

INTRODUCTION TO FOOD SCIENCE AND TECHNOLOGY

LECTURE 11

FOOD SAFETY: RISKS AND HAZARDS

**QUALITY CONTROL AND LEGISLATIVE ASPECTS
(CHAPTER 23 -24)**

PROFESSIONAL ETHICS

FOOD SAFETY, RISKS AND HAZARDS

- Scientists think of food safety in terms of **hazards and risks**.
- A **hazard** is the capacity of a thing to cause harm.
- The probability that a defined harm will occur is **the risk** associated with the hazard.
- We recognize hazards and take actions which will reduce risk to an acceptable or improved level.

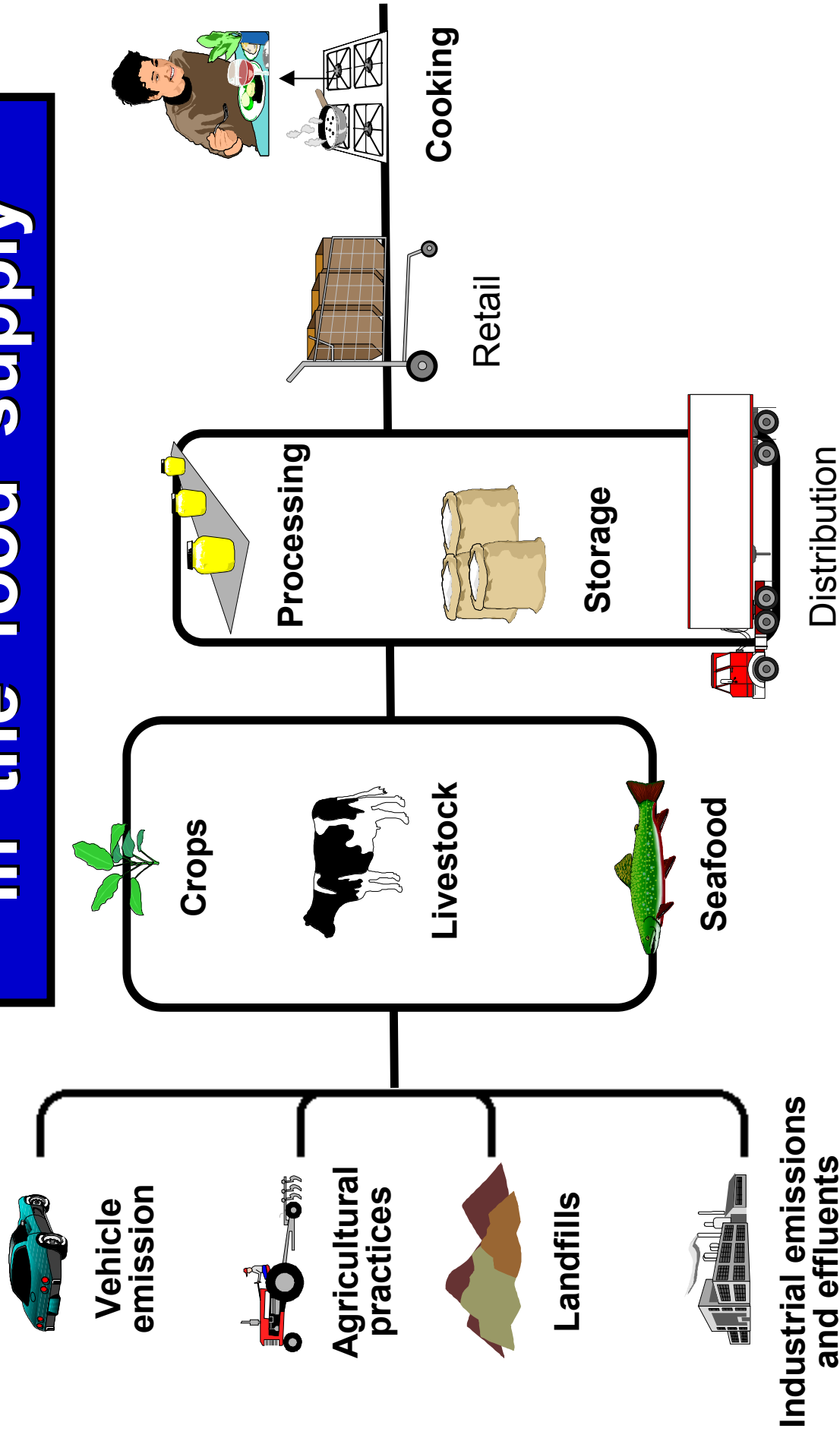
FOOD SAFETY, RISKS AND HAZARDS

- Scientists first identify hazards related to foods or food components and then estimate the size of the risk that the hazard will occur.
- They go through a multistep process which starts with hazard identification (i.e. pesticide or food chemical).
- Then they evaluate the size of the risk associated with the hazard. Scientists ask what is the statistical probability that this hazard will occur. This is done by using statistical estimates of how large the risk to humans could actually be under the worst case.

FOOD SAFETY, RISKS AND HAZARDS

- The process of identifying the hazards and estimating their size **RISK ASSESSMENT**.
- The next step in the process is to decide what to do about the risk; that is to decide whether or not the risk is acceptable. This is a judgment and termed **RISK MANAGEMENT**. This process is less scientific and more social and political. In most cases, government representatives make such decisions on the acceptability of risks.
- The goal of food safety is to reduce the size of risks to the lowest reasonable level without severe disruption of the food supply.

Where hazards arise in the food supply



FOOD-RELATED HAZARDS

There are five broad general categories and several subcategories of hazards associated with foods.

Biological hazards

Nutrition-related diseases

Chemical hazards

Direct food additives and macrocomponents of food

Physical hazards

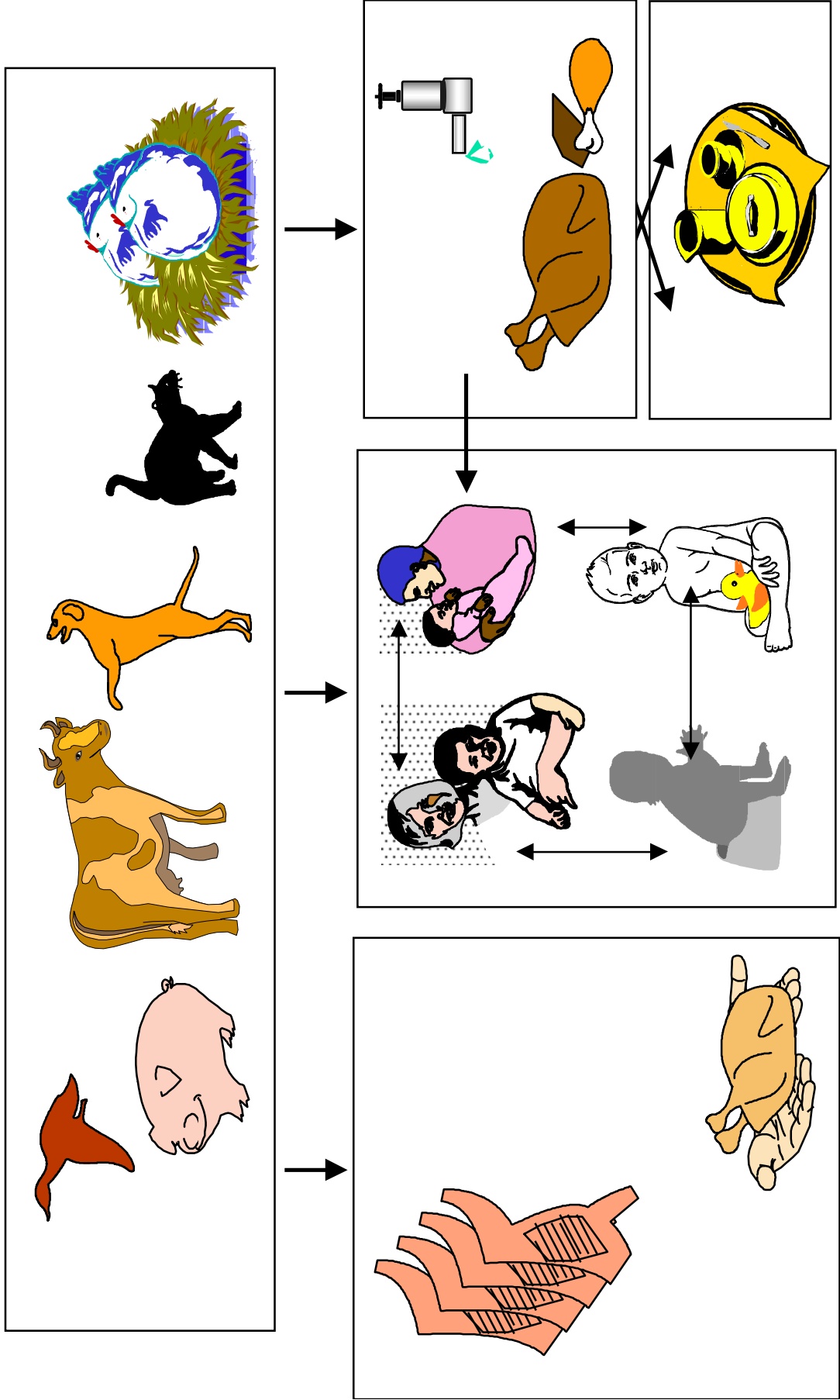
BIOLOGICAL HAZARDS

- Biological hazards include: Bacterial, fungal, viral and parasitic (protozoa and worms) organisms and/or their toxins.
- There are many microorganisms which are pathogenic in humans.
- There are two types of food-borne disease from microbial pathogens: infections and intoxications

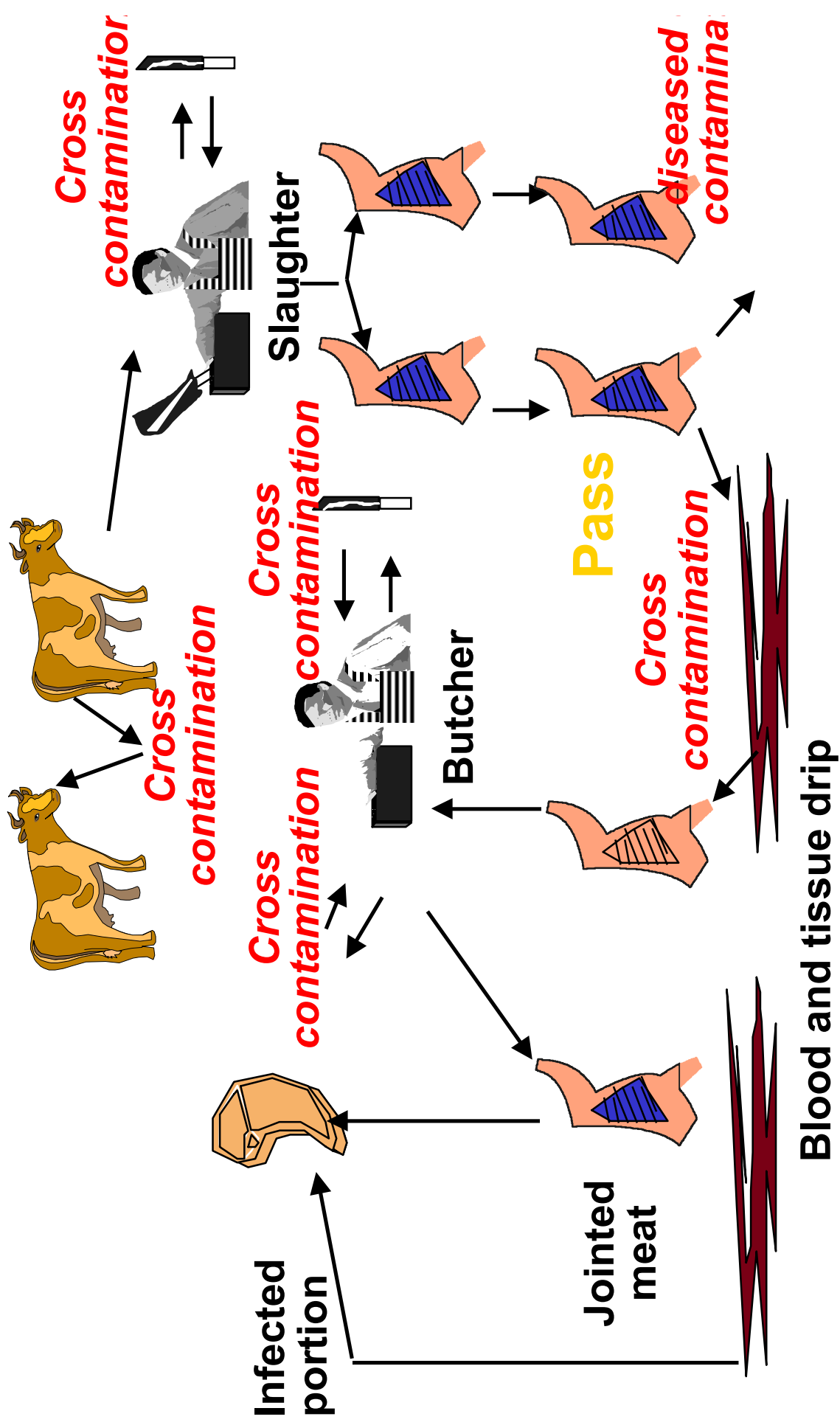
BIOLOGICAL HAZARDS

- **Infections** result from ingestion of live pathogenic organisms which multiply within the body and produce disease.
- **Intoxications** occur when toxins produced by pathogens are consumed. Intoxications can occur even if no viable microorganisms are ingested. This often occurs when foods are stored under conditions which allow the pathogens to grow and produce toxin. Subsequent processing of the food may destroy the microorganisms but not the toxin.

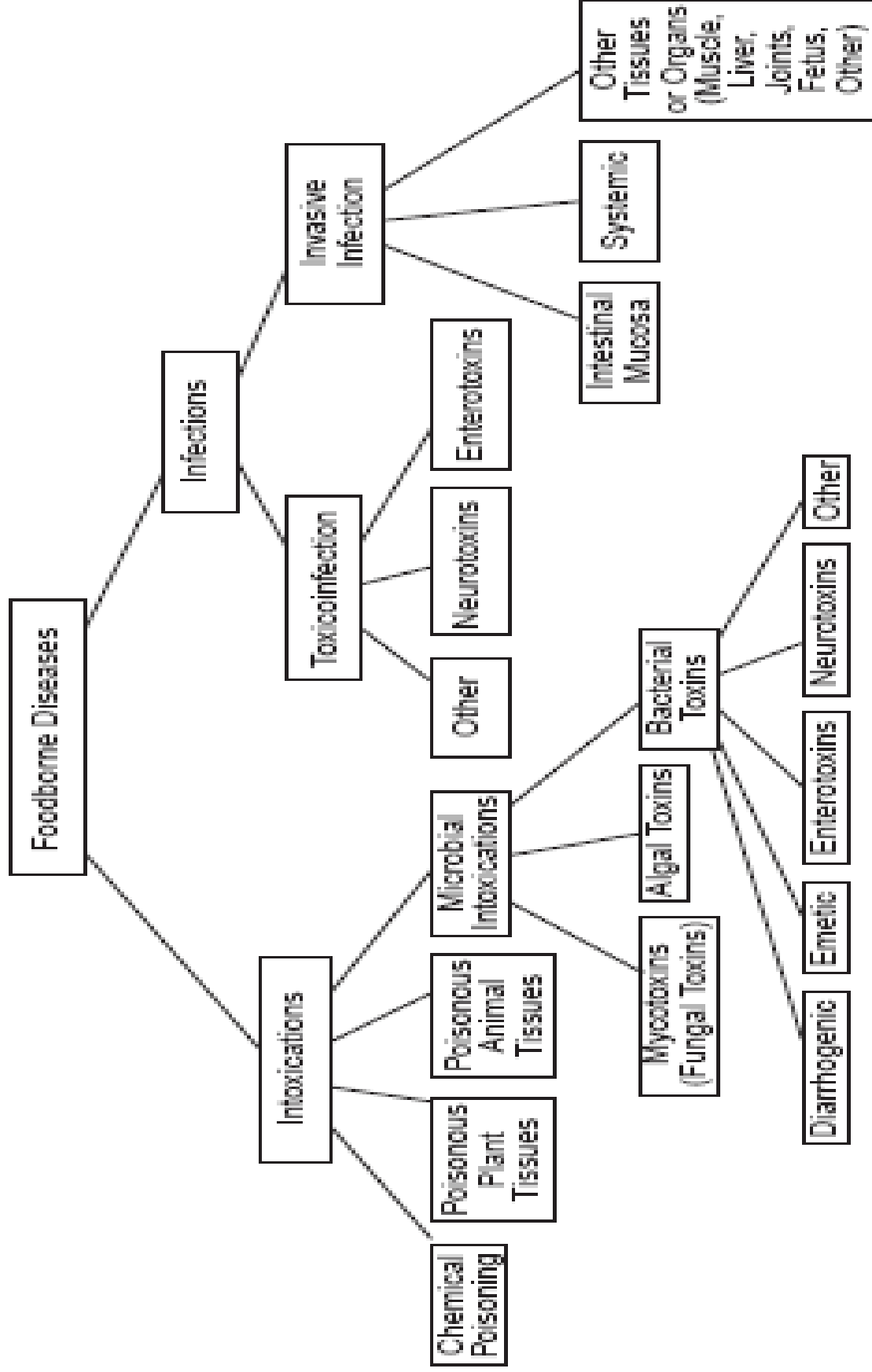
Transmission of *Campylobacter*



The contamination chain for meat



A Classification of foodborne disease causes



Source: CAST report, Figure 2.1, 1994 (adapted from Bryan, 1982).

NUTRITION RELATED DISEASES

- There is a relationship between health and the diet and the major objective of eating is to maintain or even improve health.
- Food and diet play a role in chronic diseases such as heart disease and cancer. Certain diets can increase the risk of heart disease and cancer. Other diets appear protective.
- In addition, many people overconsume foods, and diseases related to obesity are common.

CHEMICAL HAZARDS

Added Chemicals:

Agricultural Chemical (pesticides, fungicides, fertilizers, antibiotics, growth hormones)

Prohibited substances

Toxic elements and compounds (lead, zinc, arsenic, mercury, cyanide)

Food additives :

Preservatives (nitrite and sulfate)

Flavor enhancers (MSG-monosodium glutamate)

Nutritional additives (niacin)

Color additives

Chemicals intentionally added (sabotage)

PHYSICAL HAZARDS

Material	Injury potential	Sources
Glass	Cuts, bleeding, may require surgery	Bottles, jars, utensils, light fixtures
Wood	Cut, infections, choking, may require surgery	Fields, pallets, boxes, buildings
Stones	Choking, broken teeth	Fields, buildings
Metal	Cut, infections, may require surgery	Machinery, fields, wire, employees
Insects and other filth	Illness, trauma, choking	Fields, plant postprocess entry
Plastic	Choking, cuts, infections, may require surgery	Fields, plant packaging materials, pallets, employee
Personal effects	Choking, cuts, broken teeth, may require surgery	Employees

HACCP AS A METHOD TO PREVENT FOOD-BORNE ILLNESS

The best and most effective method of assuring food safety is:

- To establish a systematic approach to raw materials screening
- To identify food manufacturing and handling procedures which result in the lowest possible risk.

One of the major tools for achieving a high degree of reliability and safety is called:

HACCP System (Hazard Analysis at Critical Control Points).

HACCP AS A METHOD TO PREVENT FOOD-BORNE ILLNESS

- **HACCP** is an approach to food manufacture and storage in which raw materials and each individual step in a process is considered in detail and evaluated for its potential to contribute to the development of pathogenic microorganisms or other food hazards.
- HACCP principles apply to microbiological, chemical and physical hazards associated with foods but are most widely applied to microbiological hazards because they are the leading cause of food-borne disease.

GOVERNMENTAL REGULATION OF FOOD AND NUTRITION LABELING

Government worldwide regulate foods with these general objectives:

- To ensure the safety and wholesomeness of the food supply
- To prevent economic fraud or deception
- To inform consumers about the nutritional contents of foods

The food industry looks to government to set high standards and to enforce these standards in order to protect itself against unethical competition

GOVERNMENTAL REGULATION OF FOOD AND NUTRITION LABELING

- Recent years have seen an increased concern by the public over the safety of foods, especially with respect to intentional and unintentional chemical additives and the incidence of microbial food-borne diseases.
- Arguments have both defended and attacked food production practices including the use of food additives, pesticides, biotechnology, and irradiation.

GOVERNMENTAL REGULATION OF FOOD AND NUTRITION LABELING

- In Turkey, Ministry of Agriculture is responsible for inspecting food plants for ensuring food safety.
- In the United States the primary responsibility for ensuring the safety and labeling of foods lies with the Food and Drug Administration (FDA) for most foods and with the U.S. Department of Agriculture (USDA) for meat and poultry products.

Food is considered adulterated if it:

1. Contains poisons or harmful substances at high concentrations
2. Contains filth, is decomposed or is otherwise unfit.
3. Was prepared and handled under unsanitary conditions such that it may have become contaminated.
4. Is derived from a diseased animal
5. Was subjected to radiation, other than where permitted.
6. Has any valuable constituent omitted

7. Has a specified ingredient substituted by a nonspecified ingredient
8. Has a concealed defect
9. Is increased in bulk weight or reduced in its strength making it appear better than it is.
10. Contains a coloring agent that is not approved or certified.

- GMP: "Good Manufacturing Practice" defines requirements for acceptable sanitary operation in food plants.
- GRAS: "Generally Recognized As Safe" . These are substances added to foods that have been shown to be safe based on a long history of common usage in food. Typical GRAS substances include the common spices, natural seasonings, and numerous flavoring materials, baking powder chemicals, fruit and beverage acids etc.

- Food Additives** must meet the following additional requirements:
- Intentional additives must perform an intended and useful function
 - Additives must not deceive consumers or conceal faulty ingredients or defects in manufacturing practices
 - An additive must not substantially reduce the food's nutritional value.
 - An additive cannot be used to obtain an effect that could be obtained by otherwise good manufacturing practices
 - A method of analysis must exist with which to monitor the use of the additive in foods.

FOOD LABELING

- One of the main goals of governmental regulation of foods is ensuring that consumers are given complete and useful information about the food products they purchase.
- This information is important for both economic and health reasons.
- Ingredient labeling also helps people avoid foods to which they may be allergic.

FOOD LABELING

The information to be supplied on the label:

Food Name

Net quantity of contents

Ingredients

Company name

Product Dates

Nutrition Information

Other information (Trademark or copyright symbols, religious symbols, bar code etc.)

INTERNATIONAL FOOD STANDARDS AND CODEX ALIMENTARIUS

• In matters of international scope two important agencies are:

WHO - World Health Organization of the United Nations

FAO- Food and Agricultural Organization of the United Nations

• These are organized to increase and improve food resources, nutrition and health throughout the world.


INTERNATIONAL FOOD STANDARDS AND CODEX ALIMENTARIUS

The need for coordination in setting standards has long been recognized and in 1962 an international body operating under the auspices of the **United Nations** through **FAO/WHO** was established and designated as the **Codex Alimentarius Commission**.

The object of this commission:

- To develop international and regional food standards and publish them in a *Codex Alimentarius*.
- To develop agreements on international standards and safety practices for foods and agricultural products.

JECFA- The Joint FAO/WHO Expert Committee
on Food Additives sets standards for purity of
food additives.



Code of Ethics
for the
Profession of Engineering

The Struggle Between . . .



“Right & Wrong”

“Moral & Immoral”

“Just & Unjust”

Ethics: (eth/ iks)

- 1. The study of standards of conduct and moral judgment.**
- 2. The system or code of morals of a particular philosopher, religion, or group, etc...**

Engineering Ethics

**Code of Ethics for Engineers :Fundamental Rules
Engineers, in the fulfillment of their professional duties,
shall:**

- **Hold superior the safety, health and welfare of the public in the performance of their professional duties.**
- **Perform services only in areas of their competence.**
- **Issue public statements only in an objective and truthful manner.**
- **Act in professional matters for each employer or client as faithful agents or trustees.**
- **Avoid deceptive acts in the solicitation of professional employment**

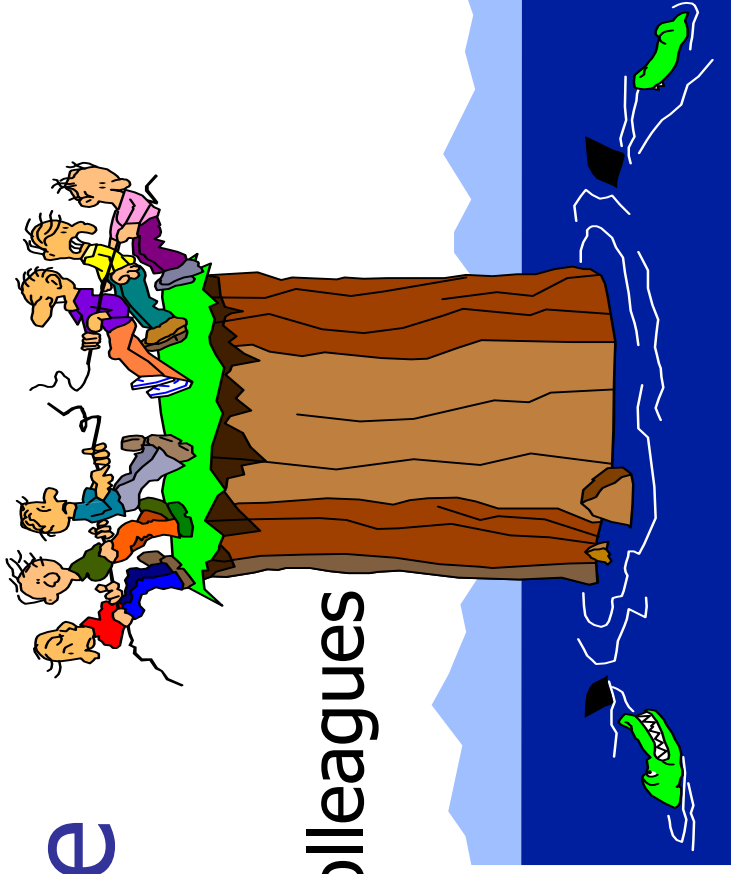
Personal Ethics

- some everyday examples

- **Copying of homework or tests**
- **Copying of Videos or CD's**
- **Software piracy**
- **Expense account padding , income taxes**
- **"Borrowing" office supplies from employer**
- **Plagiarism**
- **Using the copy machine at work for personal purposes**



Ethical Issues are Seldom Black and White



Conflicting demands:

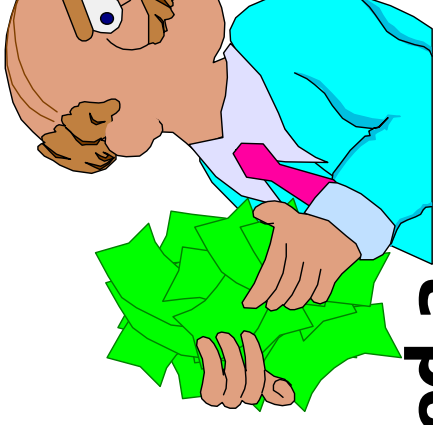
Loyalty to company and colleagues

Concern for public welfare

Personal gain, ambition

Ethical standards are usually relative and personal, so there is seldom an “absolute” standard.

Moral Dilemmas



Kickbacks

A County Engineer in Virginia demanded a 25% kickback in secret payments for highway work contracts he issued. In 1967 he made such an offer to Allan Kammerer, a 32 year old civil engineer who was vice president of a young and struggling consulting firm greatly in need of the work. Kammerer discussed the offer with others in the firm, who told him it was his decision to make. Finally Kammerer agreed to the deal, citing as a main reason his concern for getting sufficient work to retain his current employees. (Martin and Schinzingler, pg 14)

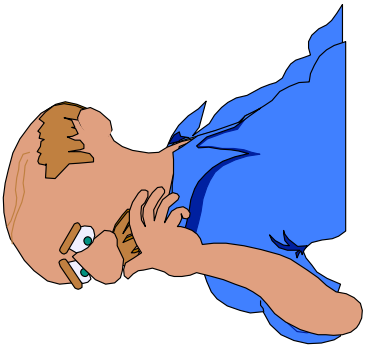
More Moral Dilemmas

Waste dumping

“On a midnight shift, a wrongly prepared solution of sodium cyanide, a reactant in an organic synthesis, is temporarily stored in drums for reprocessing. Two weeks later, the day shift foreman cannot find the drums. Roy, the plant manager, finds out that the batch had been illegally dumped into the sanitary sewer. He severely disciplines the night shift foreman. Upon making discrete inquiries, he finds out that no apparent harm has resulted from the dumping.” (Martin and Schinzingler, pg 32)

Should Roy inform government authorities, as is required by law in this kind of situation?

More Moral Dilemmas



“I have a wife and kids...”

Older engineers, in particular, find job security in competition with ethical instinct. An older PE, in the shadow of a comfortable retirement, was confronted by a new general manager of the plant in which he was employed as a facilities engineer. In consideration of plans for a plant expansion, the general manager insisted that he reduce footings and structural steel specifications below standards of good practice. He was told to choose between his job and his seal on the plans. Did he really have a choice?

(ref Martin and Schinzingler, pg 212)

Whistle-Blowing

"Whistle-blowing" - the act of a man or woman who, believing that the public interest overrides the interest of the organization he[or she] serves, publicly "blows the whistle" if the organization is involved in corrupt, illegal, dishonest or harmful activity.

Some of the enemies of business now encourage an employee to be disloyal to the enterprise. They want to create suspicion and disharmony and pry into the proprietary interests of the business. However, this is labelled **"INDUSTRIAL ESPIONAGE"**, and not whistle-blowing or professional responsibility. It may be a tactic for spreading disunity and creating conflict within a company.

Examples of problems that might warrant whistle-blowing

- Incompetence
- Criminal Behavior
- Unethical Policies
- Threat to Public Safety
- Injustices to Workers

Moral Guidelines to Whistle-Blowing

It is morally permissible for engineers to engage in external whistle-blowing concerning safety:

1. If the harm that will be done by the product to the public is serious and considerable
2. If they previously make their concerns known to their superiors
3. If getting no satisfaction from their immediate superiors, they exhaust the channels available within the corporation, including going to the board of directors.

Whistle-Blowing (cont)

In order for whistle-blowing to be morally obligatory, there are two further requirements:

4. He [or she] must have documented evidence that would convince a reasonable, impartial observer that his [or her] view of the situation is correct and the company policy wrong.
5. There must be strong evidence that making the information public will in fact prevent the threatened serious harm.

A Reasonable Care Model of Professional Responsibility

A person, *P*, is responsible for the harm he or she causes when his or her conduct fits the following pattern:

- (1) as a member of a profession, *P* has a duty to conform to the standard operating procedures of his or her profession, unless those standards are lower than those that a nonprofessional would adopt in a given situation, in which case *P* has a duty to conform to the higher standard:
- (2) at time *t*, action *X* conforms to the standard of reasonable care defined in (1);
- (3) *P* omits to perform *X* at time *t*,
- (4) Harm is caused to some person, *S*, as a result of *P*'s failure to do *X*.

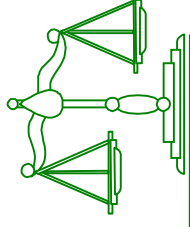
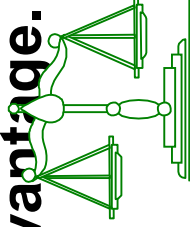
Functions of a Code

- Protect the profession and its credentials.
- Influence public and private policy.
- Improve professional practice.
- Identify and reprimand(punish) all unqualified technicians.

Confidentiality

While doing consultancy or expert-witnessing for firms, you should conform to “confidentiality” .

You should keep to yourself any private information you have obtained during the job, and not discuss the client’s specific case with competitors or other bodies who might make use of the information at your client’s disadvantage.



VALUES IN SCIENCE

- Honesty
- Responsibility
- Accountability
- Independence
- Collaboration
- Recognition of contribution

SCIENTIFIC MISCONDUCT

- Deliberate fabrication, falsification, or misrepresentation of data
- Plagiarism
- Error and negligence

IFST

IFST(Institute of Food Science & Technology) is the independent incorporated **professional** qualifying body for food scientists and technologists. Its aims are :

1. to serve the **public interest** by furthering the application of science and technology to all aspects of the supply of safe, wholesome, nutritious and attractive food, nationally and internationally;
2. to advance the standing of **food science and technology**, both as a subject and as a profession;
- 3.to assist members in their **career and personal development** within the profession;
- 4.to uphold professional standards of **competence** and **integrity**

IFST Code of Professional Conduct for Food Engineers

One of the characteristics distinguishing a profession from an occupation is a recognition that the profession must be practised for the benefit of the public as well as that of the practitioners.

The IFST Code is restricted to twelve briefly-stated ethical principles:

- 1. to promote the aims of the Institute;**
- 2. so to conduct himself or herself as to reflect credit upon the profession;**
- 3. to use all proper means to maintain the standards of the profession and to extend its usefulness and sphere of influence;**
- 4. to respect any confidence gained in his or her professional capacity;**
- 5. when making statements or recommendations in a professional capacity to do so objectively and fairly;**
- 6. to take legitimate steps through proper channels to ensure (or assist in ensuring) the wholesomeness of any food with which he or she is concerned;**
- 7. to avoid unwarranted statements that reflect upon the character or integrity of other members of the profession;**
- 8. to recognise his or her responsibility for the professional guidance of subordinates under his or her immediate control;**
- 9. to recognise his or her responsibility towards the environment;**
- 10. to recognise his or her responsibility towards students;**
- 11. to recognise his or her responsibility to maintain and enhance professional competence by continuing updating and improving his or her knowledge and proficiency in its application;**
- 12. to support fellow members who may find themselves in difficulties on account of their adherence to this Code and the Institute in its efforts to protect them.**

Professional Conduct Guidelines

GUIDELINE NO. 1 WHOLESOMENESS OF FOOD

GUIDELINE No. 2 RELATIONS WITH THE MEDIA

GUIDELINE No. 3 CONFIDENTIALITY OF INFORMATION

GUIDELINE No. 4 CONFLICTS INVOLVING PROFESSIONAL ETHICS

GUIDELINE No. 5 DUTIES TOWARDS SUBORDINATES

GUIDELINE No. 6 SCIENTIFIC ISSUES AND FOOD PROMOTION

GUIDELINE No. 7 RESPONSIBILITIES TOWARDS STUDENTS

GUIDELINE No. 8 RESPONSIBILITIES TO THE ENVIRONMENT

Summary

- Where you draw the line is your choice
- Corporate ethics begins with personal ethics
- You can be held personally and legally responsible for your professional actions
- It is important to understand your company's attitude toward ethics - it should be a factor in your choice of employer

**Ethics is your responsibility
to yourself
to your community
to humanity**

