

# **Treatment for Internal Contamination**

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REAC/TS**

# Learning Objectives

- Identify element-specific treatments for intakes of radionuclides
- Describe methods for assessing the efficacy of treatment

# Immediate Diagnosis

- Nasal swipes (~ 5% on inhalation intake)
- Nasal blows
- Sputum
- When all else fails - get a good history!

# Clearance Time - Nasopharynx

Time in Minutes  
to Swallowing

Anterior Nares	60
Nasopharynx	10 (10 mm/min)

# Treatment Methods

- Block absorption
- Block depositon
- Dilute
- Displace
- Remove (chelate)

# Absorption of Ingested Radionuclides

GROUP	ELEMENTS	%ABSORBED
Alkali Metals	$^{24}\text{Na}$ , $^{42}\text{K}$ , $^{85}\text{Rb}$ , $^{137}\text{Cs}$	High ~90
Group VIII Metals	$^{59}\text{Fe}$ $^{60}\text{Co}$ $^{105}\text{Ru}$	10 30-90 3

# Absorption of Ingested Radionuclides

GROUP	ELEMENTS	%ABSORBED
Lanthanides	$^{144}\text{Ce}$ , $^{147}\text{Pm}$ , $^{156}\text{Eu}$ , $^{160}\text{Tb}$	<0.1
Actinides	$^{228}\text{Th}$ , $^{235}\text{U}$	<0.1
Transuranics	$^{237}\text{Np}$ , $^{239}\text{Pu}$ , $^{241}\text{Am}$	<0.001

# Reduction of Absorption From Gastrointestinal Tract

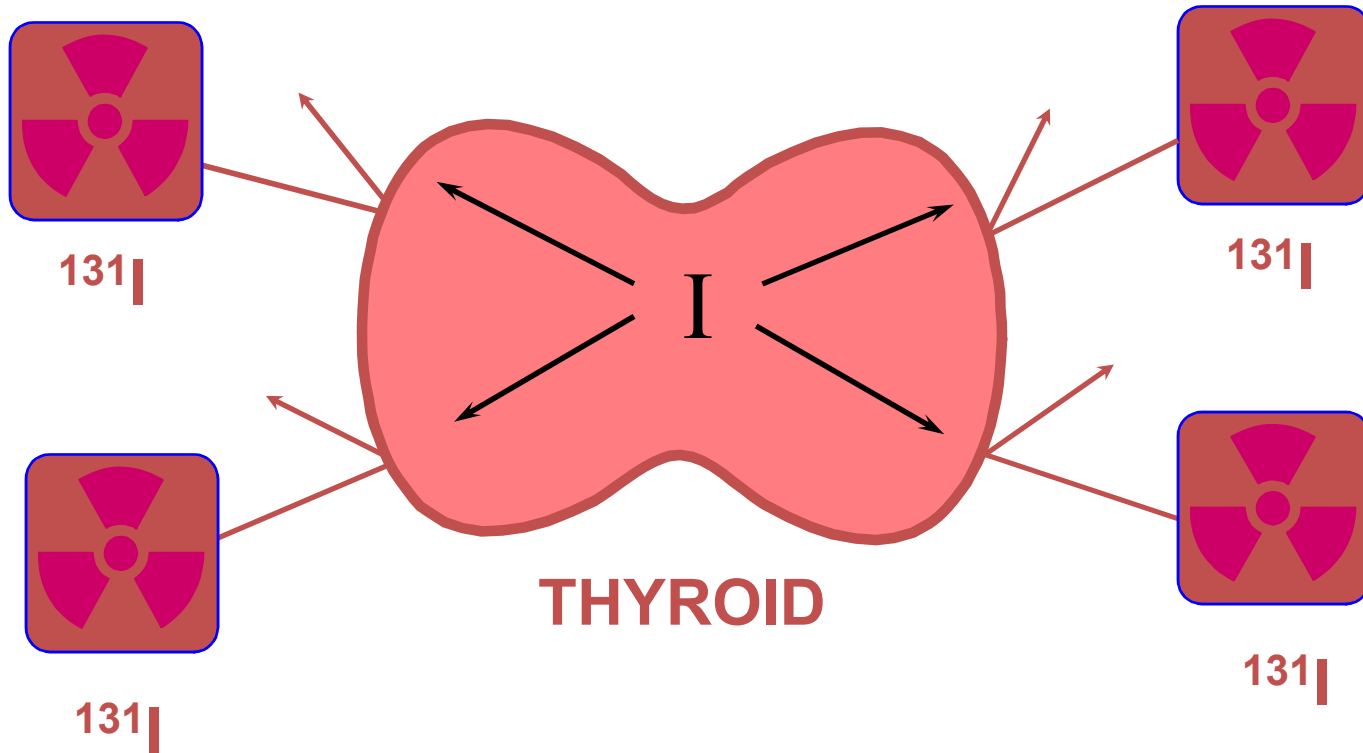
1. Antacid
2. Precipitation into insoluble salt
3. Catharsis



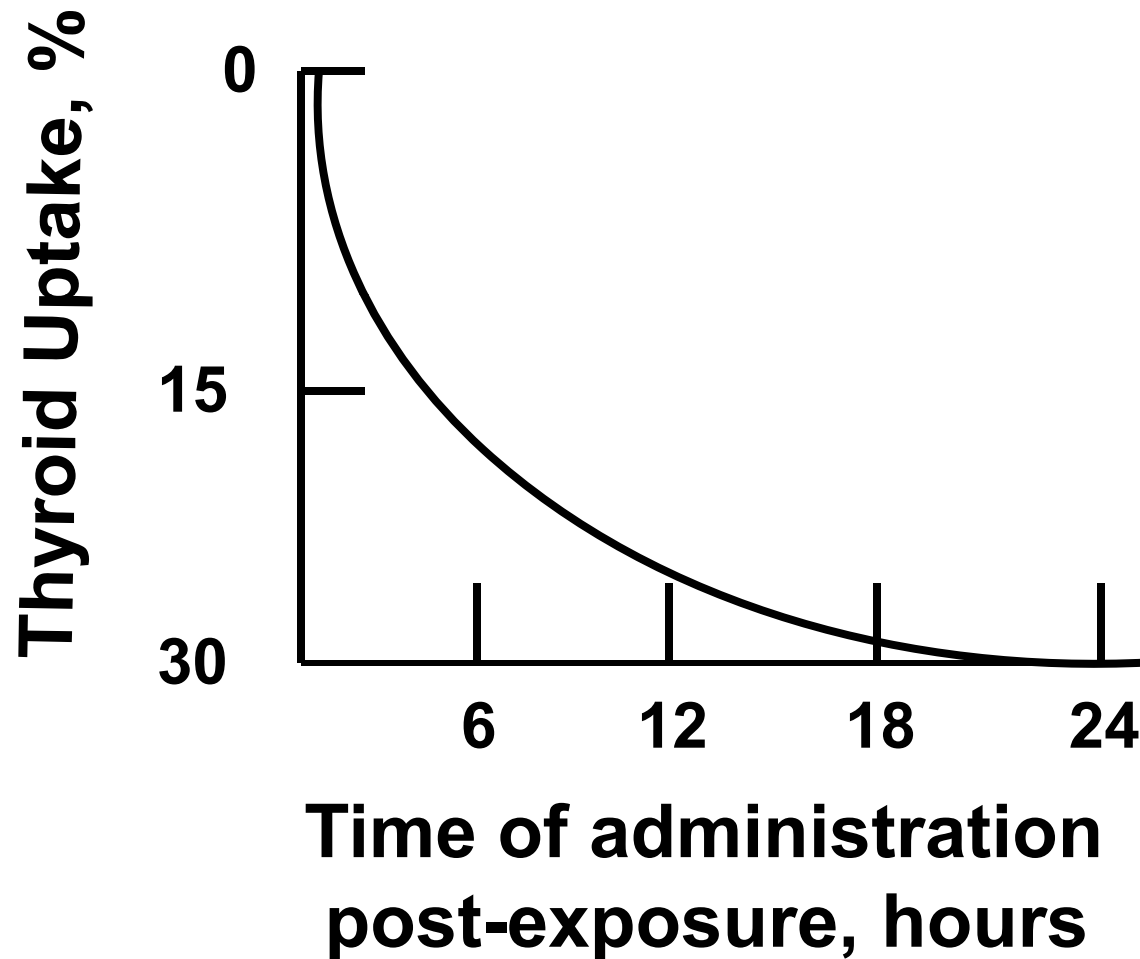
## Prussian Blue is Highly Effective in Treatment of $^{137}\text{Cs}$ Uptake

- Binds ions in gut
- Reduces biological half life to one third of untreated value
- Not absorbed
- Reduces recycling

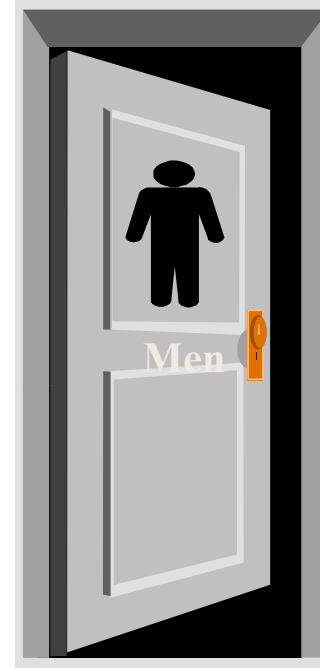
# Saturate the Critical Organ with the Stable Isotope



# Prompt KI Treatment for $^{131}\text{I}$ Intake is Highly Effective



# Isotopically Dilute



**TRITIUM**

# Displace

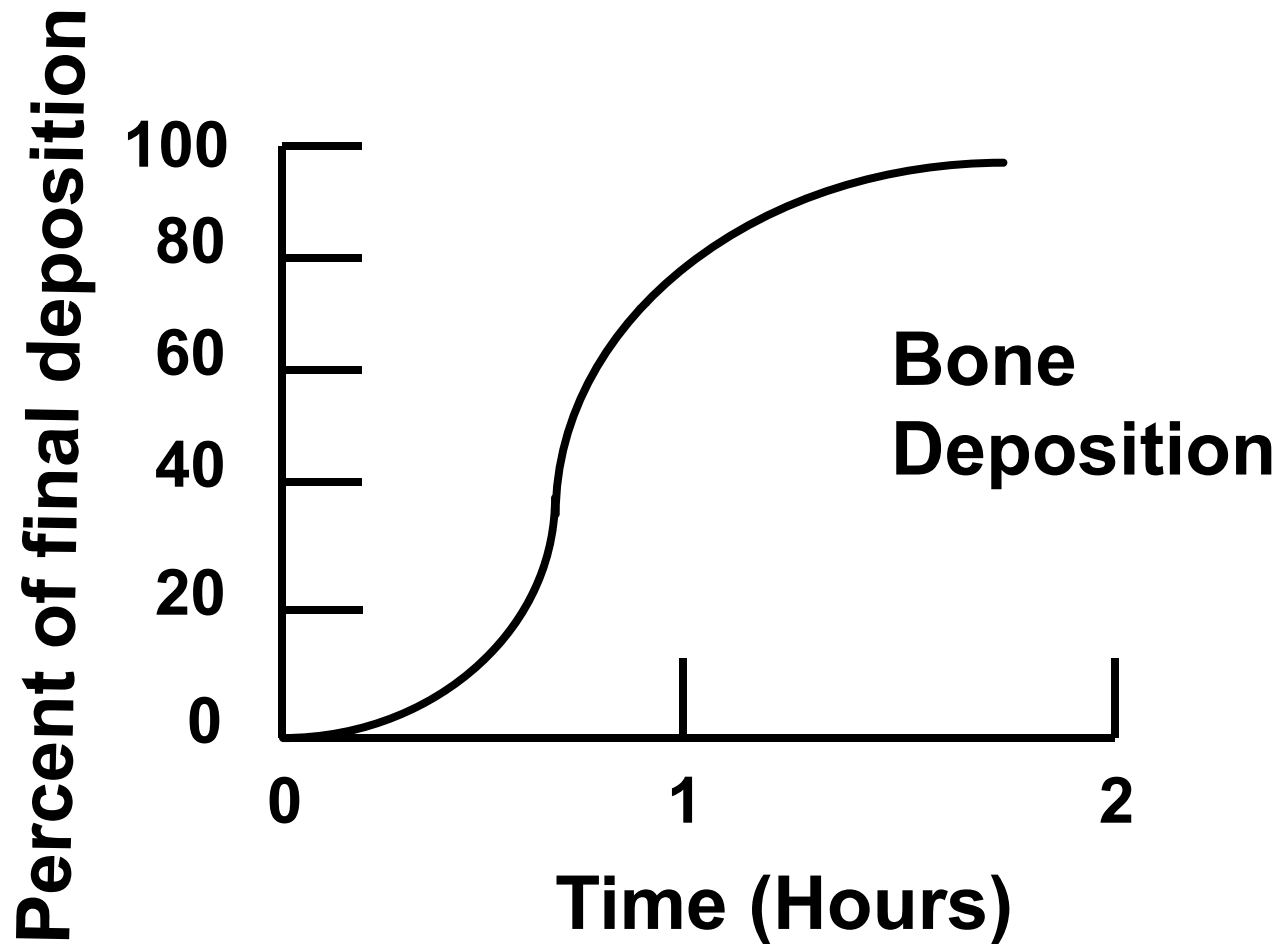
USE CALCIUM TO COMPETE WITH  
RADIOSTRONTIUM

USE STABLE IODIDE TO COMPETE WITH  
RADIOTECHNETIUM

# Chelate

- DTPA - Diethylenetriaminepentaacetic Acid
- EDTA - Versene
- BAL - Dimercaprol
- DFOA - Deferoxamine
- PCA - Penicillamine

# Uptake of Actinides Is Remarkably Rapid



# Prompt DTPA Treatment of $^{239}\text{Pu}$ Intake is Highly Effective

Retention (% of Uptake)

	Control	DTPA Treated
Liver	14.0	0.47
Skeleton	57.0	5.9



# How to Administer DTPA

- Direct IV injection of undiluted DTPA over 5-10 minutes.
- Aerosol: 1 gram undiluted in Bird respirator; inhalation takes 10-15 minutes.

# Common Medications that have Chelating Effects

- Anti-Inflammatory Drugs
  - Salicylates
  - Indocin
  - Aminopyrine
  - Tylenol
  - Butazolidin Group
- Steroids
  - Cortisone, Hydrocortisone, etc.
- Psychotropic Drugs
  - Chlorpromazine
  - Dilantin

# Common Medications that have Chelating Effects (cont.)

- Antimicrobial Drugs that Chelate
  - p-Aminosalicylic Acid Fe, Cu
  - Bacitracin Zn
  - Isoniazid Fe, Cu, Mn, Co
  - Kanamycin Ca
  - Neomycin Fe, Al
  - Novobiocin Mg
  - Penicillin Co
  - Polymyxin Mg, Mn, Ca, Fe
  - Streptomycin Mn
  - Tetracycline Fe, Mg, Mn, Mo, Al, Ca

# Uranium

PROBLEM: Chemical toxicity to kidney

## TREATMENT:

- Sodium bicarbonate to alkalinize urine
- May need renal dialysis until renal recovery from injury.

# Keep the Patient Busy!

- Cabbage for  $^{131}\text{I}$ ,  $^{99}\text{Mo}$ ,  $^{75}\text{Se}$
- Eggs for  $^{59}\text{Fe}$
- Soybean flour for  $^{65}\text{Zn}$ ,  $^{59}\text{Fe}$
- Stop Vitamin C for  $^{59}\text{Fe}$

# Common Drugs Useful

- Hygroton  $^{86}\text{Ru}$
- Phosphagel  $^{85}\text{Sr}, ^{90}\text{Sr}$
- Gaviscon  $^{85}\text{Sr}, ^{90}\text{Sr}$
- Neutraphos  $^{32}\text{P}$

# REMINDER

- Any decorporation therapy is a medical treatment, and so must be prescribed and administered by a qualified and licensed medical practitioner
- But don't be surprised if the practitioner asks you what to do