

# Microbiology

## The study of microbiology is divided into various fields

- **Taxonomic division of fields**

Bacteriology; mycology; virology; phycology; and protozoology

- **Functional division of fields**

Growth; metabolism; disease; sterilization etc.  
Industrial microbiology; food microbiology; environmental microbiology; agricultural microbiology; and medical microbiology

# Microbiology at UWS Campbelltown

## Second year subjects

### **Basic Microbiology**

Coordinator: Dr. C. Kuek

- Structure, function and occurrence of microorganisms
- Microbial taxonomy
- Metabolism
- Nutrition
- Growth and death

### **Microbial physiology and genetics**

Coordinator: Dr. A. Khan

- Microbial strategies of energy generation
- Growth and survival in nature and culture
- Gene expression and regulation
- Mutation; gene transfer

# Microbiology at UWS Campbelltown

## Third year subjects

<b>Environmental Microbiology</b> Coordinator: Dr. A. Khan <ul style="list-style-type: none"><li>• Microbial ecology</li><li>• Microbiology of the air, water and soil</li><li>• Biodegradation</li></ul>	<b>Industrial Microbiology</b> Coordinator: Dr. C. Kuek <ul style="list-style-type: none"><li>• Fermentation</li><li>• Bioprocess technology</li><li>• Optimization</li></ul>
<b>Medical Microbiology</b> Coordinator: Dr. A. Khan <ul style="list-style-type: none"><li>• Pathogenic microorganisms, etiology, epidemiology</li><li>• Diagnosis, prevention and control of diseases</li><li>• Chemotherapy, vaccination</li></ul>	<b>Microbiological Quality Assurance &amp; Control</b> <i>(not currently offered)</i> <ul style="list-style-type: none"><li>• Microbial spoilage and hazards</li><li>• Control of microorganisms</li><li>• Quality control and assurance</li></ul>










# The Impact of Microbiology

## Some Examples of the Influence of Microorganisms on the Socio-economic Activities of Man

### a. The Great Irish Potato Famine

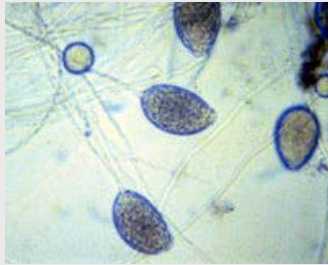
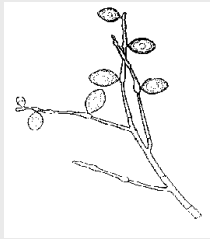
Ireland, 1845

- Mainstay crop is potato
- Late blight disease appears



## The Great Irish Potato Famine continued

- *Phytophthora infestans* was the pathogen



- The Great Irish Potato Famine resulted
- One in four people died. Dislocation of Irish society.

## The Great Irish Potato Famine continued

- Massive emigration to the United States
- In 1960, JFK became the first U.S. President of Irish descent

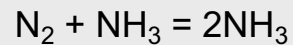


## Influence of microorganisms on the socio-economic activities of man

### b. Bacteria of the genus *Rhizobium*

Nitrogen gas comprises 78% of the atmosphere  
It is not in a biologically or industrially useful form

#### • N fixation: The Haber Process



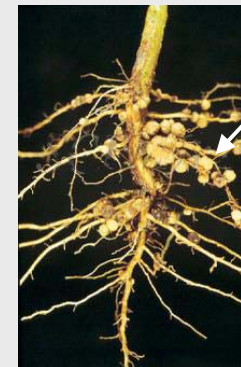
Energy intensive;  
requires 400 – 600°C  
and 200 – 400 atm. Pressure

≅ 44 X 10<sup>6</sup> tons of N<sub>2</sub> year<sup>-1</sup> is fixed using the Haber process

## Bacteria of the genus *Rhizobium* continued

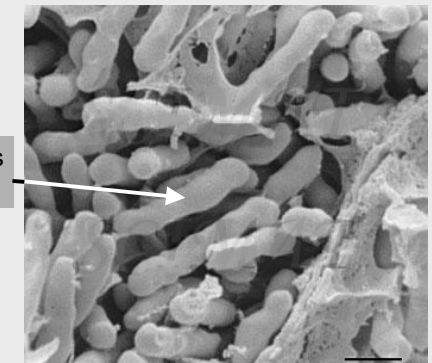
#### • N fixation: The biological process

Rhizobia bacteria  
Symbiosis in the roots of legumes

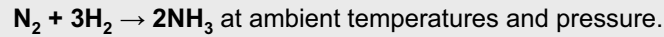


Nodules

Bacteroides  
In nodule



## Bacteria of the genus *Rhizobium* continued



Energy supplied by the plant host in the form of ATP  
Ammonia is converted by plants to amino acids

≅ **193 X 10<sup>6</sup> tons of N<sub>2</sub> year<sup>-1</sup> is fixed biologically**

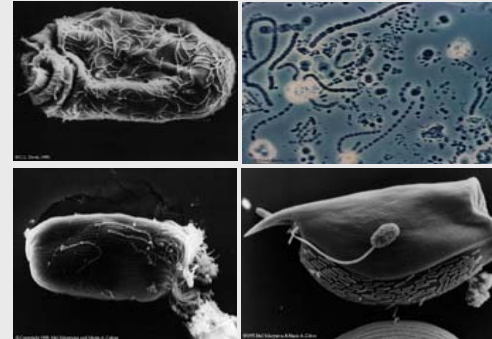
cf. 44 X 10<sup>6</sup> tons of N<sub>2</sub> year<sup>-1</sup> is fixed using the Haber process

- Reduces the requirement for nitrogenous fertilizers in agriculture
- Whole agricultural systems throughout the world depend on nitrogen fixation.

## Influence of microorganisms on the socio-economic activities of man c. Rumen microorganisms

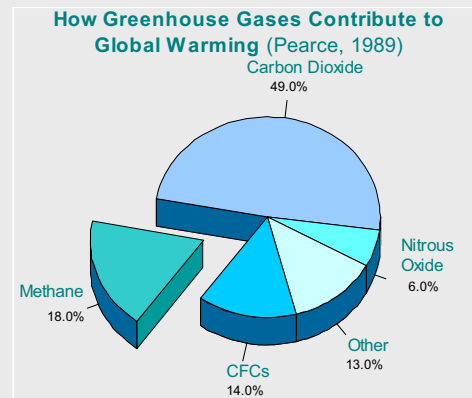
### Gaseous emissions by ruminants and the greenhouse effect?

Ruminants (e.g. sheep and cattle) depend on communities of microorganisms in their rumen for the production of energy from their herbaceous diets



## Rumen microorganisms continued

- Cellulose → Assimilable compounds for growth of the ruminant + CH<sub>4</sub>
- Methane is second (by contribution) in importance to CO<sub>2</sub> in the greenhouse effect  
It traps 25 times more of the sun's heat than CO<sub>2</sub>



### Estimates of methane production by cattle (Pearce, 1989)

- 200 g day<sup>-1</sup> cow<sup>-1</sup>
- 1300 million cattle worldwide
- 100 million tonnes CH<sub>4</sub> year<sup>-1</sup>

## Influence of Microorganisms on the Socio-Economic Activities of Man d. Microorganisms used in food production

### Menu a la Laboratoire

#### Soup

Miso (soybeans arranged by *Aspergillus* and *Saccharomyces*)

#### Salad

Olives prepared by *Leuconostoc*  
Fleshy fungus (*Agaricus*) grown on thoroughbred manure and seasoned by *Acetobacter*

#### Entrees

*Saccharomyces cerevisiae* and *Lactobacillus* will prepare rye, pumpnickel, and sourdough

#### Single-Cell Protein

A delightful casserole of sewage-fed cyanobacteria, flavored with Poi (lactic-acid bacteria work their magic on taro root)

#### Fettucine Torula

Spicy noodles "proteinized" by *Torulopsis* yeast

Tender slices of *Methylophilus*-fed beef marinated in soy sauce (produced by a symphony of microorganisms)

#### Carne Macha

An assortment of sausages from *Pediococcus* and *Penicillium italicum*

#### Vegetable

Cabbage fermented to pH 3.5 by *Leuconostoc plantarum*

#### Dessert

*Lactobacillus bulgaricus* will prepare yoghurt  
Assorted cheeses by *Streptococcus* and *Lactobacillus*, assisted by *Penicillium roquefortii* and *Penicillium camembertii*

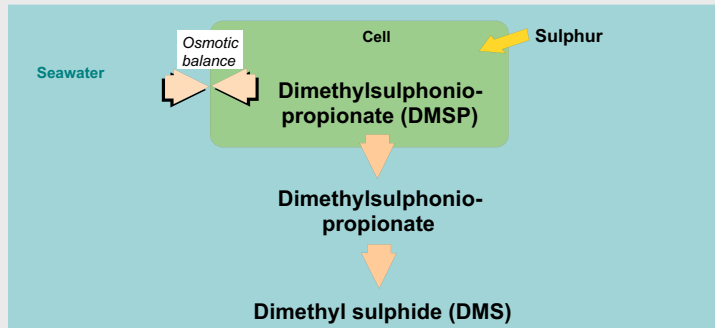
#### Drinks

Alcoholic beverages by *Saccharomyces*  
Non-alcoholic beverages  
Beer  
*Lactobacillus* buttermilk  
wine *Erwinia*'s coffee

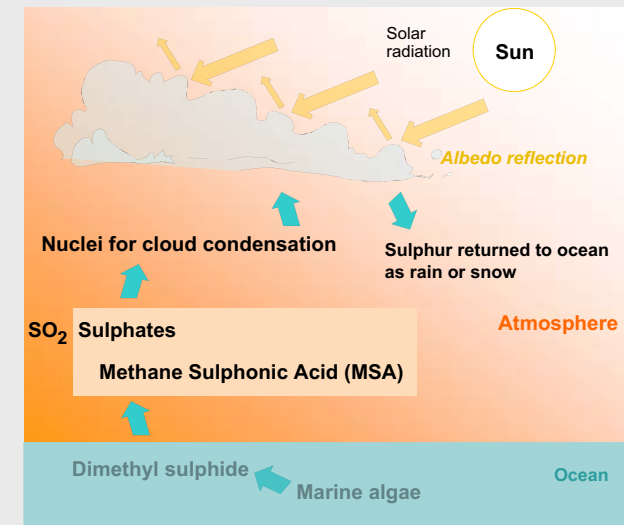
## Influence of Microorganisms on the Socio-Economic Activities of Man

### e. Marine Algae as the Global Thermostat

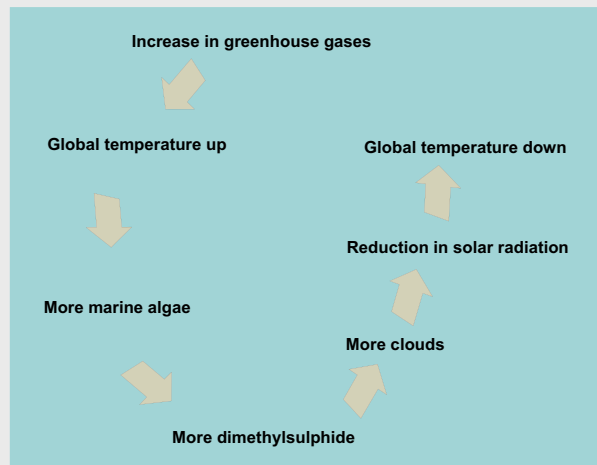
Can marine algae control global warming due to the greenhouse effect?



### Marine algae as the global thermostat continued



### Marine algae as the global thermostat continued



## Assignment

### Topic: The impact of microbiology on society

A structured report on the impact which the science of microbiology, or a specific microorganism or microorganisms has had on society

#### Keywords useful in making a choice of subject area

- disease
- politics
- industry
- economic development
- socio-economics
- medicine

#### Confirmation with Assignment Coordinator

- Theme and title
- Proposed contents



# Preparation of the assignment

