Study Questions
1. Compare and contrast the terms undernourished vs. malnourished.
2. Why do food shortages exist?
3. What are humans’ major food sources, and what problems arise in producing/harvesting these?
4. Discuss factors required for successful agriculture.
5. Discuss the pros and cons of genetically modified organisms (GMOs) in the context of food resources.
6. Discuss the international and domestic use of GMOs.
7. What is meant by the terms “green revolution” and “sustainable agriculture?”

Food and Nutrition
Food gives us:
- Energy (Calories, kcals)
- Physical structure (protein, fat)
- Vitamins and Minerals

Food security: the ability to obtain sufficient, healthy food on a day-to-day basis
- In 1960, nearly 60% of people in developing countries were chronically undernourished
- World population has increased 1.7%; food production has increased 2.2%
- Less than 20% of people in developing countries now chronically undernourished

Undernourished: insufficient calories
Over 850 million people suffer chronic hunger

Why are people undernourished?
Current world food supply could support world population with 2800 kcal per day!

Factors Contributing to World Hunger Include:
- Bad weather (drought, famine)
- Political instability
- Social crises
- Poverty
**Malnourished:** imbalanced or insufficient nutrients

Malnutrition can lead to:
- Mental deficiencies
- Physical deficiencies
- Blindness
- Diabetes
- Cancer
- Heart attack
- Obesity

Overweight people now outnumber underweight people

To be healthy, one needs a balance of both **amount** and **type** of food

**Food Sources**
- Major Crops (wheat, rice, maize)
- Fruits/Vegetables
- Meat
- Seafood

More than 1/3 of world cereal is consumed by livestock animals
Comparison of number of kilograms of grain needed to produce 1 kg of live weight gain

Over-crowded livestock operations can contribute to:
• air and water pollution
• antibiotic resistance
• infectious diseases

Seafood is also a major protein source

Agricultural Essentials
• Soil: mixture of rock, live and dead organisms

Water
All plants need water to grow
Too little or too much can be harmful
Salinization (accumulation of salt) can be a problem
• **Fertilizer**

  Calcium, magnesium, nitrogen, potassium, phosphorus are often limited or absent in soil.

  Adding these nutrients via fertilizer increases crop yield.

  Can pose human health risks.

• **Energy**

  Farming requires lots of energy!

  Fossil fuels power farming machines.

  Distributing fertilizers, pesticides requires energy.

  Food must be processed, packaged, shipped, stored, etc.

• **Pest Control**

  Chemical pesticides  |  Biological controls

  Can kill non-target species  |  Insect predators

  Different organisms become pests.

  Create resistant pests.

• **The Green Revolution**

  • Increased crop yields due to synthetic fertilizers

  • Cross-breeding plants for high-yield varieties

• **Genetically Modified Organisms (GMOs)**

  Genetic Engineering: transplanting DNA (gene)

  from one organism to another

  Advantages of GMOs:

  • Increased crop yield

  • Drought/frost resistant crops

  • Disease resistant crops

  • Pest resistant crops

  • Improved nutritional content
**Wild-type plant**        **Salt-tolerant plant**

• Food without toxins or allergens  
• Plants that contain vaccines  
• Animals that produce pharmaceutical drugs  
• Animals that grow faster, eat less  
• Animals that could donate organs?  

“Pharm” animals

**Concerns Regarding GMOs**

• GMOs could “escape”  
• Might interbreed with wild relatives  
• Might accelerate pesticide resistance  
• Unequal access to technology

**Current Use of GMOs**

• GMOs are used internationally  
• U.S. majority of soybeans, cotton, corn are GMOs  
• 60% of all processed food estimated to contain GMOs  
• No “GMO” label is required

**Sustainable Agriculture**

**Sustainable agriculture:** just and lasting food production techniques (“regenerative farming”)

• Produce sufficient food to feed the world  
• Minimize/repair damage caused by destructive farming practices

**Soil Conservation**

• Reduce erosion  
  (terracing, contour plowing, strip-farming)

• Provide groundcover (cover crops, mulch)
Natural, Agroecological Farming

- Small scale, low-input farms
- Less fertilizers, pesticides, etc.
- Reduced erosion