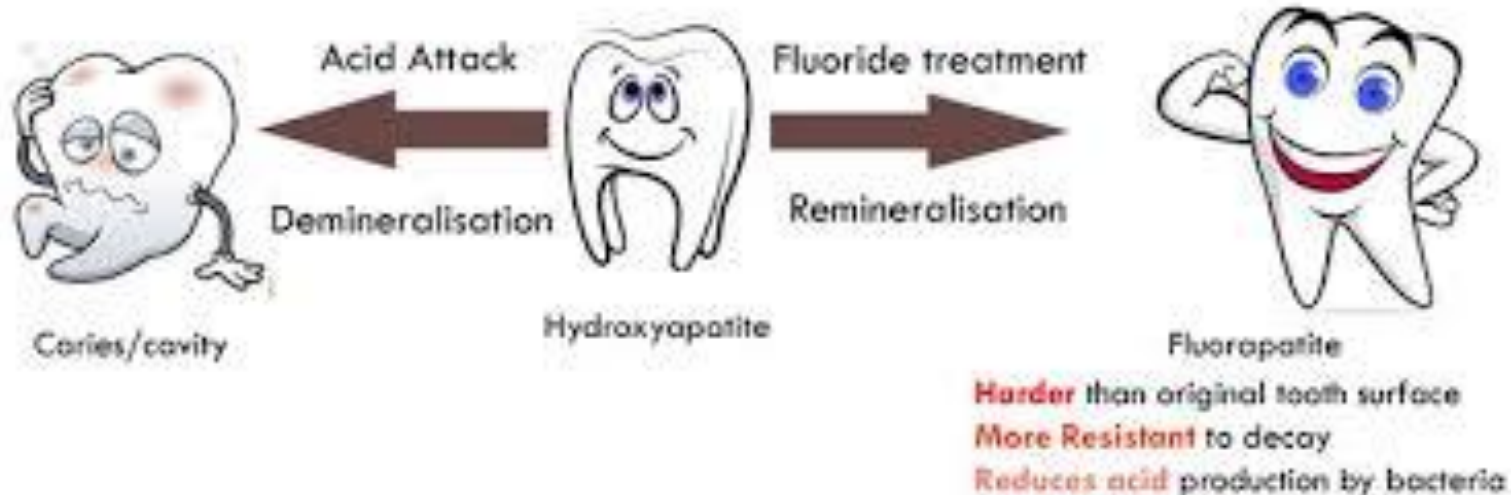


Fluorides in Dentistry

Lec 3

Dr.Dhuha M Hasan

Fluoride appears to provide its **benefit** when present in the oral cavity. Its effectiveness depends on how **frequently** it is administered in the mouth. Fluoride can be used to **increase the resistance to dental caries**.



Fluoride content is commonly expressed in parts per million (ppm) which is equivalent to 1mg fluoride per kilogram or liter of water. Thus, 1ppm fluoride equal to 1mg fluoride per liter of water

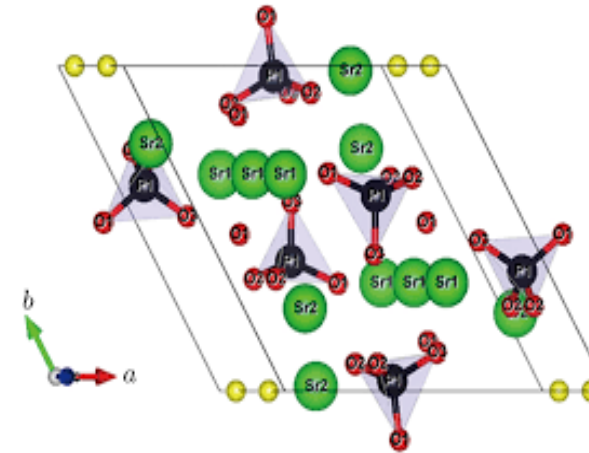


Fluoride in Environment:

✓ Fluorine is never seen in nature in the elemental form because its the most **electro negative** of all chemical elements.

--Its belongs to the group of **chemical elements called halogens**, which refers to their ability to **form salts in union with a metal**.

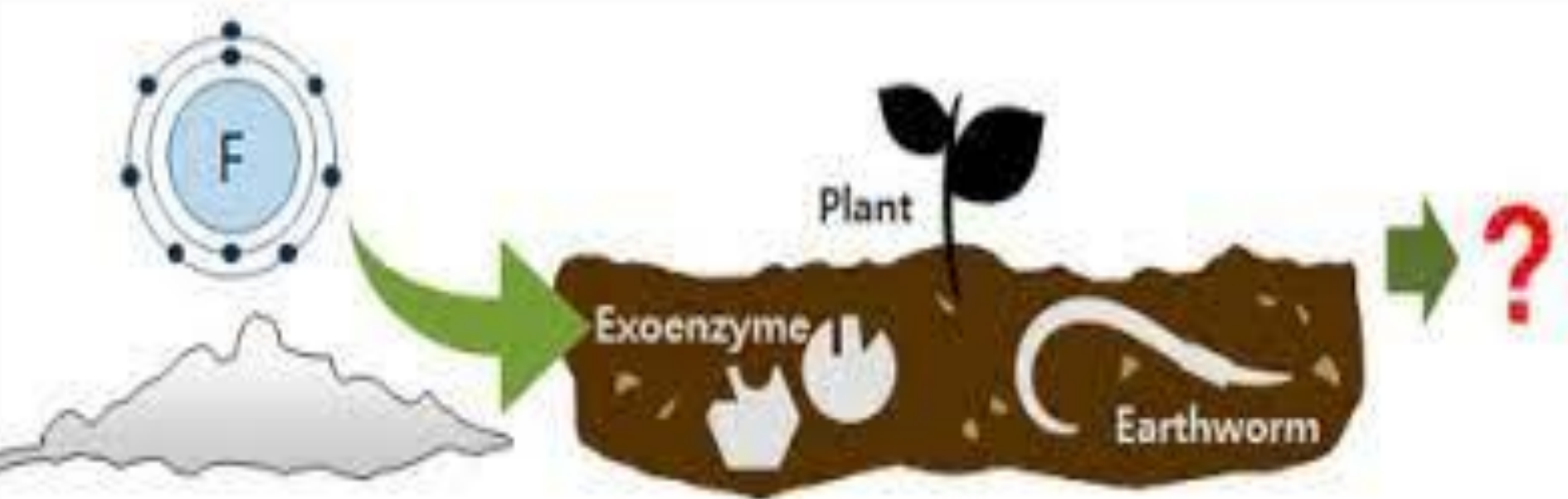
--- Halogens, and in particular fluorine, are highly reactive being one electron short of a full outer shell. This electron can be gained by reacting with, for example, calcium, forming **calcium fluoride** (ionic compound CaF_2). Thus, fluoride is the term used when fluorine is combined chemically with a positively charged counterpart. The complexes often consist of crystalline ionic salts such as fluorapatite ($\text{Ca}_{10}[\text{Po}_4]_6\text{F}_2$).



Fluorine is one of 118 chemical atomic elements in the periodic system. In its pure form, it is a **poisonous pale yellowish brown gas**.

□ **In soil: Fluoride** concentration of soil increases with depth. In high mountain areas the fluoride content of the soil is usually higher.

In rock and soil, fluoride may occur in a wide variety of minerals, including **fluorspar** contains calcium fluoride, **cryolite** contains aluminum fluoride.



In waters:

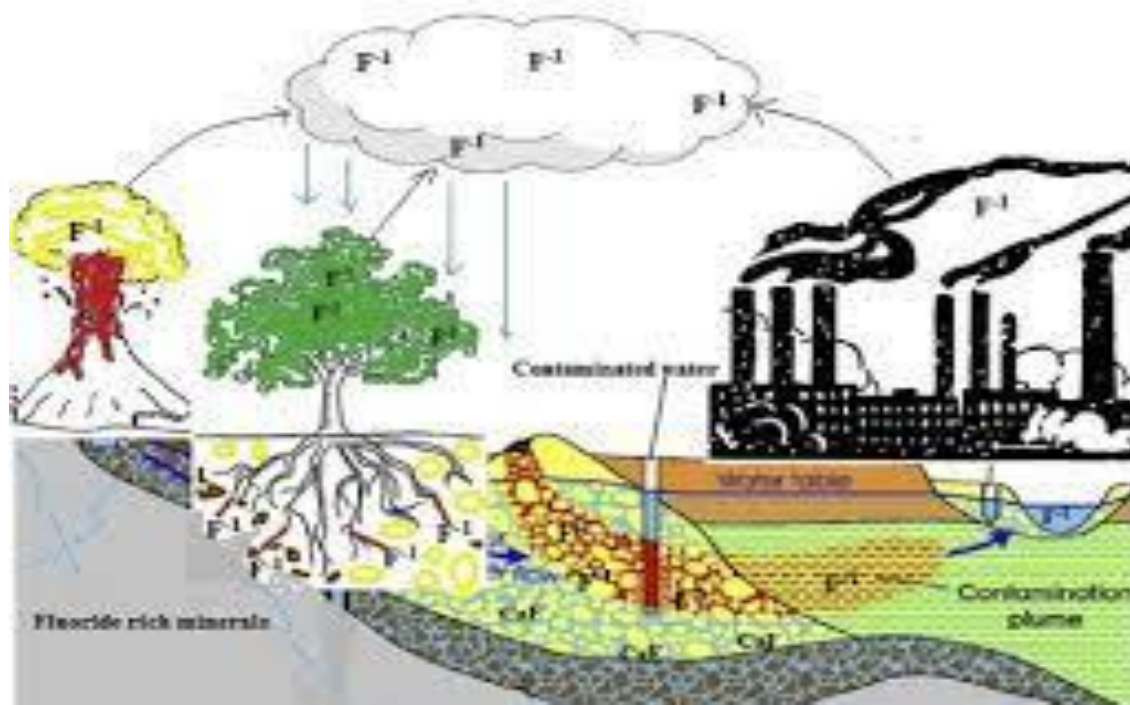
All water contains fluorides in varying concentrations .As ✓ many of the minerals in the soil are soluble in water, fluoride is found in varying concentrations in the groundwater, **Sea water** contains significant quantities of fluoride at levels **0.8–1.4 mg/lt**. In water from **lakes, rivers, and artesian wells** the fluoride content is usually below **0.5 mg /L** although concentrations as high as **95 mg /L** have been recorded in **Tanzania**. The highest natural fluoride concentration ever found in water was **2800 mg/L**, recorded in Lake in **Kenya**.



In atmosphere:

fluoride originating from :

- 1-**dust** of fluoride-containing ✓
 - 2-**soils from gaseous industrial waste**, ✓
 - 3-the **burning of coal fires in populated areas** ✓
 - 4-**gases emitted in areas of volcanic activity** in nature. ✓
- ➔ enter food chain by depositing on plants.. ✓



Fluoride intake: The major sources of fluoride are

1. **Food** ▶ Most foods have fluoride as fish.
2. **Liquid** ▶ drinking water and beverages, tea contains up to 7 ppm.
3. **Fluoride-containing dental products.** ▶ tooth paste, fluoride gel.

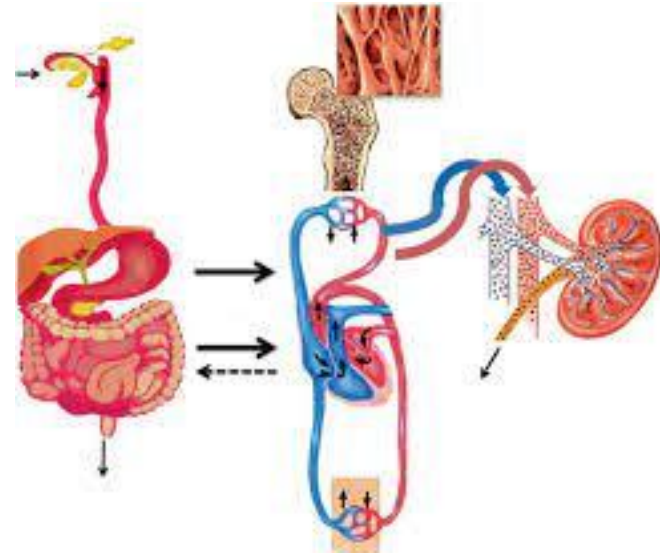


Fluoride Metabolism

• Absorption of fluoride:

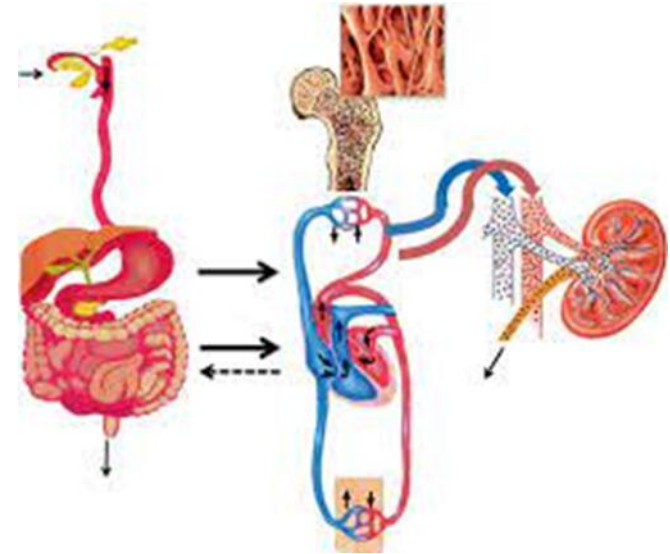
Approximately **75 -90 %** of the fluoride ingested each day is **absorbed from the alimentary tract**.

Fluoride may also be **inhaled from air borne fluoride**. Readily soluble fluoride compounds such as **NaF** tablets or aqueous solution of NaF are **completely absorbed** whereas compound with solubility such as **CaF₂, MgF and AlF₃**, are **less completely absorbed**. So the presence of Ca may lead to formation of insoluble salts with fluoride and absorption reduced to 70% and in food rich with Ca to 60%. The ingestion of fluoride **with food retards its** absorption..



Absorption from stomach occurs readily and is inversely related to the pH of the gastric content. The absorption process occurs by passive diffusion.

The rate of gastric absorption is directly related to the acidity of the contents so that, for any given dose, the peak plasma level is higher and occurs sooner when the contents are more acidic.



• Distribution of Fluoride in the Body

1-Fluoride in Plasma:

- Plasma is the biological fluid into which and from which fluoride must pass for its **distribution** elsewhere in the body and for its **elimination** from the body.

- There are two general forms of fluoride in human plasma. A-The ionic form (also called as inorganic fluoride or free fluoride) and B-the non ionic or bound fluoride.

- Together the ionic and non ionic fraction is called “**total**” **plasma** fluoride. **Ionic fluoride** is not bound to proteins, to other components of plasma or to soft tissue. The concentration of ionic fluoride in soft and hard tissue is directly related to the amount of ionic fluoride intake.

- Plasma fluoride levels increase with age.



2. Fluoride in Soft Tissues

- The **intracellular** fluoride concentrations are from **10–50 % lower than those of plasma**.
- hydrogen fluoride (**HF**) is the form in which fluoride **migrates** and establishes diffusion across cell membranes.

===Since the pH gradient across the membranes of most cells can be decreased or increased by altering extracellular pH, it is possible to promote the net flux of fluoride into or out of cells. **This is the basis for the suggestion that alkalinization of the body fluids is a useful adjunct in the treatment of acute fluoride toxicity.**



note

3. Fluoride in Calcified Tissues

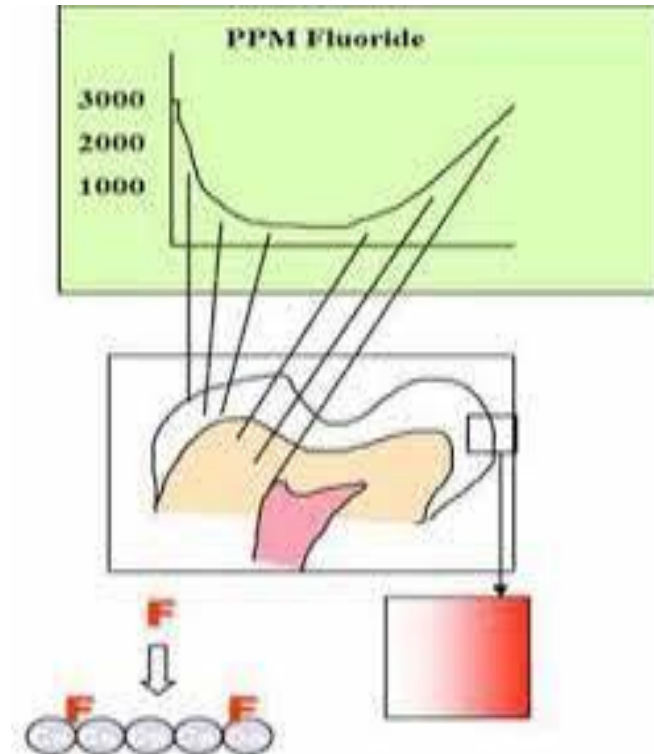
Approximately **99** percent of the body burden of fluoride is associated with calcified tissues. The fluoride concentration **in bone is not uniform**.

In **long bones**, for example, the concentrations are **highest in the periosteal region**. They decline sharply within a few millimeters of the periosteal surface and increase slightly as the **endosteal** region is approached.

Cancelous bone has higher fluoride concentrations than compact bone.

Surface enamel fluoride concentrations tend to decrease with age in areas subjected to tooth wear but increase in areas that accumulate plaque.

Dentine fluoride levels decline progressively from the pulpal surface to the dentine-enamel junction (DEJ). Enamel fluoride concentrations are highest at the surface and decline progressively toward the DEJ
Bulk enamel



● Fluoride Excretion

1. In Urine

Fluoride is excreted primarily via urine. Fluoride is freely **filtered** through the **glomerular capillaries** and then undergoes a variable degree of **tubular re-absorption**. The percentage of the filtered fluoride ***reabsorbed*** from the renal tubules can range from about **10** to **90** percent. The degree of reabsorption **depends** largely on the 1-pH of the tubular fluid, 2-urinary flow and 3-renal function.

Urinary fluoride clearance increases with urine pH due to a decrease in the concentration of HF..

Numerous factors (e.g. diet and drugs) can affect urine pH and thus affect fluoride clearance and retention.

The renal clearance of fluoride in the adult typically ranges from 30 to 50 ml/min, whereas clearance rates of the other halogens (chloride, iodide and bromide) are usually less than 1.0 ml/min.

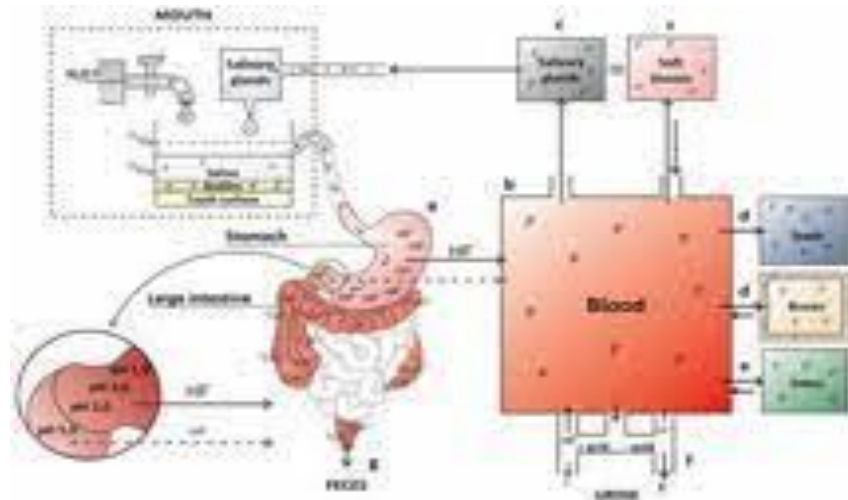
The excretion of fluoride in urine is reduced in individuals with impaired renal function.

2. In Faeces

. Fluoride present in faeces results from **two sources**: 1-the ingested fluoride that is not absorbed and 2-the absorbed fluoride that is reexcreted into the gastrointestinal tract. Fecal fluoride usually accounts for less than **10** percent of the amount ingested each day.

3. In Sweat

Usually, only a **few percent** of the fluoride intake is excreted in the sweat. However, under **excessive sweating as much as 50 percent** of the total fluoride excreted may be lost via **perspiration**.



4. In Saliva

Less than 1 percent of absorbed fluoride is reported to appear in the saliva.

The concentration of fluoride in saliva is about two-thirds of the plasma fluoride concentration and seems to be independent of flow rate, in contrast to the situation for most electrolytes.

In fact, saliva does not represent true excretion, **because most of the fluoride will be recycled in the body.**



Note

However, the fluoride content of the saliva is of major importance for maintaining a fluoride level in the oral cavity.

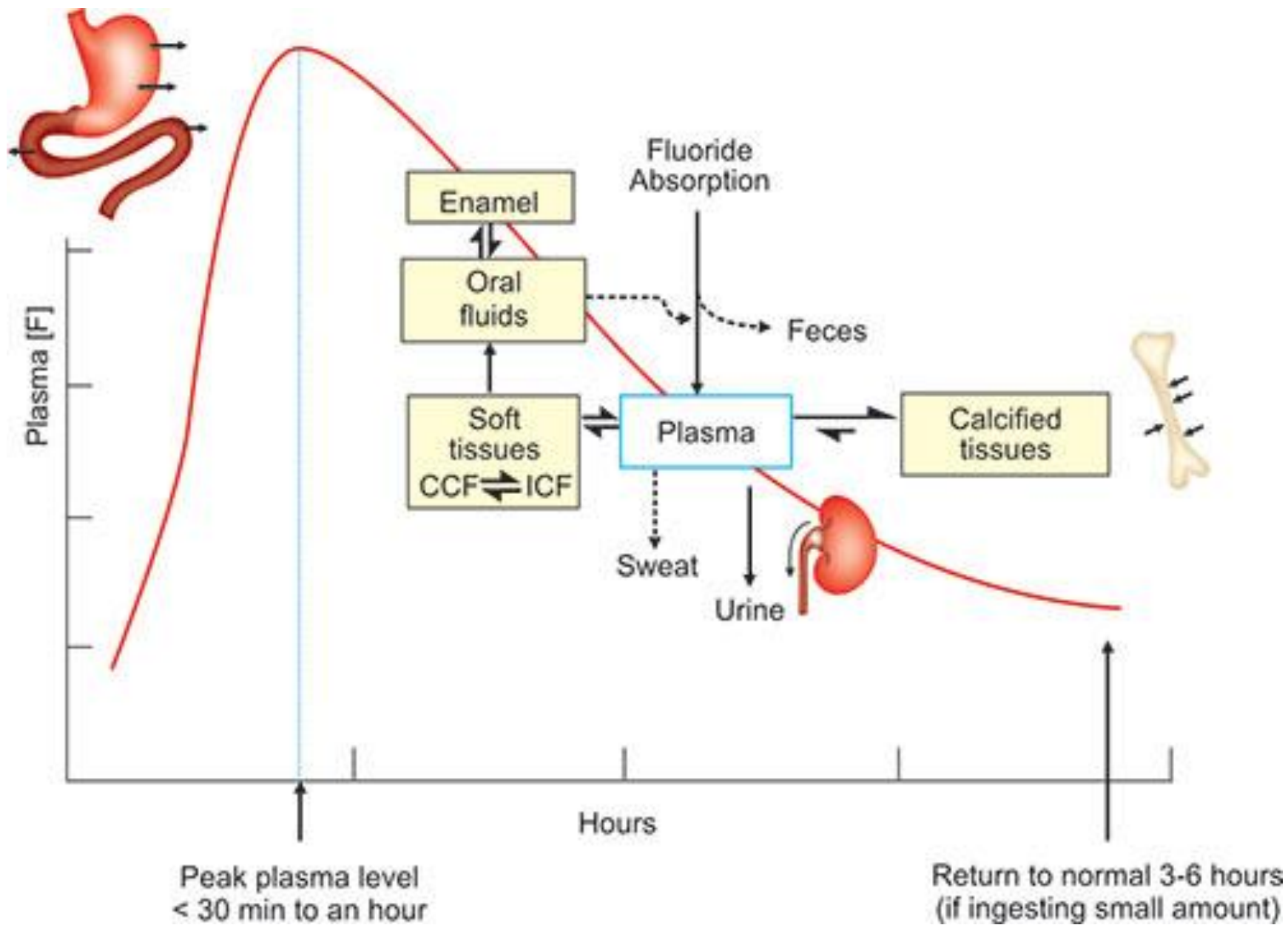
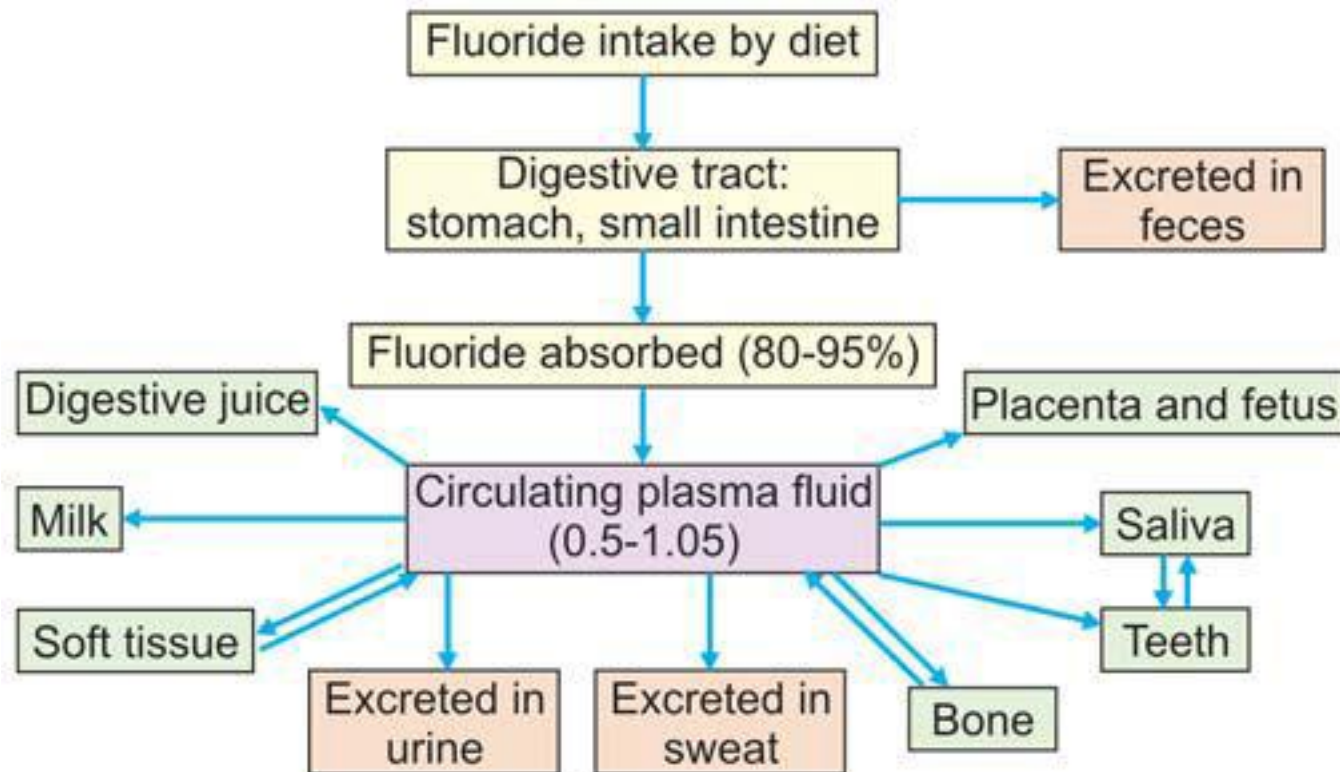


Fig. Metabolism of fluoride in human body



FLUORIDE

GOOD OR BAD?

