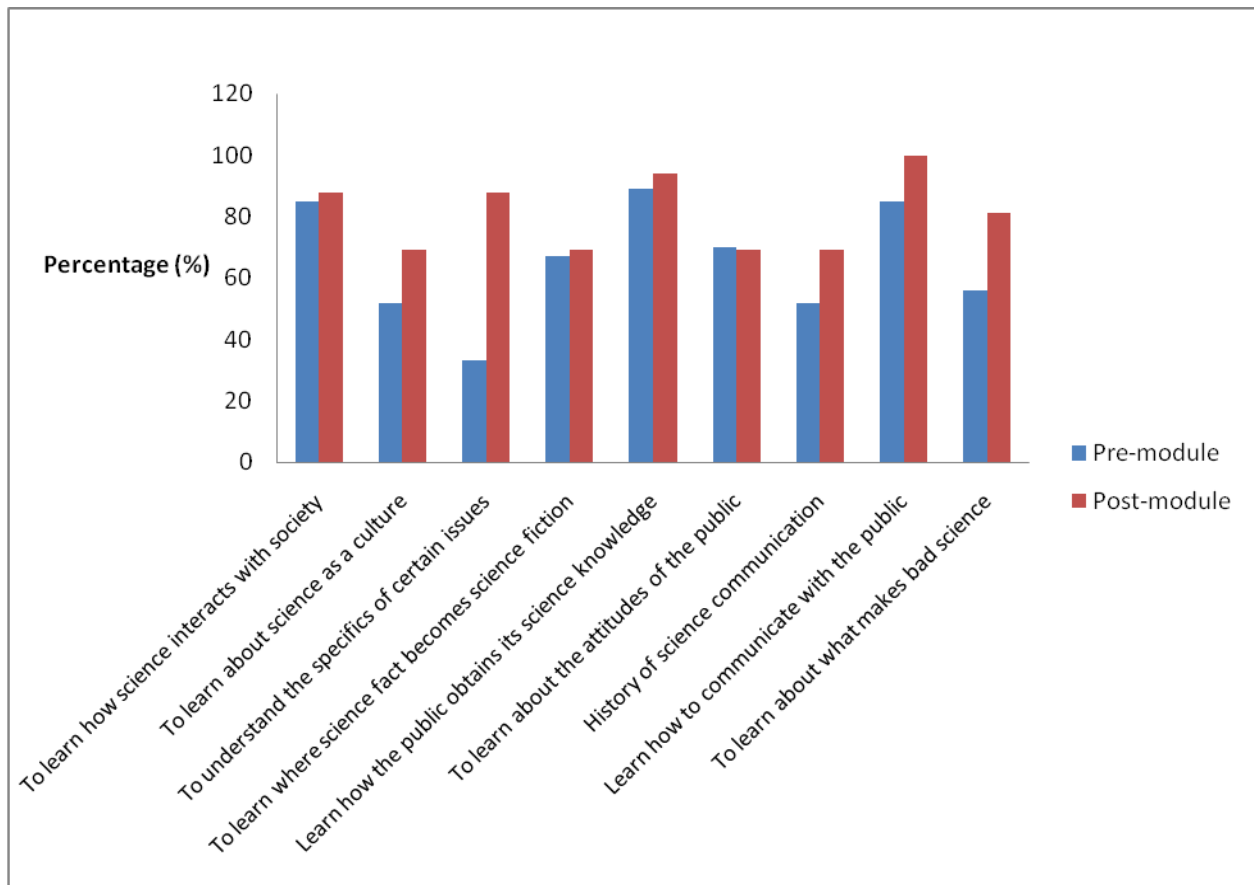


Figure 1. Specific areas students expected to learn about on the science communication module garnered pre and post module

From the data shown in figure 1, it was pleasing to see that 100% of the students felt they had learnt how to communicate with the public. Interestingly, the one area which increased dramatically post module was their understanding of the specifics of certain issues, e.g. The BSE crisis, which formed the case study component of the module design. It was interesting that the students didn't expect to learn about these specific science communication issues within this type of module.

Expectations of the module

Using a Likert Scale, where 1 was strongly disagree and 5 strongly agree, the students were asked how much they thought they would enjoy the module. Post course they were asked how much they had enjoyed the module (using the same scale). The data is shown in figure 2.

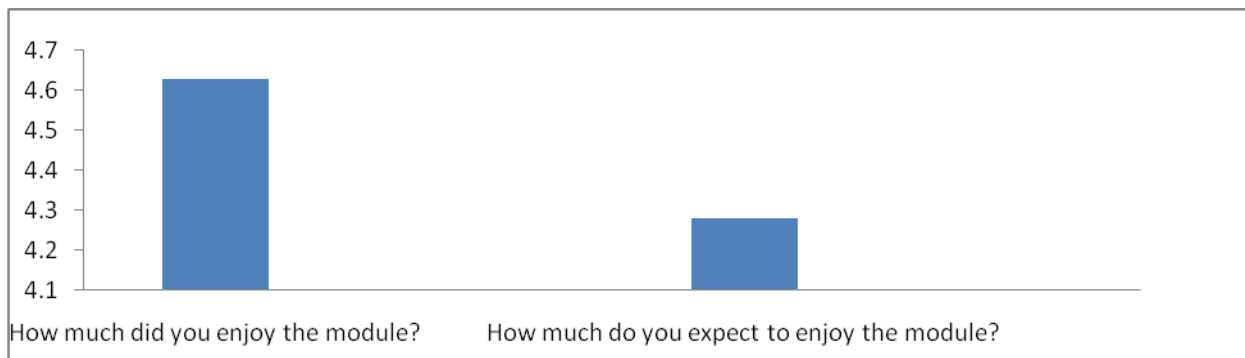


Figure 2. Student expectation of module enjoyment pre and post module

It was clear that the students started with high expectations of the module, but I was pleased to see that they had enjoyed it even more than they expected.

When asked if they could pick **one** word which described the module, 40% of the students said it had been "thought provoking" and 33% "stimulating".

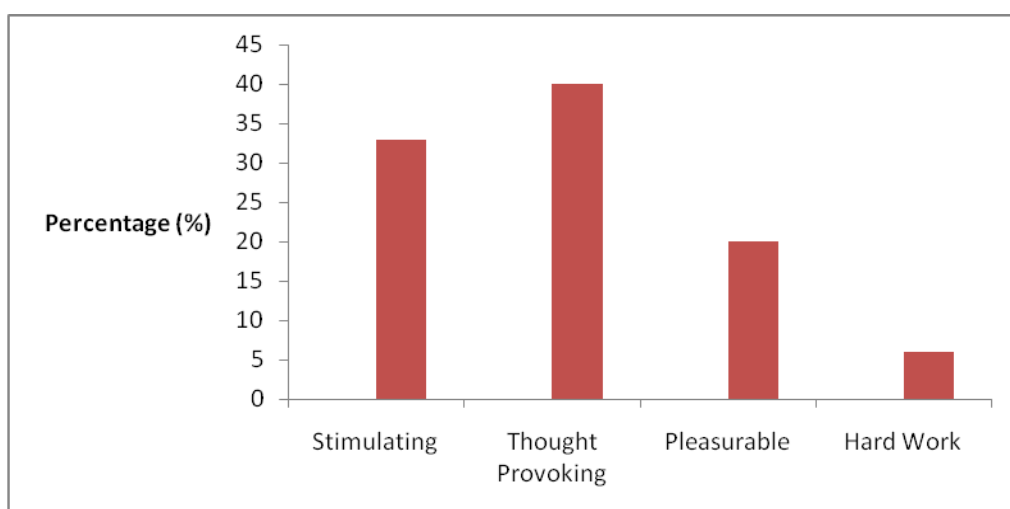


Figure 3. Responses to the question "If you could pick one word to describe the module what would it be?"

Student free text responses to the questionnaire

What extra motivation did you have for choosing this module?

- Gain extra confidence in communication skills
- Dissertation based on the communication of risk and science
- Previous work experience interested me further into the importance of being able to communicate your findings to the scientific community/public
- Following on from gaining experience due to my aspiration to become a teacher. I thought it would be a good chance to explore ways to communicate and to find out how science is viewed by the public
- I wanted to gain experience of interacting with the public and possibly learn some teaching skills
- I possibly want a career in teaching
- I was made aware of the course content early in my second year by the module organiser, who suggested it might appeal to my interests
- interesting and different; gives an extra edge
- challenge organisational and presentation skills
- great for my course-biology with management

- Previous modules run by Kay have been excellent in terms of content and organization
- Public are generally ignorant of science and this needs to change

What other skills do you want to learn?

- working with children
- Being able to explain/demonstrate science in a simple understandable way to the general public and children
- Time management
- develop comfort when talking about science to others
- Learning how to develop scientific ideas/principles to be understood by the public

What other skills did you learn?

- Project design, time management, interaction with the public and children
- science communication was good for a wider understanding of science and useful in interviews
- learnt to engage with children better. I learnt how to convey scientific content to an intelligent lay audience
- It has been great contacting and working with a number of professionals and institutions outside of UEA
- Teaching
- Speaking and talking to people about science

Other learning

- enjoyable break from the other units
- I also wanted to learn about scientists as individuals within a 'scientific culture' ie the diversity of their approaches and attitudes towards science and the public

Comments from the module evaluation for science Communication BIO-3C6Y

- *"A very stimulating and thought provoking module. I enjoyed interacting with children and lay persons very much."*
- *"Really glad I chose this unit. Everyone in BIO should learn about Sci. Com."*
- *"In some of the case studies e.g. stem cells, it was difficult to strike a balance so that the BIO students weren't too bored, yet at a level ECOLOGY/ENV students could understand."*
- *"A module that encouraged me to think outside the box and become aware of society's perception of scientific issues, I thoroughly enjoyed it, from learning communication theory to putting it into practice with the activity."*
- *"The Blackboard site was amazing the amount of useful information on there was at such a standard and use that other subjects should aspire to."*

Where have the students gone?

We wanted to find out the first *destination* of our students, we were able to stay in touch with the majority of them though a variety of methods, including using personal contact, the UEA Alumni database and Facebook.

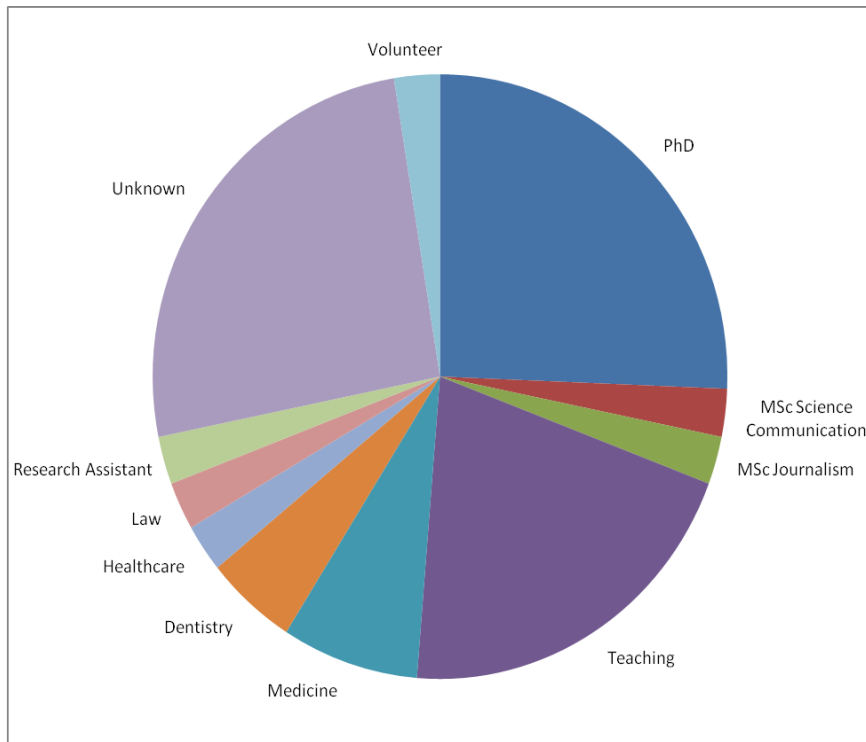


Figure 4. First Destination of the students completing the science communication module from 2007-9.

The data indicates that the majority of students do further study after completing their degrees, either medicine, MSc, PhD or a PGCE. All of these require an understanding of communication.

Critical Friends/External Advice

The support of our critical friends has been invaluable. Dr Helen James, inspired by her involvement in the development award, has designed and is currently running a second year module 'Biology in Society' which forms a compulsory module in the new Biology with Science Communication degree programme. There are 45 students enrolled on this module in the 2009-10 academic year. Dr Irene Lorenzoni delivered high quality teaching in the public perception of risk and climate change analysis. Dr Laura Bowater has been of invaluable assistance in developing new teaching ideas and helping to ensure the quality of the module through observation and assessment. This academic year she is supervising one of the projects (widening participation in medicine). Dr Angela Cassidy, a research fellow investigating the communication of the badger and bovine TB link delivered a seminar in this area and assisted in marking. Conversations with Angela have enabled us to formulate an MSc programme in Science Communication. I met Mr Richard Baldwin at the 2008 British Science Association Science Communication conference; he has recently joined UEA, investigating the public perception of climate change. He was able to give a seminar for the science communication module this year and was involved in marking.

I attended a Science and Society conference in Brighton 2009, and gave a presentation on the development of the science communication module. One of the delegates, Dr Taylor then came to observe the science communication module in action:

"I want to improve undergraduate provision at the University of Brighton's Faculty of Science and Engineering in the area of science communication. Kay has been extremely supportive and consequently we hope to begin delivery of a module entitled 'Science, Culture and Communication' from September 2010. I have always been impressed by Kay's willingness to share examples of good practice in HE teaching and learning and more specifically to give me the benefit of her considerable experience in the field of Science Communication. She provided me with very useful teaching material and invited me to

UEA so that I could observe, and learn from, one of her classes. Kay's enthusiasm for high quality teaching and learning provision in HE is obvious, and infectious."

Dr Huw Taylor, Reader in Public Health Microbiology, University of Brighton

Dr Graham Appleton from the British Trust for Ornithology has been involved with the module for the last three years. He delivers seminars in the area of birds and human interaction. He has agreed to offer a video project in the 2010-11 academic year.

Dissemination

- UK Centre for Bioscience Biosciences Representatives forum, September 2008 (www.bioscience.heacademy.ac.uk/events/repforum08.aspx)
- UEA Learning and teaching day June 2009
- Science and Society conference, University of Brighton July 2009
- The British Science Association Science Communication conference, June 2009
- BBSRC Excellence with Impact Day, January 2010.

In addition I spoke with Dr Fiona Wylie from Cardiff University about imbedding science communication and we intend that I should visit her later this year.

The future

I am pleased to announce that a new degree programme 'Biology with Science Communication' jacs code, C1P9 was offered in the 2009-10 academic year and we have one student on the degree programme. This project has been invaluable in bringing the degree programme to fruition and shows a commitment on behalf of our School to the importance of science communication. I have included the start of the degree programme in the project plan. The degree programme involved the design of two new modules:

- a work placement module involving a period of work with one of our partner organisations.
- a science documentary production module run in collaboration with the School of Film and Television Studies.

The UK Centre for Bioscience Departmental Teaching Enhancement Scheme grant has also enabled us to have meetings to discuss the development on an MSc in Science Communication. We hope to be able to offer this degree in the 2011-12 academic year. The programme will be delivered through the collaboration of three schools, biological sciences (BIO); environmental sciences (ENV) and Film and TV (FTV) studies. This shows the remarkable journey we have been on within BIO and the willingness to imbed an entirely new discipline with the school. This could not have been achieved without the initial support from the UK Centre for Bioscience.

BIO-3C6Y Science Communication

20 credits, CC, Year Long. Open to all students in the Science Faculty.

Module organiser: Dr KH Yeoman

Lecturers: Mr GF Appleton (BTO), Dr LJ Bowater (MED), Mr John Burton (World Land Trust), Dr R. Davies, Dr J Carter (REE), Dr A Cassidy (IFR), Dr M Hutchings, Dr H James, Ms R. Jarrold (EDU), Mr R Baldwin (ENV), Ms D Metland (Content Consultants), Ms K Moore (Norwich Castle Museum), Dr A Munsterberg, Prof AE Osbourn (JIC), Mr J Piercy (Science Made Simple), Dr P Yates (Forensic Science Services) and Dr KH Yeoman

Aims:

To bring an understanding of how science is disseminated to the public. Students will be made aware of the models of science communication. They will investigate science as a culture and how this culture interfaces with the public. An appreciation will be gained of how science information can be used to change public perception and how it can sometimes be misinterpreted.

Learning Outcomes:

1. A knowledge of how science communication in the UK has been shaped by historical institutions such as the Royal Society and the current models surrounding science communication
2. An understanding of learning and communication theory
3. An appreciation of how science is communicated to the public through the use of case studies, such as genetically modified food and the BSE crisis
4. In conducting their project students will acquire a set of professional and transferable skills in time management, event design, organization and administration.

Assessment:

Coursework 100%

There will be an assessed essay (3000 words) in the Autumn semester in an area of science communication based around the case studies (25%), a proposal for the essay is submitted before writing (5%), oral presentation (10%), participation (10%), project report (50%).

Reading:

You will be reading from a variety of sources, including papers and reports.

Project:

You will be given a choice of projects, details of which will be given to you in week 1.

The course will run with the aid of Blackboard

Lecture and Seminar Programme:

Autumn Semester

(Mon. 14.00-15.30*; Tues. 10.00-11.30*; Fri. 12.00) *To allow time for discussion some of the case studies only will be 90 minutes.

Week	Day	Date	Topic	Lecturer
1	F	25.9	Introduction and project choice	KHY
2	M	28.9	A potted history of modern science	KHY
	Tu	29.9	Learning and communication theory	KHY
	F	02.10	Science communication	KHY

3	M	05.10	21 st Century science communication	KHY
	Tu	06.10	The role of science centres	JP
	F	09.10	Science and the public as cultures	KHY
4	M	12.10	Science in the media	KHY
	Tu	13.10	Science communication via the web	DM
	F	16.10	Museum science communication	KM
5	M	19.10	Discussion on the assessed essay and what is Action Learning?	KHY
	Tu	20.10	Science communication in business	JC
	F	23.10	Action learning Set 1	KHY
6	M	26.10	The public perception of risk	AC
	Tu	27.10	Case Study: The BSE Crisis	HAI
	F	30.10	Science and education 21 st Century	RJ
7	M	02.11	Case study: Frankenstein foods	KHY
	Tu	03.11	Case study: The public perception of biodiversity	RD
	F	06.11	The Saw Trust, art in science	AEO
8	M	09.11	Case study: Badgers and TB	AC
	Tu	10.11	Case study: The rise of MRSA	MH
	F	13.11	Action learning set 2	KHY
9	M	16.11	Case study: Bad science in the press	LB
	Tu	17.11	Case study: Humans and birds	GFA
	F	20.11	Action learning set 3	KHY
10	M	23.11	Case study: Science in advertising	KHY
	Tu	24.11	Case study: Climate change	RB
	F	27.11	Science Communication in the Courtroom	PY
11	M	30.11	Case Study: Stem cells and cloning	AM
	Tu	01.12	Case study: The World Land Trust	JAB
	F	04.12	Project evaluation	KHY
12	M	07.12		

Spring Semester

Revisit Action Learning Sets, oral presentations (TBA) Project work. The event 'Colours in Biology' will be held at the Inspire Science Centre on Saturday 6th March 2010. The Avenue Junior School Science Club will run in weeks 6-10 on Wednesday at 15.00-17.00. The timescale for other projects will be discussed in the Autumn semester.

BIO-2B1Y Biology in Society

20 credits, Unslotted, Year Long
Available as free choice only.

Module organiser: Dr. H.A. James
Lecturers: Prof A. Davy, Drs. H.A. James, A. Smajdor (MED), L. Steenberg (FTV) and K. Yeoman

Aims:

This module will provide an opportunity to discuss various aspects of biology in society. Students will be able to critically analyse the way biological sciences issues are represented in popular literature and the media and an idea of the current 'hot topics' in biological ethics.

Learning Outcomes:

Upon completion of this module students will be able to:

1. compose a reasoned argument (both in writing and orally)
2. complete in-depth literature reviews within specified scientific areas
3. explain how technological and scientific advances are changing our perception of what can be defined as science fiction
4. discuss the degree to which the media can influence public perception of what is fact and what is fiction
5. evaluate ethical issues associated with rapid and exciting developments in contemporary scientific research (bioethics)
6. illustrate that the sciences and the arts are disciplines that overlap significantly.

Assessment:

100% coursework. Coursework will consist of four components: Essay 1 (40%) on a current bioethics case study (learning outcomes 1,2,5); Presentation (10%) on essay 1 (learning outcomes 1,2,5); Essay 2 (40%) critique of scientific principles underlying specific pieces of fiction (learning outcomes 1,2,3,4,6); participation in seminars (10%).

Reading:

Numerous articles and web links will be available via the Blackboard site for the module.
For the Spring semester Science Fiction / Science Fact theme: Brake ML and Hook N (2008) Different Engines. How science drives fiction and fiction drives science. Macmillan.

Seminars:

Seminars will be ~1.5 hours long and be in depth discussions of various topics in bioethics or the portrayal of science in various media. Participation in the seminars will be assessed (10% of overall mark).

Practicals:

There are no practicals associated with this module.

Lecture Programme:

Aut: Mon 12.00; Thur 10.00-12.00. **Spr:** Tue 09.00-11.00 except Tu* which start at 10.00 (lectures 1 hour long, seminars usually 1.5 hours long except *)

Week	Date	Day	Topic	Lecturer
Autumn				
1	24.09	Th	Intro.: Why Biology in Society?	HAJ
2	28.09	M	From Ethics to Bioethics	AS
	01.10	Th	Conflict & Controversy in Bioethics	AS
3	05.10	M	Roles & responsibilities of scientists	HAJ
	08.10	Th	Science Communication	KY
4	12.10	M	Biology in Society: Politics	HAJ
	15.10	Th	<i>Seminar:</i> Genetic screening	HAJ
5	19.10	M	Biology in Society: Research	HAJ
	22.10	Th	<i>Seminar:</i> Animal Experimentation	HAJ
6	26.10	M	Biology in Society: Medical	HAJ
	29.10	Th	<i>Seminar:</i> Stem cell research	HAJ
7	02.11	M	no lecture	
	05.11	Th	<i>Seminar:</i> IVF	HAJ
8	09.11	M	Biology in Society: Environmental	AD
	12.11	Th	<i>Seminar:</i> GM crops	KY
9	16.11	M	no lecture	
	19.11	Th	<i>Seminar:</i> Biological Control	HAJ
10	23.11	M	student presentations	
	26.11	Th	student presentations	
11	30.11	M	student presentations	
	03.12	Th	student presentations	
12	07.12	M	student presentations	
	10.12	Th	student presentations	
Spring				
1	12.01	Tu	Science fiction - science fact	HAJ
2	19.01	Tu	Portrayal of biology in the arts (books and radio)	HAJ
3	26.01	Tu*	Portrayal of biology in the arts (films and TV)	HAJ
4	02.02	Tu*	<i>Seminar:</i> disease pandemics	HAJ
5	09.02	Tu	<i>Seminar:</i> cloning	HAJ
6	16.02	Tu	<i>Seminar:</i> designer babies	HAJ
7	23.02	Tu	<i>Seminar:</i> CSI	LS
8	02.03	Tu	Conclusion	HAJ
9-12			No lectures/seminars	

Questionnaire for 3C6Y Science Communication

My name is Dr Kay Yeoman and I have a grant from the Higher Education Academy (HEA) to design and evaluate this new module in Science Communication. I would like to understand your motivations for choosing this module, your expectations from it and your plans for the future.

The questionnaire should take approximately 15 minutes to complete. There are no right or wrong answers. I am interested in your opinions, as ALL responses are relevant. Please hand it back to me before you leave the seminar.

If you have any queries or would like more information, please contact me, Dr Kay Yeoman at k.yeoman@uea.ac.uk.

Section one: About you

Please tick the appropriate boxes in this section

1. Gender

Male Female

2. Age

19-21 22-25 26-30 over 30

3. Your school of study

BIO ENV CMP CAP MTH

4. Please fill in your degree course code in the box below

Section two: Motivation

5. Why did you choose this module? Please tick all that apply, if there are more please fill in the box below

Sounded interesting

Nothing else appealed

Gain experience

6. What skills do you think you will develop? Please tick all which apply, if there are more please fill in the box below.

- Writing
- Speaking in groups
- Oral Presentations
- Designing display materials
- Constructing an argument
- Working in a team
- Independent learning
- Working with outside organisations

Section three: Your Expectations of the module.

7. On this module do you expect to learn the following? Please tick all that apply, if there are more please fill in the box below.

- To learn how science interacts with society
- To learn about science as a culture
- To understand the specifics of certain issues
e.g. stem cells or climate change
- To learn where science fact becomes science fiction
- To learn how the public obtains science knowledge
- To learn about the attitudes of the public
- To learn the history of science communication
- To learn how to communicate with the public
- To learn about what makes bad science

8. Please circle your answer on the scale from 1 (strongly disagree) to 5 (strongly agree) how much you think you will enjoy this module

Strongly disagree Strongly agree Don't know
1 2 3 4 5

9. Please tick the boxes next to the words which match your expectations of this module

- Academically vigorous
- Stimulating
- Thought provoking
- Time consuming
- Hard work
- Pleasurable
- Boring

10. From question 9 above, if you could pick just one word from the list above to describe your expectation what would it be? Please write this word in the box below.

Section four: Your Future

11. Do you know what you would like to do after you have finished your degree? Please tick an option or write in the box below.

- PhD
- Masters
- PGCE
- Medical Degree
- Management Training
- Journalism
- Something related to Science communication
- Don't know