Food Microbiology

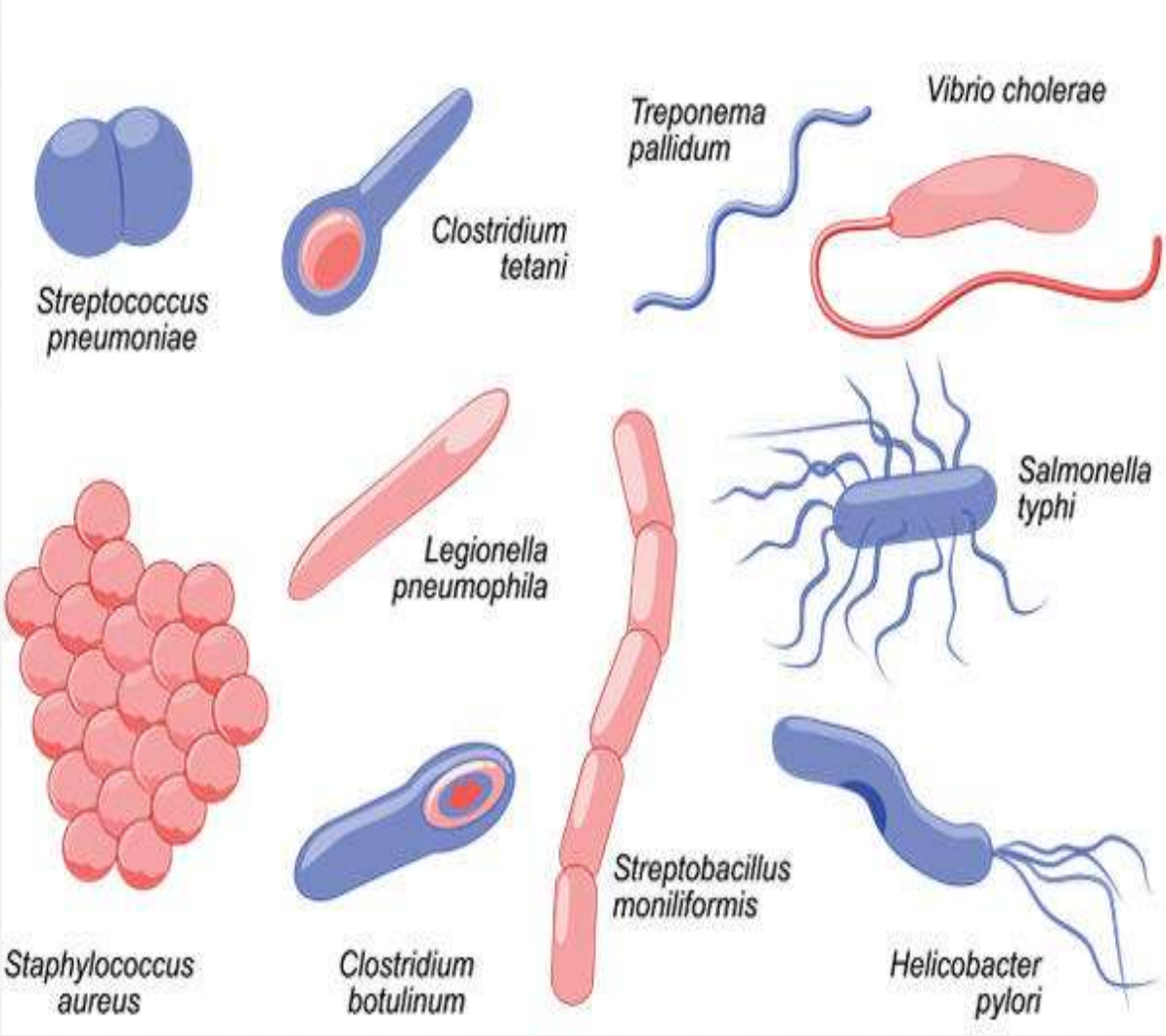
General Characteristics Of Main Group Of Microorganisms- Bacteria, Fungi And Yeast

BACTERIA

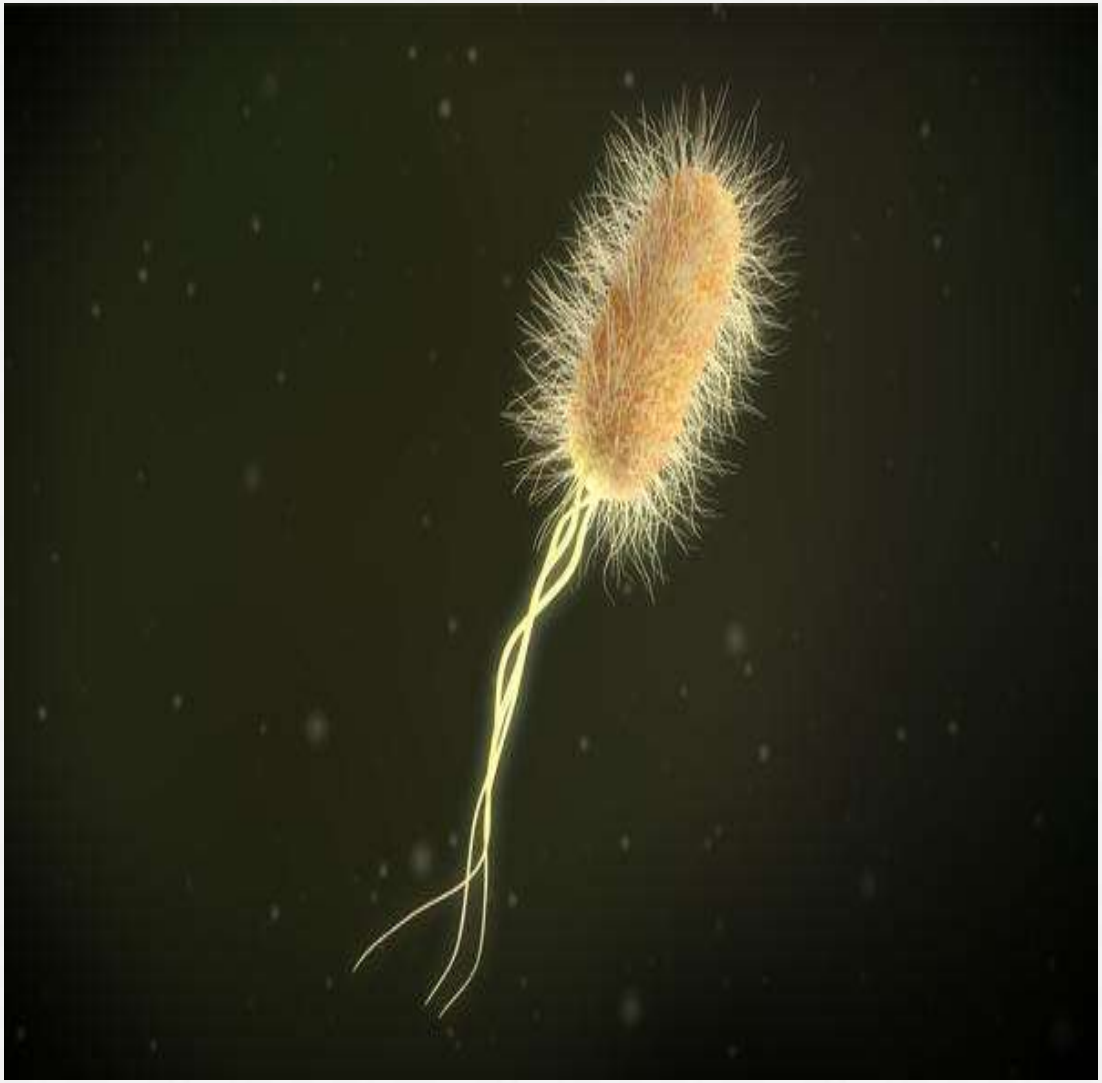
- Bacteria are Prokaryotes – No nucleus or organelles bound in membranes
- DNA is a single circular chromosome
- No Histones associated with DNA
- Cell Walls of peptidoglycan (polymer of NAG and NAM cross-linked with polypeptide chain)
- Smaller ribosome unit
- Divide by binary fission (not mitosis)

INTRODUCTION OF BACTERIA

- Bacteria are single celled microbes. The cell structure is simpler than that of other organisms as there is no nucleus or membrane bound organelles. Instead their control centre containing the genetic information is contained in a single loop of DNA. Some bacteria have an extra circle of genetic material called a plasmid. The plasmid often contains genes that give the bacterium some advantage over other bacteria. For example it may contain a gene that makes the bacterium resistant to a certain antibiotic.
- Bacteria are classified into five groups according to their basic shapes: spherical (cocci), rod (bacilli), spiral (spirilla), comma (vibrios) or corkscrew (spirochaetes). They can exist as single cells, in pairs, chains or clusters.


Streptococcus pneumoniae
Clostridium tetani
Treponema pallidum
Vibrio cholerae
Legionella pneumophila
Salmonella typhi
Staphylococcus aureus
Clostridium botulinum
Streptobacillus moniliformis
Helicobacter pylori

- Bacteria are found in every habitat on Earth: soil, rock, oceans and even arctic snow. Some live in or on other organisms including plants and animals including humans. There are approximately 10 times as many bacterial cells as human cells in the human body. A lot of these bacterial cells are found lining the digestive system. Some bacteria live in the soil or on dead plant matter where they play an important role in the cycling of nutrients. Some types cause food spoilage and crop damage but others are incredibly useful in the production of fermented foods such as yoghurt and soy sauce. Relatively few bacteria are parasites or pathogens that cause disease in animals and plants.



How do bacteria reproduce?

- Bacteria reproduce by binary fission. In this process the bacterium, which is a single cell, divides into two identical daughter cells. Binary fission begins when the DNA of the bacterium divides into two (replicates). The bacterial cell then elongates and splits into two daughter cells each with identical DNA to the parent cell. Each daughter cell is a clone of the parent cell.
- When conditions are favourable such as the right temperature and nutrients are available, some bacteria like *Escherichia coli* can divide every 20 minutes. This means that in just seven hours one bacterium can generate 2,097,152 bacteria. After one more hour the number of bacteria will have risen to a colossal 16,777,216. That's why we can quickly become ill when pathogenic microbes invade our bodies.

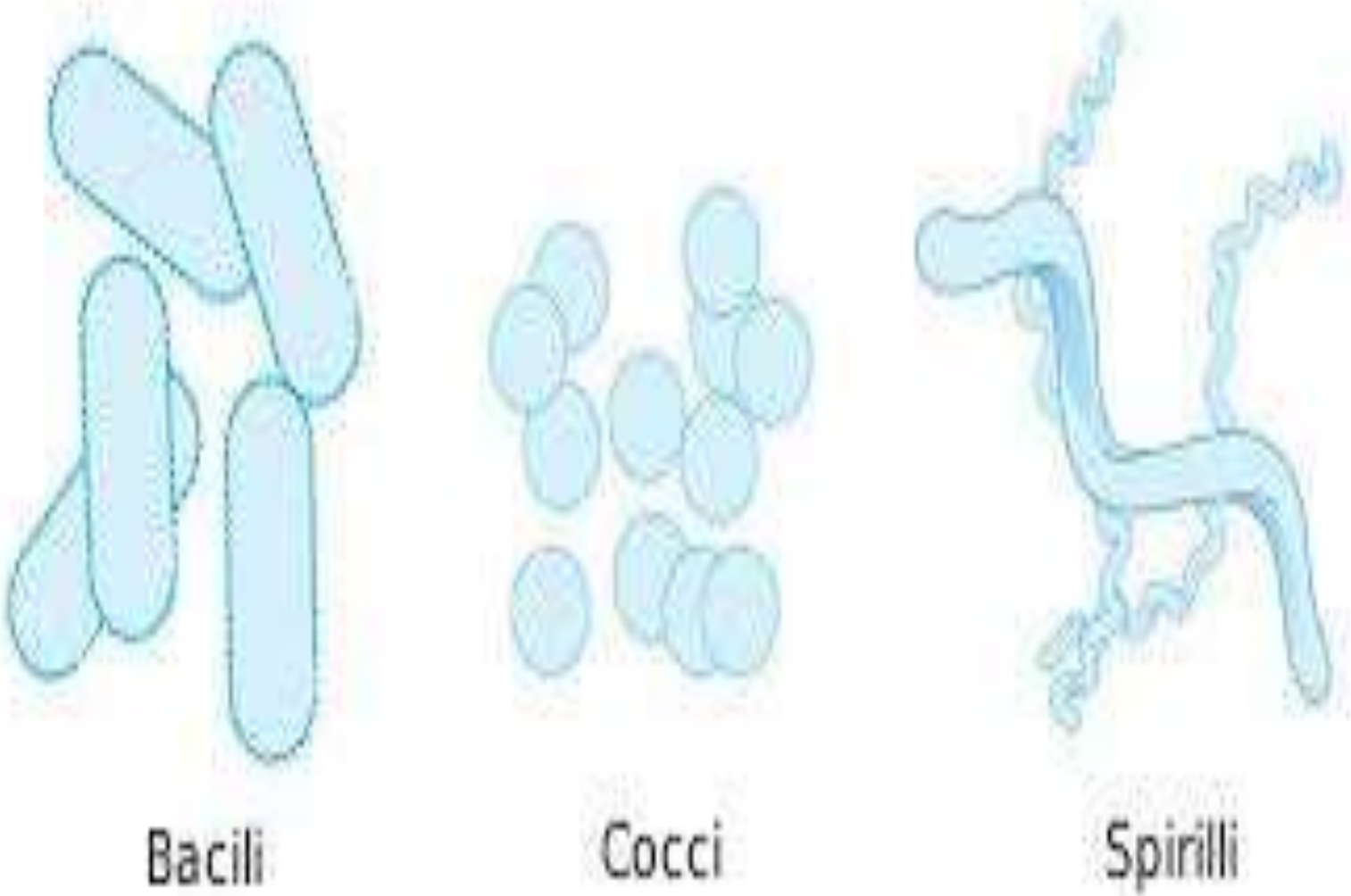
CHARACTERISTICS OF BACTERIA

Bacteria are the most successful organisms on the planet. They lived on this planet for two billion years before the first eukaryotes and, during that time, evolved into millions of different species

Size and Shape:

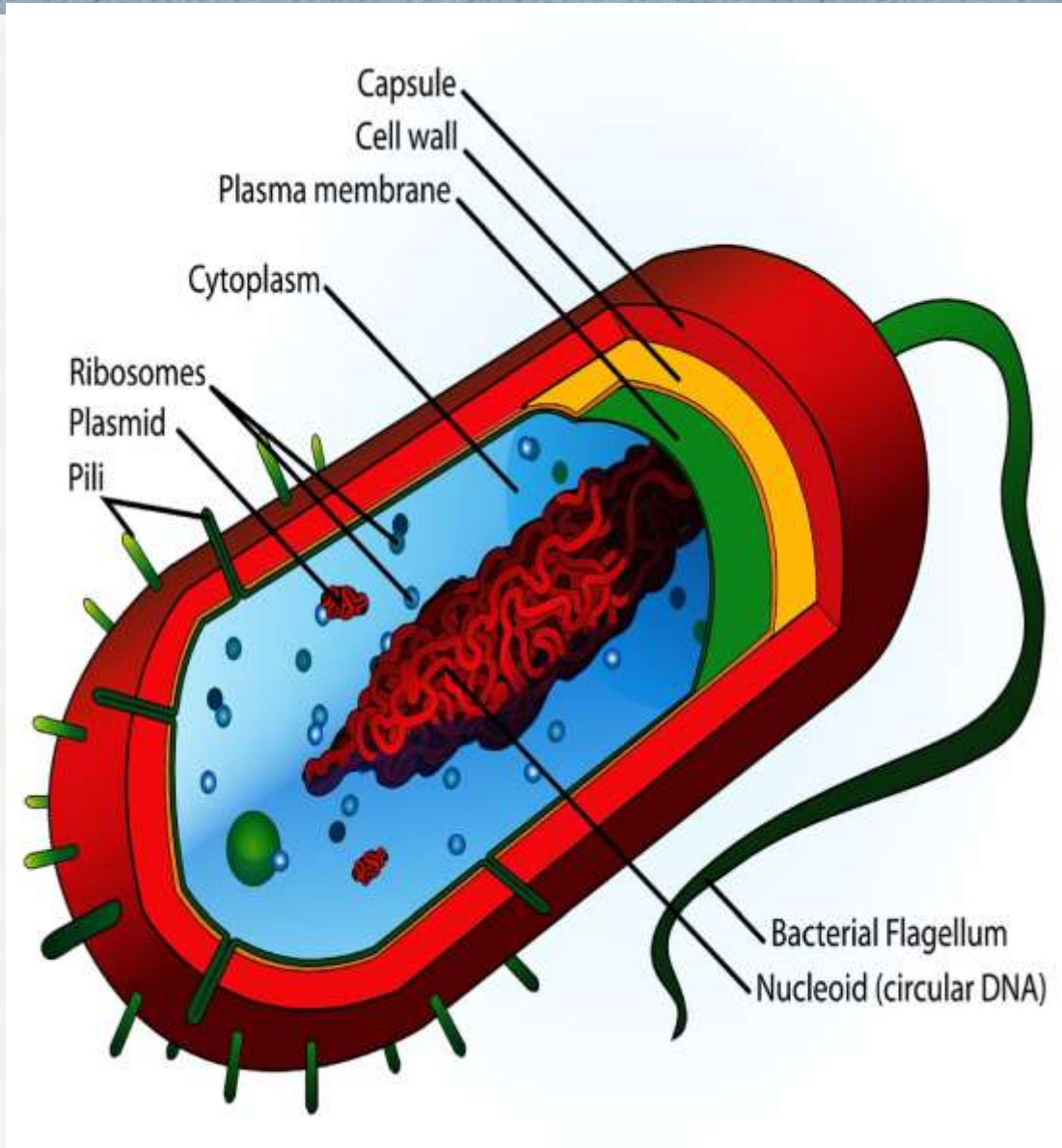
Bacteria are so small that they can only be seen with microscope. When bacteria viewed under the microscope, they have three distinct shapes. Bacteria can be identified and classified by their shape:

- **Bacilli** are rod-shaped.
- **Cocci** are sphere-shaped.
- **Spirilli** are spiral-shaped


Bacili
Cocci
Spirilli

SIMILARITIES TO EUKARYOTES

- Like eukaryotic cells, bacterial cells have:
- Cytoplasm, the fluid inside the cell.
- A plasma or cell membrane, which acts as a barrier around the cell.
- Ribosomes, in which proteins are put together.
- DNA. By contrast though, bacterial DNA is contained in a large, circular strand. This single chromosome is located in a region of the cell called the **nucleoid**. The nucleoid is not an organelle, but a region within the cytoplasm. Many bacteria also have additional small rings of DNA known as ***plasmids***.


Capsule
Cell wall
Plasma membrane
Cytoplasm
Ribosomes
Plasmid
Pili
Bacterial Flagellum
Nucleoid (circular DNA)

Unique Features

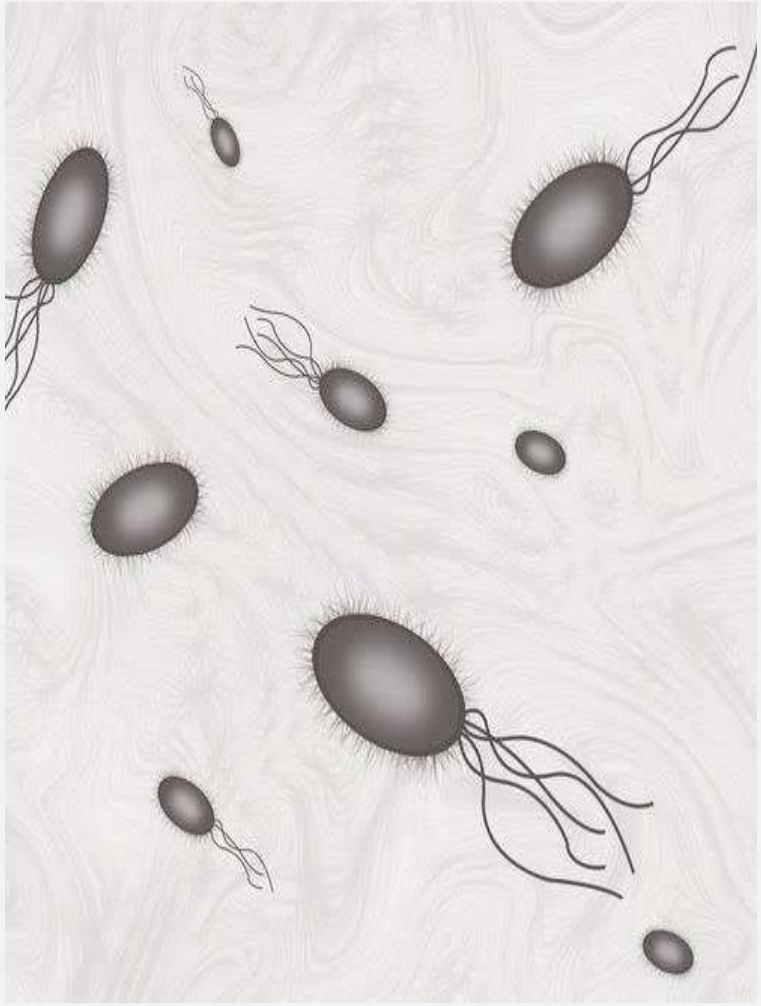
- Bacteria lack many of the structures that eukaryotic cells contain. For example, they don't have nucleus. They also lack membrane-bound organelles such as mitochondria or chloroplasts. The DNA of a bacterial cell is also different from a eukaryotic cell. Bacterial DNA is contained in one circular chromosome, located in the cytoplasm. Eukaryotes have several linear chromosomes. Bacteria also have two additional unique features: a cell wall and **flagella**. Some bacteria also have a capsule outside the cell wall.

The Cell wall

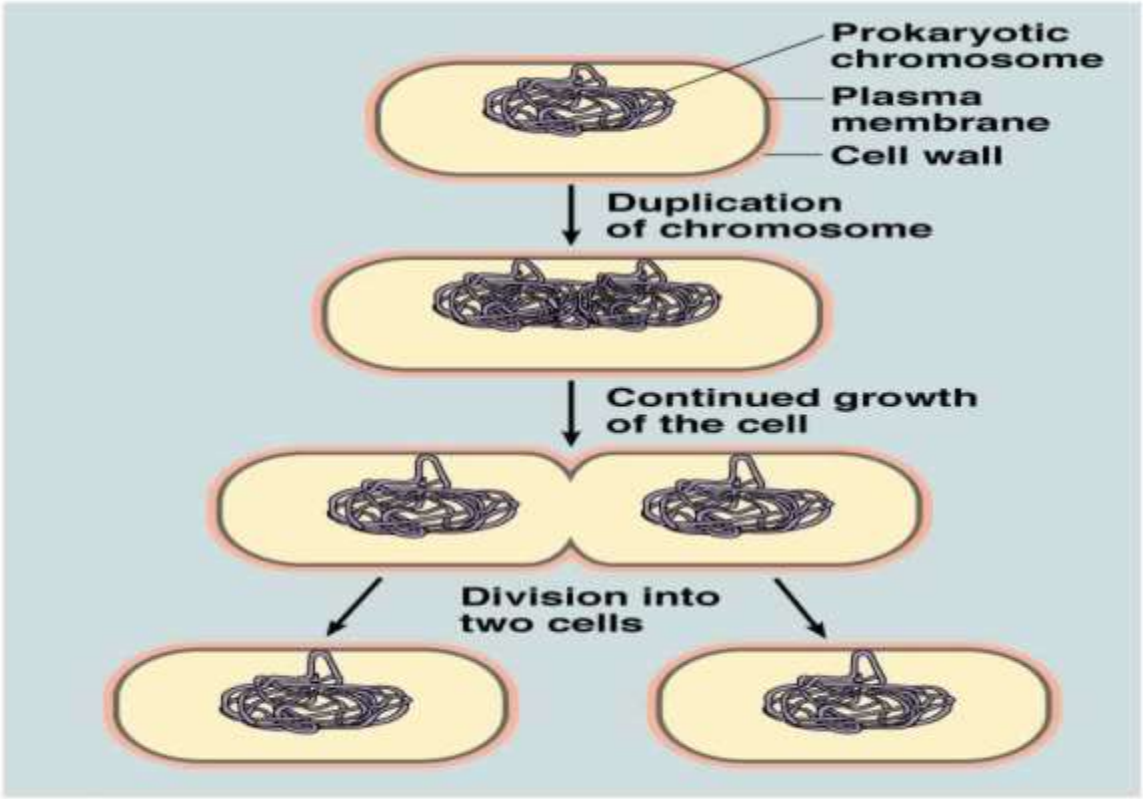
- Bacteria are surrounded by a **cell wall** consisting of **peptidoglycan**. This complex molecule consists of sugars and amino acids. The cell wall is important for protecting bacteria. The cell wall is so important that some antibiotics, such as penicillin, kill bacteria by preventing the cell wall from forming.
- Some bacteria depend on a host organism for energy and nutrients. These bacteria are known as **parasites**. If the host starts attacking the parasitic bacteria, the bacteria release a layer of slime that surrounds the cell wall. This slime offers an extra layer of protection.

Flagella

- Some bacteria also have tail-like structures called flagella. Flagella help bacteria move. As the flagella rotate, they spin the bacteria and propel them forward. It is often said the flagella looks like a tiny whip, propelling the bacteria forward. Though some eukaryotic cells do have a flagella, a flagella in eukaryotes is rare.



Bacteria divide by “binary fission”



Eukaryotes – “true nucleus”, and membrane bound organelles

DNA is membrane bound, inside nucleus, nuclear membrane is a double membrane

Chromosomes are usually multiple (paired), and have special histone protein associated with the DNA molecules

Membrane bound “organelles”: packages where specialized functions take place: mitochondria, lysosome, ER, Golgi, etc.

Cell wall if present is chemically simple (cellulose, or chitin)

Slightly larger ribosome

Cells divide by a process like mitosis (and can have meiosis too)

Uses of Bacteria*

Bacteria can be used to:

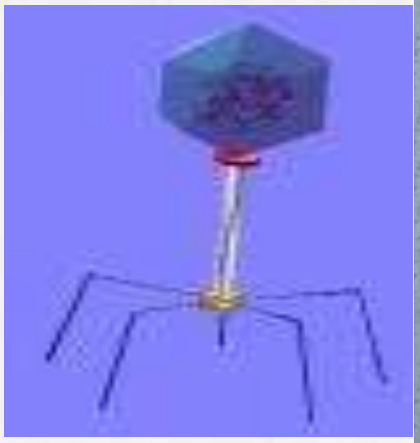
- Replace pesticides
- Degrade herbicides
- Eat or neutralize toxic waste
- Synthesise riboflavin
- Decompose sewage waste
- Produce food by fermentation processes
- Make probiotics
- Separate the fibres of jute, hemp and flax in preparation for making sacks and ropes.

CHARACTERISTICS OF VIRUSES

Are Viruses Living or Non-living?

- Biologists consider viruses to be non-living because:
  - Are not cells
  - Do not grow or respond to their surroundings
  - Cannot make food, take in food, or produce wastes
  - Viruses do not respond to stimuli.
- They can only multiply if in another living cell

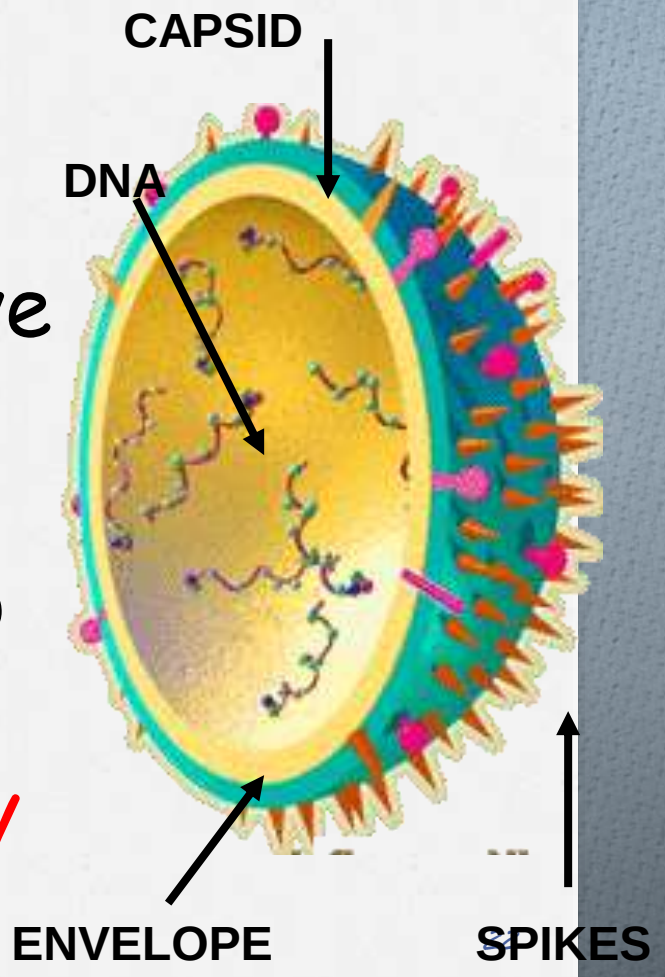
Characteristics

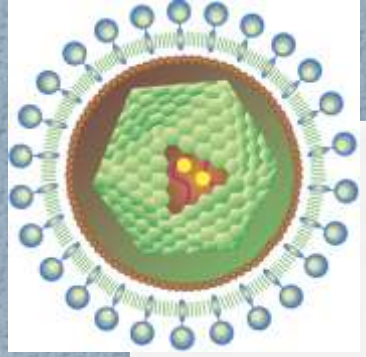


- Non living structures
- Non-cellular
- Contain a protein coat called the capsid
- Have a nucleic acid core containing DNA or RNA (one or the other - not both)
- Capable of reproducing only when inside a HOST cell

Characteristics

- Some viruses are enclosed in an protective envelope
- Some viruses may have spikes to help attach to the host cell
- Most viruses infect only SPECIFIC host cells





HIV VIRUS

EBOLA VIRUS

Characteristic

- Outside of host cells, viruses are inactive
- Viruses cause many common illnesses/ diseases
- Some viruses may cause some cancers like leukemia

MEASLES

Characteristics

- Viruses cause many common illne diseases
- Some viruses may cause some cancers like leukemia

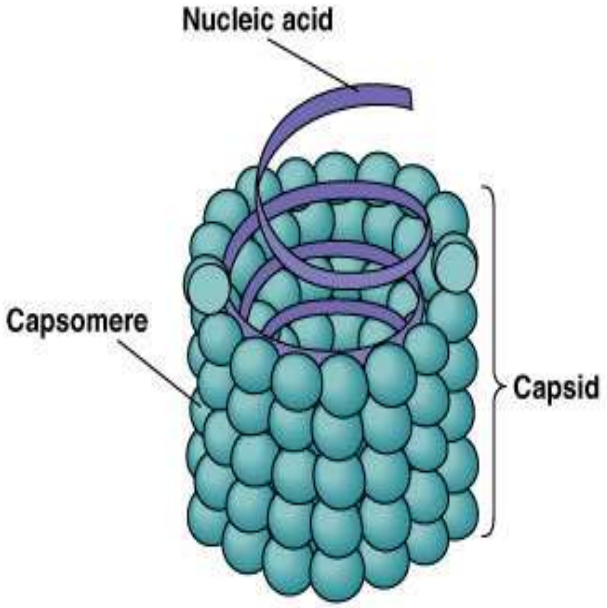
MEASLES

What do Viruses look like?

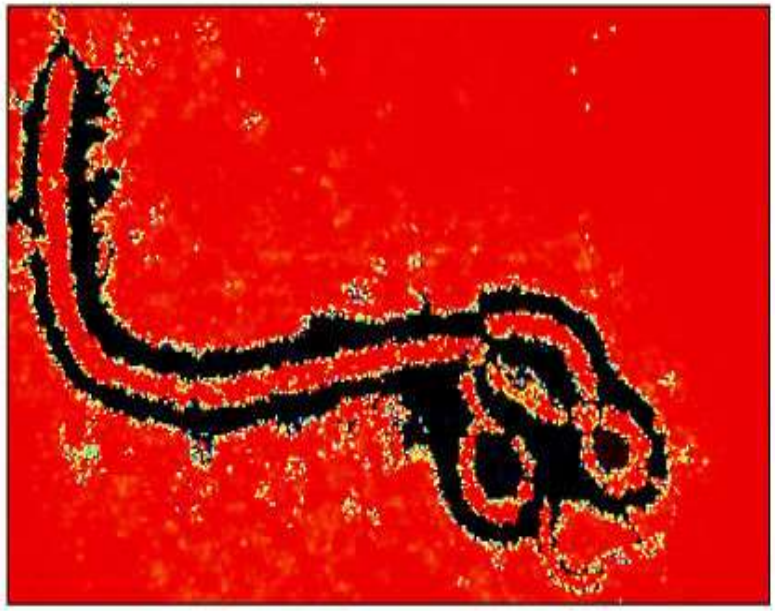
- Viruses are unusual and different from other things in nature.
- Viruses come in a variety of shapes

- Some may be helical shape like the Ebola virus
- Some may be polyhedral shapes like the influenza virus
- Others have more complex shapes like bacteriophages

Types of Viruses: Helical Viruses

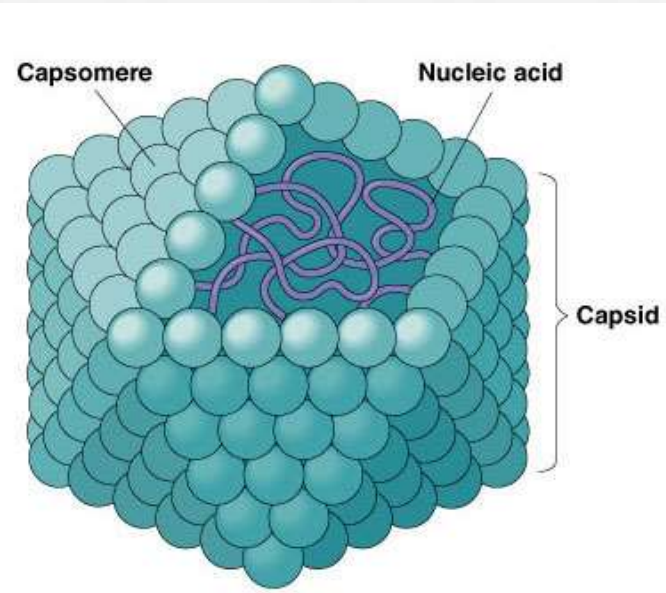


(a) A helical virus

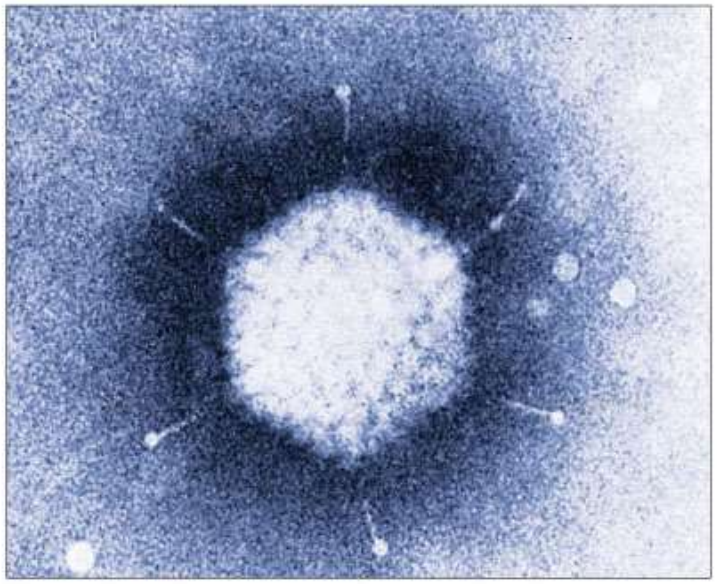


(b) Ebola virus

Polyhedral Viruses

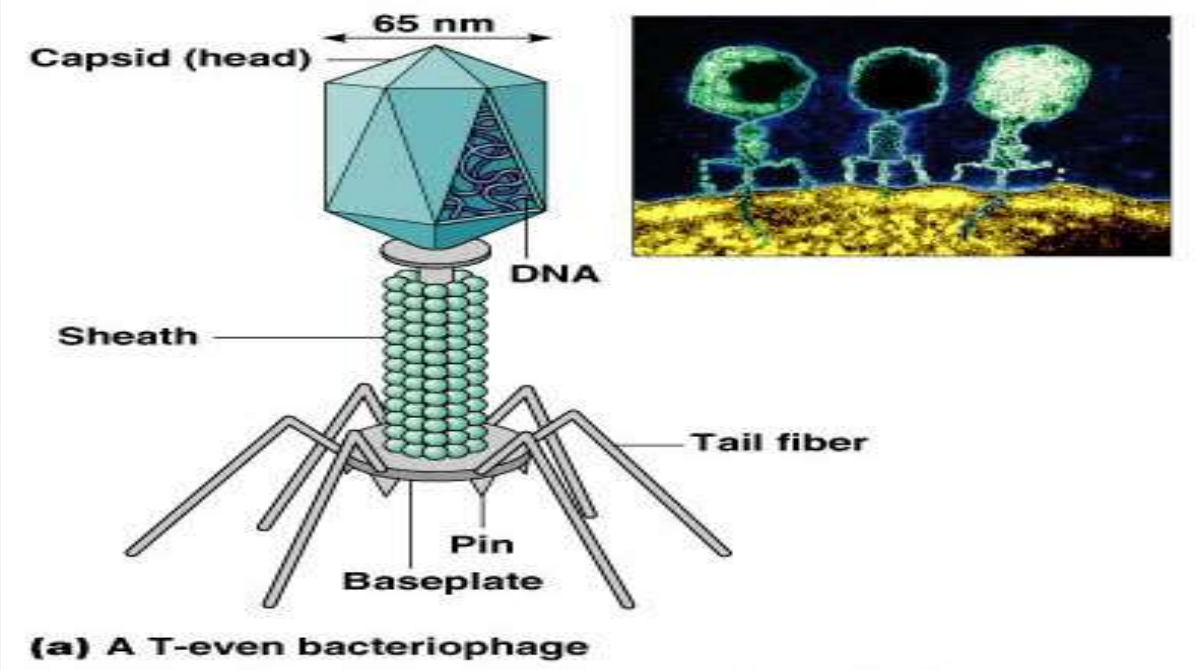


(a) A polyhedral virus



(b) A *Mastadenovirus*

Complex Viruses



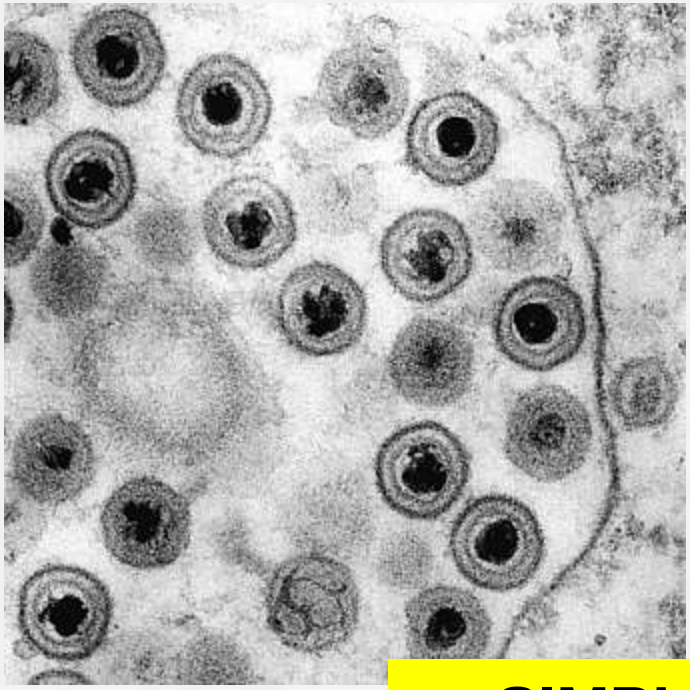
Viral Taxonomy

- Family names end in -viridae
- Genus names end in -virus
- Viral species: A group of viruses sharing the same genetic information and ecological niche (host).
- Common names are used for species
- Subspecies are designated by a number

Used for Virus Identification

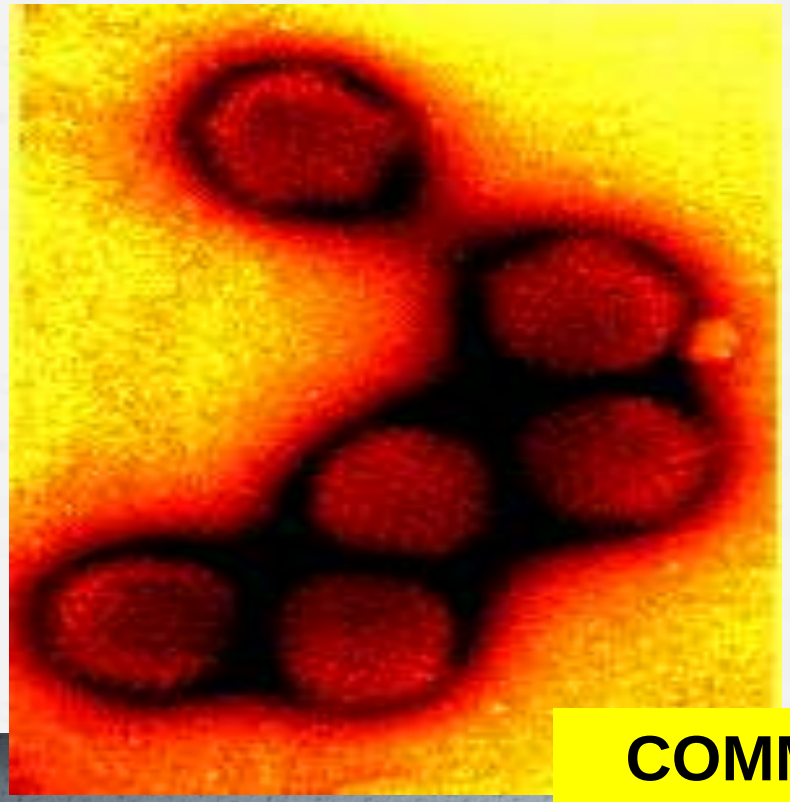
- Morophology
  - RNA or DNA Virus
  - Do or do NOT have an envelope
  - Capsid shape
  - HOST they infect

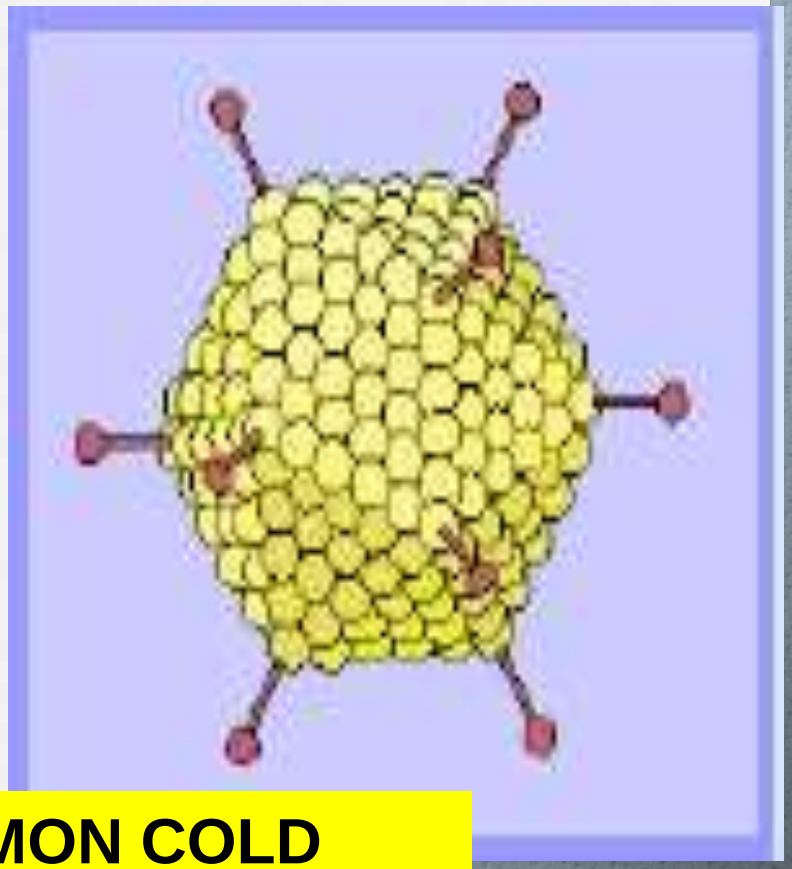
Herpes Virus



SIMPLEX I and II

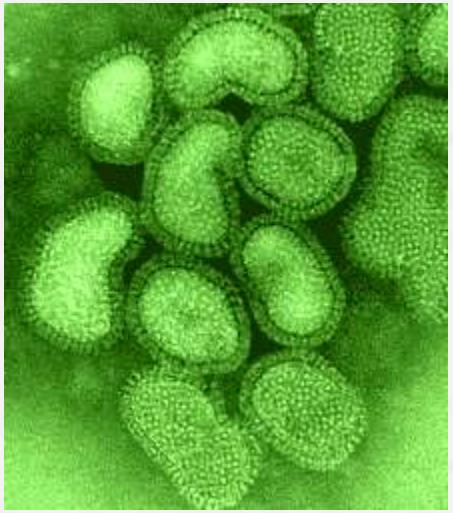
Adenovirus





COMMON COLD

Influenza Virus



PARASITISM

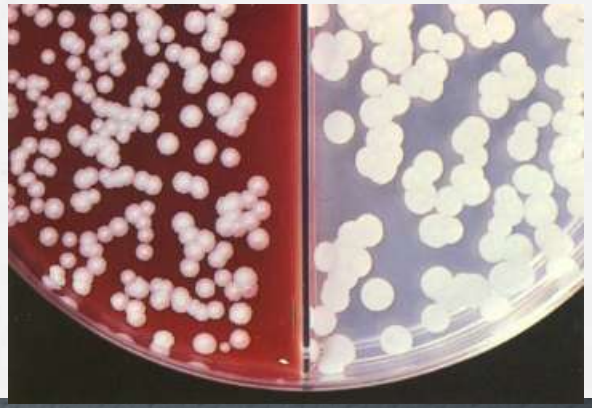
- Viruses are parasites.
  - A parasite is an organism that depends upon another living organism for its existence in such a way that it harms that organism.

Fungi – Yeasts

The objectives of this lab is are:

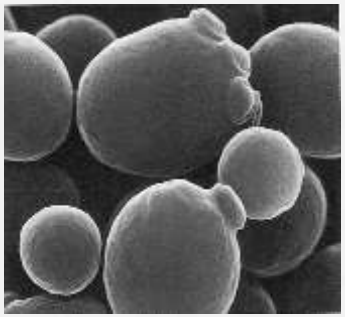
1. To characterize the Yeast fungus.

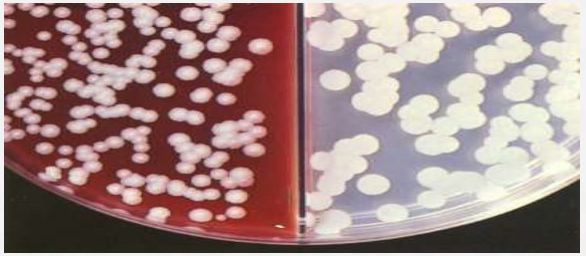
2. To distinguish various types of Yeasts.
3. To be able to identify those various types of yeasts with the microscope.
4. To be able to prepare wet mounts of Yeast and visualize them under 100x oil immersion.



Yeast - Major Characteristics

- Unicellular Fungi
- Eukaryotic
- Facultative anaerobes
- Capable of forming colonies on solid culture media (see pictures on the right).
- Occur worldwide
- Over 1,500 species described





Characteristics of Fungi

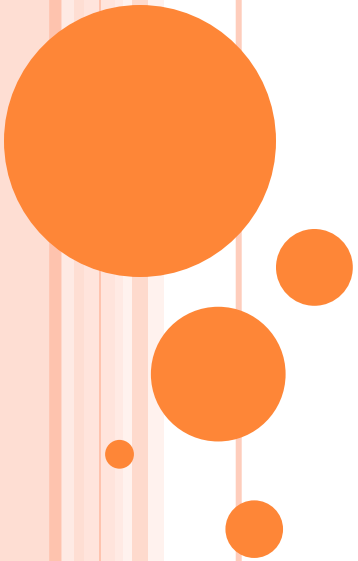
- Fungi are found everywhere, usually invisible to the naked eye.
- They are mostly free-living, living in the soil, air and dead matter.
- They are heterotrophs; they obtain food from other organisms.
  - Most feed on dead organisms, i.e. are saprotrophic.
  - Some are parasitic and cause ill health – e.g. thrush and athlete's foot in humans, and rust in plants.
- Some live in symbiotic relationships with plants and animals, e.g. lichen (a combination of fungi and algae), and mycorrhizae.
- Most are useful
- Reproduce:
  - Asexually by means of reproductive spores
  - Sexually, when in unfavourable conditions, by resistant zyrospores.
  - By budding or binary fission (e.g. yeast)

Uses of Fungi

- As a food source, i.e. mushrooms.
- Produce biological compounds, e.g. alcohol, plant growth regulators and enzymes.
- Produce anti-biotics, e.g. penicillin.
- Control haemorrhage after birth.
- Control cholesterol levels
- For fermentation processes, e.g. yeast.

BACTERIA	VIRUSES	FUNGI
Need Microscope to see them	Smaller then Bacteria	Single Cells (Yeast) or threads (Mushrooms)
Need warmth, moisture, nutrients	Depend on living hosts	Need warmth, moisture, nutrients
Divided into Aerobes and Anaerobes	'Non' Living	Aerobes or Anaerobes
Saprophytes or Parasites	Always Parasites	Saprophytes or Parasites
Can be harmful of Useful	Always Harmful	Can be Harmful or Useful
Harmful: cause diseases, eg tetanus, TB, pneumonia, sore throats, food poisoning, Cholera etc	Cause diseases, eg Measles, Mumps, Poli, Flu, Cold Sores, Aids...	Cause diseases, may be poisonous, decay food
Uses: antibiotics, rot things		Uses: eaten, beer and bread making, antibiotics

Protein



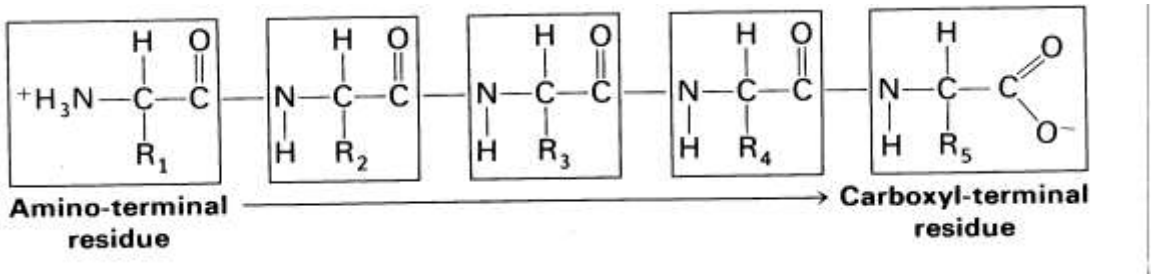
Introduction

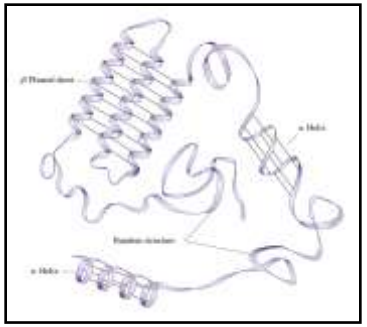
- Are most abundantly distributed organic compounds
- 70 kg man= protein weight constitute 12 kg
- Skeleton and connective tissue contains half
- Body protein and other half is intracellular

Protein Digestion

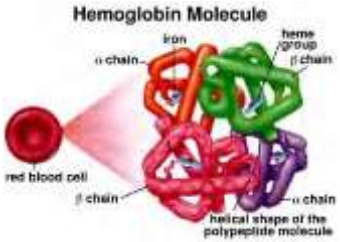
Protein breakdown begins in the **stomach**.

No protein hydrolyzing enzymes are found in saliva.





Hydrolysis (10% of peptide bonds) & **denaturization** by pepsin enzyme & HCl acid produce **short chain polypeptides** in the stomach.



Trypsin, chymotrypsin, & carboxypeptidase from Pancreatic juices,

and **Aminopeptidase** from cells in the small intestine Brush Zone create “free” **amino acids**.

Free amino acids are absorbed thru intestinal wall via active transport.
Enter bloodstream and are brought to cells.

The total supply of free amino acids available is called: the **Amino Acid Pool**.

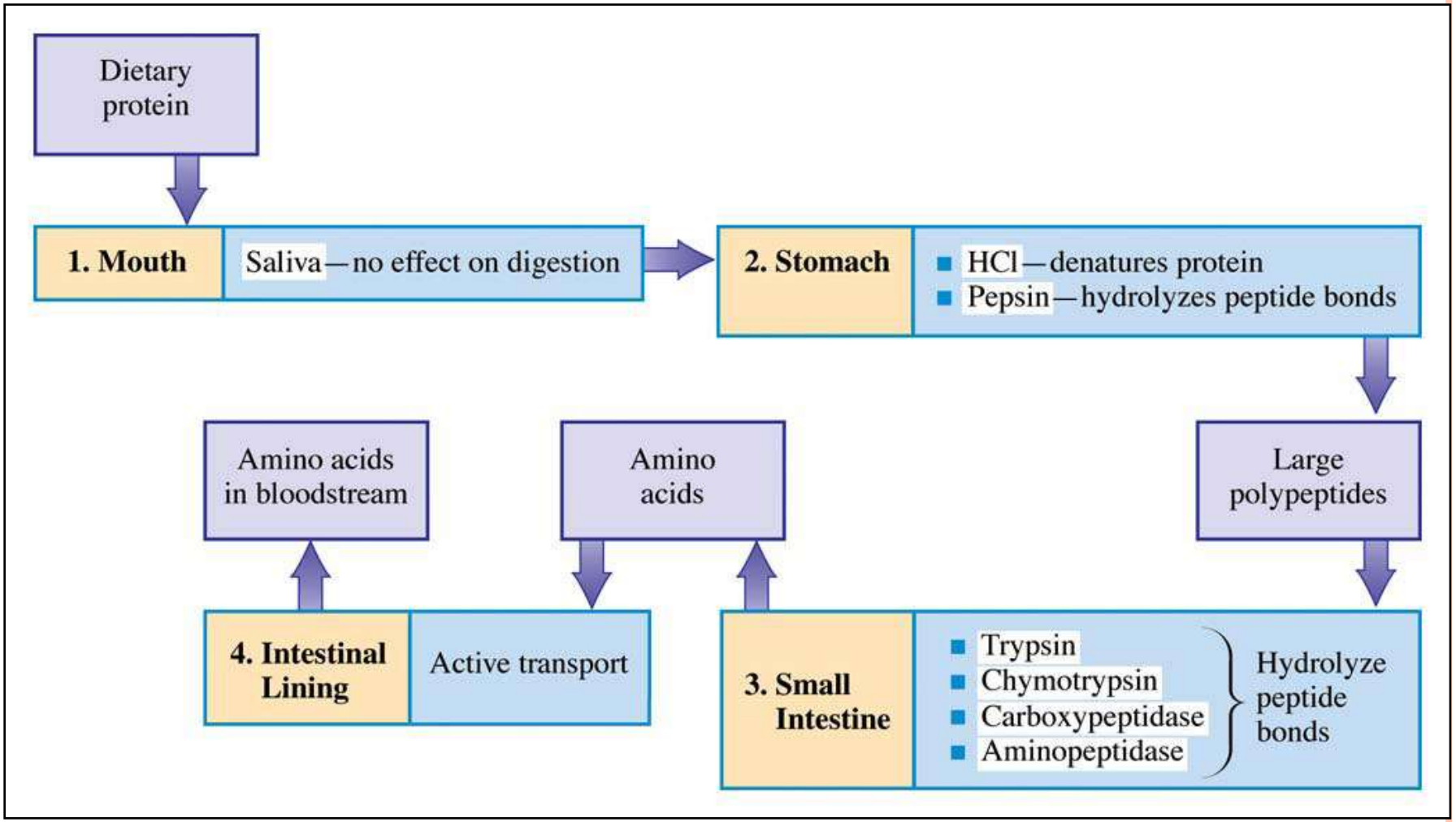
<u>3 sources of "free" amino acids:</u>

1. Dietary protein breakdown
2. Biosynthesis of amino acids in the Liver
3. Protein turnover (I prefer apple turnovers)

Protein turnover is the breakdown & re-synthesis of body protein:

- Old tissues
- Damage
- Recycling enzymes & hormones

Summary of protein digestion in the human body.Possible fates for amino acid degradation products.



Transamination and **Oxidative Deamination:**

Two steps in degrading amino acids

1) remove α-amino group
2) breakdown & process carbon skeleton

Release of an **amino group** is also two steps:

1) **Transamination**
2) **Oxidative deamination**

Central role of glutamate:

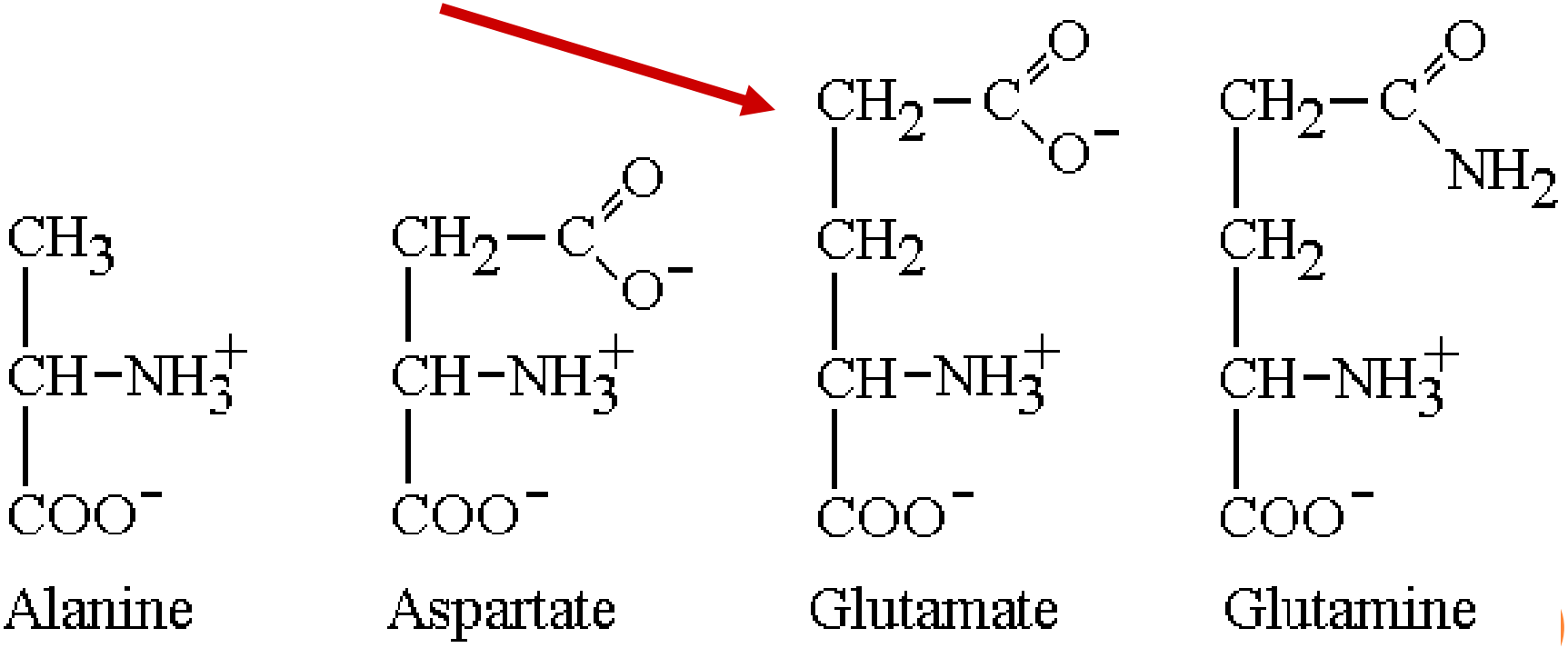
Amino acids:

Glutamate, **aspartate**, **alanine** & **glutamine**

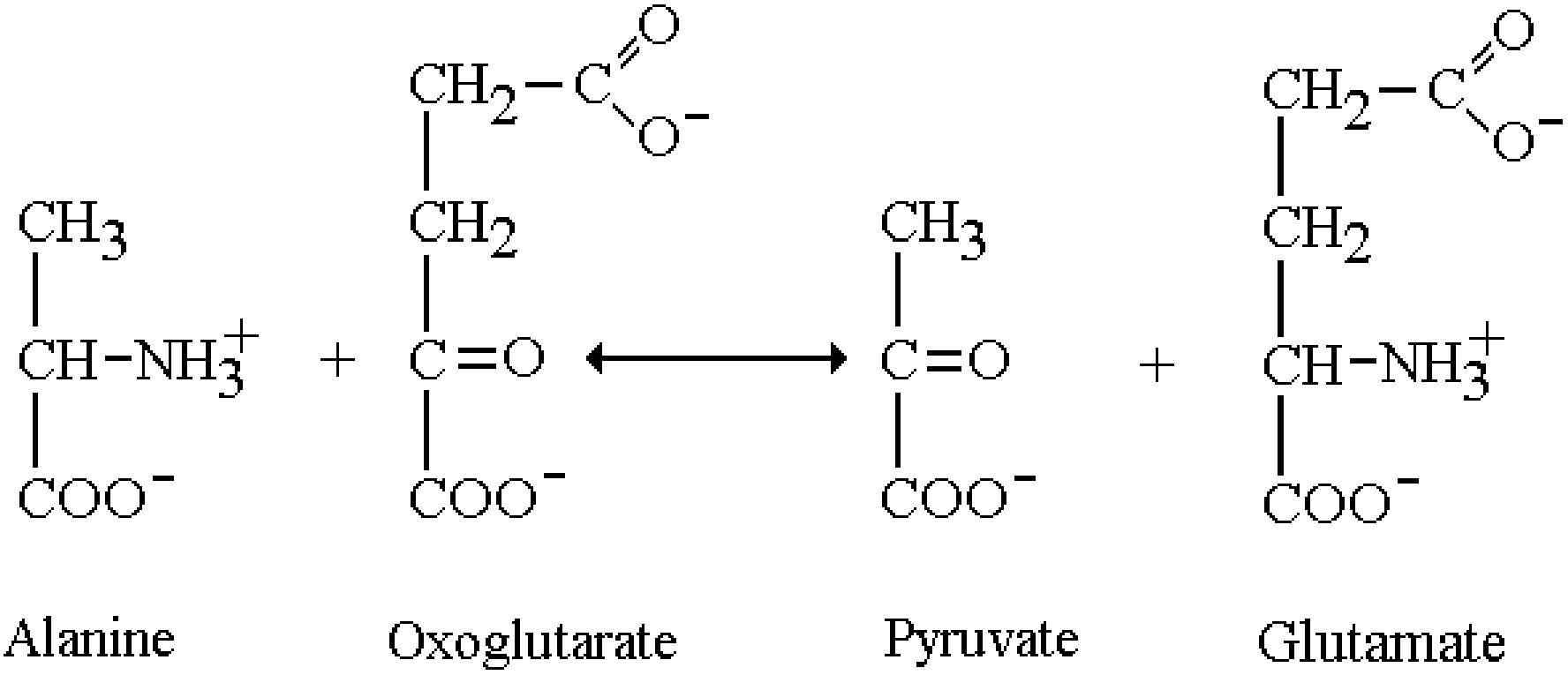
present in higher concentrations in mammalian cells.

Have metabolic functions as well as roles in proteins.

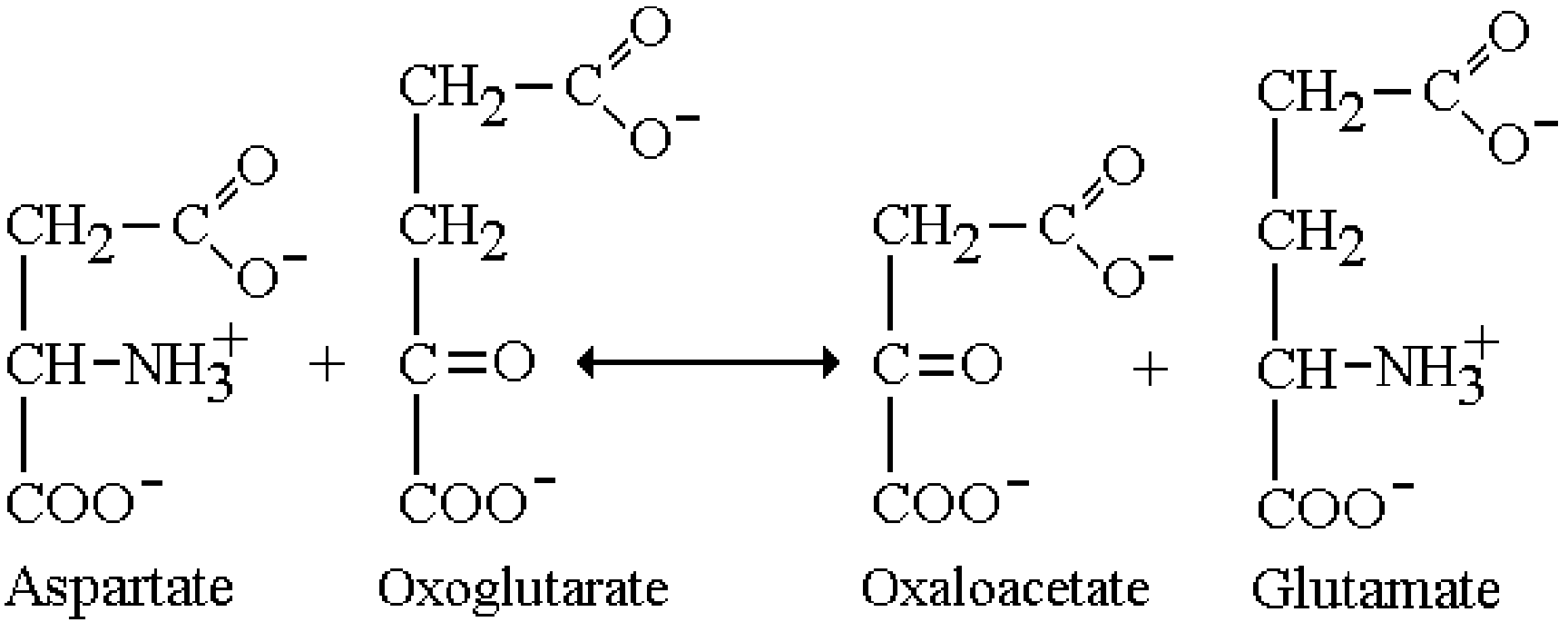
Glutamate is the most important, metabolically.



Some **transaminases** are used for diagnosing disorders:
enzyme **alanine aminotransferase**
Escapes in large amounts from dead or dying liver tissue.
Measured in blood samples for diagnostic purposes.



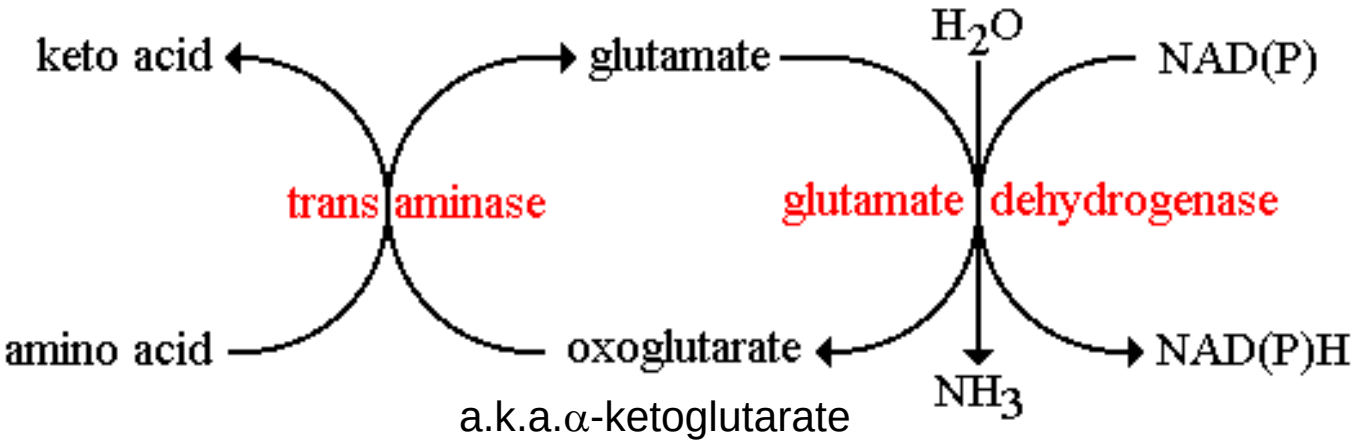
Transaminase enzyme **aspartate aminotransferase**
very active enzyme inside heart cells.
Also escapes in large amounts from dead or dying heart tissues & enters bloodstream.
Measured in blood for diagnosing myocardial infarction.



Trans-deamination (sum it up)

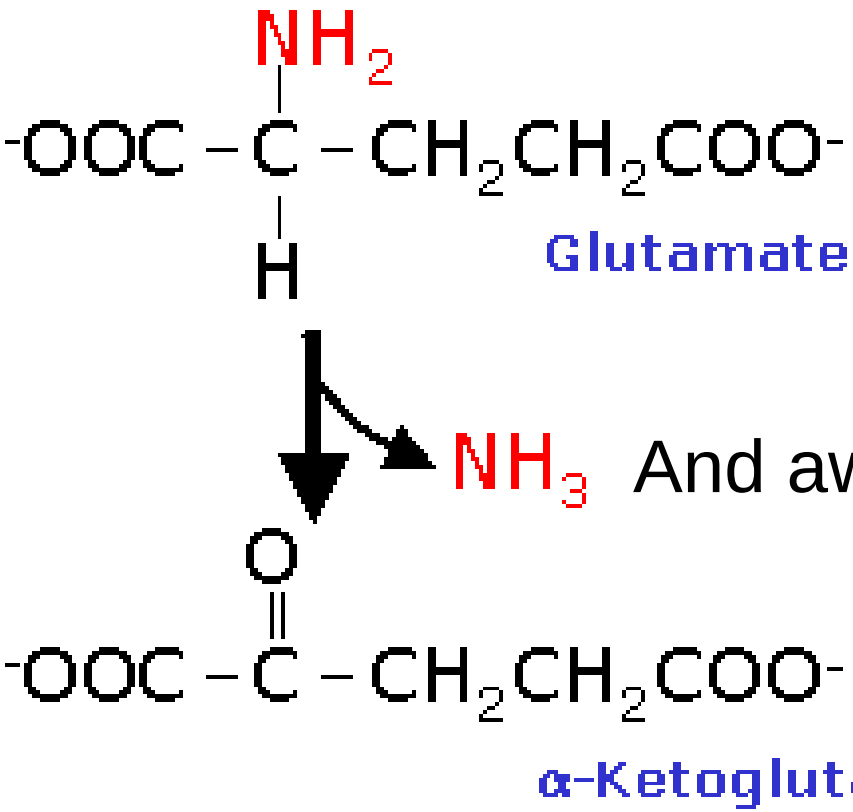
Most **transaminases** share a common substrate and product (oxoglutarate and glutamate) with the enzyme **glutamate dehydrogenase**.

This permits a ***combined*** N excretion pathway for individual amino acids: "trans-deamination." **Glutamate** has a central role in the overall control of nitrogen metabolism.



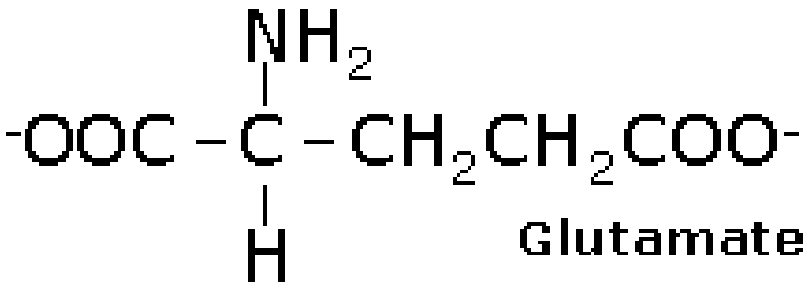
Oxidative Deamination

The **glutamate** produced from the transamination step is then deaminated by **oxidative deamination** using the enzyme **glutamate dehydrogenase**:



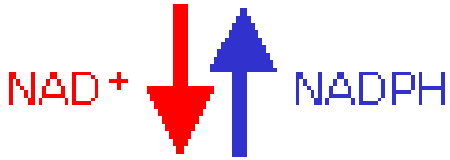
Recycles back to a ketodiacid & releases ammonia

Glutamate dehydrogenase [GluDH]
will reversibly convert
glutamate to **α-ketoglutarate**
and **α-ketoglutarate** to **glutamate**.

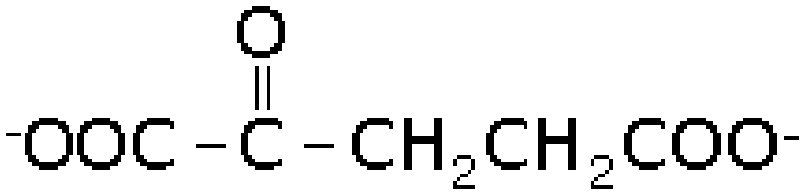


Glutamate

Deamination reaction uses **NAD+**



reverse reaction uses **NADPH**



α-ketoglutarate

Uses ***both*** **NAD+** and **NADPH** – how to regulate it?

Urea cycle:

Ammonium salts (NH_4^+) are toxic compounds.

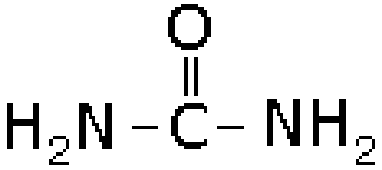
Oxidative deamination converting glutamate to α-ketoglutarate is an easily shifted equilibrium reaction.

Ammonium ions building up favors the synthesis of excessive amounts of glutamate, decreasing the Krebs cycle intermediate

α-ketoglutarate.

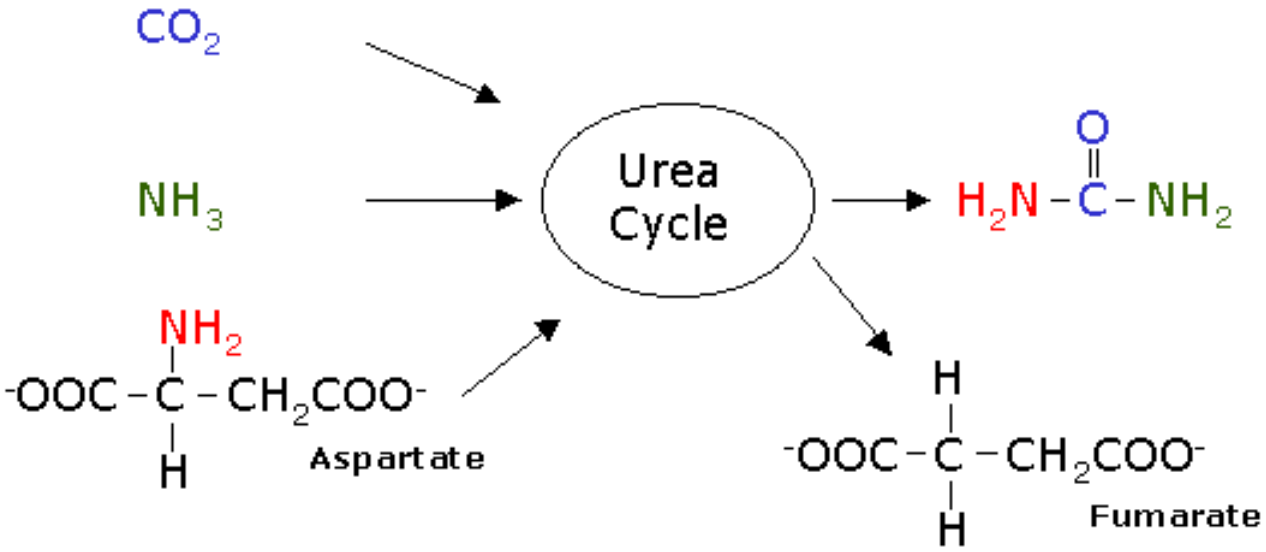
This in turn decreases **ATP production**, and that affects the nervous system.

The answer is Urea:



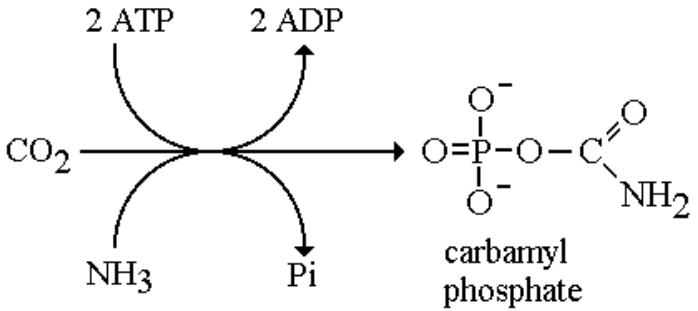
The **inputs** to the urea cycle are NH_3, CO_2 and aspartic acid and ATP.

The **outputs** are urea, ADP and fumaric acid.

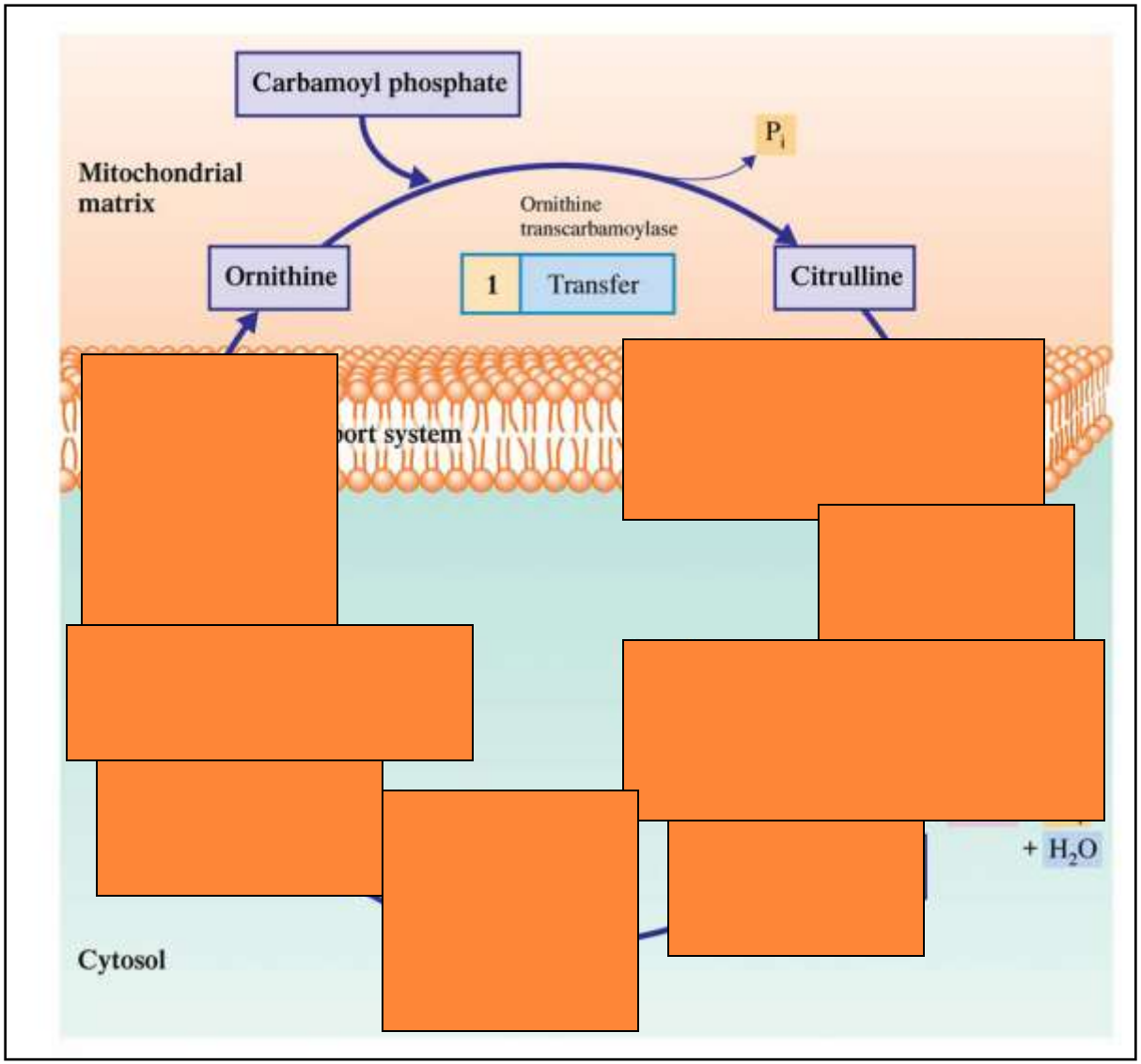


The carbonyl group of urea is derived from **CO_2**

Ammonia contributes one of the amine groups on urea

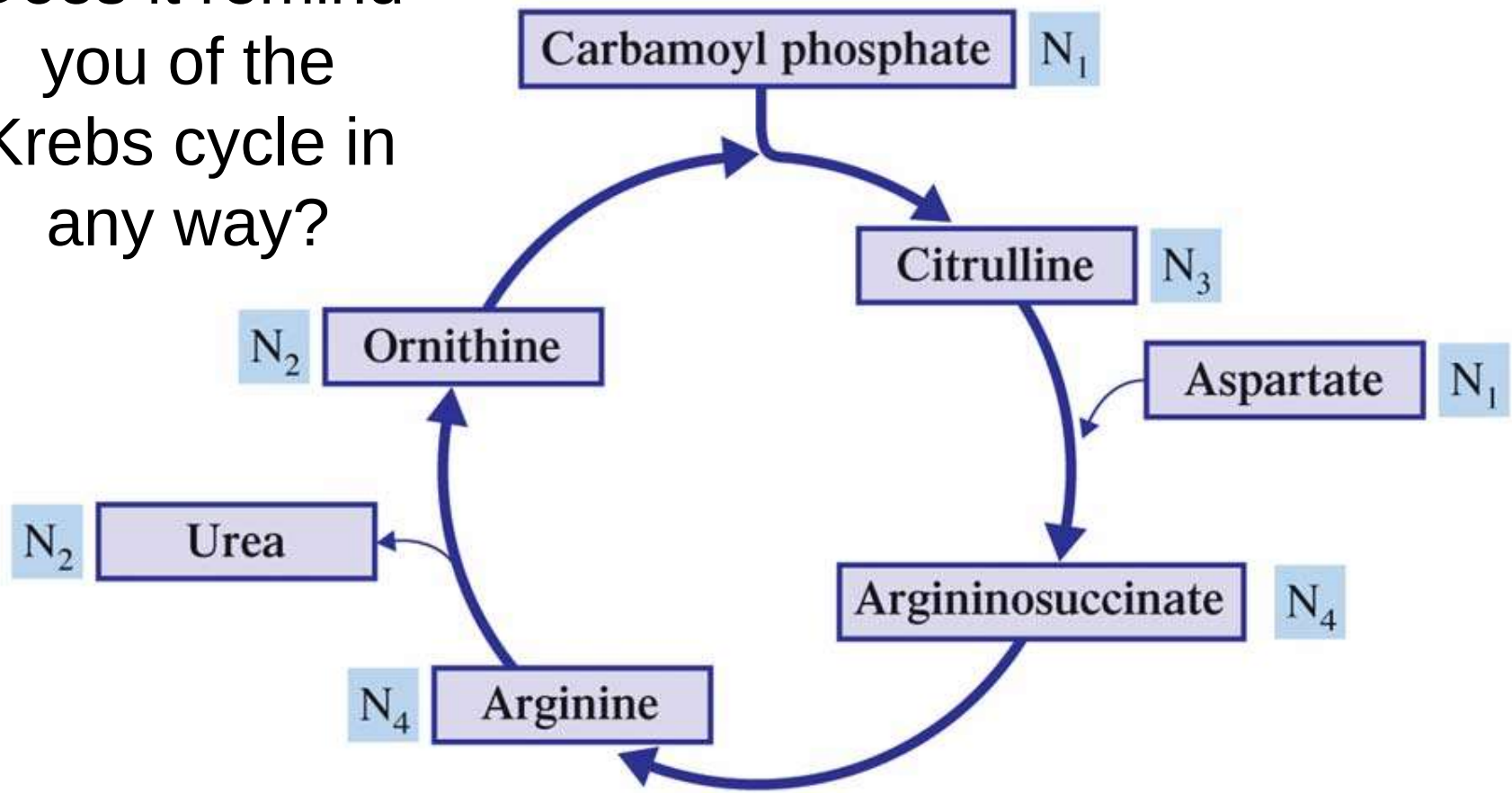


THE FOUR-STEP UREA CYCLE IN WHICH CARBAMOYL PHOSPHATE IS CONVERTED TO UREA.

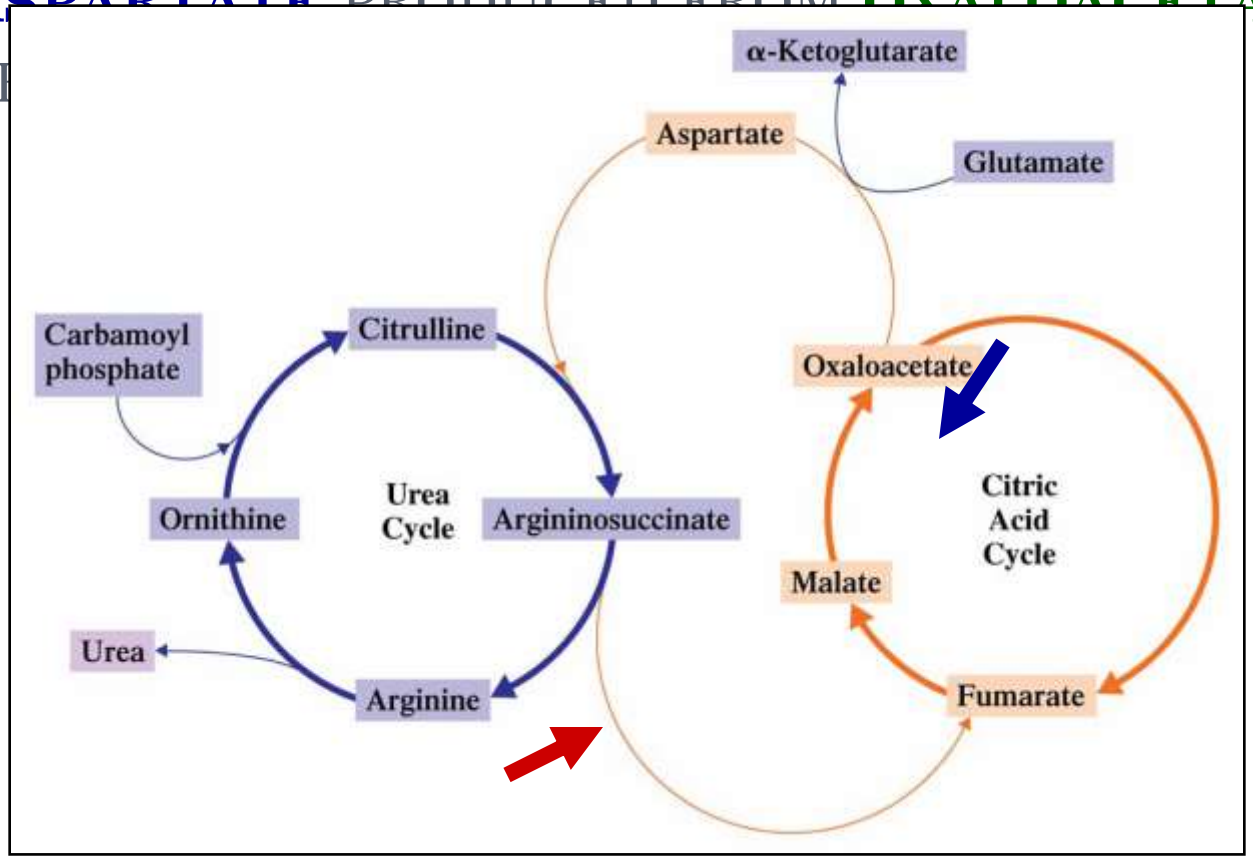


The nitrogen content of the various compounds that participate in the urea cycle.

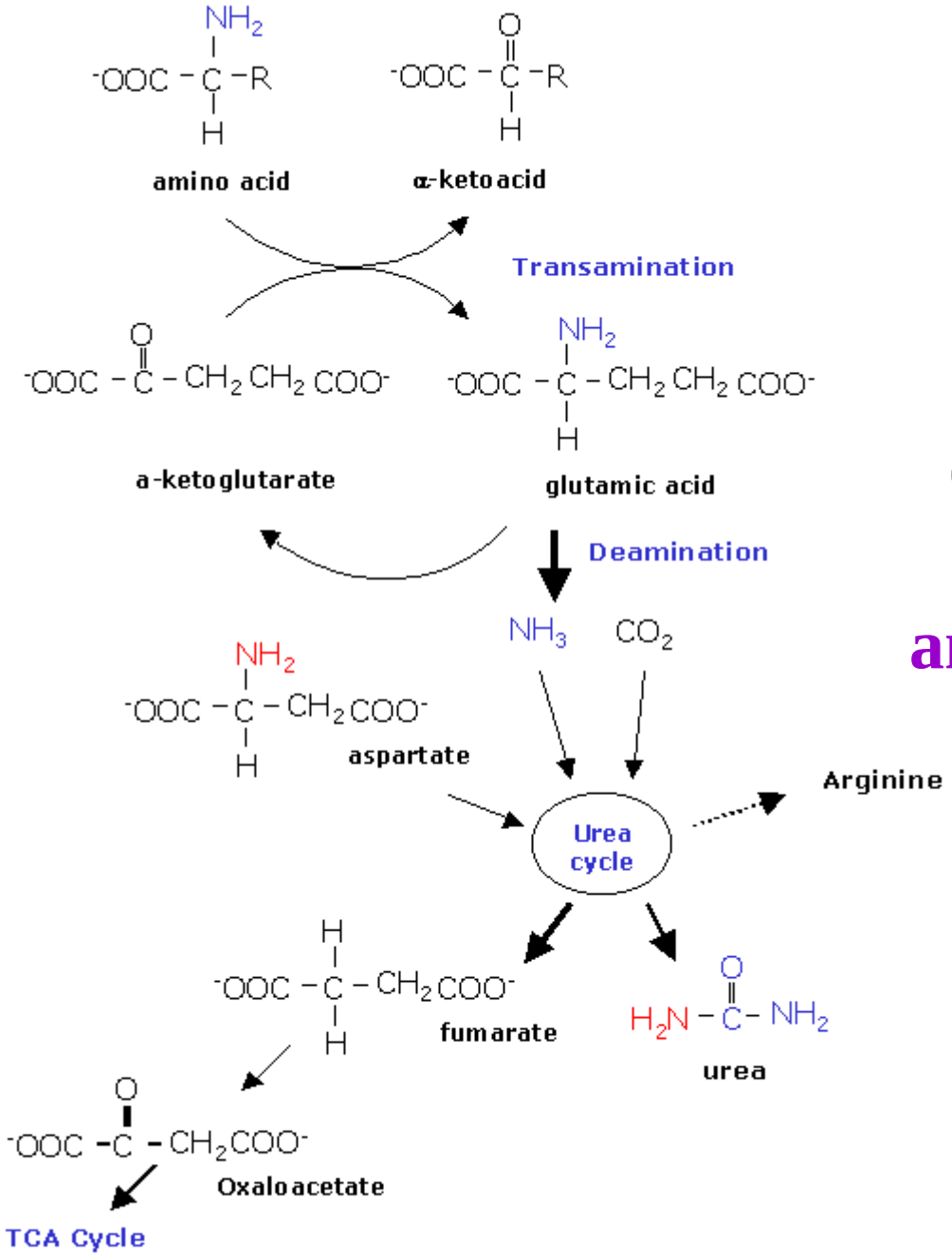
Does it remind you of the Krebs cycle in any way?



FUMARATE FROM THE UREA CYCLE ENTERS THE KREBS CYCLE. **ASPARTATE** PRODUCED FROM **OXALOACETATE** OF THE KREB



OXALOACETATE HAS 4 POTENTIAL FATES: TRANSAMINATION; CONVERSION TO GLUCOSE; FORMATION OF CITRATE; CONVERSION TO PYRUVATE



Summary:

Transamination takes off amine groups from amino acids and forms **glutamate** (ionized glutamic acid)

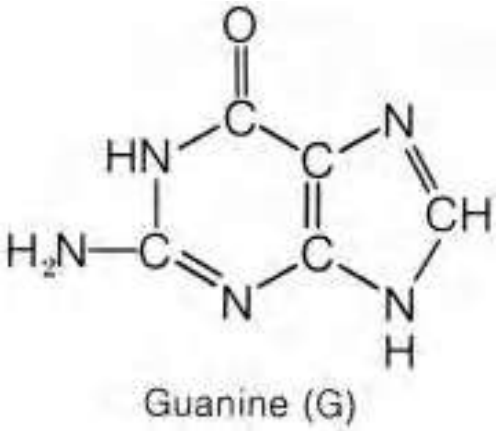
Amine groups form **ammonia** when removed in **deamination**

This combines with **CO_2** & **Aspartate**.

Forms **urea**, **Arginine**, & **Fumarate**

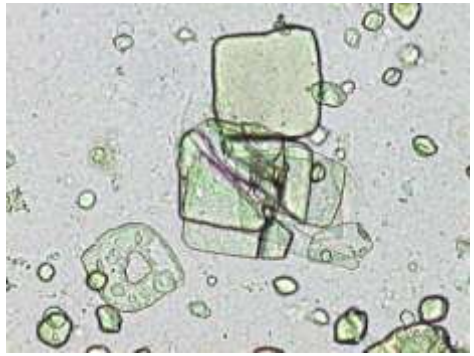
Alternative methods of nitrogen excretion

Aquatic species excrete free **ammonia** through gills.
Terrestrial critters produce **Urea** - very soluble - still needs water for removal via kidneys.
Imposes a minimum daily water requirement.
Spiders excrete **guanine**,
5 nitrogen atoms in a small molecule.



Guanine (G)

Reptiles & birds excrete **uric acid** – very ***insoluble*** purine compound – forms supersaturated solutions. Concentrated urine, supersaturated with uric acid, goes from cloaca into hindgut – uric acid crystalizes & water is reabsorbed.



In humans uric acid deposits crystals & causes gout.

Amino Acid Biosynthesis

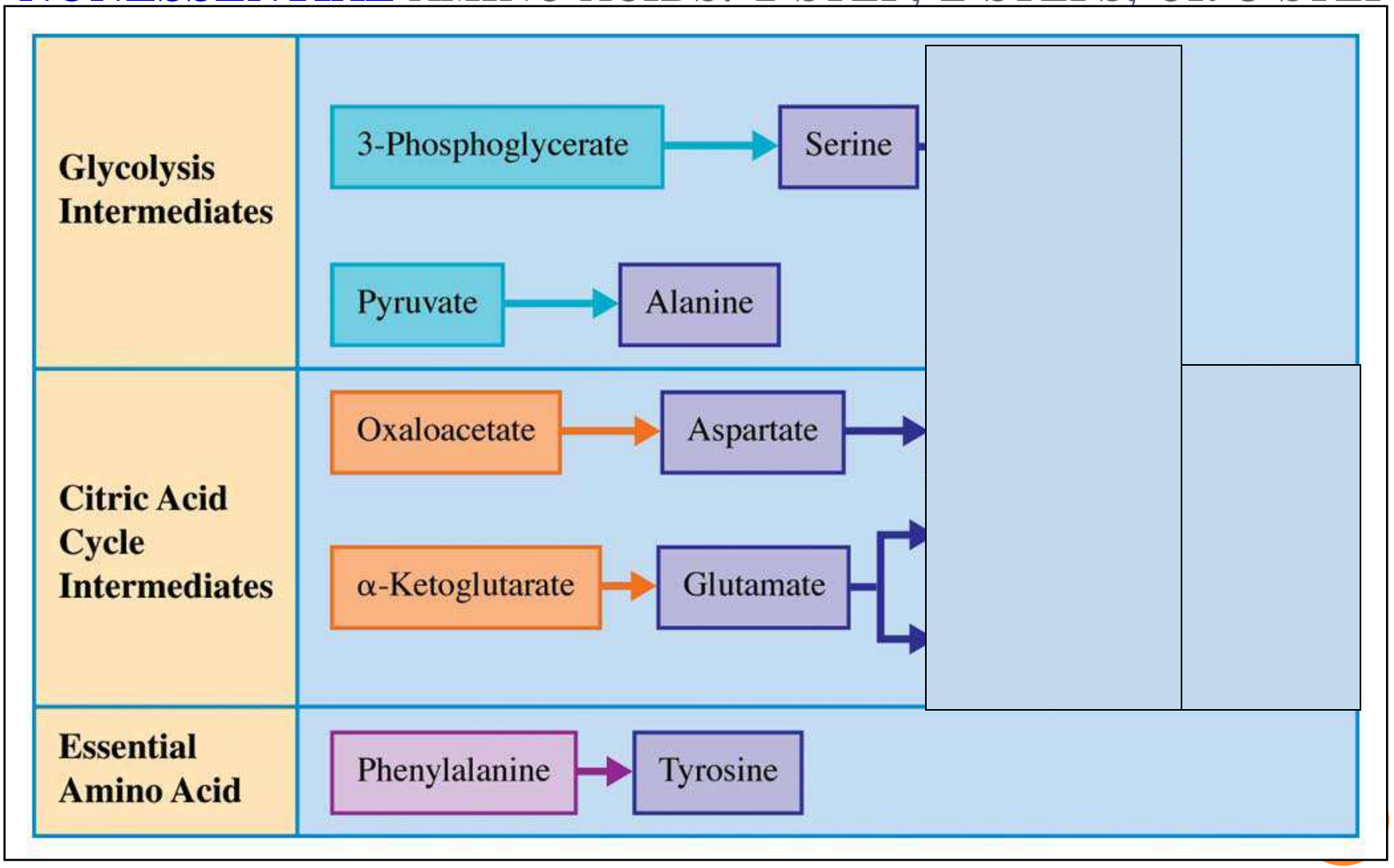
Essential amino acids can be made by plants & bacteria in 7 to 10 steps.
We obtain these amino acids by eating plants.

11 Non-essential amino acids synthesized in 1 to 3 steps.

Use glycolysis intermediates:
3-phosphoglycerate & pyruvate

Krebs cycle intermediates:
Oxaloacetate & **α-ketoglutarate**

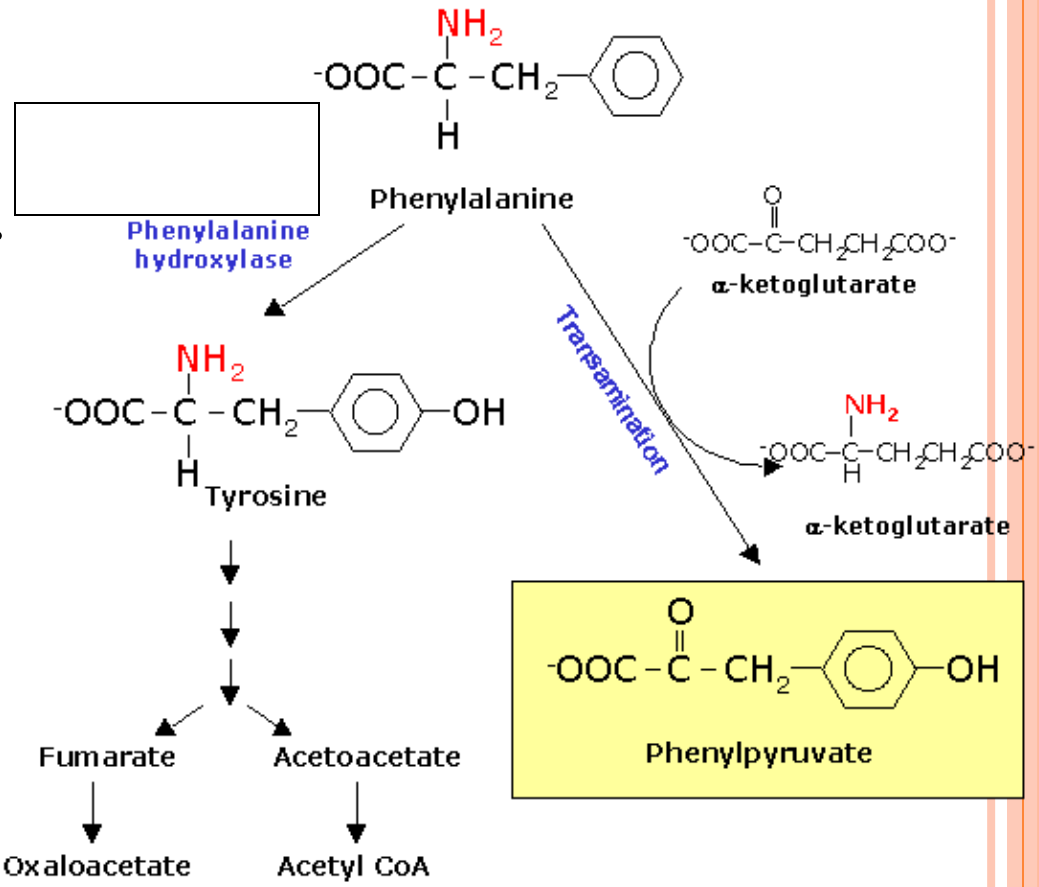
STARTING MATERIALS FOR BIOSYNTHESIS OF 11 **NONESSENTIAL** AMINO ACIDS: 1 STEP, 2 STEPS, OR 3 STEPS



Alanine, aspartate, & glutamate use transamination

Phenylalanine & tyrosine degradation:

Degradation of phenylalanine starts with conversion to tyrosine catalyzed by phenylalanine hydroxylase. Fumarate & acetoacetate are formed. Fumarate is converted to **oxaloacetate** for TCA cycle & acetoacetate is converted to **acetyl CoA**.



Phenylketonuria (PKU):

Defective phenylalanine hydroxylase – **phenylalanine** accumulates in body.

Phenylalanine is transaminated to **phenylpyruvate**.

Accumulation of phenylpyruvate leads to severe mental retardation in infants.

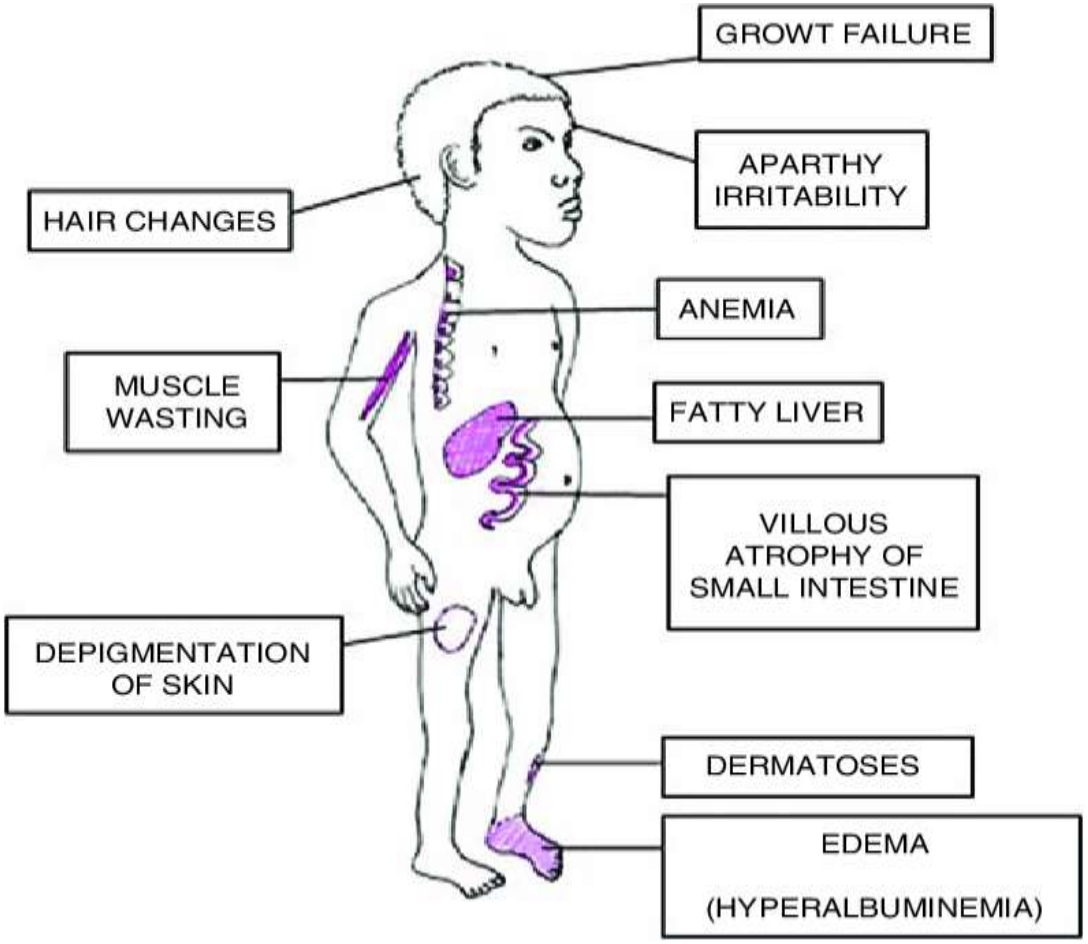
Persons suffering from phenylketonuria should not consume foods containing high levels of phenylalanine, such as aspartame.

DIFFERENCE BETWEEN KWASHIORKOR &MARASUMUS

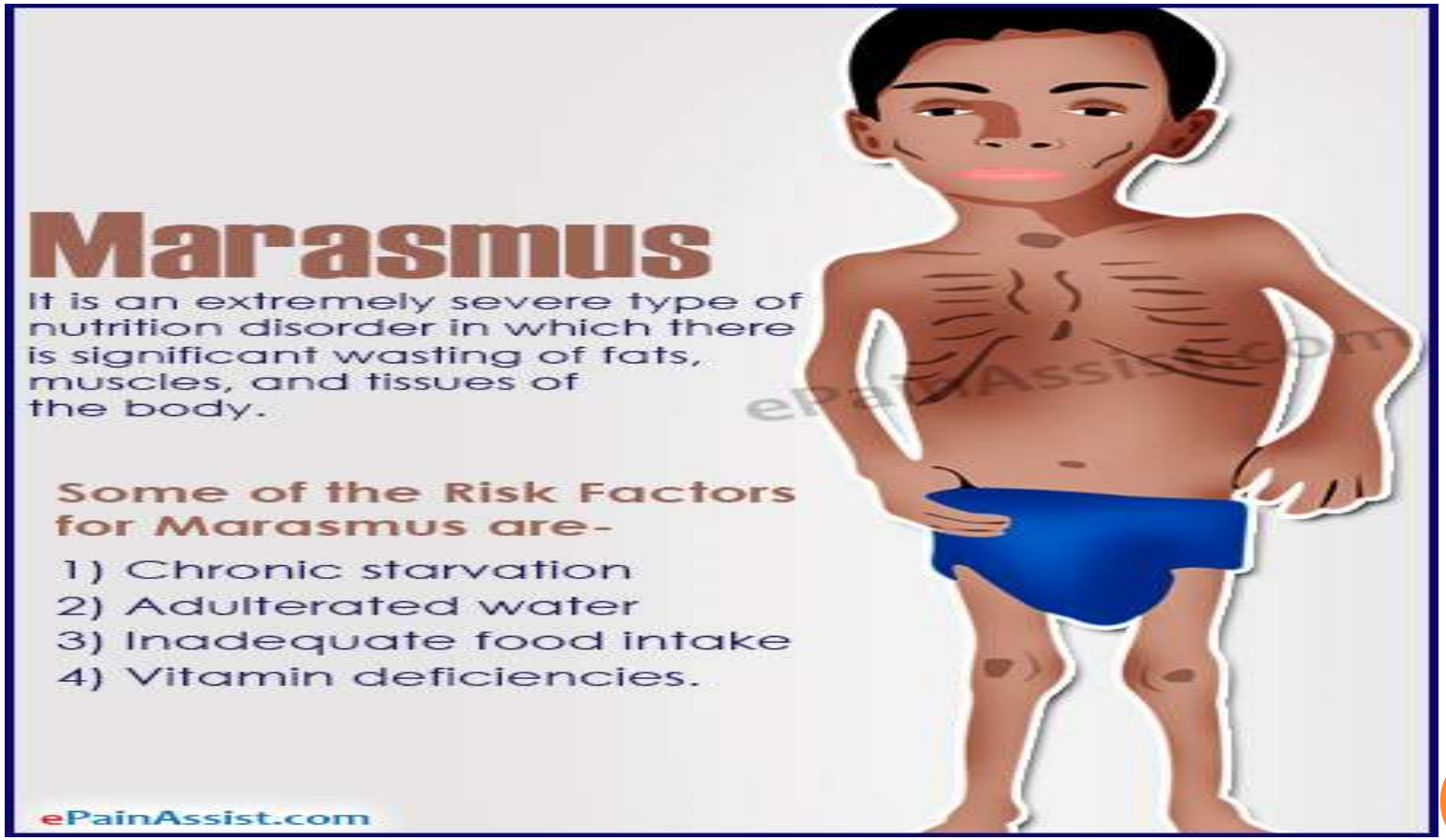
- Marasmus is a form of severe malnutrition characterized by energy deficiency.

- It can be distinguished from kwashiorkor in that kwashiorkor is protein deficiency with adequate energy intake whereas marasmus is inadequate energy intake in all forms, including protein.

KWASHIORKOR



MARASMUS


Marasmus
It is an extremely severe type of nutrition disorder in which there is significant wasting of fats, muscles, and tissues of the body.
Some of the Risk Factors for Marasmus are-
1) Chronic starvation
2) Adulterated water
3) Inadequate food intake
4) Vitamin deficiencies.
ePainAssist.com

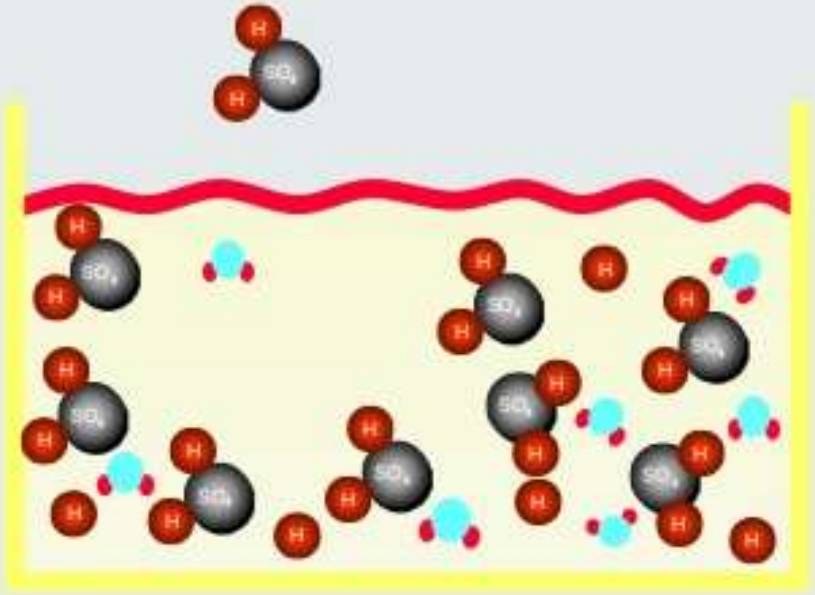
ACID-BASE BALANCE

BY: Mrs. C. Sathyalakshmi

Associate Professor Department of FSN

ACIDS

- Hydrogen containing substances which dissociate in solution to release H^+
- Any ionic or molecular substance that can act as a proton (H^+) donor.
  - Strong acid : HCl, H_2SO4, H_3PO4.
  - Weak acid : H_2CO3, CH_3COOH.



Metabolic Sources of Acids

- **VOLATILE ACIDS (20,000mEq/day):**

➢ Produced by oxidative metabolism of CHO,Fat,Protein

➢ Average **15000-20000** mmol of CO_2 per day

➢ Excreted through **LUNGS** as CO_2 gas

- **FIXED ACIDS (1 mEq/kg/day)**

➢ Acids that do not leave solution, once produced they remain in body fluids until eliminated by **KIDNEYS**

Eg: Sulfuric acid, Phosphoric acid, Organic acids

✓ Are most important fixed acids in the body

✓ Are generated during catabolism of:

- amino acids(oxidation of sulfhydryl groups of cystine, methionine)
- Phospholipids(hydrolysis)
- nucleic acids

ACIDS

- *Physiologically important acids include:*
  - Carbonic acid (H_2CO_3)
  - Phosphoric acid (H_3PO_4)
  - Pyruvic acid ($C_3H_4O_3$)
  - Lactic acid ($C_3H_6O_3$)

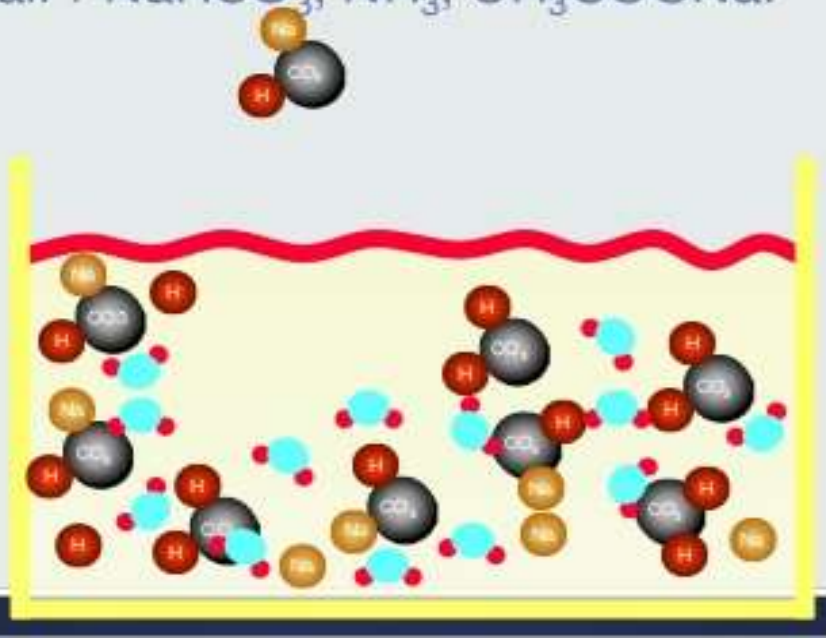
Lactic acid

Pyruvic acid

Phosphoric acid

Bases

- Bases can be defined as:
  - ♥ A proton (H^+) acceptor
  - ♥Any ionic or molecular substance that can act as a proton acceptor.
    - ♥Strong alkali : NaOH, KOH.
    - ♥Weak alkali : $NaHCO_3$, NH_3, CH_3COONa.



Bases

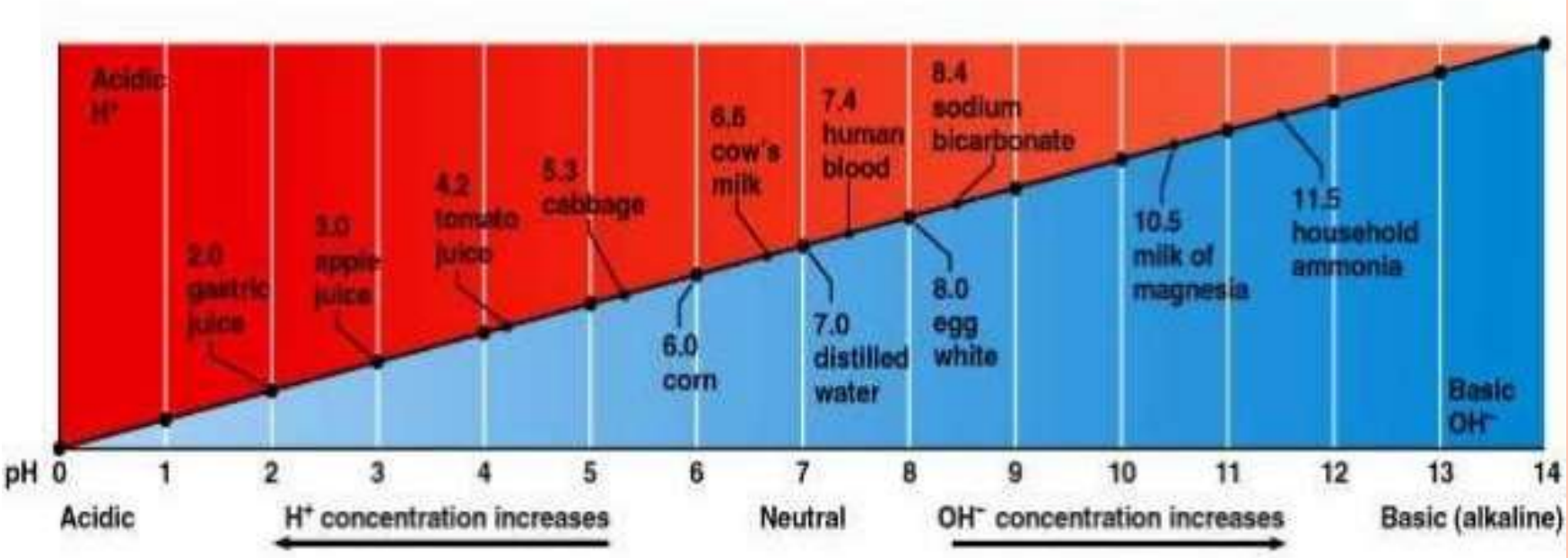
- *Physiologically important bases include:*
  - **Bicarbonate (HCO_3^-)**
  - **Biphosphate (HPO_4^{-2})**

Biphosphate

Buffer

- Ability of an acid-base mixture to resist sudden changes in pH is called its buffer.
- Buffer is a solution of weak acid and its corresponding salt.
- Buffer resists a change in pH when a small amount of acid or base is added to it.
- By buffering mechanism a strong acid (or base) is replaced by a weaker one.

pH


Acidic
H+
2.0
gastric
juice
3.0
apple
juice
4.2
tomato
juice
5.3
cabbage
6.5
cow's
milk
7.4
human
blood
8.4
sodium
bicarbonate
10.5
milk of
magnesia
11.5
household
ammonia
6.0
corn
7.0
distilled
water
8.0
egg
white
Basic
OH-
pH 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
Acidic
H+ concentration increases
Neutral
OH- concentration increases
Basic (alkaline)

pH

- pH is the negative log of hydrogen ion concentration.

$$pH = -\log[H^+]$$

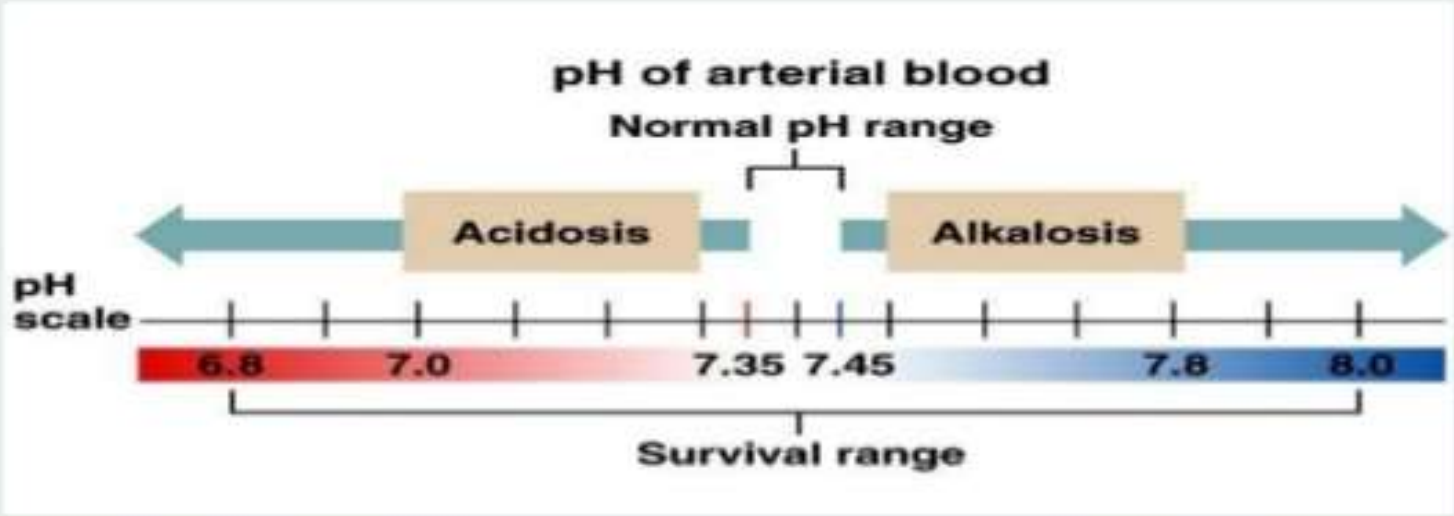
- If $[H^+]$ is high, the solution is acidic; pH < 7
- If $[H^+]$ is low, the solution is basic or alkaline ; pH > 7

Table 2.5 Hydrogen Ion Concentrations and pH

Grams of H^+ per Liter	pH	
0.00000000000001	14	↑ Increasingly basic
0.0000000000001	13	
0.000000000001	12	
0.00000000001	11	
0.0000000001	10	
0.000000001	9	
0.00000001	8	
0.0000001	7	Neutral–neither acidic nor basic
0.000001	6	
0.00001	5	
0.0001	4	
0.001	3	Increasingly acidic
0.01	2	
0.1	1	
1.0	0	↓

The Body and pH

- Homeostasis of pH is tightly controlled
- Extracellular fluid = 7.4
- Blood = 7.35 – 7.45
- < 6.8 or > 8.0 death occurs
- Acidosis (acidemia) below 7.35
- Alkalosis (alkalemia) above 7.45



- Two types of acids are produced in the body:

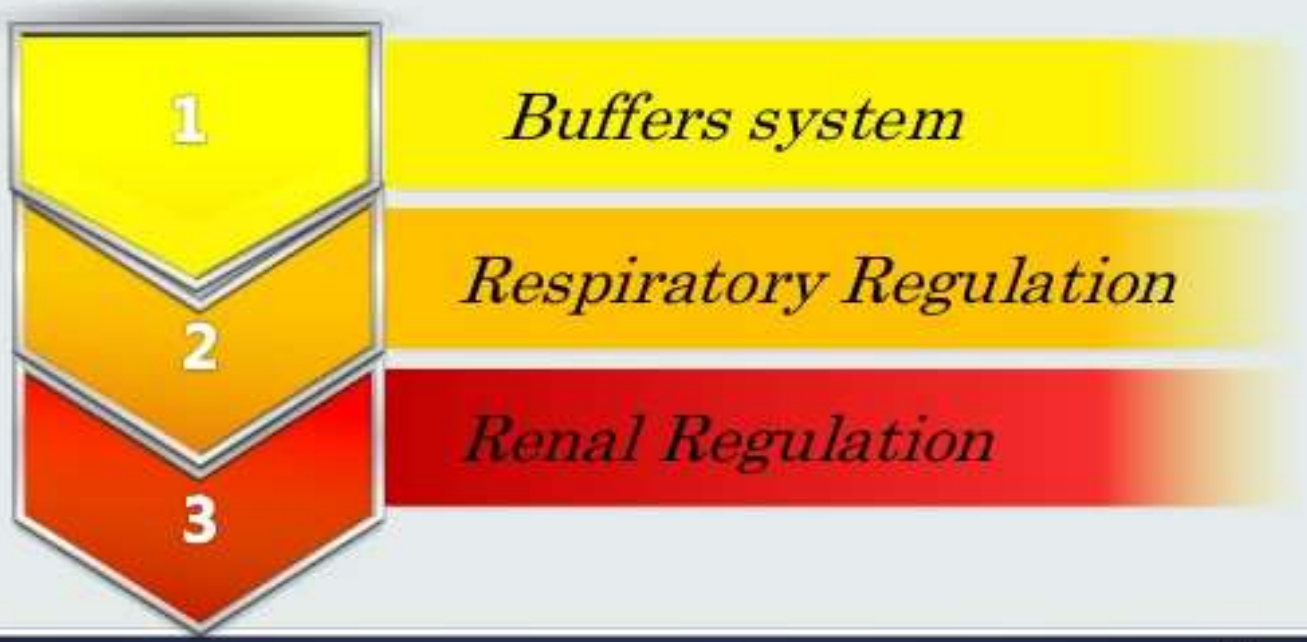
✓ **Volatile acids :** Carbonic acid formed from CO_2

✓ **Non-volatile acids:** metabolism of protein, CHO, lipids

e.g. lactic acid, keto acid, sulphuric acids

Regulation of blood pH.

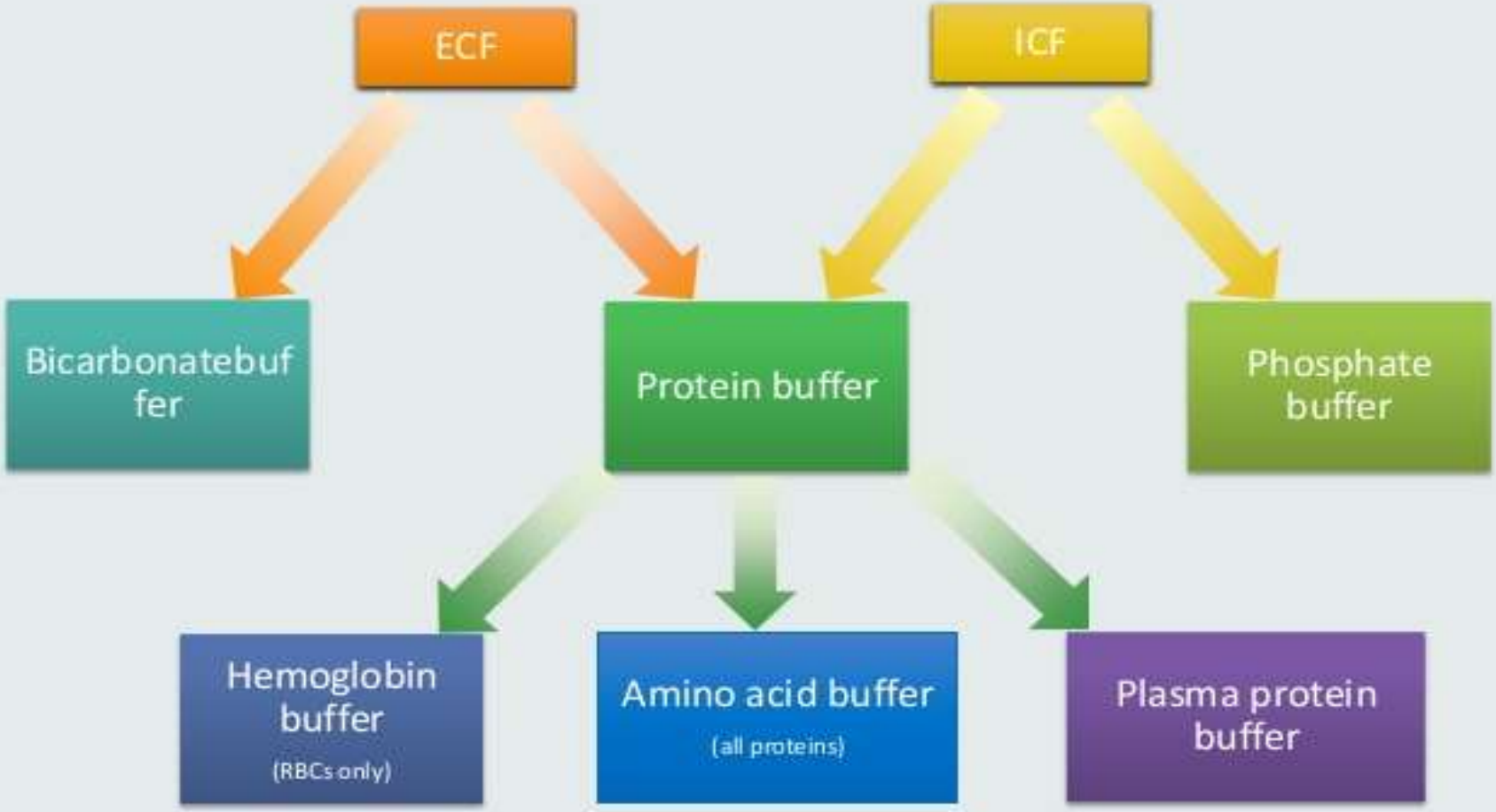
- To maintain the blood pH at 7.35 –7.45, there are three primary systems that regulate the hydrogen ion concentration in the body fluids.
- These are:



Buffer system

- These are the first line of defense against pH change
- React very rapidly within seconds.
- The buffer systems of the blood, tissue fluids and cells; immediately combine with acid or base to prevent excessive changes in pH.
- It do **not eliminate** hydrogen ions from the body or add them to the body but only keep them tied up until balance can be re-established.
- Three major chemical buffer systems
  - Bicarbonate buffer
  - Phosphate buffer
  - Protein buffer

Buffer Systems in Body Fluids



Bicarbonate Buffer System ($NaHCO_3^-/H_2CO_3$)

- Bicarbonate Buffer is the most important extracellular fluid buffer.
- Bicarbonate Buffer constitute, Sodium bicarbonate ($NaHCO_3$-) and carbonic acid (H_2CO_3).
- Carbonic acid dissociates into hydrogen and bicarbonate ions.
- Under normal circumstances there is much more bicarbonate present than carbonic acid (the ratio is approximately 20:1).

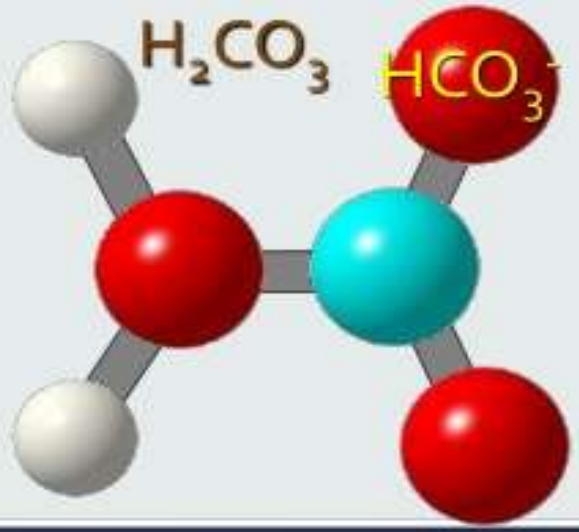
$$H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$$

Mechanism of action of bicarbonate buffer

- When pH is rising….

$$H^+ + HCO_3^- \rightleftharpoons H_2CO_3 \rightleftharpoons CO_2 + H_2O$$

- Hydrogen ions *generated* by metabolism or by ingestion react with bicarbonate base to form more carbonic acid

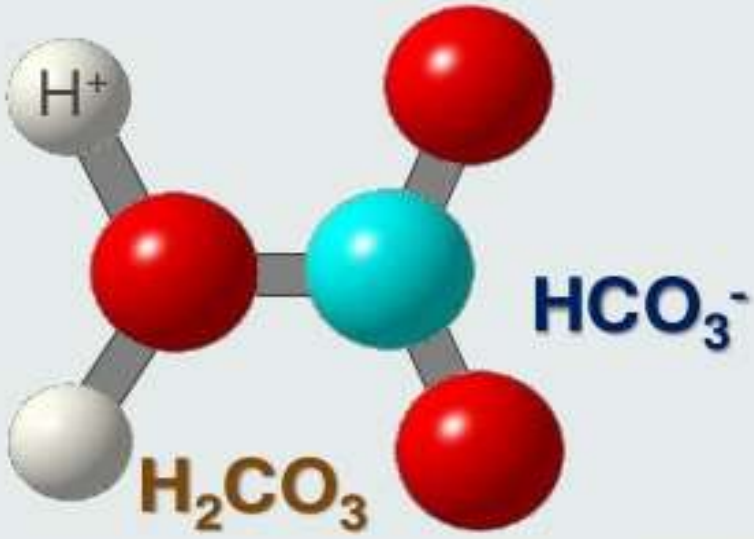


Mechanism of action of bicarbonate buffer

- When pH is falling….

$$H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$$

♠Hydrogen ions *generated* by metabolism or by ingestion react with bicarbonate base to form more carbonic acid



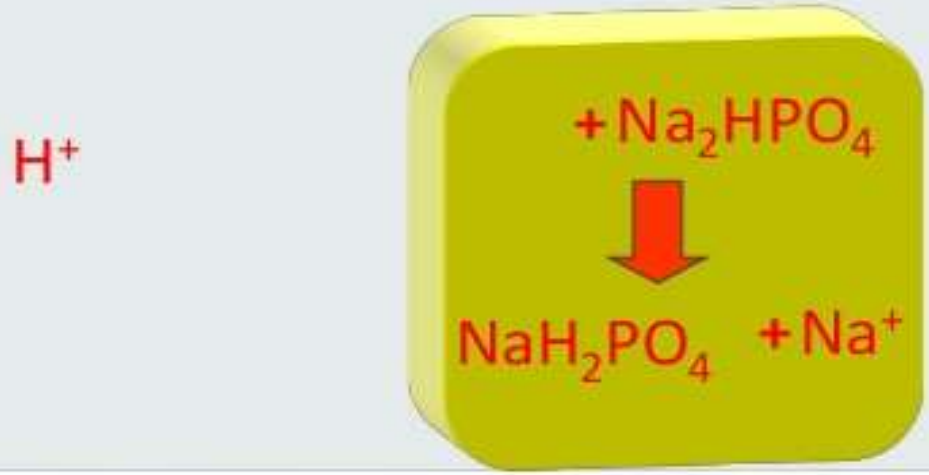
Importance of Bicarbonate Buffer

- Present in high concentration – (accounts 40-50%)
- Have alkali reserve – (ratio of HCO_3^- to H_2CO_3 is 20:1)
- Concentration of component can be regulated by
  - The base constituent, bicarbonate (HCO_3^-), is regulated by the kidney
  - While the acid part, carbonic acid (H_2CO_3), is under respiratory regulation

PHOSPHATE BUFFER SYSTEM (Na_2HPO_4/ NaH_2PO_4)

$$Na_2HPO_4 + H^+ \rightleftharpoons NaH_2PO_4 + Na^+$$

- It is not important as blood buffer.
- It plays a major role in buffering **renal tubular fluid** and the **intracellular fluid.**
- The normal ratio of Na_2HPO_4 and NaH_2PO_4 in plasma is 4:1 and this is kept constant by the help of kidneys for which phosphate buffer system is directly related to the kidneys.



PHOSPHATE BUFFER SYSTEM

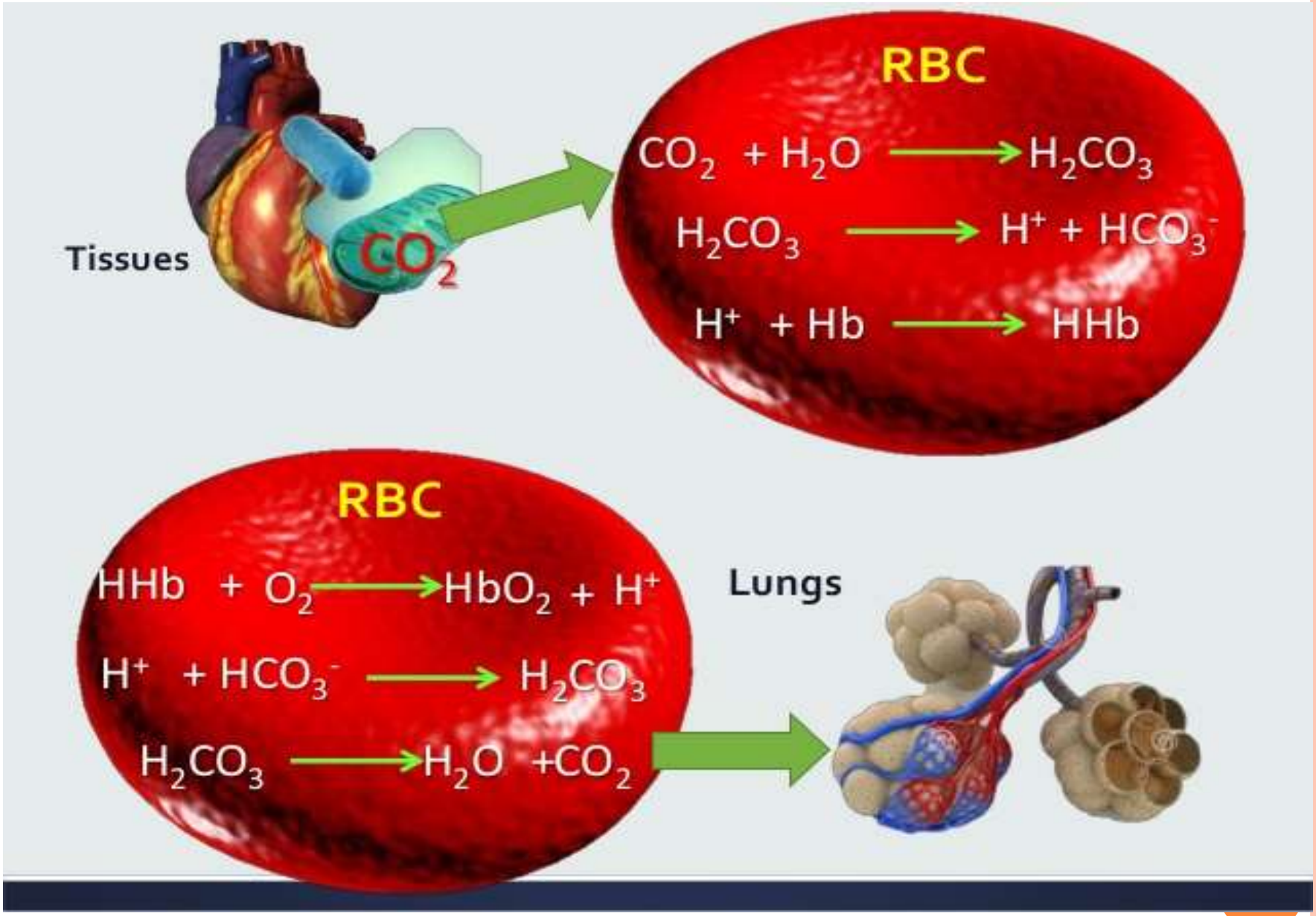
- Regulates **pH** within the cells and the urine
- Phosphate concentrations are higher intracellular and within the kidney tubules.
- More phosphate ions are found in tubular fluids
- More powerful than bicarbonate buffer system

PROTEIN BUFFER SYSTEM

- In the blood, plasma proteins especially albumin act as buffer because:
- – It contain a large number of dissociable
  - acidic (COOH) &
  - basic (NH_2) groups.
- – In acid solution, NH_2 accept excess H+
- – In basic solutions, COOH give up H+
- – Other important buffer groups of proteins in the physiological pH range, are the **imidazole groups of histidine**.

Hemoglobin buffer

- Hemoglobin buffers in RBC plays an important role in **respiratory regulation** of pH.
- It helps in **transport of metabolically** produced **CO_2** from cell to lungs for excretion.
- As hemoglobin releases **O_2** it gains a great affinity for **H^+**


Tissues
CO_2
RBC
$CO_2 + H_2O \rightarrow H_2CO_3$
$H_2CO_3 \rightarrow H^+ + HCO_3^-$
$H^+ + Hb \rightarrow HHb$
RBC
$HHb + O_2 \rightarrow HbO_2 + H^+$
$H^+ + HCO_3^- \rightarrow H_2CO_3$
$H_2CO_3 \rightarrow H_2O + CO_2$
Lungs

FLUID AND ELECTROLYTES BALANCE

CONTENTS:

- Introduction
- Normal Anatomy and Physiology
- Regulation of water intake
- Electrolyte balance
- IV Fluids

INTRODUCTION:

- When unicellular organisms evolved into multicellular organism, they faced several physiological challenges including the maintenance of water and salt balance in an environment.

- Rather than being surrounded by an external sea, they carried their own internal sea or Extracellular Fluid (ECF), in which their cells could bathe in a constant chemical environment, which the great French physiologist Claude Bernard called the 'milieu interieur'.

Normal anatomy and physiology

- Water comprises 60%(40L) of the body weight of an average adult.
- the percentage is lower in obesity, since adipose tissue contains less water than lean tissue.

- Fluid balance refers to the proper levels of water and electrolytes being in the various body compartments according to their needs

- Osmotic pressure (created by the dissolved electrolytes in body fluids) and hydrostatic pressure (created by the water in body fluids) are the main forces behind any molecular movement between body compartments.


Total Body Water
Intercellular Fluids
(25L, 40% of body
Extracellular Fluids
(15L, 20% of body weight)
Intravascular/Blood Plasma
(within the
Interstitial
(extravascular fluid surrounding the cells)

ICF	Rich in K^+, Mg^{++}, HPO_4^{2-}, SO_4^{2-}, and protein anions.
ECF	Rich in Na^+, Cl^-, HCO_3^-, and Ca^{++}.

Key to fluids:

= Blood plasma

= Interstitial fluid

= Intracellular fluid

Key to symbols:

Na^+ = Sodium

K^+ = Potassium

Ca^{2+} = Calcium

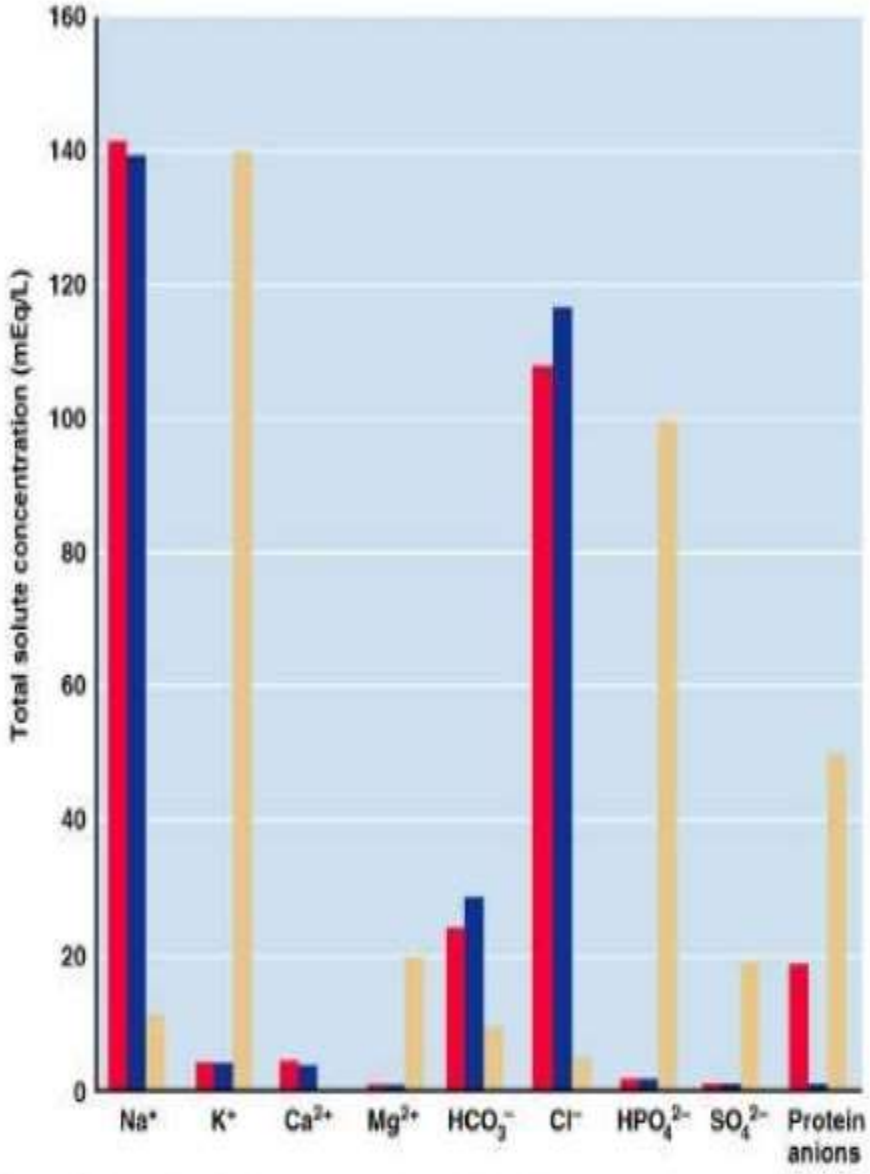
Mg^{2+} = Magnesium

HCO_3^- = Bicarbonate

Cl^- = Chloride

HPO_4^{2-} = Hydrogen phosphate

SO_4^{2-} = Sulfate



WATER BALANCE

Intake (ml)		Output (ml)	
Water from beverages	1200	Urine	1500
Water from solid food	1000	Insensible losses from skin and lungs	900
Metabolic water from oxidation	300	Faeces	100

Excess water loss

- Fever : 100 ml / degree fever / day
- Tracheostomy (unhumidified air) : >1.5 L / day
- Children - 1.5 to 2 L/m2

REGULATION OF WATER INTAKE

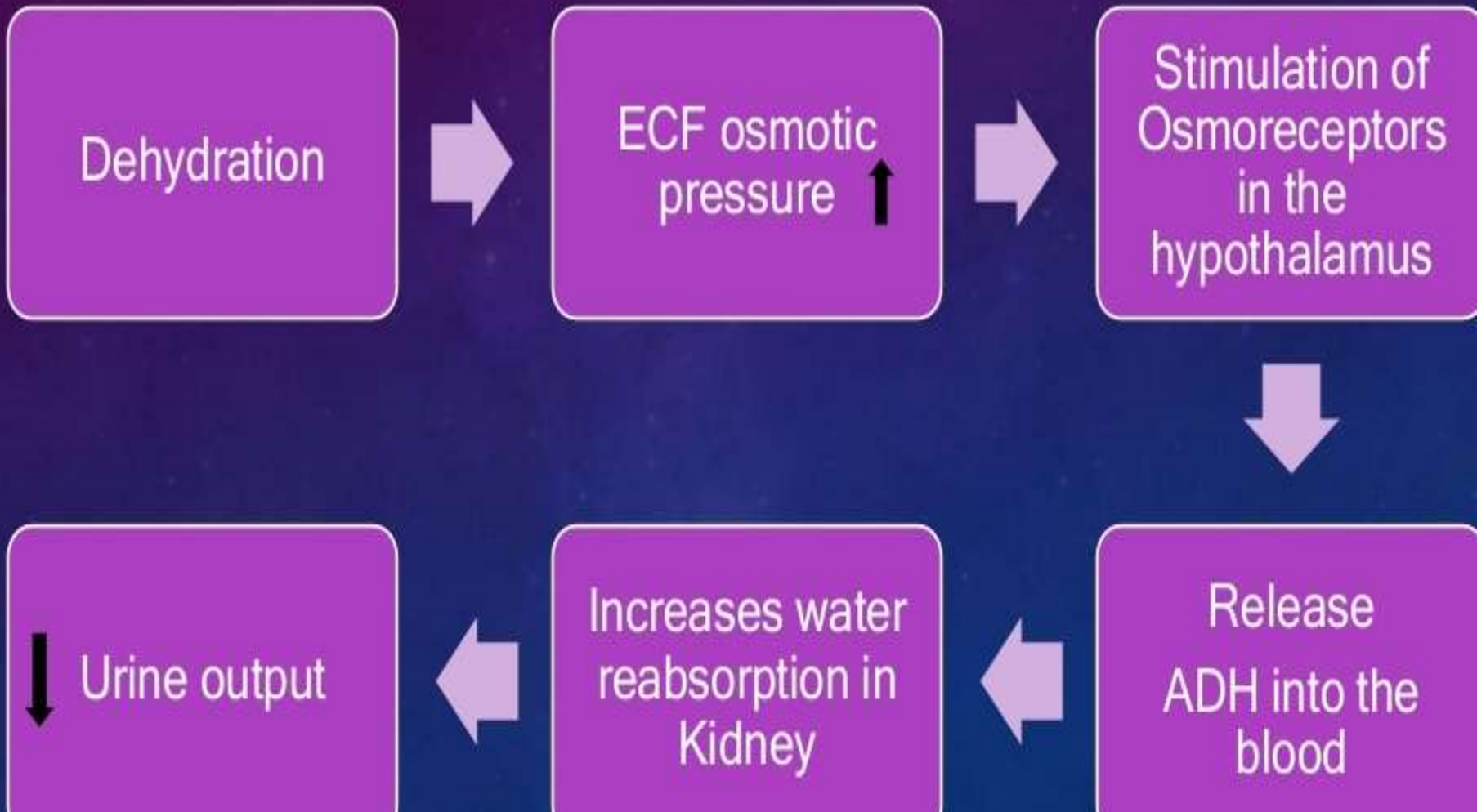
- The body loses as little as 1% of its water.
- An increase in osmotic pressure of extracellular fluid due to water loss stimulates osmoreceptors in the thirst center (hypothalamus).
- Activity in the hypothalamus causes the person to be thirsty and to seek H2O.

- Drinking and the resulting distension of the stomach by water stimulants nerve impulses that inhibit the thirst center.

- water is absorbed through the wall of the stomach, small intestine, and large intestine.

- The osmotic pressure of extracellular fluid returns to normal.

EVENTS IN REGULATION OF WATER OUTPUT



ELECTROLYTE BALANCE

- Electrolytes are chemical substances that release cations (positively charged ions) and anions (negatively charged ions) when they are dissolved in water.

- The most important electrolytes include Na^+, K^+, Cl^-, Ca^{+2}, and HPO_4.

BODY FLUID & ELECTROLYTES DISTURBANCES

VOLUME CHANGES	CONCENTRATION CHANGES	COMPOSITION CHANGES
• Hypovolemia • Hypervolemia	• Hyponatremia • Hypernatremi	• Potassium Abnormalities • Calcium Abnormalities • Magnesium Abnormalities

VOLUME CHANGES

HYPOVOLEMIA

- diminished **ECF.**
- **CAUSES :-**
- GI losses from vomiting,
- nasogastric suction,
- diarrhea,
- fistula drainage
- soft-tissue injuries

HYPERVOLEMIA

- INCRESED **ECF.**
- **CAUSES :-**
- Iatrogenic or Secondary to renal insufficiency
- Cirrhosis

HYPOVOLEMIA

- **SIGNS**
- Dry oral mucus membrane
- Tachycardia
- Dry axilla
- Diminished skin turgor

HYPERVOLEMIA

- **SIGNS**
- **CVS:** elevated JVP, venous distension - pulmonary edema.
- **GI:** edema of bowel
- **Tissue:** pitting edema - ascites

HYPOVOLEMIA

- **MANGAEMENT**
- Haemorrhage - whole blood transfusion 1st line of choice.
  - 6% dextran
  - 6% hetastarch
  - 5% albumin
  - 3.5% urea-bridged gelatin
  - 1lt of ringer's lactate
- Burn - 4ml/kg/% of body area

HYPERVOLEMIA

- **MANAGEMENT**
- Prevention is the best way
- Diuretics
- Increase oncotic pressure: or albumin infusion (may followed by diuretics)
- Dialysis

CONCENTRATION CHANGES

HYPERNATRIUM

- Asymptomatic
-
- Symptomatic (**Na>160 mEq/L**)

HYPONATRIUM

- Na^+ is the most abundant positive ion of ECF compartment and is critical in determining the ECF and ICF osmolality.
- Normal amount **135-145 mEq/l.**
- Sign & symptoms : **<120 mEq/l.**

HYPERNATRIUM

- **SIGNS & SYMPTOMS**
- CNS: Restlessness, ataxia, irritability, tonic spasms, delirium, seizures, coma
- Musculoskeletal: Weakness
- CVS: Tachycardia, hypotension, syncope

HYPONATRIUM

- **SIGNS & SYMPTOMS**
- CNS: confusion, lethargy, headache, seizure, coma
- GI: nausea, vomiting
- Skeletal system : muscle twitches
- **TREATMENT**
- Diuretics like Frusemide

COMPOSITION CHNAGES

POTTASIUM ABNORMALITIES

HYPOKALEMIA

- Serum K^+ < 3.5 mEq /L

Etiology :

- Excessive potassium excretion
- Hyperaldosteronism

Treatment :

- KCl 10 mEq/L/hr IV - pripherally
- KC1 20 mEq/L/hr IV - centrally

HYPERKALEMIA

- Serum K^+ > 5.1 mEq /L

Etiology :

- Blood transfusions
- Acidosis
- Impaired excretion of potassium

Treatment :

- IV Dextrose 50gms
- Sodium bicarbonate 50-100mmol

CALCIUM ABNORMALITIES

- Majority of the 1000 to 1200gm of calcium in the average-sized adult is found in the bone .
- Normal daily intake of calcium is 1 to 3 gm.
- Normal serum level = 8.8-10.5 mg/dl
- Ionized portion (1.2 mg/dl) is responsible for neuromuscular stability
- Most is excreted via the GI tract

HYPOCALCEMIA

- Serum calcium level <8.8 mg/dl

CAUSES:

1) Acute pancreatitis,
2) Massive soft-tissue infections
3) Acute and chronic renal failure,
4) Pancreatic and small-bowel fistulas,
5) Hypoparathyroidism

HYPERCALCEMIA

- Serum calcium level >10.5mg/dl

CAUSES:

1) Hyperparathyroidism
2) Cancer - PTH-like peptide in malignancies

HYPOCALCEMIA	HYPERCALCEMIA
1. Hypotension	1. Hypertension & Bradycardia
2. Anxiety	2. Constipation & Anorexia
3. Psychosis	3. Nausea & Vomiting
4. Paresthesia	4. Pain
5. Laryngeal Spasm	5. Psychosis
6. Numbness And Tingling Tetany With Carpopedal Spasm, Convulsions	6. Weight Loss, Thirst, Polydipsia, And Polyuria
7. Chvosteck & Trousseau's Signs	7. Easy Fatigue, Weakness, Coma

TREATMENT :-

1. IV calcium – 1gm in D5 or NS
2. Oral calcium & vitamin D

MAGNESIUM ABNORMALITIES

- Total body content of magnesium 2000 mEq, about half of which is incorporated in bone.
- Normal daily dietary intake of magnesium is approximately 240 mg
- Normal serum level = 1.5- 2.4 mg/dl
- Deficiency causes impaired repletion of Na^{+} & CA^{2+}

HYPOMAGNESEMIA

- Plasma level less than 1mmol/l

CAUSES:

  - starvation,
  - malabsorption syndromes,
  - GI losses,
  - prolonged IV with magnesium-free solutions
  - Drugs - aminoglycosides.

- **Sign & symptoms** - similar to that of hypocalcemia
- **Treatment** :- IV 49.3% $MgSO_4$ 5-10ml

ACID-BASE BALANCE

- pH - 7.4
- Three primary system regulates acid-base balance in our body :-
  a) Chemical acid-base buffer systems of the body fluids.
  b) Respiratory centre
  c) Kidneys.
- A pH < 7.4 - Acidosis
- A pH > 7.4 - alkalosis

SIGNS AND SYMPTOMS

- **Acidosis** -
  a) Increased respiratory rate
  b) Increased in heart rate
  c) Cyanosis
  d) Fruity smell
- **Alkalosis** -
  a) Decreased respiratory rate

TREATMENT

- **Acidosis** :-
  a) 7.5% sodium bicarbonate iv
  b) Sodium lactate
  c) Sodium gluconate
- **Alkalosis** :-
  a) Ammonium chloride
  b) Lysine monohydrochloride

THANK YOU

"Thanks for inviting me to dinner -
It's really great!"

FOOD MICROBIOLOGY

CONTAMINATION AND PREVENTION OF SPOLIAGE OF CEREALS AND CEREALS PRODUCTS

INTRODUCTION

- Agricultural grasses grown for their edible seeds are called cereals
- Three cereals – rice, wheat, and maize provide more than half of all calories eaten by humans. Of all crops, 70% are grasses.
- Cereals constitute the major source of carbohydrates for human and perhaps. The major source of protein and include rice in southern and easten Asia, maize in central and wheat ,bralley in Europe, northern Asia and the Americans.

ABOUT CEREALS

7 BENEFITS OF CEREALS

CONTAMINATIONS

- The exteriors of harvested grains retains some of the natural flora they had while growing plus contamination from soil ,insects & other sources.
- Freshly harvested grains contain loads of a few thousand to million of bacteria /gm and mold spores
- Bacteria are mostly in the families Pseudomonas, Micrococci, Lactobacilli and Bacilli.
- Scouring & washing the grains remove some of the microorganisms, but most of the microorganisms are removed with the outer portions of the grains during milling.The milling processes especially bleaching reduce no. of organisms.

- Corn meal and flour contain several hundred to several thousand bacteria and mold per gram. Species of FUSARIUM & PENICILLUM are dominant molds. Because of the incubation in a moist conditions , malts contain high numbers of bacteria , usually in the millions per gram.the surface of freshly baked bread is free of viable microorganisms but is subject to contamination by molds spores from the air during cooling & before wrapping .cakes are similarly subject to contamination .spores of bacteria able to cause ropiness in bread will survive the baking process.the contamination of cereals grains products with molds has become a significant concern because of the presence of mycotoxin.

- But there then is possibility of contamination during other procedures such as blending & conditioning.
- Bacteria in wheat flour include spores of Bacillus , coliform bacteria ,and few representatives of the genera Achromobacter ,Flavobacterium , Sarcina ,Micrococcus and Serratia. Mold spores are of aspergilli ,penicillia ,alternaria & cladosporium.patent flours usually give lower counts than straight or clear & no. decreases with storage of flour.
- Higher counts usually are obtained on prepared flours (8000 to 12000 per gram on the average) & whole-wheat flours, which contain also the outer parts of wheat.
- The need to reduce contamination by mold and to avoid conditions which allow their growth is emphasized because of frequent isolation of **Aspergillus flavus ,** which can produce aflatoxin.
- Some commonly isolated molds such as fusaria & penicillia are undesirable since they are capable of producing mycotoxins.

PREVENTION

- Most cereals and cereal products have such a low moisture content that there is little difficulty in preventing the growth of microorganisms as long as the foods are kept dry .
- Such materials are stored in bulk or in containers to keep out vermin , resist fire and rapid changes in temperature and hence increase in moisture.
- The storage temp. of about 4.4 to 7.2c is recommended for the dry products.
- Many bakery products eg. bread ,rolls, cakes, pastries &canned mixes contain enough moisture to be subject to spoilage unless special preservative methods are employed.

Methods are

- **Asepsis**: improperly sanitized equipments may be source of rope bacteria and the acid –forming bacteria that cause sourness of dough. bread ,cakes and other baked products may be subject to spoilage by molds should be protected against contamination by mold spores
- **Use of heat** :bakery products may be sold unbaked ,partially baked or fully baked .the complete baking process destroys all the bacterial cells, yeasts ,mold spores but not spores of rope –forming bacteria.they can survive during heat so unbaked products are kept for short period or kept cool during longer storage of time.
- **Use of low temp.** :baked products should be kept under cool conditions or refrigerated in home for the prevention of food spoilage. These can be stored for months in the frozen conditions.

- **Use of chemical products** :a large no. of preservatives have been employed ,particularly as mold inhibitors , in breads , rolls , cakes . Sodium and calcium propionate , sodium diacetate and sorbates are used extensively .acidification of dough with acetic acid has been used to combat rope.
- **Use of irradiation** :in bakeries , ultraviolet rays have been to destroy or reduce numbers of mold bacteria in dough and proof rooms, on the knives of slicing machine , on the surface of breads ,cakes .ionizing radiations , gamma and cathode rays have been applied experimentally for the preservation of baking goods.

SPOILAGE

Cereals grains ,meals &flours made from them should not be subject to spoilage if are stored or kept properly because their moisture content is too low to support even the growth of molds. Now different cereal products are discussed below :

- Cereal grains &meals :a little moisture will result in growth of molds at the surface , where air is available. A wet mash of the meals will under go an acid fermentation by lactic acid and coliform bacteria normally present on the surface of plants. This may be followed by the alcoholic fermentation by yeasts as soon as the acidity is increased enough to favor them . The major factors included in the spoilage of stored grain by molds include microbial content , moisture levels above 12 to 13 %, physical damage & temperature. Most common species of molds are Aspergillus , Penicillium and Fusarium.these molds can produce mycotoxins .

- FLOUR : Dry cleaning and washing , milling & sifting of flour reduce the content of m.o., but important kinds still are represented in whole –grain flours e.g. and the spoilage would be similar to that described for cereal grains and meals. Slight moistening of white flour brings about spoilage by molds. Because of the variations in microbial content of different lots of flour , the type of spoilage in a flour paste is difficult to predict. If acid –forming bacteria are present , an acid fermentation begins , followed by alcoholic fermentation by yeasts if they are there and then acetic acid by ACETOBACTER SPECIES. In the absence of lactics and coliforms , micrococci have been found to acidify the paste .

- BREAD : the fermentation taking place in the dough for various kinds is due to microorganisms are desirable and even necessary in making certain kind of bread .the acid fermentation by LACTICS and COLIFORM BACTERIA that is normal in flour pastes or dough may be too extensive if too much time is permitted , with the result that the dough bread made from it may be too 'sour' . excessive growth of proteolytic bacteria during this period may destroy some of the gas –holding capacity so essential during the rising of the dough & produce a sticky dough. the chief types of microbial spoilage of baked bread have been moldiness and ropiness , usually termed "mold" & "rope".

CAUSES OF SPOILAGE

MOLD : molds are the most common and hence the most important cause of the spoilage of bread and most bakery products. The temp. attained in the baking procedures usually are high enough to kill all the molds spores in and on the loaf. They can come from the air during cooling , from handling or from wrappers .chief molds involved in the spoilage of bread are "bread mold", RHIZOPUS NIGRICANS with its white cottony mycelium and black dots of sporangia ;the green –spored PENICILLIUM EXPANSUM;ASPERGILLUS NIGER with its greenish or purplish –brown conidial heads and yellow pigment diffusing into the bread. Mold spoilage is favored by - heavy contamination due to air circulation . During slicing when there is more air is introduced into the loaf .

- ROPE – ropiness of bread is fairly common in home baked bread, especially during hot weather ,but it is in commercially baked bread because of preventive measures now employed .ropiness is caused by a mucoid variant of BACILLUS SUBTILIS .the spores of these species can withstand the temperature of the bread during baking , which does not exceed 100°c , can germinate &can grow in the loaf if conditions are favorable. The area of ropiness is yellow to brown in color & is soft ,sticky to touch. In one stage the slimy material can be drawn out into long threads when the bread is broken and pulled apart.first the odour is evident ,then discoloration and finally softening of the crumb , with stickness and stringiness.

ROPINESS AND MOLDINESS IN BREADS

RED BREAD

- "Red or bloody" ,bread is striking in appearance but rare in occurrence .the red color results from the growth of pigmented bacteria, usually SERRATIA MARCESCENS , an organism that often is brilliantly red on starchy foods. Molds such as MONILIA SITOPHILA may impart a pink to red color to bread .a red color in the crumb of dark bread has been caused by OIDIUM GEOTRICHUM.
- CHALKY BREAD : chalky bread is so named because of white , chalklike spots .the defects has been blamed on the growth of yeast like fungi, ENDOMYCOPSIS FIBULIGERA and TRICHOSPORON VARIABLE.
- CAKES AND OTHER BAKERY PRODUCTS: molds are main cause of spoilage in cakes .the deterioration of bread , cakes , pies and other bakery products caused "staling" is due to physical damage during holding and not to microorganisms. Freezing and storage in the frozen conditions is effective in preventing these changes.

SPOILAGE BY MOLDS, CHALKY BREAD

- Macaroni and tapioca : swelling of moist macaroni has been reported to be caused by gas production by bacteria resembling ENTEROBACTER CLOACAE .during the drying of macaroni on paper a mold of the genus Monilia has been found responsible for purple streak at the contact points with the paper .tapioca prepared from the root starch of cassava will spoil if moistened .spoilage by an orange – pigmented , starch –hydrolyzing bacteria has been shown .

Contamination And Prevention Of Spoilage Of Fruits And Vegetables

INTRODUCTION:

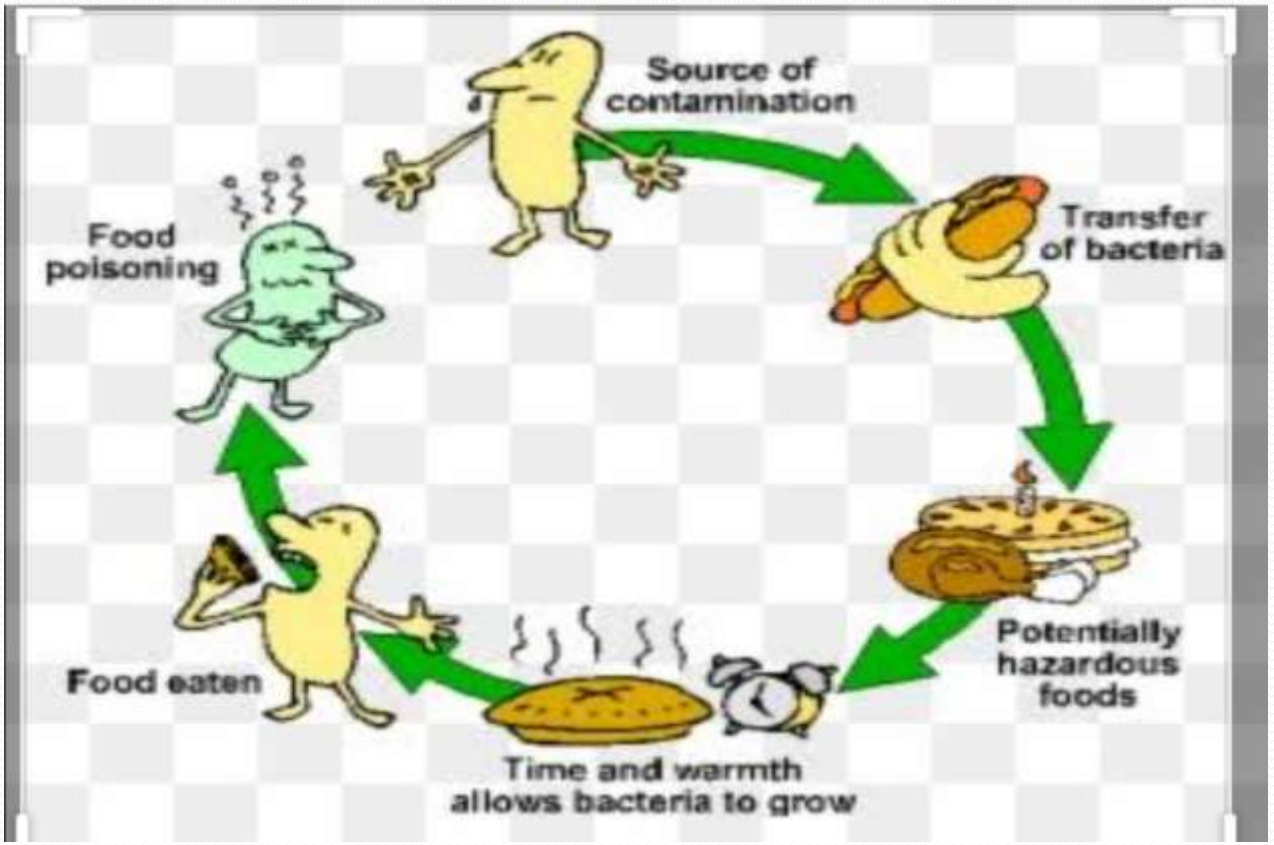
Consumption of fruits and vegetables produces has dramatically increased in the united states by more than 30% during the past few decades. This focus of this chapter is to provide a general background on microbiological spoilage of fruit and vegetable products that are organized in three categories: fresh whole fruits and vegetables, fresh- cut fruits and vegetables and fermented or acidified vegetable products.

SPOILAGE OF FRUITS AND VEGETABLES:

- About 20% of Vegetables and fruits harvested for human consumption in the world is lost due to microbial spoilage.

- Fermented vegetables and fruits can be contaminated with different microorganisms during processing which can cause spoilage.
- Spoilage is any change occurring in fruits and vegetables, making them inedible for human , fresh vegetable and fruits contain natural micro flora coming from soil, water, air and other sources.
- The presence of air, high humidity and high temperature as extrinsic factors during storage of vegetables and fruits increases the chances of microbial growth and spoilage.

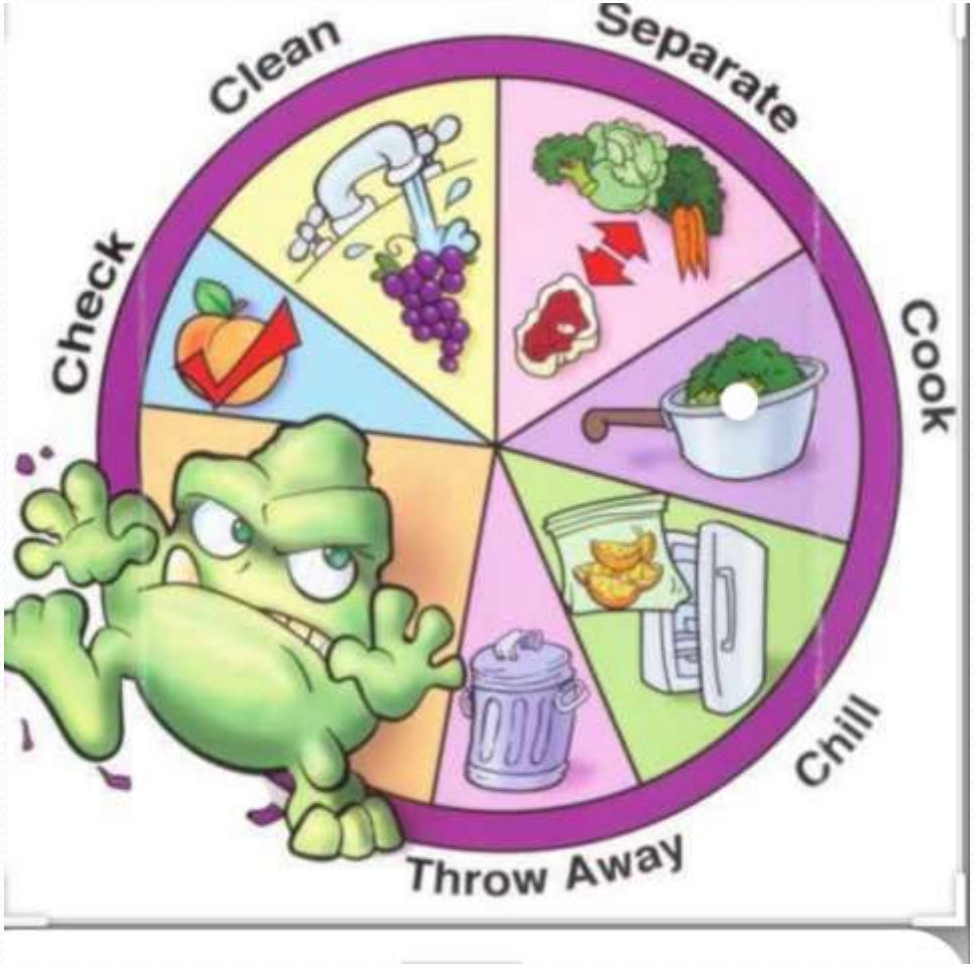
Food poisoning



SPOILAGE OF FRUITS AND VEGETABLES

- The deterioration of raw vegetables and fruits may result from physical factors, action of their own enzymes, microbial action, or combination of these agencies.
- Mechanical damage resulting from action of animals, birds, or insects or from bursting, wounding, cutting, freezing, desiccation, or other mishandling may predisposed towards increased enzymatic action or the entrance or growth of micro organisms.
- Contact with spoiling fruits and vegetables may bring about transfer of organisms, causing spoilage and increasing the wastage.
- If oxygen is available, the plant cells will respire as long as they are alive, and hydrolytic enzymes can continue their action after death of their cells.
- Disease of vegetables and fruits may result from the growth of an organisms that obtains its food from the host and usually damages it or from adverse environmental conditions that cause abnormalities in functions and structures of the vegetables or fruits.

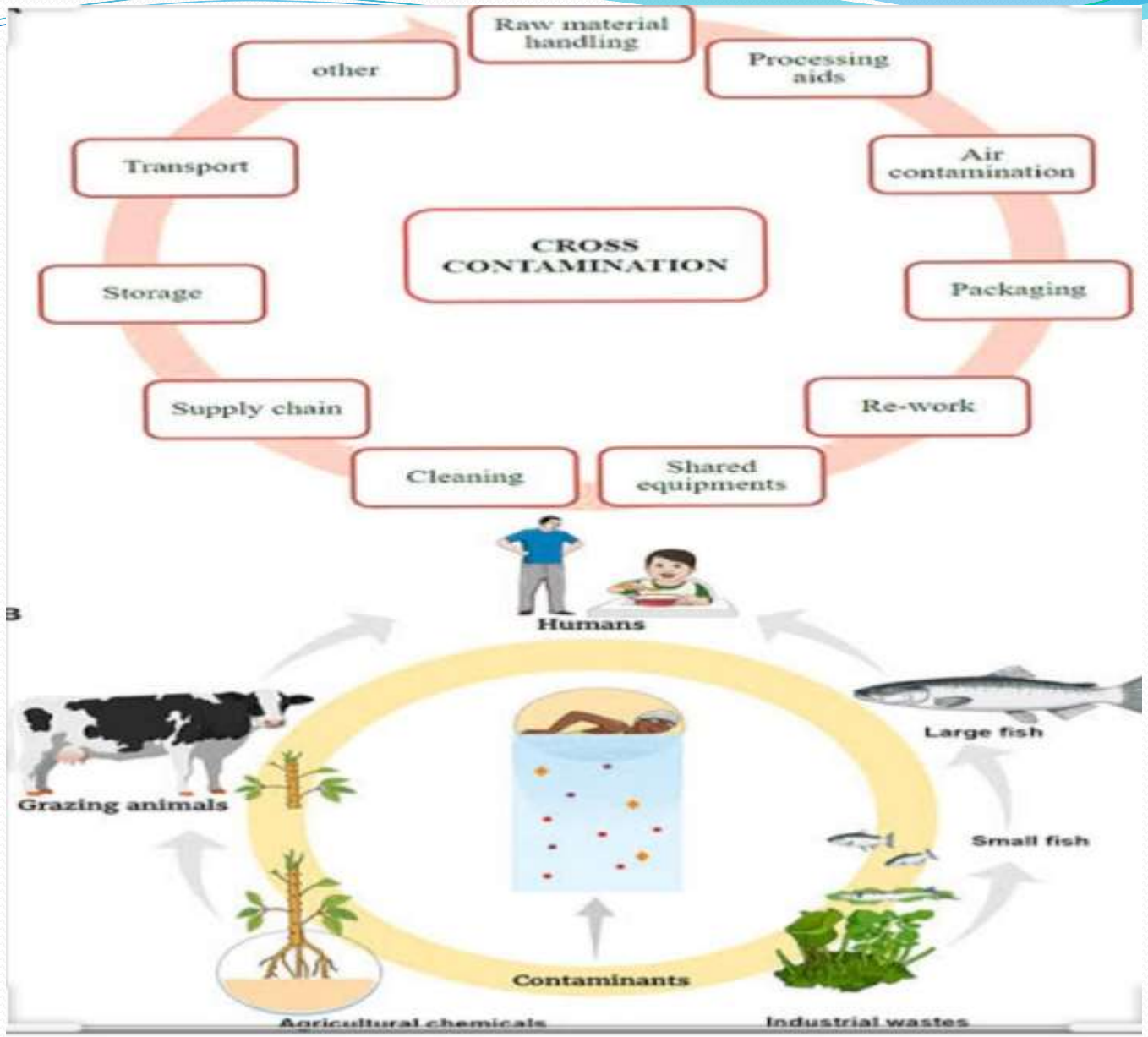
Prevention



GENERAL TYPES OF MICROBIAL SPOILAGE

- Bacterial soft rot, caused by *Erwinia carotovora* and related species.
- Grey mold rot caused by species of *Botrytis.*
- Rhizopus soft rot, caused by species of *rhizopus.*
- Anthracnose, usually caused by *Colletotrichum lindemuthianum*.
- Alternaria rot, caused by *Alternaria tenuis* and other species.
- Blue mold rot, caused by species of *Penicillium* digitatum and other species.
- Downy mildew, caused by species of *Phytophthora*, *Bremia*, and other genera.
- Watery soft rot, caused chiefly by *Sclerotinia sclerotiorum*.
- Stem end rots, caused by species of molds of several genera, e.g. *Diplodia*, *Alternaria*, *Phomopsis*, *Fusarium*, and others.

- Black rot, often caused by species of *Alternaria* but sometimes of *Ceratostomella*, *Physalospora* and other genera.
- Pink mold rot, caused by pink spored *Trichothecium roseum*.
- Fusarium rots, a variety of types of rots caused by species of *Fusarium*.
- Green mold rot, caused usually by species of *Cladosporium* but sometimes by other green spored molds, e.g. *Trichoderma*.
- Brown rot, caused by *Sclerotinia* species.
- Black mold rot, caused by *Aspergillus Niger*.
- Sliminess or souring, caused by saprophytic bacteria in piled, wet, heating vegetables


Raw material handling
Processing aids
Air contamination
Packaging
Re-work
Shared equipments
Cleaning
Supply chain
Storage
Transport
other
CROSS CONTAMINATION
Humans
Large fish
Small fish
Industrial wastes
Contaminants
Agricultural chemicals
Grazing animals

THE 10 MOST CONTAMINATED FRUITS AND VEGETABLES:

1) Pre-washed organic leafy vegetables

2) Berries

3) Hawaiian fruit and vegetables

4) Herbs from china

5) Green tea

6) Organic chia seeds

7) Mangoes, Rice and Bananas

8) Beets, carrots and squash and even cantaloupe

9) Potatoes and other Root vegetables

10) Indian mangoes, Aubergines, Taro plants and Gourd

PRESERVING FRUITS AND VEGETABLES:

Storing:

Storing is the easiest method for keeping your harvest, but most vegetables don't have a long shelf life. Root vegetables that can be cured , like onions and winter squash, will last the longest.

Basic Storing Tips:

- Only store fully mature, healthy vegetables. Any bruised or immature vegetables should be eaten fresh or preserved by other means.
- Clean of soil and allow the outside of vegetables to dry before freezing.
- Keep a few inches of the stem on winter squash and also cut the green tops of root crops to an inch or so.

Freezing:

Many Vegetables keep well in the freezer. When blanched and frozen soon after harvesting, this can be the best method for retaining nutrients, as well as color, texture and flavor. Most vegetables can last 8 to 12 weeks in the freezer.

Basic Freezing Tips:

- Freeze food immediately after packaging.
- Keep freezer temperature at 0 degrees F Or lower. You can set your freezer control to -10 degrees F. the day before freezing, to speed the process.
- Don't try to pack your freezer with unfrozen produce. This will only lower the temperature in the freezer and lengthen the time needed for the produce to chill.

Canning:

Canning is a great method for preserving fruits and vegetables with a high water content, like tomatoes, mushrooms, beans and peaches, but it is essential you follow canning guidelines to the letter.

Basic Canning Tips:

- Use Clean jars and new seal lids.
- Process in boiling water or a pressure canner for the specified amount of time.

Drying:

Drying fruits, vegetables and herbs is also a very easy process and can be done without any special equipment of speed up by using the oven or a dehydrator. Dried fruits, seeds, jerky, leather and even popcorn can be done by these methods.

Basic Drying Tips:

- Provide good air circulation while drying, to prevent spoilage.
- Be sure the fruits and vegetables are fully mature and disease free.

Pickling:

Cucumbers come to mind when we think of pickling, but many vegetables and fruits can be preserved in this manner, including peppers, cauliflower, apples and pears Relishes are also prepared by pickling.

Basic Pickling Tips:

- Always follow a tested recipe, Even in vinegar, spoilage can happen. Canning pickled products by the boiling water methods further stop spoilage.

- Choose only disease- free fruits of vegetables and wash them well before processing.

Jams and Jellies:

No method of preserving food smells as wonderful as making jams and jellies.

Basic Tips for making jams and jellies:

- The freshest, sweetest fruit makes the best jelly.
- The acidity level has to be right for the fruits to gel, lemon juice is added to low acid fruits.
- Don't after sugar amounts in recipes. Sugar helps preserve and gel the fruits.

Recommended practices for preservation of fruits and vegetables:.

- *Wash your hands thoroughly with hot water and soap before beginning to prepare food.*
- *Make sure that kitchen utensils and appliances are well cleaned and disinfected.*
- *Always store food in a clean place.*
- *Use herbs and spices as little as possible, because they are an important source of contamination.*
- *Use clean and pure salt only if the salt is not pure; heat it on a dry, metal sheet above the fire.*
- *Allow only clean drinking water to come in contact with fruits and vegetables.*
- *Never allow anyone who is sick or has open wounds to come in contact with food that is to be preserved.*

PREVENTION OF SPOILAGE:

- To prevent harvested products from spoiling, they can be preserved; physiological aging and enzyme changes are then stopped or delayed and microorganisms are prevented from multiplying on the product.
- Enzymes can be deactivated by heating the fruit or vegetables. The same effect can be achieved by making the fruit or vegetables sour or by drying them.
- The peel of a fruit or vegetable provides natural protection against micro organisms.
- To retain the desired quality of a product longer than if it were simply stored after harvesting, it must be preserved.
- To preserve food it must first be treated , with the goal of stopping physiological aging and enzyme changes and preventing the growth of micro organisms.

MICROBIAL SPOILAGE OF FRUITS AND VEGETABLES:

Although each fruits and vegetables has certain types of decomposition and kinds of micro organisms predominant in its spoilage, some general types of microbial spoilage are found more often than rest in vegetables and fruits. The most commonly occurring types of spoilage are as follows:

1) Bacterial soft rot caused by Erwina carotovora and related species.
2) Gray mold rot caused by species of botrytis. E.g.: cinera a name derived from the gray mycelium of the mold. It is favored by high humidity and a warm temperature.

3) Rhizopus soft rot caused by species of Rhizopus e.g.: Stolonifer. A rot results that often is soft and mushy. The cottony growth of the mold with small, black dots of sporangia often covers masses of the foods.

4) Anthracnose usually caused by colletotrichum lindemuthianum, C. cocodes and other species. The defect is spotting of leaves and fruits.

5) Alternaria rot caused by Alternaria tenuis and other species. Areas become greenish brown early in the growth of the mold and later turn to brown or black spots.

6) Blue mold rot caused by species of penicillium digitatum and other species. The bluish green color that gives the rot its name results from the masses of spores of the mold.

7) Downy mildew caused by species of phytoptithora, Bremia and other genera. The molds grow in white, woolly masses.

8) Watery soft rot caused chiefly by sclerotinia sclerotiorum is found mostly in vegetables.

9) Black mold rot caused by Apergillus Niger. The rot gets its name from the dark brown to black masses of spores of the mold termed "smut" by the lyperson.

10) Pink mold rot caused by pink spored Trichothecium roseum.

11) Fusarium roots a variety of types of roots caused by species of Fusarium.

12) Brown rot caused chiefly by Sclerotinia species.

FOOD MICROBIOLOGY

CONTAMINATION, PRESERVATION AND SPOILAGE OF MILK AND MILK PRODUCTS.

INTRODUCTION:

MILK PRODUCTS INCLUDE MILK, CREAM, BUTTER, FROZEN DESERTS, CHEESE, FERMENTED MILKS, CONDENSED &DRIED MILK PRODUCTS. THE NUTRITIONAL QUALITIES OF MILK &MILK PRODUCTS MAKE THE DESIRABLE FOODS FOR HUMANS AND YOUNG ANIMALS. MILK IS A PRODUCT OF ANIMAL ORIGIN, & ITS SANITARY QUALITIES ARE INFLUENCED BY MANY FACTORS IN THE COURSE OF ITS PRODUCTION , PROCESSING & DELIVERY TO THE CONSUMER.

CONTAMINATION:

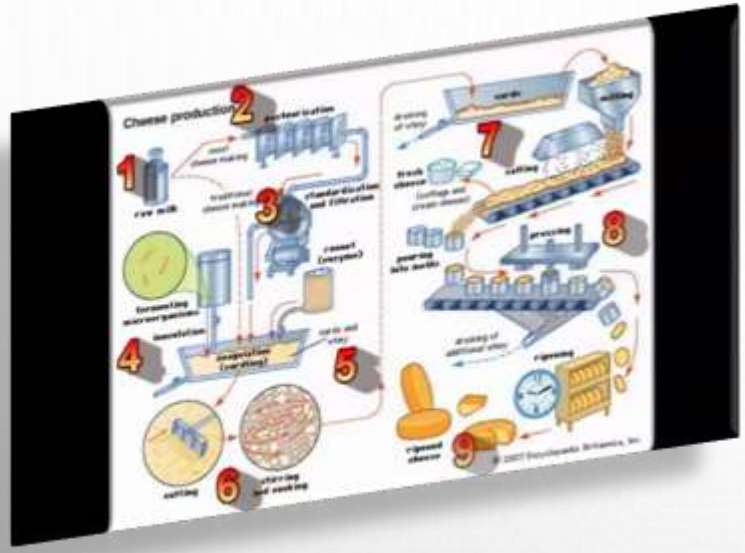
CONTAMINATION OF MILK OCCURS FROM VARIOUS SOURCES WHICH ARE:

CONTAMINATION FROM THE COW:

COW IS THE MAIN SOURCE TO GIVEN MILK, WHICH CONTAINS RELATIVELY FEW BACTERIA, WHICH CONTAINS RELATIVELY FEW BACTERIA, WHEN IT LEAVES THE UDDER OF A HEALTHY COW & GENERALLY THESE BACTERIA DO NOT GROW UNDER USUAL CONDITION OF HANDING.

UNDER UNUSUAL CONDITIONS MILK IS SUBJECTS TO CONTAMINATION FROM THE COW. THAT IS:

A. THE INTERIOR OF THE UDDER
B. THE EXTERIOR OF THE UDDER
C. THE COAT OF THE COW


Cheese production
1
2
3
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5
6
7
8
9

CONTAMINATION FROM MILKING UTENCILS

VARIOUS UTENSILS USED FOR MILKING & HANDING ARE THE MOST IMPORTANT SOURCES TO GAIN BACTERIA IN THE MILK.

IN MECHANICAL MILKING ,THE INCREASE USE OF EQUIPMENT SUCH AS MILKING MACHINES, PERMANENT PIPELINES, & FARM STORAGE TANKS PREVENTING EXPOSURE OF THE MILK TO DUST, INSECTS & EXTERNAL SOURCES OF CONTAMINATION. THE MATERIAL USED FOR EQUIPMENT SHOULD BE WELL CLEANED AND SANITIZED TO AVOID INTERNAL CONTAMINATION. THE EQUIPMENT SHOULD BE OF STAINLESS STEAL OR ALUMINUM .

THE EQUIPMENT DON'T HAVE SCRATCHES BECAUSE THEY COLLECT MILK.

FOR CLEANING THE EQUIPMENT THESE POINTS SHOULD BE KEPT IN MIND:

BACTERIA SHOULD BE PHYSICALLY REMOVED FROM UTENSILS, RESIDUAL MILK SHOULD BE COMPLETELY ELIMINATED.

EQUIPMENT SHOULD BE STORED UNDER DRY CONDITION TO PREVENT GROWTH. BEFORE THE USE OF EQUIPMENT, BACTERIA SHOULD BE KILLED BY APPLYING OF HEAT OR CHEMICAL GERMICIDAL.

CONTAMINATION FROM MISCELLANEOUS SOURCES:

ORGANISMS OCCUR IN AIR VARYING IN NUMBER & PRESENT IN A DORMANT CONDITION. THE NUMBER OF THESE BACTERIA ARE RELATIVELY LOW. THE TYPES OF MICRO ORGANISM NORMALLY PRESENT IN AIR ARE:

SPOREFORMERS, MICROCOCCI, & MOLD SPORES.

THE AIR MAY BE EXPECTED TO ADD, DURING HAND MILKING 5ML OF MILK. CONTINUOUS RAISING OF DUST CAN ALSO ADD HUNDREDS OF BAC/ML OF MILK . DUST PARTICLES FROM MANURE, SOIL, & FEED MAY CONTAIN BACTERIA. MILKING MACHINES MAY CONTAIN LESSER BACTERIA FROM THE AIR.

PRESERVATION:

ASEPSIS

REMOVAL OF MICROORGANISM

USE OF LOW TEMPERATURE

DRYING

USE OF PRESERVATIVES

SPOILAGE:

MILK AND CREAM

MILK IS AN EXCELLENT CULTURE MEDIUM FOR MANY KIND OF MICROORGANISMS, BEING HIGH IN MOISTURE, NEARLY NEUTRAL

PH, AND RICH IN MICROBIAL FOOD.

THE GENERA FOUND IN COLD-STORED MILK INCLUDE, PSEUDOMONAS, ACINETOBACTER, AEROBACTER ALCALIGENS, AND FLAVOBACTERIUM AS WELL AS SOME MEMBERS OF ENTEROBACTERIACEAE. WITH EXTENDED STORAGE OF MILK PRODUCTS AT REFRIGERATED TEMPERATURES, PSYCHROTROPHIC ORGANISMS ARE A CAUSE OF SPOILAGE.

SPOILAGE OF MILK USUALLY IS CAUSED BY PSYCHROTROPHS THAT RECONTAMINATE THE MILK AFTER PASTEURIZATION. ALSO INVOLVED ARE THERMODURIC PSYCHROTROPHS AS WELL AS HEAT STABLE PROTEASES PRODUCED BEFORE PASTEURIZATION.

GAS PRODUCTION:

GAS FORMATION WITH ACID FORMATION

CHIEF GAS FORMER ARE COLIFORM BACTERIA, CLOSTRIDIUM SPP., GAS FORMING BACILLUS SPECIES THAT YIELD BOTH HYDROGEN AND CARBONDIOXIDE, YEAST AND HETEROFERMENTATIVE LECTICS THAT PRODUCE ONLY CARBON DIOXIDE.

GAS PRODUCTION EVIDENCED BY FOAM AT THE TOP OF MILK AND IS SUPERSATURATED WITH THE GAS, BY GAS BUBBLES CAUGHT IN CURD, BY FLOATING CURD CONTAINING GAS BUBBLES CAUGHT IN CURD, BY FLOATING CURD CONTAINING GAS BUBBLES, OR BY A RIPPING APART OF THE CURD BY RAPID GAS PRODUCTION, CAUSING THE SO CALLED STORMY FERMENTATION OF MILK.

COLIFORM BACTERIA ARE RESPONSIBLE FOR MOST FORMATION. HETEROFERMENTATIVE LACTIS ALSO MAY PRODUCE GAS, BUT USUALLY NOT ENOUGH TO BE EVIDENT.

YEAST USUALLY ARE ABSENT OR IN LOW NUMBER IN MILK AND DONOT COMPETE WELL WITH THE BACTERIA.

PROTEOLYSIS:

THE HYDROLYSIS OF MILK PROTEINS BY MICROORGANISM USUALLY IS ACCOMPANIED BY THE PRODUCTION OF BITTER FLAVOR CAUSED BY SOME OF THE PEPTIDES RELEASED.

PROTEOLYSIS IS FAVORED BY STORAGE AT LOW TEMPERATURE, BY DESTRUCTION OF FORMED ACID IN THE MILK BY THE DESTRUCTION OF FORMED ACID IN THE MILK BY MOLDS AND FILM YEASTS OR THE NEUTRALIZATION OF ACID BY PRODUCTS OF MICROORGANISMS.

ACTIVELY PROTEOLYTIC BACTERIA ARE FOUND AMONG SPECIES OF MICROCOCCUS, ALCALIGENS, PESUDOMONAS, PROTEUS, FLAVOBACTERIUM, AND SERRATIO, ALL OF WHICH ARE GENERA OF NON-SPORE-FORMING BACTERIA AND OF GENERA

BACILLUS AND CLOSTRIBIUM OF THE SPOREFORMERS.

ROPINESS:

ROPINESS AND SLIMINESS CAN OCCUR IN MILK, CREAM.

BACTERIAL ROPINESS IS CAUSED BY SLIMY CAPSULAR MATERIAL FROM THE CELL AND CELLS AND ORDINARILY DEVELOPS BEAT AT LOW TEMPERATURE.

THE ROPINESS USUALLY DECREASE AS THE ACIDITY OF THE MILK OR CREAM INCREASES.

TWO MAIN TYPES OF ROPINESS: SURFACE ROPINESS AND ROPINESS THROUGHOUT MILK.

SURFACE ROPINESS IS CAUSED OFTEN BY ALCALIGENS VISCOLACTIS, AN ORGANISM CHIEFLY FROM WATER OR SOIL THAT CAN GROW FAIRLY WELL IN THE VICINITY OF 10C.

CHANGES IN MILK FAT:

MILK FAT MAY BE DECOMPOSED BY VARIES BACTERIA, YEASTS AND MOLDS.

A) OXIDATION OF THE UNSATURATED FATTY ACID.

- YIELD ALDEHYDES, KETONES AND ACID AND RESULT IN TALLOW ODORS AND TASTES.

B) HYDROLYSIS OF THE BUTTERFAT TO FATTY ACID AND GLYCEROL

BY THE ENZYME LIPASE.

C) COMBINED OXIDATION AND HYDROLYSIS TO PRODUCE RANCIDITY.

SPECIES OF LIPASE FORMING BACTERIA ARE FOUND IN MANY OF THE BACTERIA GENERA E.G. PSEUDOMONAS, PROTEUS ALCOGLIGENS, BACILLUS, MICROCOCCUS, CLOSTRIDIUM AND MANY OTHERS.

PSEUDOMONAS FRAGI AND STAPHYLOCOCCUS AUREUS PRODUCE FAIRLY HEAT- RESISTANT LIPASES WHICH MAY SURVIVE PASTEURIZATION IF PRESENT IN THE RAW MILK.

ALKALI PRODUCTION:

PSEUDOMONAS FLUORESCENS AND ALCOLIGENES VISCOLACTIS.

PRODUCTION OF AMMONIA FROM ORGANIC ACIDS AND UREA RESULTS IN A ALKALI FORMATION.

FLAVOR CHANGES:

SOUR OR ACID FLAVOR:

CLEAN: PRODUCED BY STREPTOCOCCUS LACTIS AND OTHER LACTICS

AROMATIC: BY STREPTOCOCCI AND AROMA FORMING LEUCONOSTAC SPECIES

SHARP: BY COLIFORM BACTERIA, CLOSTRIDIUM SPP.,

BITTER FLAVOURS: RESULT FROM PROTEOLYSIS, LIPOLYSIS OR EVEN FERMENTATION OF LACTOSE.

ORGANISMS: COLIFORM BACTERIA , YEASTS, ACTINOMYCETES

BURNT FLAVOUR: STREPTOCOCCUS LACTIS VAR. MALTIGENS PRODUCE THIS FLAVOUR.

COLOR CHANGES:

BLUE MILK: PSEUDOMONAS SYNCYANEA WHEN GROW WITH STREPTOCOCCUS LACTIS

YELLOW MILK: PSEUDOMONAS SYNXANTHA AND SPECIES OF FLAVOBACTERIUM.

RED MILK: SERRATIA MARCESCENS, MICROCOCCUS ROSEUS

BROWN MILK: PSEUDOMONAS PUTREFACIENS

CONCLUSION:

MILK IS A WHITE NUTRIENTS-RICH LIQUID FOOD PRODUCED IN THE MAMMARY GLANDS OF MAMMALS. IT IS THE PRIMARY SOURCE OF NUTRITION FOR INFANT MAMMALS BEFORE THEY ARE ABLE TO DIGEST OTHER TYPES OF FOOD .EARLY- LACTATION MILK CONTAIN COLOSTRUMS, WHICH CARRIES THE MOTHER ANTIBODIES TO ITS YOUNG AND CAN REDUCE THE RISK OF MANY OTHER NUTRIENTS INCLUDING PROTEIN AND LACTOSE.

REFERENCE:

MICROBIAL CONTAMINATION AND FOOD DEGRADATION, VOLUME 10

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ALEXANDRU MIHAI GRUMEZESCU YEAR: 2011

FOOD MICROBIOLOGY: PRINCIPLES INTO PRACTICE
VOLUME 1: MICROORGANISMS RELATED TO FOODS, FOODBORNE DISEASES, AND FOOD SPOILAGE
OSMAN ERKMEN
T.FARUK BOZOGLU
YEAR: 2016
ENCYCLOPEDIA OF FOOD MICROBIOGY
CARL A. BATTI
YEAR: 2014

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CONTAMINATION AND PREVENTION OF SPOILAGE OF MEAT, FISH AND OTHER SEA FOODS

INTRODUCTION

- **FOOD CONTAMINATION** REFERS TO THE PRESENCE OF HARMFUL CHEMICALS AND MICROORGANISMS IN FOOD, WHICH CAN CAUSE CONSUMER ILLNESS.

- THIS ARTICLE ADDRESSES THE CHEMICAL CONTAMINATION OF FOODS, AS OPPOSED TO MICROBIOLOGICAL CONTAMINATION, WHICH CAN BE FOUND UNDER FOODBORNE ILLNESS.

- THE IMPACT OF CHEMICAL CONTAMINANTS ON CONSUMER HEALTH AND WELL-BEING IS OFTEN APPARENT ONLY AFTER MANY YEARS OF PROCESSING AND PROLONGED EXPOSURE AT LOW LEVELS (E.G., CANCER).

- UNLIKE FOOD-BORNE PATHOGENS, CHEMICAL CONTAMINANTS PRESENT IN FOODS ARE OFTEN UNAFFECTED BY THERMAL PROCESSING.

- CHEMICAL CONTAMINANTS CAN BE CLASSIFIED ACCORDING TO THE SOURCE OF CONTAMINATION AND THE MECHANISM BY WHICH THEY ENTER THE FOOD PRODUCT.

COMTAMINATION OF MEAT

- THE GROWTH OF MICROBES IN MEAT IS GOVERNED BY A NUMBER OF INTRINSIC AND EXTRINSIC FACTORS. INTRINSIC PROPERTIES OF MEAT, SUCH AS PH AND MOISTURE CAN PROMOTE MICROBIAL GROWTH, WHEREAS TEMPERATURE IS AN EXTRINSIC FACTOR.
- FRESH MEAT HAS A HIGH WATER CONTENT THAT IS FAVOURABLE FOR THE GROWTH OF MICROORGANISMS. IT ALSO GENERALLY CONTAINS BACTERIA, INCLUDING THOSE THAT CAN CAUSE DISEASES. THE ANIMALS NATURALLY CARRY BACTERIAL SPECIES LIKE *SALMONELLA* AND *E. COLI* IN THEIR INTESTINES, AND RAW MEAT CAN BECOME CONTAMINATED DURING THE SLAUGHTER PROCESS.

- EQUIPMENT AND TOOLS USED IN THE PROCESSING MEAT CAN ALSO BECOME CONTAMINATED WITH MICROBES AND SPREAD THOSE TO THE RAW MEAT.
- BACTERIA MULTIPLY RAPIDLY AT TEMPERATURES FROM 40 °F TO 140 °F. PATHOGENIC BACTERIA DO NOT NECESSARILY MULTIPLY IN MEAT LEADING TO ILLNESS. SOME SPECIES SUCH AS *STAPHYLOCOCCUS AUREUS* TEND TO BE OUTCOMPETED BY OTHER HARMLESS FLORA OR SPOILAGE BACTERIA THAT LEAD TO A BAD ODOUR THAT CAUSE MOST CONSUMERS TO DISCARD.

PREVENTION OF MEAT CONTAMINATION

- THESE GUIDELINES ARE AS FOLLOWS:

(1) KEEP REFRIGERATED OR FROZEN;

(2) THAW IN REFRIGERATOR OR MICROWAVE;

(3) KEEP RAW **MEAT** AND POULTRY SEPARATE FROM OTHER FOODS

(4) WASH WORKING SURFACES (INCLUDING CUTTING BOARDS), UTENSILS, AND HANDLES AFTER TOUCHING RAW **MEAT** AND POULTRY;

(5) COOK THOROUGHLY;

(6) KEEP HOT FOOD HOT.

CONTAMINATION OF FISH

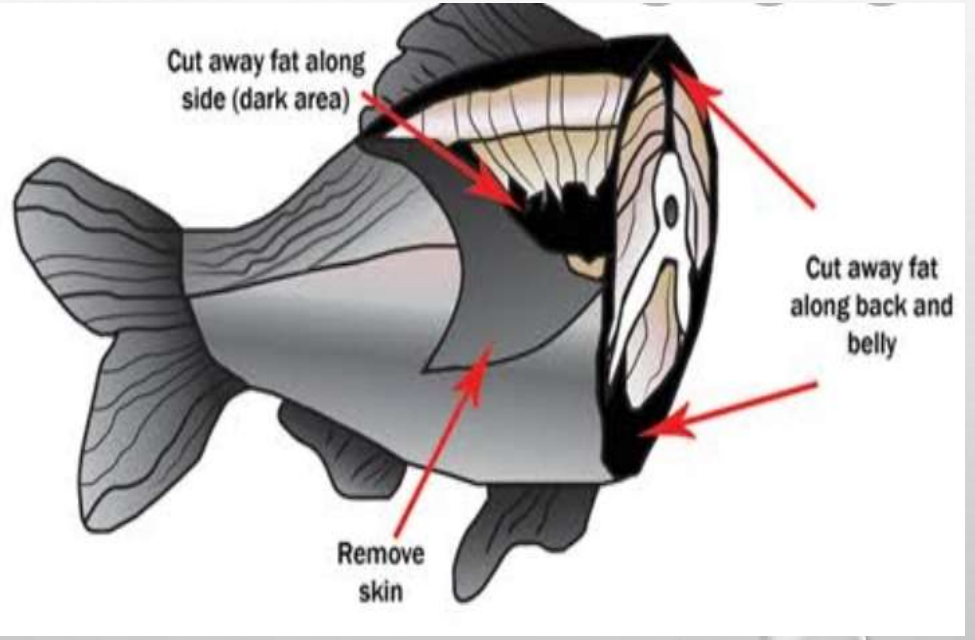
- FISH PROVIDE A HEALTHFUL SOURCE OF DIETARY PROTEIN AND ARE HIGH IN NUTRIENTS SUCH AS OMEGA-3 FATTY ACIDS.
- THERE IS EVIDENCE OF BENEFICIAL EFFECTS OF FISH CONSUMPTION IN CORONARY HEART DISEASE, STROKE, AGE-RELATED MACULAR DEGENERATION, AND GROWTH AND DEVELOPMENT.
- YET, BENEFITS MAY BE OFFSET BY THE PRESENCE OF CONTAMINANTS, SUCH AS METHYLMERCURY (MEHG), DIOXINS, POLYCHLORINATED BIPHENYLS (PCBS) AND SEVERAL OTHER HALOGENATED PERSISTENT ORGANIC POLLUTANTS.
- MEHG IS A KNOWN DEVELOPMENTAL NEUROTOXIC ANT, AS EVIDENCED BY SEVERAL ANIMAL STUDIES AND EPISODES OF HUMAN INTOXICATION IN JAPAN AND IRAQ.

- FARMED AND WILD-CAUGHT FISH APPEAR TO HAVE SIMILAR LEVELS OF CONTAMINANTS. ADVISORIES ARE IN PLACE THAT RECOMMEND LIMITED CONSUMPTION OF CERTAIN FISH IN CHILDREN, PREGNANT WOMEN AND WOMEN OF CHILDBEARING AGE. CAREFUL RISK-BENEFIT CONSIDERATIONS SHOULD FOSTER FISH CONSUMPTION WHILE MINIMIZING EXPOSURE TO TOXIC CONTAMINANTS.

PREVENTION OF FISH CONTAMINATION

- THE RISKS OF CONTAMINATION OF FINFISH PRODUCTS WITH ACTIVE PATHOGENS LARGELY DEPEND ON THE TYPE OF PRODUCT CONCERNED AND DISPOSAL METHODS OF THE IMPORTING COUNTRY.
- FROZEN FISH USED AS BAIT OR TO FEED HIGH-VALUE SPECIES PRESENT THE GREATEST RISK AS VEHICLES OF CONTAMINATION BECAUSE THEY ARE UNPROCESSED.
- FREEZING PRESERVES VIRAL- AND SOME BACTERIAL-PATHOGENS, THUS THE USE OF SUCH FISH AS BAIT CAN INTRODUCE THOSE PATHOGENS INTO NATURAL WATERS.

- CONVERSELY, PROCESSED FISH, PARTICULARLY FILLETS, WHICH HAVE BEEN HEAT-TREATED OR COOKED, PRESENT THE LOWEST RISK.
- IF FISH ARE PROCESSED AFTER IMPORTATION, CARE MUST BE TAKEN TO ENSURE EFFECTIVE WASTE DISPOSAL, WITH PARTICULAR ATTENTION TO THE PREVENTION OF SCAVENGING BY AVIAN VECTORS AND DRAINAGE FROM LANDFILLS INTO NATURAL WATERS. LIQUID WASTE SHOULD BE DISINFECTED AND DISPOSED OF WELL AWAY FROM NATURAL WATERS.



SPOILAGE OF SEA FOODS

- SEAFOOD IS ONE OF THE MOST HIGHLY PERISHABLE FOOD PRODUCTS BECAUSE OF THE CHEMICAL EFFECTS OF ATMOSPHERIC OXYGEN AND THE GROWTH OF SPOILAGE MICROORGANISMS
- SPOILAGE OF SEAFOOD CAN BE CAUSED BY ENZYMES, DEHYDRATION, OXIDATION, CONTAMINATION AND PHYSICAL DAMAGE. SULPHUROUS, AMMONIACAL, OR FISHY ODOURS ARE SOME OF THE MAIN ORGANOLEPTIC CHANGES TAKING PLACE DURING SPOILAGE DEVELOPMENT
- THE MAJOR CAUSE OF SEAFOOD SPOILAGE IS MICROBIAL GROWTH AND METABOLIC ACTIVITY WHICH RESULT IN THE FORMATION OF AMINES, SULPHIDES, ALCOHOLS, ALDEHYDES, KETONES, AND ORGANIC ACIDS WITH UNPLEASANT AND UNACCEPTABLE OFF-FLAVOURS.

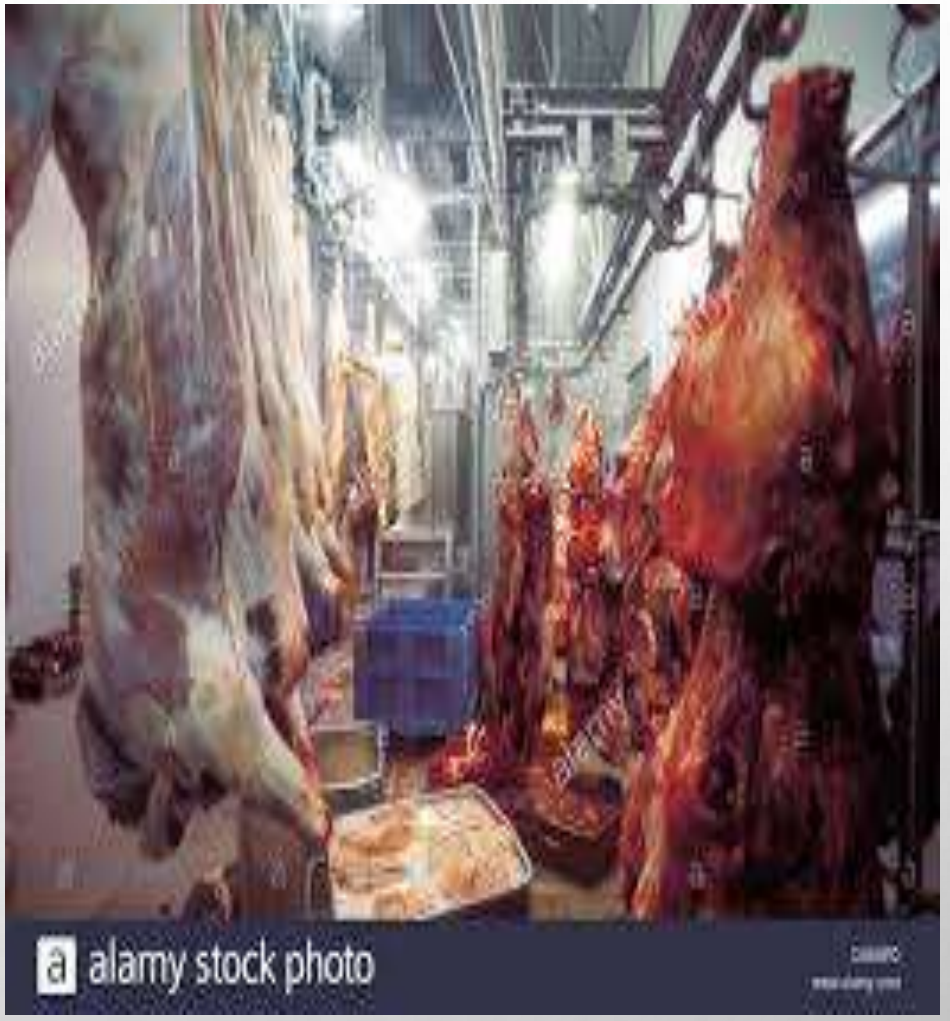
- HOWEVER, ONLY A FRACTION OF THE INITIAL MICROBIOTA OF SEAFOOD KNOWN AS SPECIFIC SPOILAGE ORGANISMS (SSOS), WHICH IS FAVOURED BY STORAGE CONDITIONS (E.G., ATMOSPHERE, TEMPERATURE), PREVAILS OVER THE REST OF THE MICROBIOTA, REACHING HIGH POPULATIONS AND PRODUCING CORRESPONDING METABOLITES (BIOCHEMICAL SPOILAGE INDICES).
- QUORUM SENSING (QS), WHICH INVOLVES THE PRODUCTION, RELEASE AND COMMUNITY-WIDE DETECTION OF EXTRACELLULAR SIGNALING MOLECULES CALLED AUTOINDUCERS, IS A CELL-TO-CELL COMMUNICATION PROCESS ENABLING MICROORGANISMS TO COLLECTIVELY ALTER BEHAVIOR PATTERNS UPON CHANGES IN CELL DENSITY AND SPECIES COMPOSITION IN SURROUNDING COMMUNITY.

PREVENTION OF SPOILAGE OF SEA FOODS;

- COLD STORAGE
- FREEZINGG
- VACUUM PACKAGING
- CANNING
- DRYING
- FERMENTATION
- IRRADIATION
- CURRYING
- SMOKING

COLD STORAGE

- *TEMPERATURE IS THE MOST IMPORTANT FACTOR INFLUENCING BACTERIAL GROWTH.*
- *PATHOGENIC BACTERIA DO NOT GROW WELL IN TEMPERATURES UNDER 3 °C (38 °F).*
- *THEREFORE, MEAT SHOULD BE STORED AT TEMPERATURES THAT ARE AS COLD AS POSSIBLE.*
- *REFRIGERATED STORAGE IS THE MOST COMMON METHOD OF MEAT PRESERVATION.*
- *THE TYPICAL REFRIGERATED STORAGE LIFE FOR FRESH MEATS IS 5 TO 7 DAYS.*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FREEZING

- *THE RATE OF FREEZING IS VERY IMPORTANT IN MAINTAINING MEAT QUALITY.*
- *RAPID FREEZING IS SUPERIOR; IF MEATS ARE FROZEN SLOWLY, LARGE ICE CRYSTALS FORM IN THE MEAT AND RUPTURE CELL MEMBRANES.*
- *WHEN THIS MEAT IS THAWED, MUCH OF THE ORIGINAL MOISTURE FOUND IN THE MEAT IS LOST AS PURGE (JUICES THAT FLOW FROM THE MEAT).*
- *FOR THIS REASON CRYOGENIC FREEZING (THE USE OF SUPERCOLD SUBSTANCES SUCH AS LIQUID NITROGEN) OR OTHER RAPID METHODS OF FREEZING MEATS ARE USED AT THE COMMERCIAL LEVEL TO MAINTAIN MAXIMAL PRODUCT QUALITY.*
- *IT IS IMPORTANT TO NOTE, HOWEVER, THAT FREEZING DOES NOT KILL MOST MICROORGANISMS; THEY SIMPLY BECOME DORMANT. WHEN THE MEAT IS THAWED, THE SPOILAGE CONTINUES WHERE IT LEFT OFF.*

VACUUM PACKAGING

- OXYGEN IS REQUIRED FOR MANY BACTERIA TO GROW.
- FOR THIS REASON MOST MEATS ARE VACUUM-PACKAGED, WHICH EXTENDS THE STORAGE LIFE UNDER REFRIGERATED CONDITIONS TO APPROXIMATELY 100 DAYS.
- IN ADDITION, VACUUM PACKAGING MINIMIZES THE OXIDATION OF UNSATURATED FATTY ACIDS AND SLOWS THE DEVELOPMENT OF RANCID MEAT.

CANNING

- THE SECOND MOST COMMON METHOD OF MEAT PRESERVATION IS CANNING.
- CANNING INVOLVES SEALING MEAT IN A CONTAINER AND THEN HEATING IT TO DESTROY ALL MICROORGANISMS CAPABLE OF FOOD SPOILAGE.
- UNDER NORMAL CONDITIONS CANNED PRODUCTS CAN SAFELY BE STORED AT ROOM TEMPERATURE INDEFINITELY.
- HOWEVER, CERTAIN QUALITY CONCERNS CAN COMPEL PROCESSORS OR VENDORS TO RECOMMEND AN OPTIMAL "SELL BY" DATE


canning
meat
Healthy
Canning


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DRIYING

- DRYING IS ANOTHER COMMON METHOD OF MEAT PRESERVATION.
- DRYING REMOVES MOISTURE FROM MEAT PRODUCTS SO THAT MICROORGANISMS CANNOT GROW.
- DRY SAUSAGES, FREEZE-DRIED MEATS, AND JERKY PRODUCTS ARE ALL EXAMPLES OF DRIED MEATS CAPABLE OF BEING STORED AT ROOM TEMPERATURE WITHOUT RAPID SPOILAGE.

FERMENTATION

- ONE ANCIENT FORM OF FOOD PRESERVATION USED IN THE MEAT INDUSTRY IS FERMENTATION.
- FERMENTATION INVOLVES THE ADDITION OF CERTAIN HARMLESS BACTERIA TO MEAT.
- THESE FERMENTING BACTERIA PRODUCE ACID AS THEY GROW, LOWERING THE PH OF THE MEAT AND INHIBITING THE GROWTH OF MANY

FERMENTATION

IRRADIATION

- IRRADIATION, OR RADURIZATION, IS A PASTEURIZATION METHOD ACCOMPLISHED BY EXPOSING MEAT TO DOSES OF RADIATION.
- RADURIZATION IS AS EFFECTIVE AS HEAT PASTEURIZATION IN KILLING FOOD-SPOILAGE MICROORGANISMS.
- IRRADIATION OF MEAT IS ACCOMPLISHED BY EXPOSING MEAT TO HIGH-ENERGY IONIZING RADIATION PRODUCED EITHER BY ELECTRON ACCELERATORS OR BY EXPOSURE TO GAMMA-RADIATION-EMITTING SUBSTANCES SUCH AS COBALT-60 OR CESIUM-137.
- IRRADIATED PRODUCTS ARE VIRTUALLY IDENTICAL IN CHARACTER TO NONIRRADIATED PRODUCTS, BUT THEY HAVE SIGNIFICANTLY LOWER MICROBIAL CONTAMINATION.
- IRRADIATED FRESH MEAT PRODUCTS STILL REQUIRE REFRIGERATION AND

IRRADIATION

LOGO

CURING AND SMOKING

- MEAT CURING AND SMOKING ARE TWO OF THE OLDEST METHODS OF MEAT PRESERVATION.
- THEY NOT ONLY IMPROVE THE SAFETY AND SHELF LIFE OF MEAT PRODUCTS BUT ALSO ENHANCE THE COLOUR AND FLAVOUR.
- SMOKING OF MEAT DECREASES THE AVAILABLE MOISTURE ON THE SURFACE OF MEAT PRODUCTS, PREVENTING MICROBIAL GROWTH AND SPOILAGE.
- MEAT CURING, AS COMMONLY PERFORMED IN PRODUCTS SUCH AS HAM

CURRING AND SMOKING

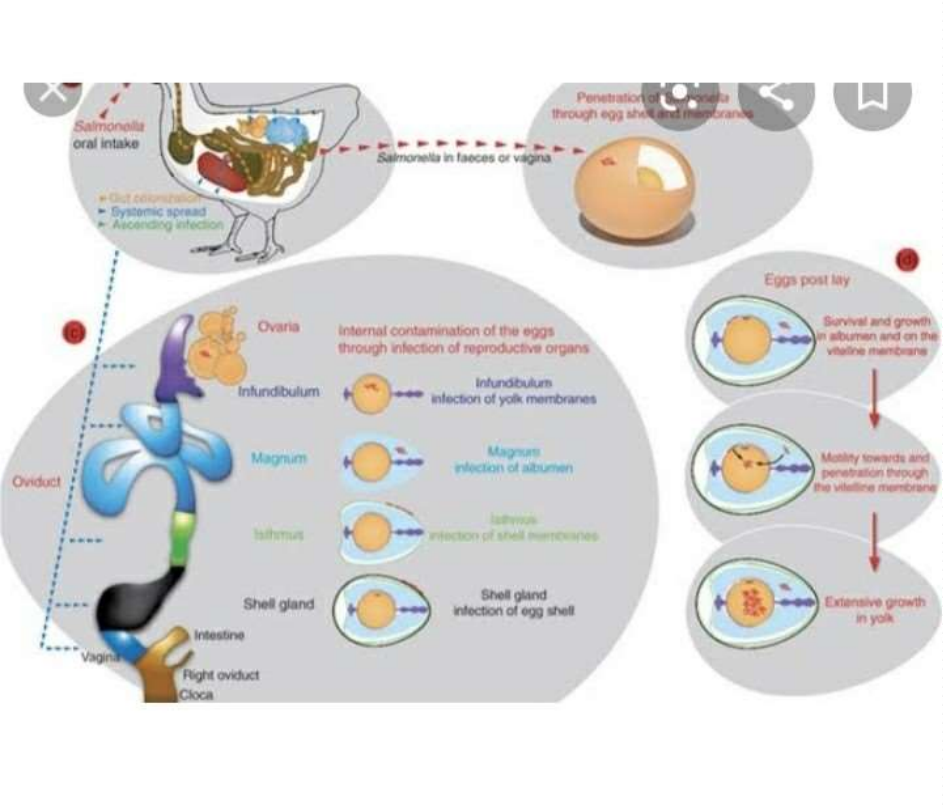
FOOD MICROBIOLOGY

CONTAMINATION AND PREVENTION SPOILAGE OF EGGS

INTRODUCTION:

The simplest solution to preserving eggs is to simply keep them cool eggs have a natural coating on the outside that helps keep the egg inside from spoiling. If that's washed off. The eggs must be refridgerated unwashed eggs,howhever can be stored in a cool closet or back room for weeks. Bacteria have the ability o move from the surfaces of the eggs through the cuticle , into the egg shells pores ,through the egg shell membrane and into the egg internal contents .

SPOILAGE OF EGGS AND EGG PRODUCTS



SPOILAGE OF EGGS AND EGG PRODUCTS

- Source of microorganism and contamination.
- Spoilage of egg and egg products.
- Non microbial spoilage.
- Microbial spoilage.
- Preservation of asepsis.
- Removal of microorganisms.
- Use of heat treatment.
- Use of low temperature.
- Use of preservatives.

SPOILAGE OF EGG AND EGG PRODUCTS

NON MICROBIAL SPOILAGE:

Untreated eggs loss moisture during storage and lose weight. The white of eggs become thinner and more water as the egg ages and yolk membrane become weaker. At high humidity bacteria and molds grow on surfaces. At how humidity and low tempreture surface growth is not favored but eggs lose weight at a faster rate and become undesirable.

MICROBIAL SPOILAGE:

The most predominate spoilage of shell eggs is a caused by gram negative rods.

BACTERIAL SPOILAGE OF EGGS

Bacteria need to overcome the anti –bacterial properties of albumen to cause spoilage of eggs .

Also they use the protein complexes as a source of nitrogen for growth.

Bacterial spoilage is called as rots three chief once green rots,colorless rots,and black rots.

The other two are pink rots and red rots.

GREEN ROTS

- Caused by pseudomonas fluorescens .
- Egg white in early stages ,become bright green in colour during later stages , yolk disintegrates and blends with white.
- Odour is lacking or is fruity or sweetish.
- Contents of egg fluoresce strongly under uv light.

FUNGAL SPOILAGE OF EGGS

FUNGAL SPOILAGE OF EGGS

- Spoilage of eggs by fungi goes through stages of mold growth.The stages give the defects their names.
- There are two stages : Pin spot molding, Fungal rotting.
- Molds that cause spoilage of eggs include species of penicillium , clodosporium , sporotrichum , mucor , Alternaria and botrytis.

CHANGES CAUSED BY MICROORGANISMS

Tasks to be accomplished by causal organisms to cause spoilage:

- Contaminate the shell.
- Penetrate the pores of the shell to membrane.
- Grow through shell membrane to reach white.
- Grow in egg white to reach egg yolk.

Time taken to penetrate varies with organism and temperature. In general, more spoilage is caused by bacteria than by molds.

CHANGES CAUSED BY MICROORGANISMS

- Changes in the membranes occur with aging flavour more rapid bacterial multiplication . The rates of physical and chemical changes in the egg depend on the time and temperature of holding the relative humidity , and the composition of the atmosphere about the eggs.
- The character of albumen hinder microbial growth include a PH 9 to 10 that may be reached during storage lysozyme enzyme which degrade the cell walls of gram – positive bacteria.

CHANGES NOT CAUSED BY MICROORGANISMS

- Untreated eggs lose moisture during storage and hence lose weight .
- Shrinkage shown by the size of the airspace or air cell of the egg.
- Changes in the physical state of the contends of the egg seen by candling or breaking
- As the eggs ages egg white becomes thinner and more watery and yolk membrane weakness.
- The poorer the egg, more movement of the yolk.
- Normal ph of egg7.6 to 9.5 storage increases the alkalinity of the egg white.

CONTAMINATION OF EGGS

CONTAMINATION OF EGGS

- Freshly laid eggs are streak.
- Shells soon become contaminated.
- Faecal matter of hen .
- Cage or nest.
- Wash water if eggs are washed handling.
- Material in which the eggs are packed.

PIN-SPOT MOLDING

- Very early mold growth.
- Small compact colonies of molds appear on the shell and usually just inside it. Colour varies with the kind of mold.
- Pencillium species cause yellow or blue or green spots inside the shell.
- Clodosporium species give dark green or black spots.
- Sporotrichum species give pink spots.

BLACK ROTS

- Most commonly caused by a species of proteus, pseudomonas and aeromonas can also cause this.
- Preteus melanovogenes causes black coloration yolk and dark colour in white.
- Caused when egg is stored at temperature . Higher than 6 the ordinary.
- Gas pressure develops in egg.
- Putrid odour.

FUNGAL ROTTING

- Final stage of spoilage.
- Mycelium of the mold has grown through the pores or cracks in the egg.
- Jellying of egg white is seen.
- The hyphea of the mold may weaken the yolk membrane enough to cause its rupture . After this, growth is stimulated by food released from the yolk.

CONTAMINATION AND PREVENTION OF SPOILAGE OF POULTRY

INTRODUCTION

- The term poultry indicates all domesticated species of birds like chicken , duck, emu, geese, guinea fowl, ostrich, pigeon, quail and turkey.

poultry is one of the fastest growing segments of livestock agriculture sector and contributes a major share in terms of protein supplementation from eggs and meat.

CONTAMINATION OF POULTRY

- The skin of live birds may contain numbers of bacteria averaging 1,500 per cm and could also be derived from the feet, feathers, and feces

- Contamination of the skin and the lining of the body cavity occurs during washing plucking and evisceration.

- The process of sticking and bleeding can also introduce contamination.

- Knives , clothes, air, and hands, and clothing of the workers can serve as intermediate of contamination.

- After handling of the meat contamination can come carts, boxes, or other containers.

SPOILAGE OF POULTRY

- most bacterial growth takes place on the surfaces, skin, lining of the body cavity, and any cut surfaces.
- Enzymes of the fowl contributes to the deterioration of dressed birds.
- Bacteria is the chief cause of spoilage and the intestines is the primary source.

SPOILAGE OF POULTRY

SIGNS OF SPOILAGE

- There is an off odor
- change in color
- feels sticky, slimy or tacky to touch

- other spoilage of bacteria such as cytophaga and flavobacterium, are often found in chill tanks but are rarely found on carcasses. The psychotropic spoilage bacteria on chicken carcasses immediately after slaughter are generally acinetobacter and pigmented pseudomonas.

- Iced, cut-up poultry often develops a slime that is accompanied by an odor described as tained acid sour or dishraggy.

PRESERVATION OF POULTRY

- The principles of preservation in meat products also applies to poultry , although the plucking and bleeding raise different problems.

- The method of killing and bleeding of the fowl has an important effect on the quality of the product.

- The method of plucking also has some influence on the keeping of the quality of the bird.

PRESERVATION OF POULTRY

STAGES OF PROCESSING POULTRY

- **STUNNING:** to render the animal immobile unconscious.
- **BLEEDING:** the stage wherein they drain the blood.
- **SCALDING:** the stage where they plunge the animals carcass into very hot water to facilitate plucking.
- **DE-FEATHERING**: the process where they remove the feathers
- **CHILLING:** this is where they keep the poultry in cold storage.

USE OF PRESERVATIVES

- Poultry are soaked up in organic acids at pH 2.5 helps lengthen shelf life.
- Some soul like turkey , and cured in a solution of salt, sugar, and sodium nitrate for several weeks.

FREEZING:

- Poultry can be kept in good conditions for months when its frozen.
- The storage temperature should be below -17.8 c with 95% humidity.

CHILLING:

- Chilling storage of poultry is for only a short period
- Dressed birds are sometimes stored in ice when there is no available mechanical refrigeration.

Weight	Time
Below 4 lbs.	4 hours
4-8 lbs.	6 hours
Above 8 lbs.	8 hours

USE OF LOW TEMPERATURE

mostly poultry is preserved by either chilling or freezing.

The lower the temperature of storage, the longer the birds can be stored without undesirable changes.

USE OF HEAT:

- Chicken and other fowls may be canned in their own juices of jelly.
- Heat processes are used for canned meat.
- The chicken or other fowl may be salted in a weak brine before being packed in to the glass jars or cans