

INTRODUCTION

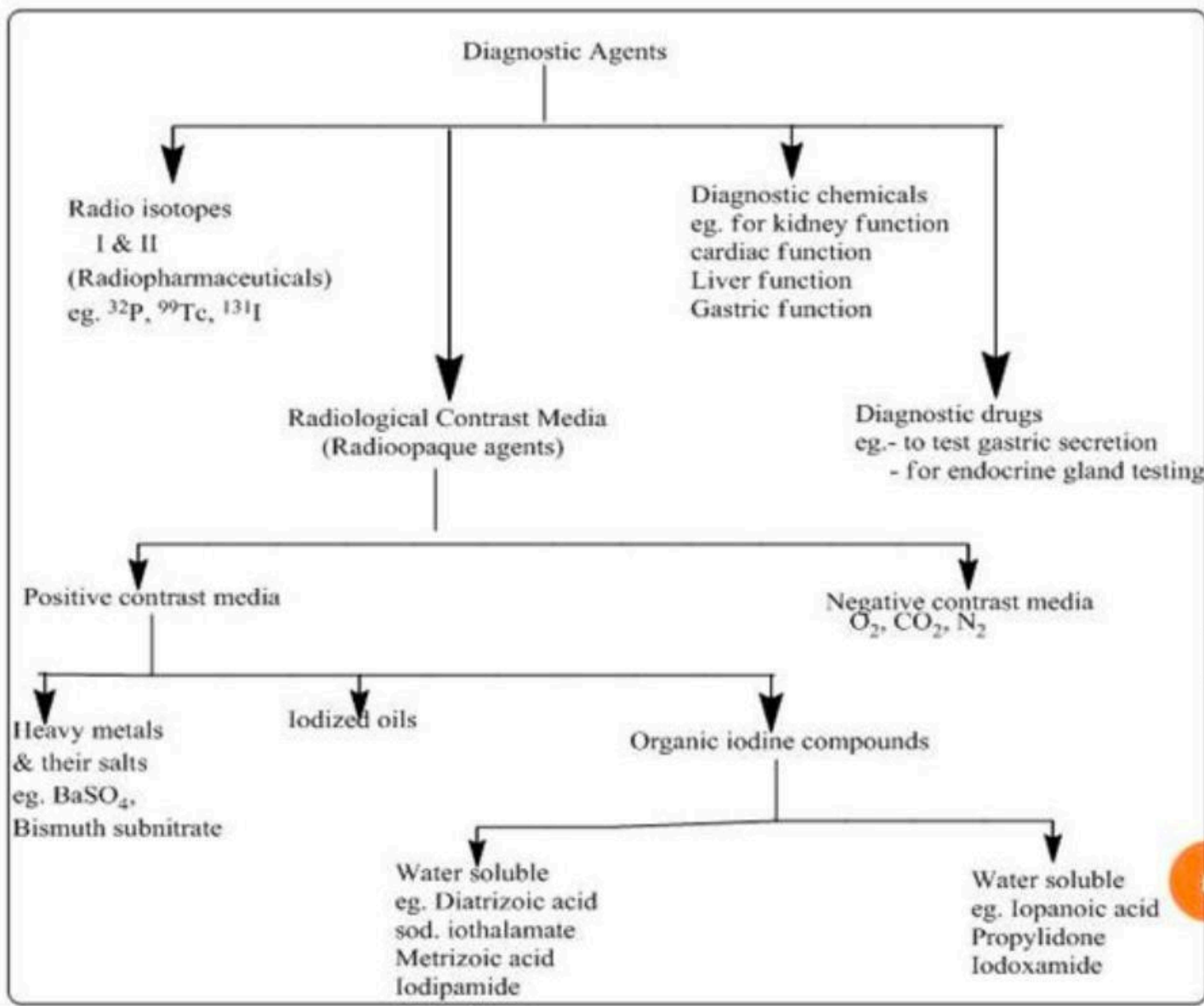
- **Diagnostic agents** are chemical or substances used to detect abnormalities in tissue and organs or to test on organ function.
- Do not have medicinal & pharmacological effects
- X-ray film used for radiography
- Radio opaque
- Some of used in organ visualization



INTRODUCTION

- 1) Angiography-Blood vessels
- 2) Arthrography-Joints
- 3) Bronchography-Lungs
- 4) Cholangiography-Gall bladder and bile duct
- 5) Hepatography-Liver
- 6) Lymphography-Lymph nodes & vessels
- 7) Myelography-Brain & spinal cord
- 8) Pyelography-Kidney and ureter
- 9) Splenohepatography-Liver & spleen
- 10) Urography-Urinary tract





RADIOPHARMACEUTICALS (RADIO ISOTOPES)

- radioactive compounds
- used for diagnosis & therapeutics treatment of human diseases
- given by various routes (mouth, injection, eye, bladder) in small amounts
- dosage can variate depend on type of test
- given under direct supervision of a specialist doctor
- Unit: Curie, becquerrels



RADIOPHARMACEUTICALS

- **Ideal Properties:**
- Easy availability
- Short effective half life
- Particle emission is adequate
- High target to non-target activity ratio
- No pharmacological effect
- Sterile & pyrogen free



RADIOPHARMACEUTICALS

○ Examples of Radiopharmaceuticals (For Diagnostic purpose)

1. Biliary tract blockage: Tc^{99m} disofenin
2. Blood volume studies: Sod. chromate Cr⁵¹
3. Blood vessel disease: Sod. pertechnetate Tc^{99m}
4. Bone diseases: Sod. Fluoride F¹⁸
5. Bone marrow disease: Cr⁵¹, Tc^{99m} sulfur colloid
6. Brain disease & tumors: Indium Iu¹¹¹
7. Cancer tumor: Gallium citrate Ga⁶⁷, Sod. Fluoride F¹⁸
8. Heart disease: Ammonia N¹³, Rubidium Rb⁸²,
Thallus chloride TI²⁰¹



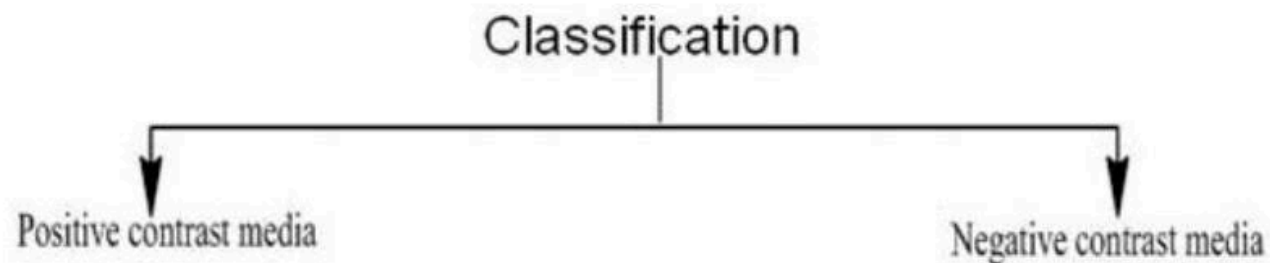
RADIOPHARMACEUTICALS

9. Kidney disease: Iodohippurate sod. I^{125} , Tc^{99m}
10. Liver disease: Ammonia N^{13} , Tc^{99m} , Albumin colloid
11. Lung disease: Krypton Kr^{81m} , Xe^{133}



RADIOLOGICAL CONTRAST MEDIA (RADIO OPAQUE AGENTS)

- Having property of opacifying X-ray radiations
- Any substance which when administered to a patient improves the visualization of an organ or tissue is called a contrast media.
- Either inorganic as well as organic



RADIOLOGICAL CONTRAST MEDIA

A) Positive contrast media:

- having ability to absorb X-rays (eg. Radioopaques)

Subdivided:

- i. Heavy Metals & their salts (Inorganic)
- ii. Iodized oils
- iii. Iodinated organic compounds (Organic)
 - a) water soluble contrast media
 - b) water insoluble contrast media



RADIOLOGICAL CONTRAST MEDIA

B) Negative contrast media:

- Transparent to X-rays
- Renders the structure of a tissue more translucent
- eg. Air, Oxygen, Nitrogen etc.
- Usually not used for diagnostic purpose
- Iodine compounds are usually more useful



RADIOLOGICAL CONTRAST MEDIA

- **Characteristics:**
- Adequate radioopacity which require iodine content 50% or more
- High water solubility (40% and above)
- Low viscosity, no osmotic effect
- Ability to administered & excretion
- Chemical stability
- Minimum toxicity & patient acceptance
- Readily available & low cost

RADIOLOGICAL CONTRAST MEDIA

A) Heavy metals and salts:

High atomic number and radioopaque
eg.

i) Barium Sulphate (BaSO_4)

- Low systematic toxicity
- Low water solubility
- Lack of osmotic activity
- Used for examination of GIT
- Used as suspension or thick cream
- Orally or through rectal route
- sod.citrate is added to stabilize preparation
- Sorbitol added to enhance function



RADIOLOGICAL CONTRAST MEDIA

ii) Metallic salt (Tantalum oxide for Bronchography & esophagography), (calcium tungstate) & (barium titanate for stomach, small intestine, esophagus)

iii) Ferrites(Fe_2O_3):

-about 80% opacity than that of BaSO_4

-contain Zn, Cu, Mn, Ni and Mg

-used for Bronchi, stomach & small intestine studies



RADIOLOGICAL CONTRAST MEDIA

B) Iodized oils:

- **Preparation:** Iodination of vegetable oils with hydroiodic acid give iodized oils
- Iodinated fatty acid derivatives
- Yellow to amber colored oils
- Decompose on exposure to light and air
- Upon administration liberate inorganic iodine in body which appear in urine
- Used in hepatography, lymphography & hepatospleenography



RADIOLOGICAL CONTRAST MEDIA

c) Organic Iodine Compound:

- Most widely used
- Tetra iodo phenolphthalein was 1st agent
- Amount of iodine is important for opacity

Subclassification:

- a) Water soluble contrast media
- b) Water insoluble contrast media



CLASSIFICATION (BASED ON CHEMICAL FEATURES)

- a. Triiodobenzoate-metrizoate
- b. Triiodoisophthalamates-lothalamic acid
- c. Triiodophenyl alkanoates-lpodates
- d. Triiodophenoxy alkanoates-lopronic acid
- e. Triiodobenzamide-Metrizamide
- f. Triiodo anilides-locetamic acid
- g. Dimeric triiodobenzoates-Iodipamide
- h. Dimeric triiodoisophthalamates-losefamic acid
- i. Other dimers & polymers-lozomic acid
- j. Diiodophenyl alkanoates-Iodoalphionic acid
- k. Diiodopyridones-Propylidone
- l. Iodophthaleins-Iodophthalein
- m. Miscellaneous-Iodohippurate sodium



RADIOLOGICAL CONTRAST MEDIA

a) Water soluble contrast media:

eg. Diatrizoate sodium

Diatrizoate meglumine

Sodium iothalamate

Metrizoic acid

Iodipamide

Ipodate sodium

Iodohippurate sodium

-mainly used for urography & angiography

-administered by retrograde method (i.e. by mechanical means)

-mild toxicity



RADIOLOGICAL CONTRAST MEDIA

b) Water insoluble contrast media

eg. Iopanoic acid

Propyliodone

Iophendylate

Iocetamic acid

Iodoxamide

-very slightly water soluble

-mainly used for cholecystography, bronchography and myelography

-patient should not drink or eat before Six hrs.

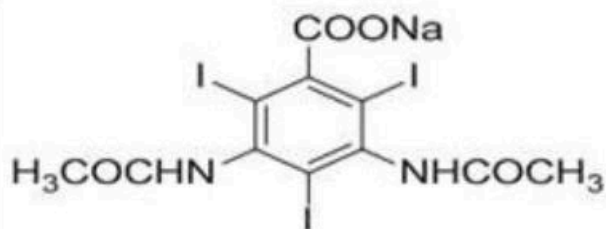


RADIOLOGICAL CONTRAST MEDIA

a) Water soluble contrast media:

1. Diatrizoate sodium:

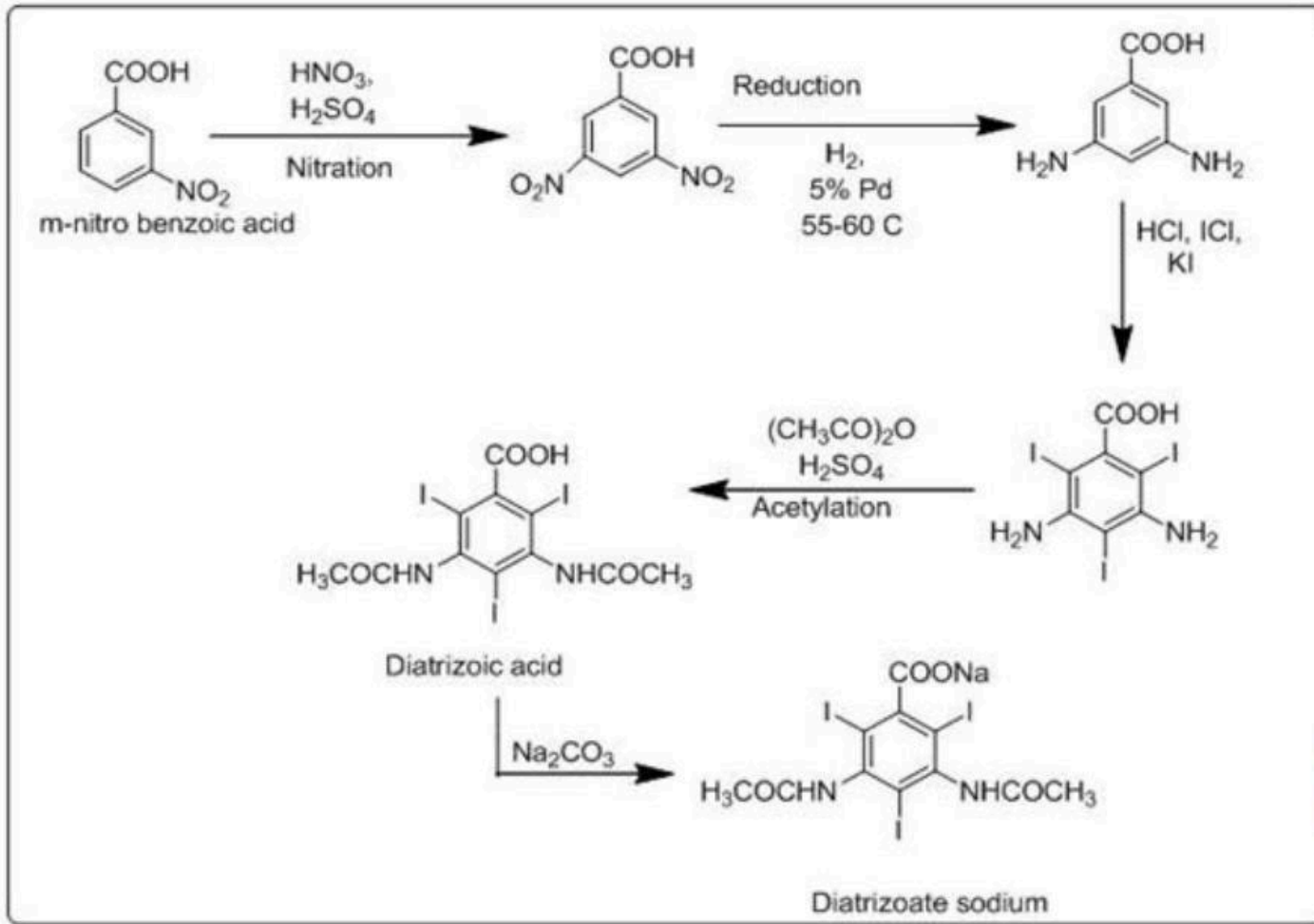
- Sodium salt of substituted triiodo benzoic acid
- Iodine content : abt 62%
- Used for angiography & urography
- Also available as meglumine salt



Diatrizoate sodium
(sodium 3,5-diacetamido-
2,4,6-triiodo benzoate)



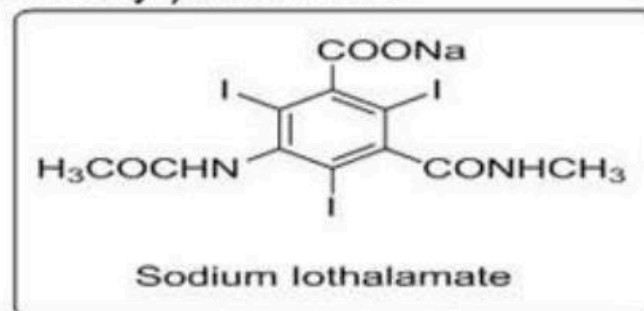
SYNTHESIS OF DIATRIZOATE SODIUM



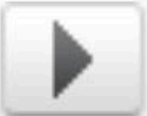
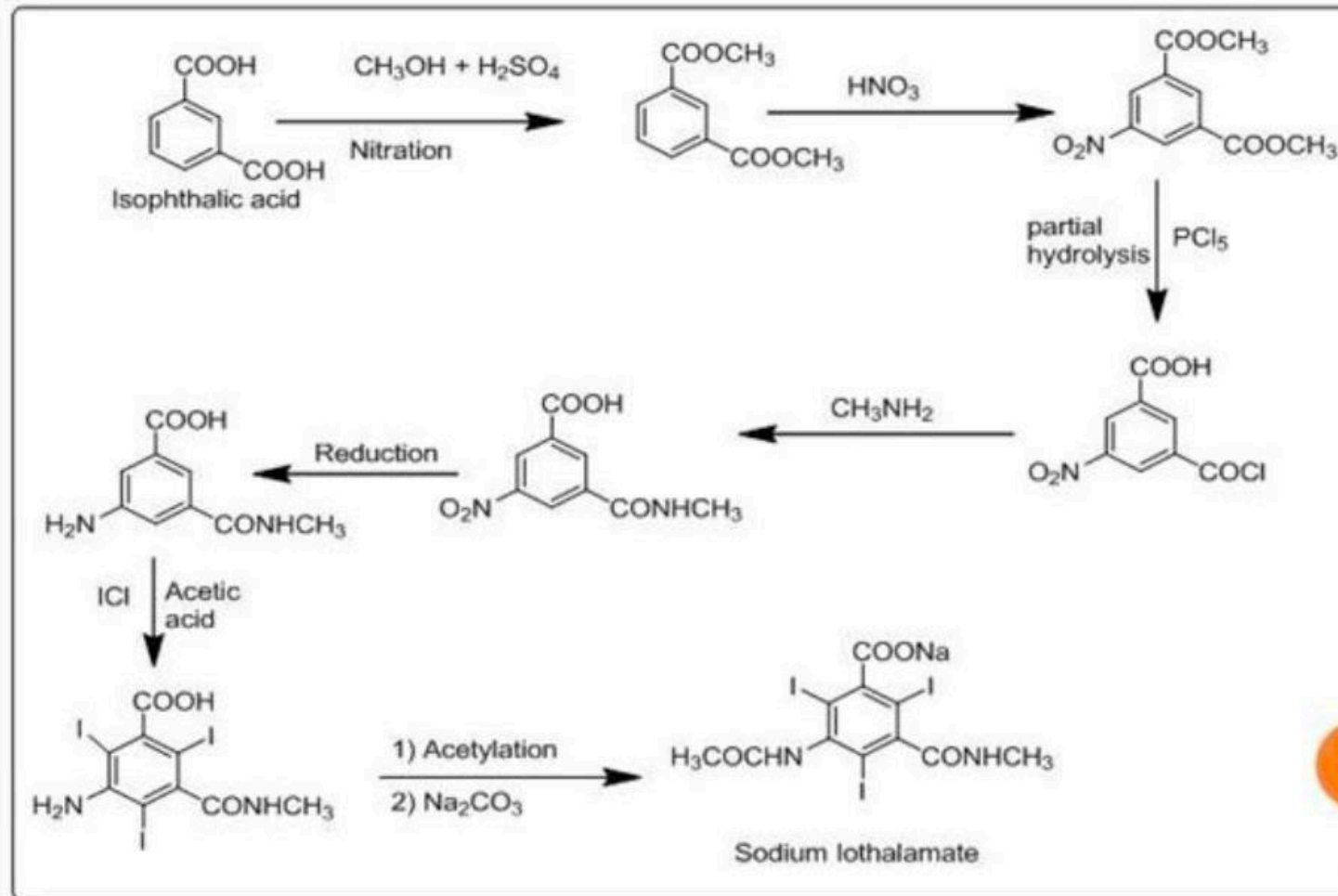
RADIOLOGICAL CONTRAST MEDIA

2. Sodium Iothalamate:

- Structural isomer of diatrizoic acid
- One acetamide ($\text{CH}_3\text{CONH-}$) group replaced by methyl carbamoyl ($-\text{CONHCH}_3$) group
- Available as meglumine salt
- Used in angiography
- Chem. Name: sodium 3-acetamido-2,4,6-triiodo-5-(methylcarbamoyl)benzoate

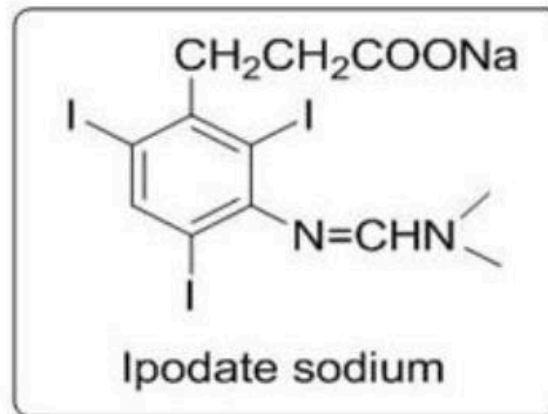


SYNTHESIS OF SODIUM IOTHALAMATE

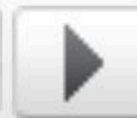
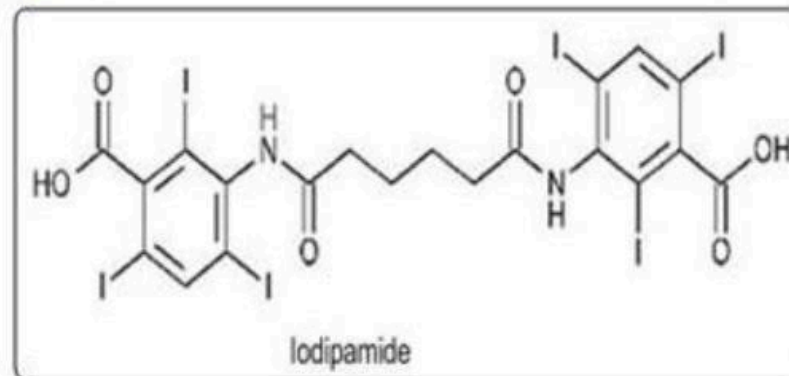


RADIOLOGICAL CONTRAST MEDIA

3) Iodate sodium:

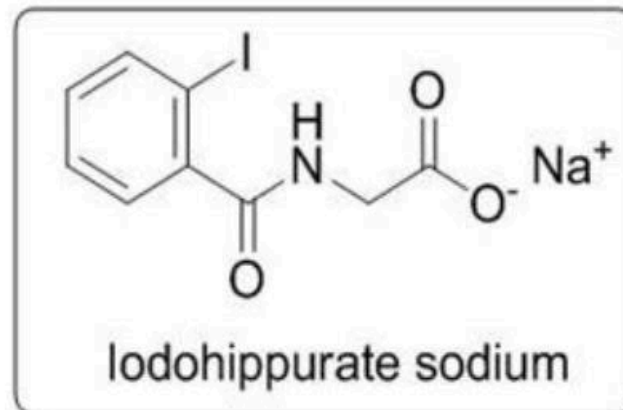


4) Iodipamide:



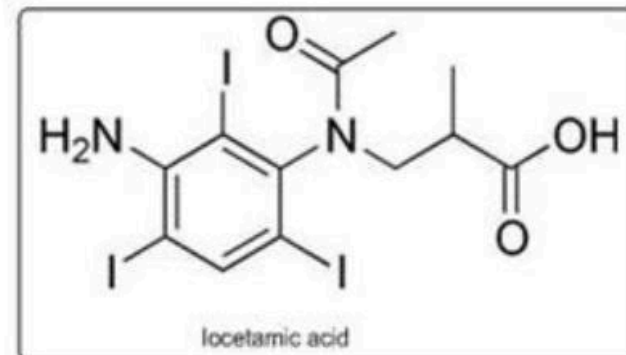
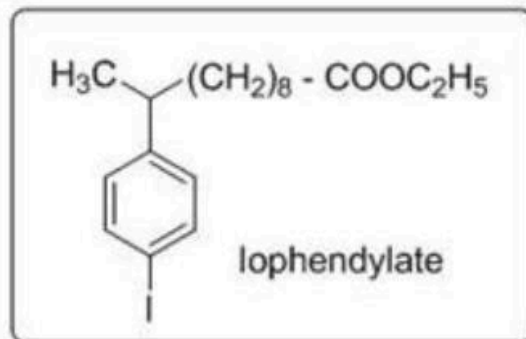
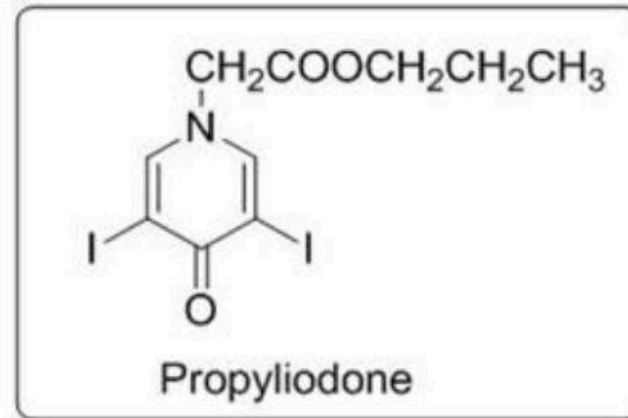
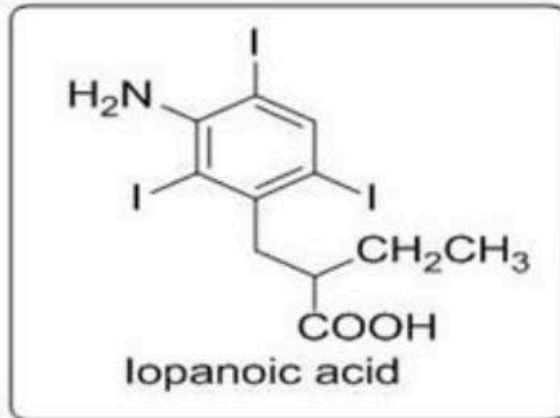
RADIOLOGICAL CONTRAST MEDIA

5) Iodohippurate sodium:



RADIOLOGICAL CONTRAST MEDIA

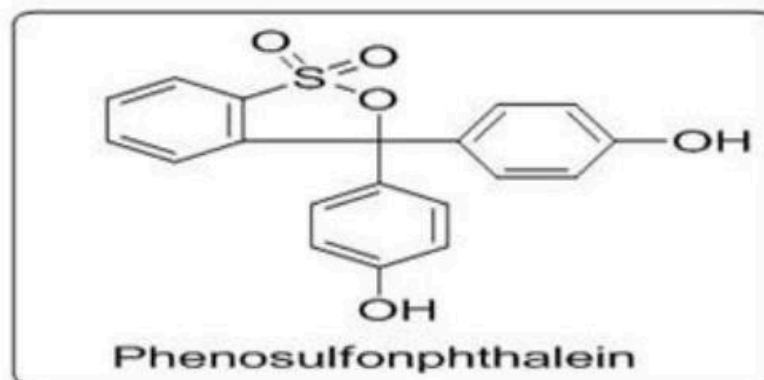
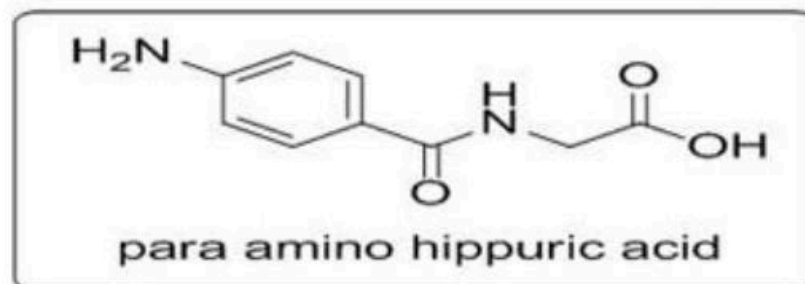
b) Water insoluble contrast media



DIAGNOSTIC CHEMICALS

a) For kidney function:

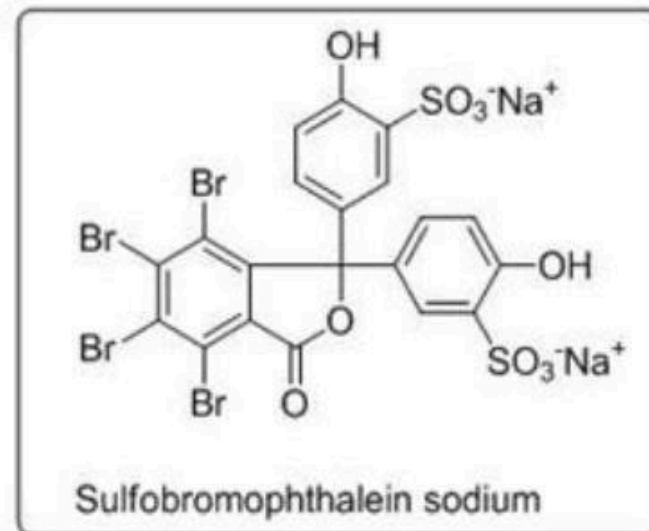
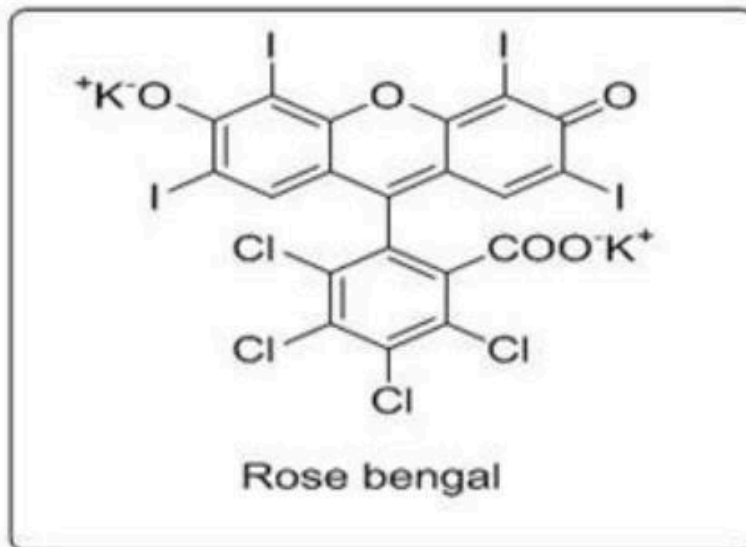
➤ p-amino hippuric acid, Inulin, Phenosulphophthalein



DIAGNOSTIC CHEMICALS

b) For liver function:

➤ Rose Bengal, Sulphobromophthalein sodium



DIAGNOSTIC CHEMICALS

c) For gastric function:

➤ Histamine phosphate, Pentagastrin, Xylose

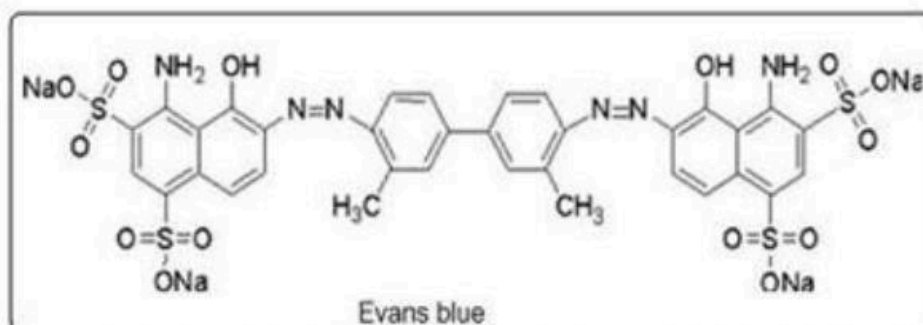


Pentagastrin

Short acting, very potent & half life 10 min

d) For cardiac function:

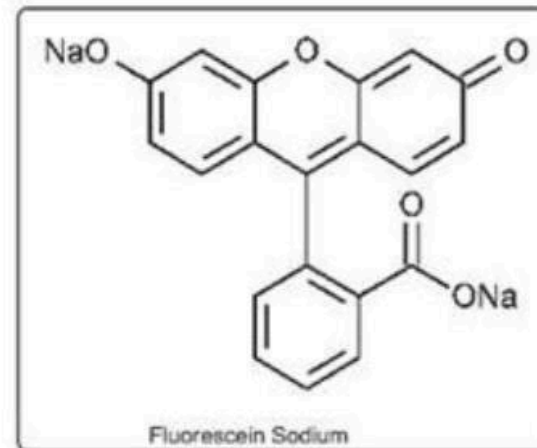
➤ Evans blue dye



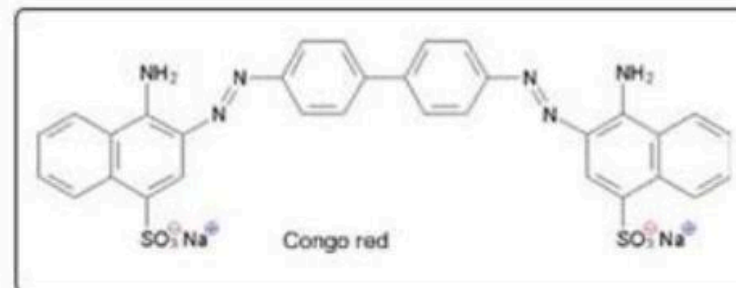
DIAGNOSTIC CHEMICALS

e) Miscellaneous:

- i) Fluorescein sodium
-used for ophthalmological studies



- ii) Congo red



- iii) Erythrosin sodium



DIAGNOSTIC DRUGS

- a) Phentolamine & Tyramine: pheochromocytoma
- b) Dexamethazone: Endocrine gland dysfunction
- c) Mannitol: Renal function
- d) L-arginine: growth hormone secretion

