

# HR305-15 Bioenergy & Biorefining

**23/24**

**Department**

Life Sciences

**Level**

Undergraduate Level 3

**Module leader**

Guy Barker

**Credit value**

15

**Module duration**

10 weeks

**Assessment**

100% coursework

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

The concept of “one world living” has stimulated a demand for sustainable feedstocks and resources for a range of industrial applications . Economic and government policies have generated a market for “first generation” biofuels, however, there are growing public concerns that the crops used as feedstock for these fuels are utilising land mass more suited for food production and are therefore not truly sustainable. The development of a truly sustainable “second generation” biofuel is ongoing and there is increasing interest to exploit plants as feedstock’s for other industrial applications via the development of bio-refineries. There is a need to take account of ethics and increasing competition for land use for different purposes in order to develop a sustainable future in which biologically based technologies will play an important role

### Module aims

This module aims to introduce students to a fast moving field of research. This research relies on the development of new technologies arising from the integration of multiple disciplines and are part of emerging biotechnology solutions for a changing climate. These new technologies have the potential for rapid industrial take up as well as being of public interest.

The module is taught from the perspective of providing an understanding of these new technologies and the importance of sustainability in feedstock production, process technologies and energy use. In addition, the importance of government policies which aim to ensure security of

fuel supplies and reduce carbon emissions on the creation of sustainable markets will be introduced. The module is based on the discussion of primary research papers and will provide insight into cutting edge research.

This module aims to introduce the drivers behind the current interest in biofuels and bio based energy sources. It will also illustrate the complex arguments which are being debated in the press and elsewhere in trying to develop a sustainable future based on biofeedstocks

## **Outline syllabus**

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

1. Introduction. (Dr. G. C. Barker)
2. Initial analysis of impact of differing land use, sustainability of different biofuels in light of carbon emissions and agricultural practices. (Dr. R. Lillywhite)
3. Life-cycle analysis and economics justification. (Dr. R. Lillywhite)
4. Background. (Dr. G. C. Barker)
5. Biofuels or sustainable energy? (Dr. G. C. Barker)
6. 1st generation biodiesel cleanliness. (Dr. G. C. Barker)
7. Advanced biodiesel. (Dr. G. C. Barker)
8. First generation bio-ethanol from sugar cane, sugar beet and wheat including economics, impact of price and sustainability. Cellulosic ethanol. (Dr. G. C. Barker)
9. Biomass crops. (Dr. G. C. Barker)
10. Sustainability of supplies –the importance of balance. (Dr. G. D. Bending)
11. Algae. (Dr. G. C. Barker)
12. Cellulosics and alternative technologies for lignin breakdown. (Dr. G. C. Barker)
13. Concept of biorefining. ((Dr. G. C. Barker)
14. Adding value. ((Dr. G. C. Barker)
15. Biogas and fuel cells. (Dr. G. C. Barker)
16. Gussing example. (Dr. G. C. Barker)
17. Industrial biotechnology. (Dr. G. C. Barker)
18. Alternative technologies for lignin breakdown. (Dr. G. C. Barker)
19. Natural product function isolation and purification. (Dr. G. C. Barker)
20. Impact of public perception on demands and markets and what role should ethical consideration play? (This will be more of a tutorial than lecture). (Dr. G. C. Barker)

## **Learning outcomes**

By the end of the module, students should be able to:

- LO1 Demonstrate understanding of the main issues with current processes in agriculture
- LO2 Demonstrate understanding of the different types of biofuels and sustainable energy, and current research techniques used to assess and analyse them
- LO3 Demonstrate understanding of new biotechnologies associated with climate, economic and governmental changes
- LO4 Demonstrate understanding of sustainability in process technologies production

- LO5 Demonstrate understanding of sustainability in feedstock production
- LO6 Demonstrate understanding of sustainability in energy production and use production

## **Subject specific skills**

- a. Demonstrate clear understanding of the scientific topic
- b. Contain evidence of extended reading and lateral integration of material not covered in the lectures
- c. Demonstrate independent thought and deep understanding
- d. Specifically answer the set question using information from multiple lectures and sources
- e. Be structured and formatted in a way that demonstrates understanding and logical flow
- f. Use multiple sources to construct complex scientific arguments and integrating these to build and develop the student's own scientific conclusions.

## **Transferable skills**

1. Critical appraisal of source material
  2. Self directed learning
  3. Adult learning
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## **Study**

### **Study time**

<b>Type</b>	<b>Required</b>
Lectures	20 sessions of 1 hour (13%)
Private study	130 hours (87%)
Total	150 hours

### **Private study description**

130 hrs of self-study and directed reading to prepare for the open book assessment

## **Costs**

No further costs have been identified for this module.

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## **Assessment**

You must pass all assessment components to pass the module.

## Assessment group A

	Weighting	Study time
Open Book Assessment	100%	20 hours

Final assessment for the module will be on open book assessment. This is an essay based assessment consisting of 4 questions- students need to answer 2. The essays cannot be answered using lecture notes alone- students will need to perform background research and essays will need to be fully referenced.

## Feedback on assessment

Pastoral meetings with personal tutor

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## Availability

### Courses

This module is Core optional for:

- Year 3 of UIPA-C1L8 Undergraduate Life Sciences and Global Sustainable Development
- Year 4 of UIPA-C1L9 Undergraduate Life Sciences and Global Sustainable Development (with Intercalated Year)

This module is Optional for:

- Year 3 of UBSA-C700 Undergraduate Biochemistry
- ULFA-C1A2 Undergraduate Biochemistry (MBio)
  - Year 3 of C1A2 Biochemistry
  - Year 3 of C700 Biochemistry
- Year 4 of ULFA-C702 Undergraduate Biochemistry (with Placement Year)
- Year 3 of ULFA-C1A6 Undergraduate Biochemistry with Industrial Placement (MBio)
- UBSA-3 Undergraduate Biological Sciences
  - Year 3 of C100 Biological Sciences
  - Year 3 of C100 Biological Sciences
- Year 3 of ULFA-C1A1 Undergraduate Biological Sciences (MBio)
- Year 4 of ULFA-C113 Undergraduate Biological Sciences (with Placement Year)
- Year 3 of ULFA-C1A5 Undergraduate Biological Sciences with Industrial Placement (MBio)

This module is Option list B for:

- Year 3 of UMDA-CF10 Undergraduate Integrated Natural Sciences (MSci)