

# Iodine in Health and Civil Defense



24<sup>th</sup> Annual Meeting of  
Doctors for Disaster Preparedness  
at Portland State University  
August 6, 2006

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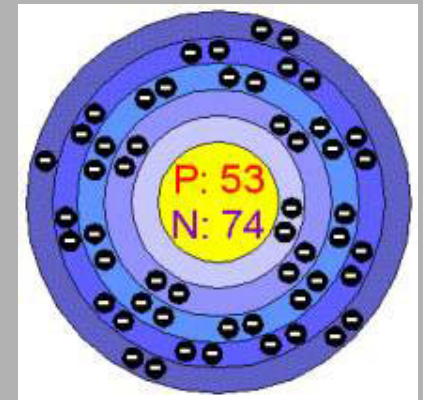
# Iodine in Heart Surgery



# Elements that Compose the Human Body

H																	He									
Li	Be											B	C	N	O	F	Ne									
Na	Mg											Al	Si	P	S	Cl	Ar									
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr									
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe									
Cs	Ba											Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra											Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub						
		La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu										
		Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr										

Periodic Table of Elements



Iodine atom

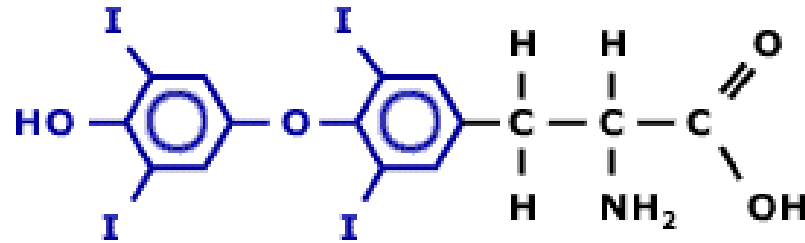


Napoleon

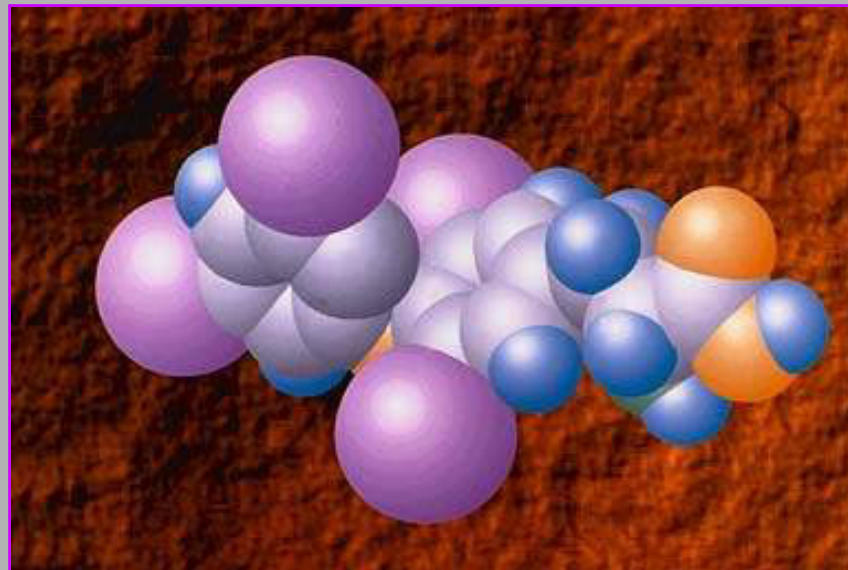


Nuclear Weapons

# Iodine in Thyroid Hormones



**3', 5', 3, 5-tetraiodothyronine  
thyroxine, T4**



# Actions of Triiodothyronine ( $T_3$ )

## ❖ Regulate cellular oxidation

- ✓ Calorigenesis
- ✓ Thermoregulation
- ✓ Intermediary Metabolism

## ❖ Necessary for protein synthesis

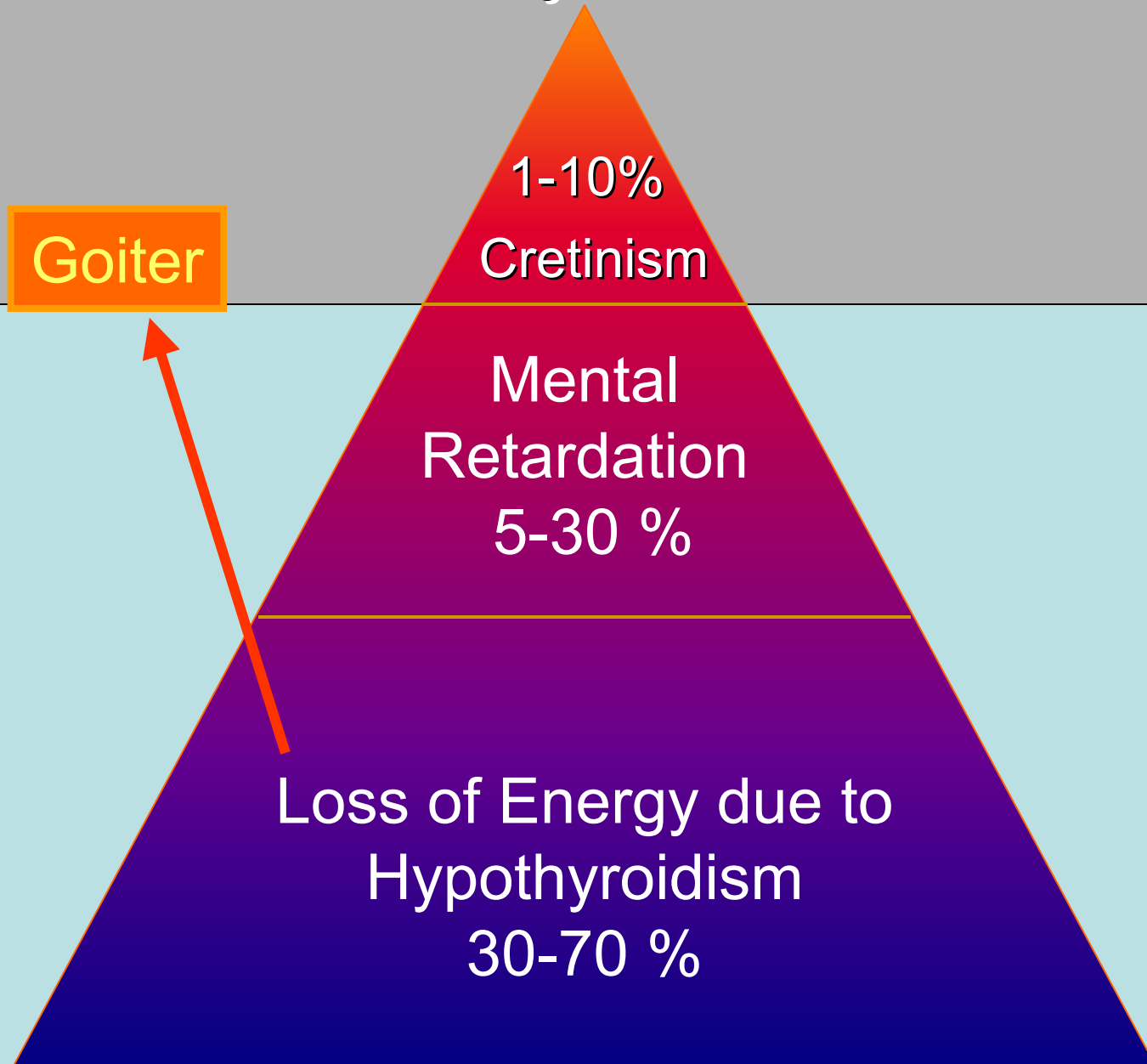
## ❖ Promotes

- ✓ Nitrogen retention
- ✓ Glycogenolysis
- ✓ Intestinal absorption of glucose and galactose
- ✓ Lipolysis
- ✓ Uptake of glucose by adipocytes

# Iodine Deficiency Disorders: Goiter

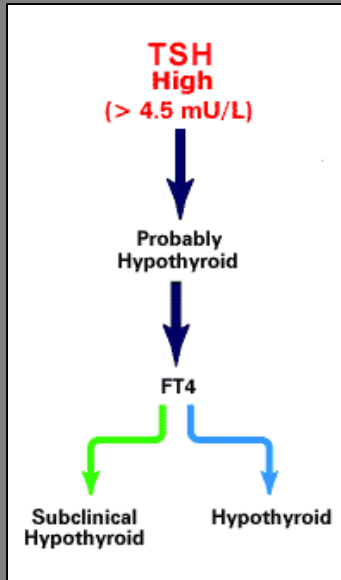


# Iodine Deficiency Disorder Iceberg





# Hypothyroidism



## ❖ Symptoms

- ✓ Fatigue (sluggishness)
- ✓ Mental impairment with decreased concentration and memory
- ✓ Depression
- ✓ Muscle aches – fibromyalgia
- ✓ Joint pains
- ✓ Constipation
- ✓ Decreased sexual energy
- ✓ Cold intolerance

## ❖ Signs

- ✓ Weight Gain
- ✓ Dry, cold (and thick) skin
- ✓ Fluid retention, myxedema
- ✓ Hair loss with dry hair
- ✓ Slow reflexes
- ✓ Hypothermia
- ✓ Manifestations of congestive heart failure

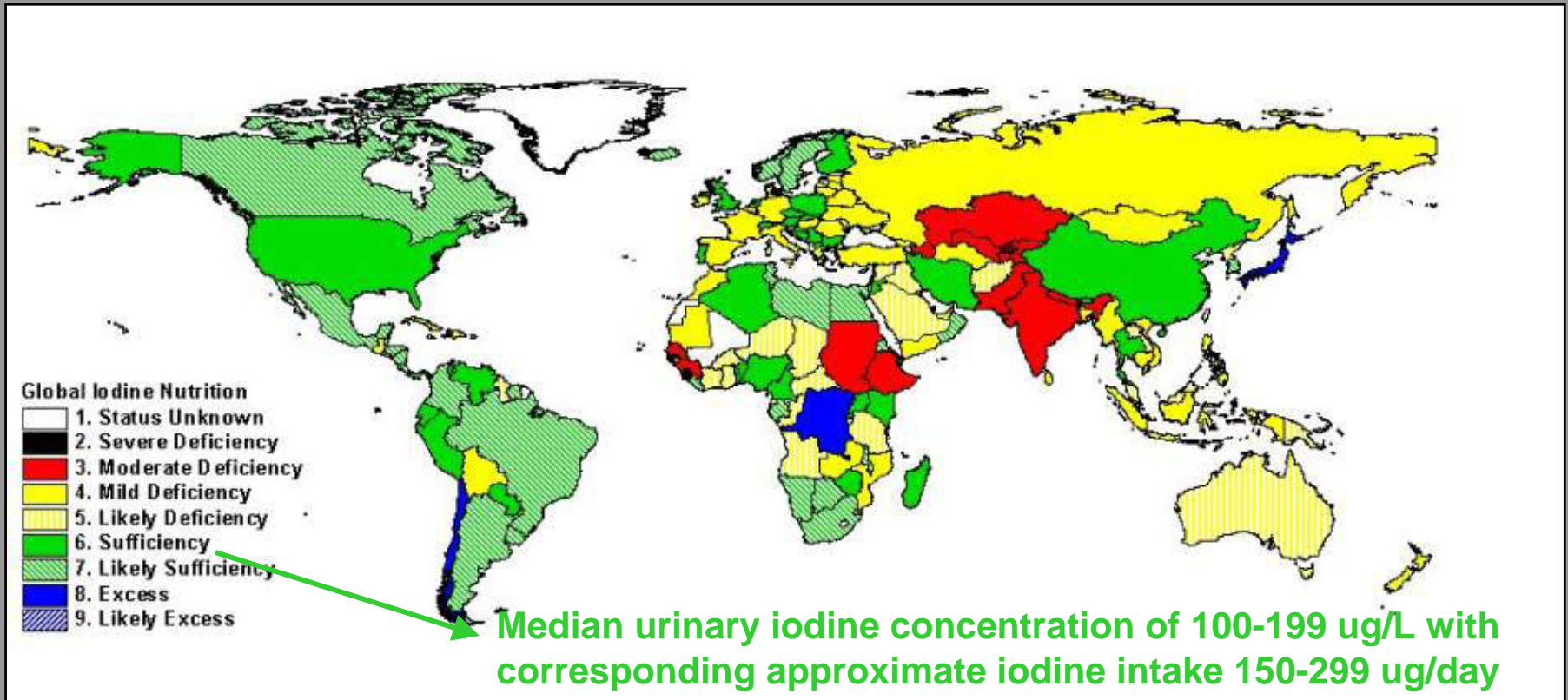
# Iodine Deficiency Disorders: Mental Retardation



# Iodine Deficiency Disorders: Cretinism



# Worldwide Iodine Nutrition



International Council for the Control of Iodine Deficiency Disorders.  
Current IDD Status Database, 2003

# Recommended Dietary Allowance (RDA) for Iodine

According to the AMA, NIH National Research Council, Joint UN FAO/WHO Expert Committee on Food Additives, and the EU IPCS

RDA: 100-150  $\mu\text{g}/\text{day}$



# Breast Cancer and Iodine

Startling ground-breaking  
new research shows  
how to prevent and how to  
*survive* breast cancer

*Dr. David M. Derry*  
*MD, PhD*

# Iodine Intake in Japan

**Table II**

**Annual change of intake of food by food groups in Japan**

(Except for the calories, all values below are expressed as gms / per capita / day)

Yrs.	1950	1952	1954	1956	1958	1960	1962	1963
Calories	2,098	2,109	2,074	2,092	2,118	2,096	2,080	2,083
Proteins								
Total	68	70	69	69.1	70.1	69.7	70.4	70.6
Animal	17	23	22	22.6	23.8	24.7	27.3	27.7
Vegetable	51	47	47	46.5	46.4	45.0	43.2	42.9
Fat	18	20	21	21.8	23.7	24.7	28.3	29.2
Carbohydrate	418	412	403	405	406	399	386	382
Sugars	7.2	14.5	15.6	15.6	12.3	12.3	13.4	14.0
Fats & Oils	2.6	3.9	4.6	5.1	5.7	6.1	7.6	8.1
Beans	53.7	68.4	68.2	72.7	71.0	71.2	70.8	69.4
Milk	6.8	10.2	12.5	19.4	22.0	29.5	35.9	38.8
Milk products		0.4	0.6	2.1	2.6	3.4	5.9	6.3
*Sea weeds (dry weight)	3.0	4.1	4.8	5.0	5.0	4.7	4.5	4.6

Iodine Intake 1950-1963:

**13.8 mg/per capita/day**

(average 4.5 gm seaweed a day. Measured Iodine content 0.3mg/gm)

Seaweed consumption in 2001:

14.6 gm (dry weight)

Iodine Intake 2001: **43.8 mg**

If Iodine content the same (was not measured)

*Nutrition in Japan, 1964. Nutrition Section, Bureau of Public Health, Ministry of Health and Welfare, Tokyo, Japan, March 1965*

# Iodine Intake in the United States

## Urinary iodine levels ( $\mu\text{g/L}$ ) in the United States, age 6-74

	NHANES I, 1971-74 <sup>1</sup>	NHANES III, 1988-91 <sup>1</sup>	NHANES 2000
Median	320	145	161
SE	0.6	0.3	0.7

Current Average Daily Intake of Iodine:  
**240  $\mu\text{g}$  (0.24 mg)**

Iodine Intake in 1970s:  
**480  $\mu\text{g}$  (0.48 mg)**

<sup>1</sup>Hollowell, JE et al. Iodine nutrition in the United States. Trends and public health implications: Iodine excretion data from National Health and Nutrition Examination Surveys I and III (1971-74 and 1988-94). J Clin Endocrinol Metab 83:3401-3408. 1998.



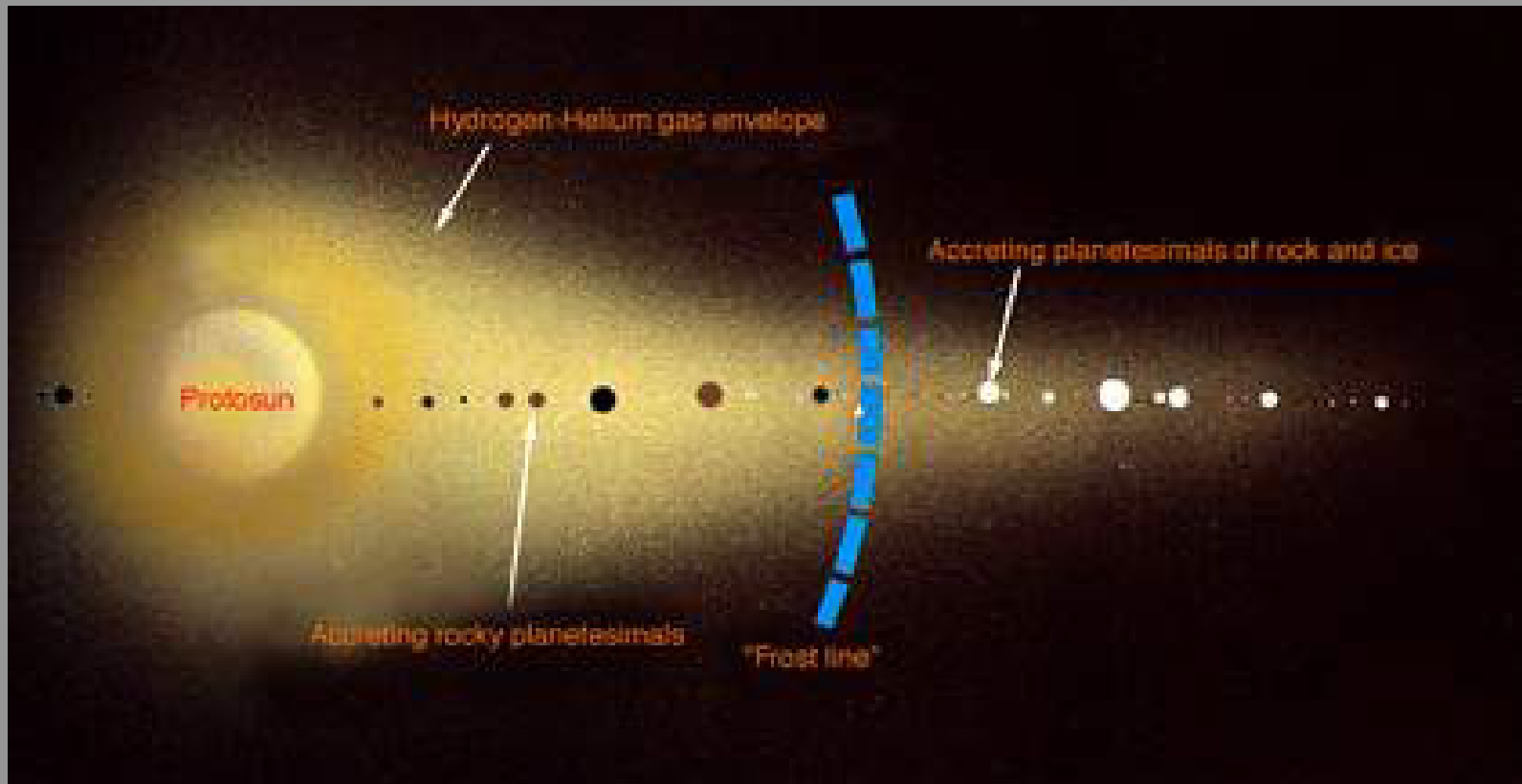
# Health Comparisons: United States and Japan

	United States	Japan
Incidence of Breast Cancer	Highest in World	Lowest
Life Expectancy	77.85 years (48 <sup>th</sup> /226 countries)	81.25 years (No. 6)
Infant Mortality Rate (deaths under age 1 per 1,000 live births)	7.0	3.5 (Lowest in World)

# Atmospheric and Evolutionary Importance of Iodine



# The Role of Iodine in the Formation of the Earth's Atmosphere



1<sup>st</sup> Atmosphere, 4.6 Ga: Hydrogen and Helium

From Solar Nebula → Stripped Off by Solar Wind

# Earth's 2<sup>nd</sup> Atmosphere, until 2.2 Ga

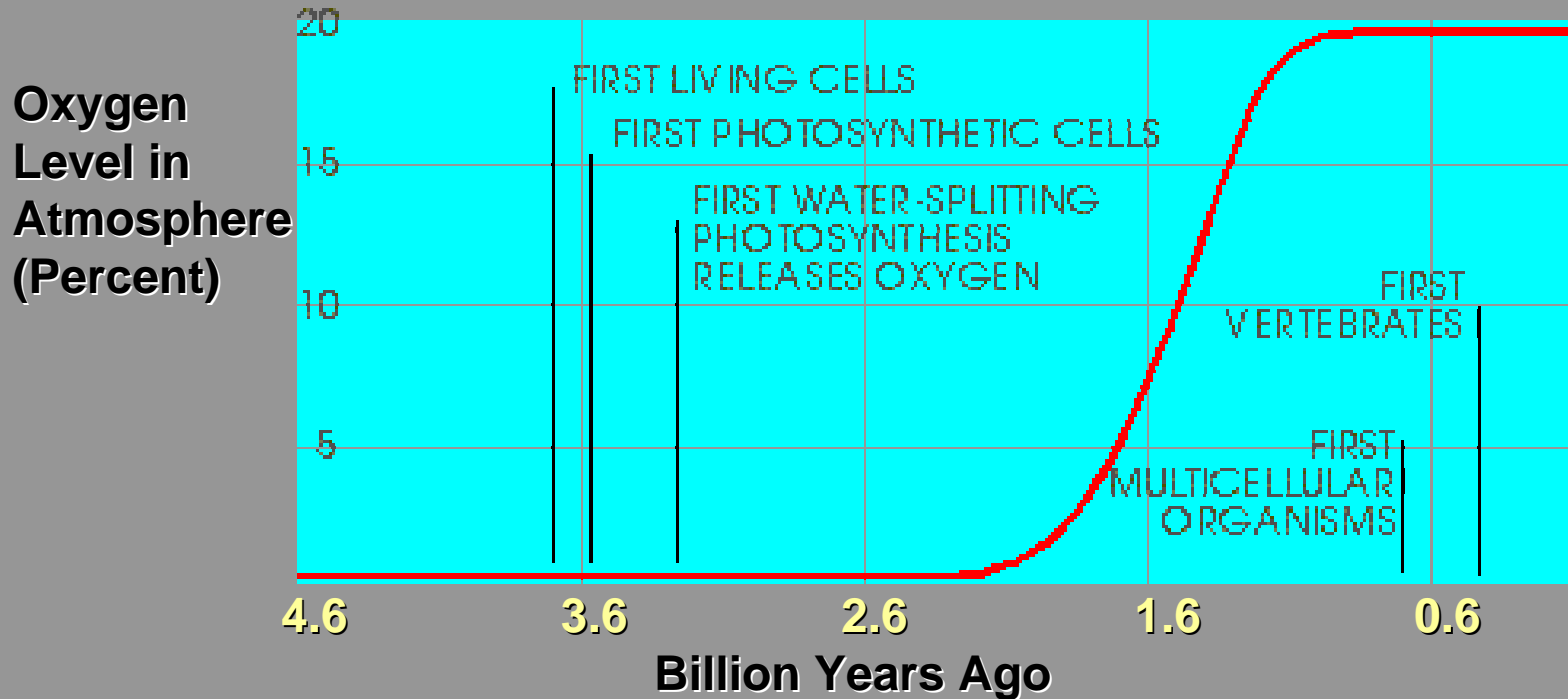
Formed from degassing of volcanoes

- H<sub>2</sub>O (water vapor), 50-60%
  - Oceans Formed from Condensation of Water Vapor
- CO<sub>2</sub> (carbon dioxide), 24%
- SO<sub>2</sub> (sulfur dioxide), 13%

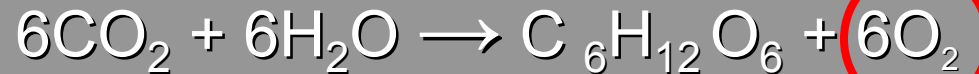
Transformed by bacterial  
**photosynthesis**



# The Earth's 3<sup>rd</sup> Atmosphere, from 2.2 Ga



Photosynthesis first done by **Cyanobacteria**:

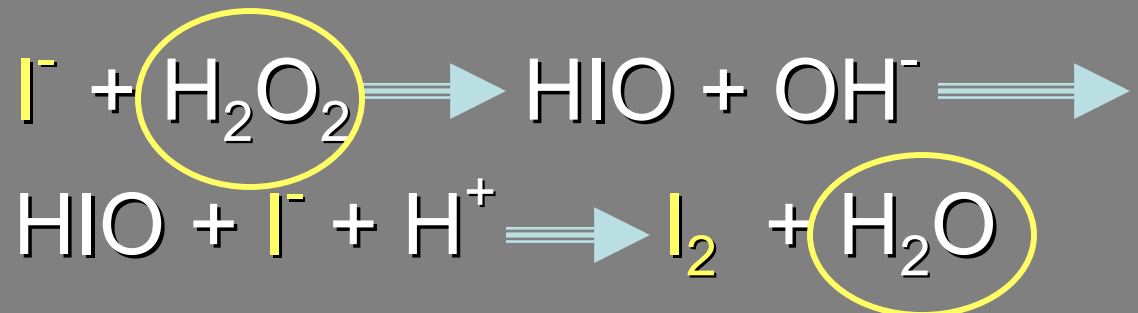
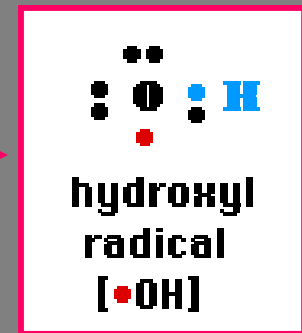
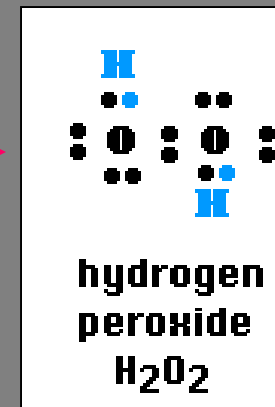
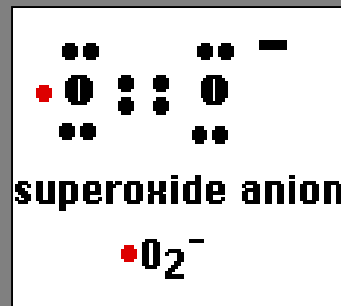


**Cyanobacteria** are also the first life forms to tolerate and use.....

**IODINE**

# Iodine as an Antioxidant

## Reactive Oxygen Species



Kupper FC, et al. Iodine uptake in Laminariales involves extracellular, haloperoxidase-mediated oxidation of iodide. *Planta* 1998;207:163-171.

# Cyanobacteria, 2.7 Ga to Present

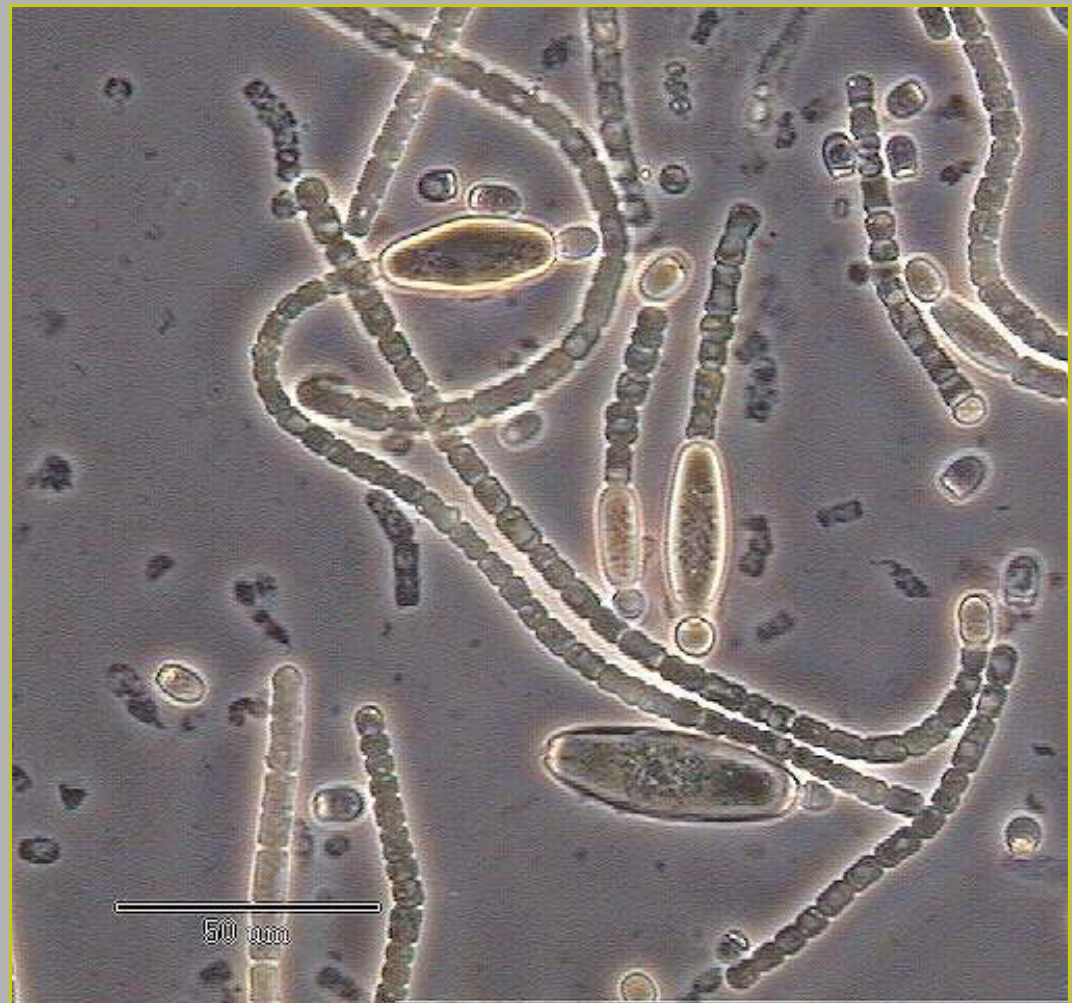
Stromatolites in  
Australia  
Containing  
Colonies of  
Cyanobacteria.



Shark Bay, Australia

# Cyanobacteria

Under the  
Microscope





# The Two Empires of Life

## Algae

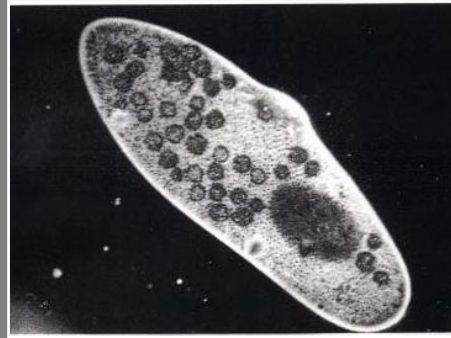
### Eukaryotes

Plants

Animals

Fungi

Protista (single-cell organisms)



Kelp, Seaweed, etc.

### Prokaryotes

Bacteria (Eubacteria)

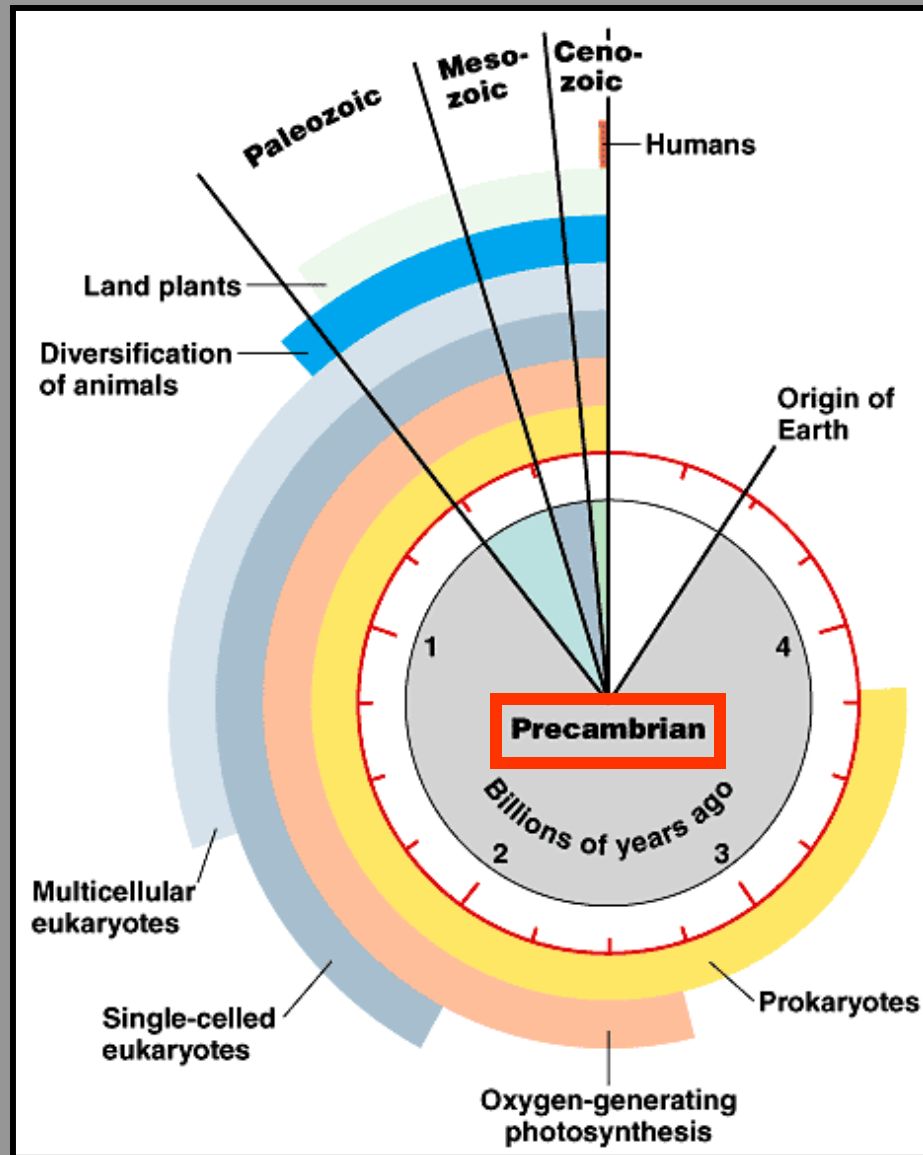
Cyanobacteria

Archaea (Archaeobacteria)



Blue Green Algae

# Evolution of Life on Earth



# Iodine in Salamanders

**Axolotl**



**Salamander**

Found in lakes near Mexico City. Grow up to 13 inches long.

# Iodine in Neanderthals

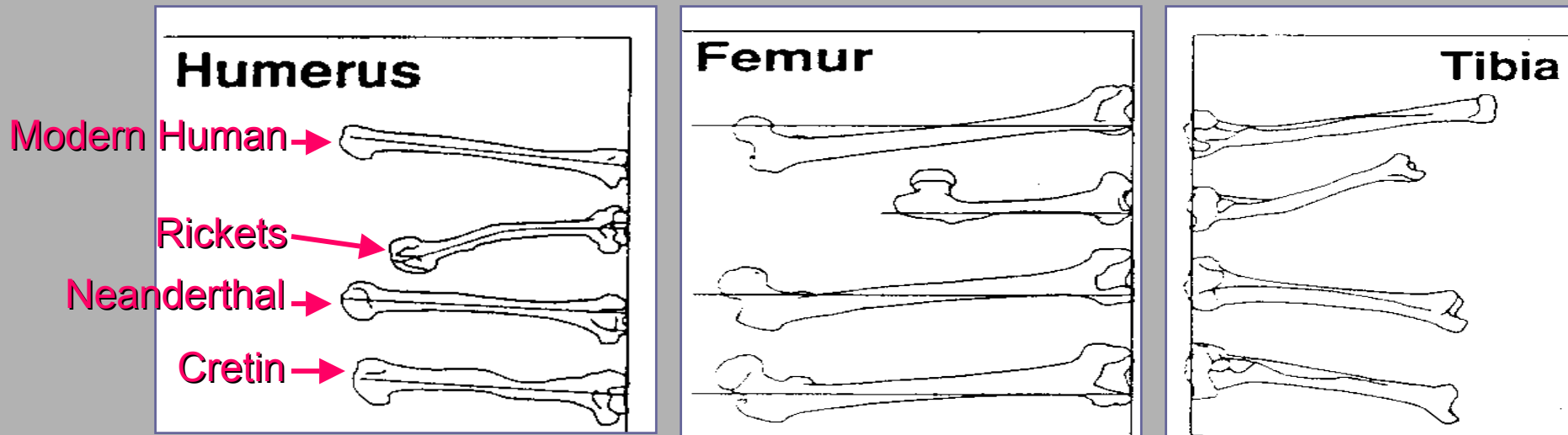


Neanderthal



Cretin

# Bone Morphology Comparisons Between Modern Humans, Neanderthals, and Cretins



Dobson JE. The Iodine Factor in Health and Evolution.  
*The Geographical Review* 1998;88(1):1-14.

# Similarities Among Skeletal Morphologies of Neanderthals and Cretins

Short stature and relatively long torso

Short Arms and Legs

Attachments indicating strong musculature

Heavy, thick-walled bones

Curved limb bones (especially the femur)

Large, deformed joints

Long pelvis, with large exterior diameter

Large long skull

Low flat forehead

Strong prominent bow ridges

Large, rounded orbits

Little chin, with wide massive jaw



# Function of Iodine in Humans and Other Animals

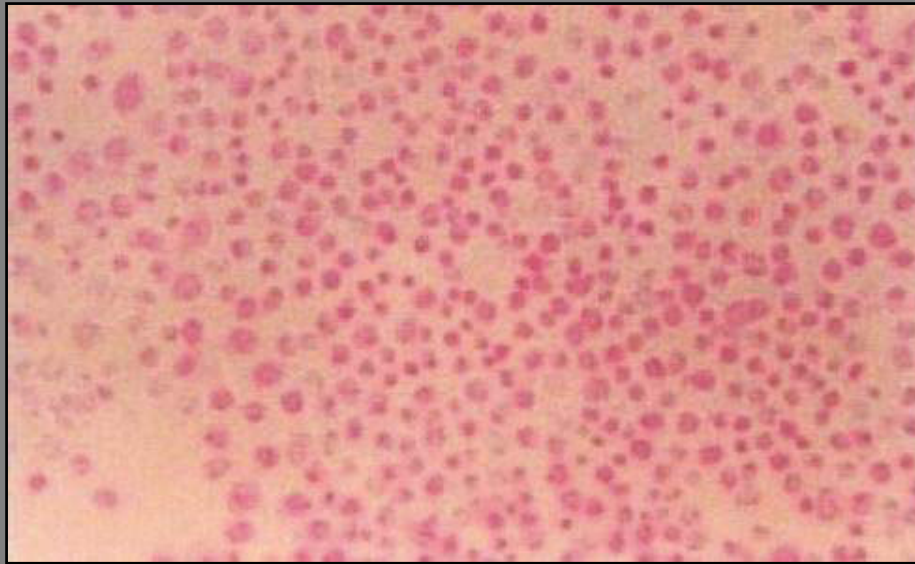
## Thyroidal -- Organic

- ❖ A Component of Thyroxine and T3

## Extrathyroidal -- Inorganic

- ❖ An Antioxidant
- ❖ Triggers Apoptosis
- ❖ Other
  - Detoxify chemicals and biological toxins
  - Anti-allergic, coat external proteins rendering them non allergic
  - Suppress auto-immunity
  - Strengthen immune system
  - Provide antiseptics in the stomach

# Iodine-Induced Apoptosis in Lung Cancer



Genetically Modified Lung Cancer Cells



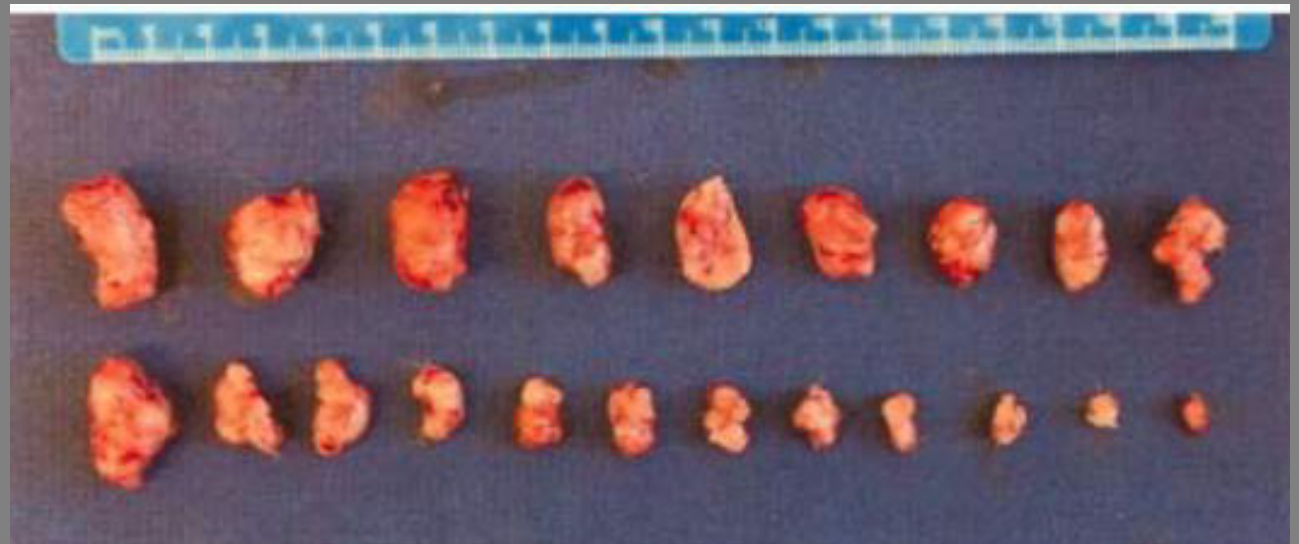
Parent (unmodified) Lung Cancer Cells

Zhang, L. et al. Nonradioactive Iodide Effectively Induces Apoptosis in Genetically Modified Lung Cancer Cells. *Cancer Research* 2003;63:5065-5072



# Effect of Iodine on Tumor Growth in Mice

Genetically Modified Tumor  
Xenograft Controls

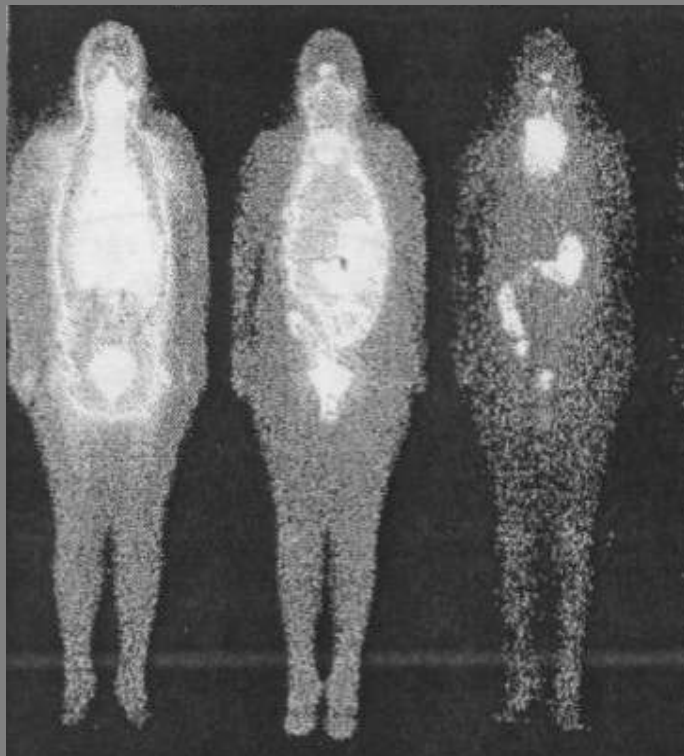


Genetically Modified Tumor  
Xenograft with Iodine

Zhang, L. et al. Nonradioactive Iodide Effectively Induces Apoptosis in Genetically Modified Lung Cancer Cells. *Cancer Research* 2003;63:5065-5072

# Organs with Iodine Concentrating Ability Via the Sodium/Iodine Symporter Pump

$^{125}\text{I}$  total-body scintiscans



30 min

6 hr

20 hr

Stomach Mucosa

Mammary Glands

Salivary Glands

Other: Ovaries

Thymus

Epidermis

Choroid Plexus

Articular, Arterial, and  
Skeletal Systems

Venturi s, et al. Role of Iodine in Evolution and Carcinogenesis of Thyroid, Breast and Stomach. *Adv Clin Path* 2000;4:11-17.

# The Reigning Truth on Iodine

1) Iodine is needed only by the thyroid gland for biosynthesis of thyroid hormones. A RDA of **100-150  $\mu\text{g}/\text{day}$**  for Iodine meets this need.

2) Daily intake of more than **1  $\text{mg}/\text{day}$**  of iodine is excessive and potentially harmful.

*When you seek a new path to truth,  
you must expect to find it blocked  
by expert opinion.*

Albert Guérard *Education of a Humanist*

# The Real Truth on Iodine

## Its Dose-Related Benefits

In microgram ( $\mu\text{g}$ )  
amounts:

For thyroid hormone

In milligram (mg)  
amounts:

Achieve optimal health

Prevent (and treat) fibrocystic  
disease of the breast

Prevent (and treat) cancer

Civil Defense

In gram (g)  
amounts:

Treat multiple diseases:  
dermatologic, pulmonary,  
cardiovascular, fungal

# Different Kinds of Iodine

- ❖ Inorganic, Nonradioactive ( $^{127}\text{I}$ )
  - KI, SSKI, Lugol's Solution, Iodoral,
  - Tincture of Iodine, Povidone-Iodine)
- ❖ Organic
  - Endogenous
    - Thyroid hormones
  - Synthetic
    - Amiodarone
    - Radiocontrast media
      - Iopanoic acid, Meglumine Iotroxate, Propylidone, etc.
- ❖ (Inorganic) Radioactive Isotopes

# Forms of Inorganic, Nonradioactive Iodine

- **KI** (Potassium Iodide)
  - A 130 mg tablet contains 100 mg of iodide
- **SSKI** (Saturated Solution of Potassium Iodide)
  - 38 mg/drop iodide (760 mg/ml)
    - 19 mg/drop in Tahoma Clinic's SSKI Tri-Quench
- **Lugol's Solution** -- 5% iodine ( $I_2$ ) and 10% KI
  - 6.5 mg/drop blend of iodine and iodide (130 mg/ml)
- **Iodorol** -- 5% iodine and 10% KI
  - One tablet = 12.5 mg blend of iodine and iodide

# Iodine Poisoning

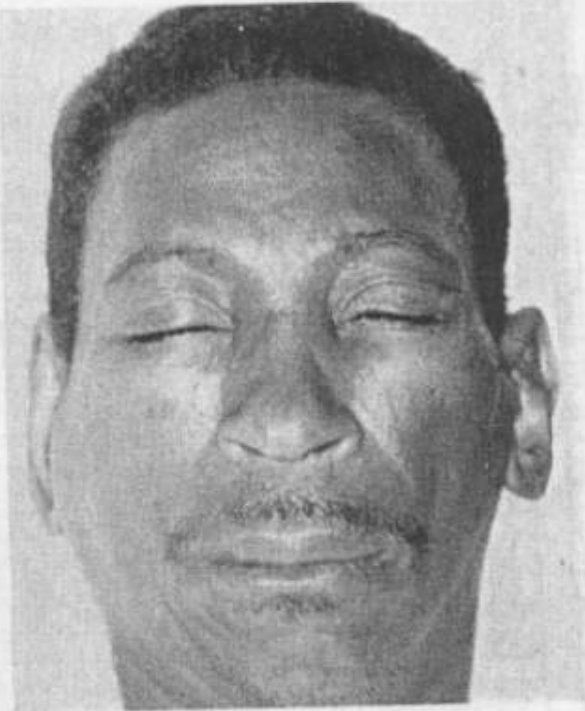


Fig 1.—Patient displaying manifestations of acute iodide intoxication with periorbital and nasal mucosal edema and enlargement of salivary glands.

Ingested **15 gm** of Iodine – **100,000 x** the RDA of 0.00015 gm (150  $\mu$ g)

Serum Iodide level was **2,950  $\mu$ g/dL** (normal is 3.5  $\mu$ g/dL with daily intake of 150  $\mu$ g Iodine)

Salivary Iodide Level **60,000  $\mu$ g/dL** (normal 105  $\mu$ g/dL)



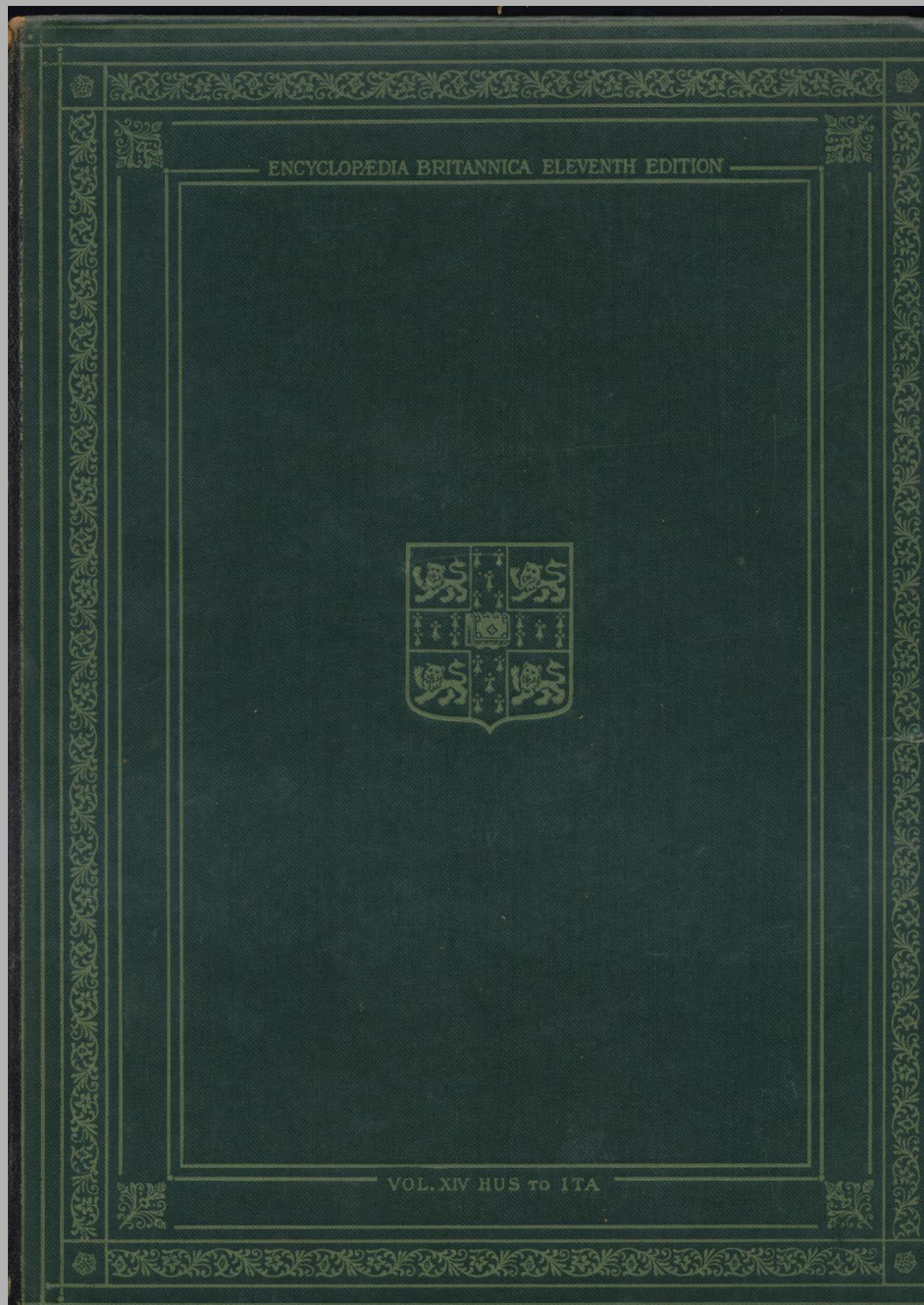
# Albert Szent-Györgyi (1893-1986)



In 1937, when awarded the Noble Prize for discovering vitamin C



In 1983, at the Marine Biological Laboratory, Woods Hole, MA



Encyclopedia Britannica  
Eleventh Edition  
1911

Volume XIV  
Hus to Ita

# Iodine in Dermatology

**Table I.** Reported uses for potassium iodide

## Infectious

- Cutaneous cryptococcosis<sup>31</sup>
- Entomophthoramycosis (caused by *Basidiobolus* and *Conidiobolus* fungi)<sup>27,28</sup>
- Human pythiosis (caused by *Pythium insidiosum* fungus)<sup>29</sup>
- Lymphocutaneous *Nocardia brasiliensis*<sup>30</sup>
- Sporotrichosis (fixed cutaneous and lymphocutaneous)<sup>5,23-26</sup>

## Neutrophilic dermatoses

- Pyoderma gangrenosum<sup>18</sup>
- Sweet's syndrome<sup>1,15,17</sup>

## Panniculitis

- Erythema nodosum<sup>1,14,15</sup>
- Nodular vasculitis<sup>1,14,15</sup>
- Subacute nodular migratory panniculitis<sup>16</sup>

## Miscellaneous

- Behçet's syndrome<sup>1,15</sup>
- Erythema multiforme<sup>1,15</sup>
- Wegener's granulomatosis<sup>19</sup>



Sporotrichosis



Pyoderma  
Gangrenosum

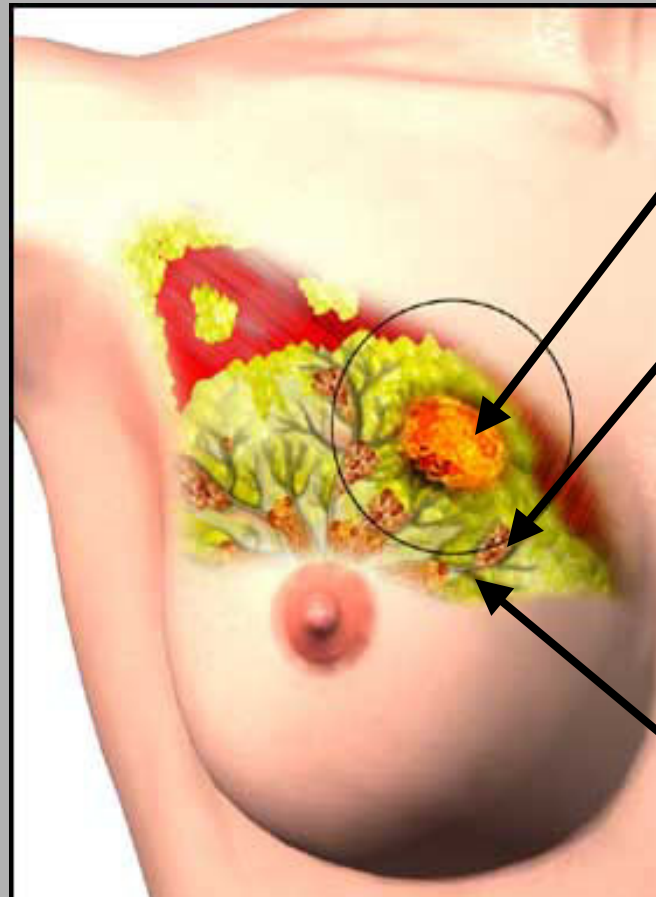


Nodular  
Vasculitis

Sterling JB, Heymann WR. Potassium Iodide In Dermatology: A 19<sup>th</sup> Century Drug for the 21<sup>st</sup> Century—Uses, Pharmacology, Adverse Effects, and Contraindications. *J Am Acad Dermatol* 2000;43:691-697.

# Fibrocystic Breast Disease

Elemental  
Iodine,  $I_2$ , more  
effective than  
Iodide,  $I^-$



Cyst

Fibrous  
tissue

Epithelial  
and  
apocrine  
hyperplasia

Ghent WR, Eskin BA, Low DA, Hill LP. Iodine Replacement in Fibrocystic Disease of the Breast. *Can J Surg* 1993;36:453-460.

# Diatomic Iodine (I<sub>2</sub>) Treatment for Fibrocystic Disease

Special Report of Efficacy and Safety Results  
(Submitted to FDA 21 March 1995)

**Table F. Analysis of Total Breast Examination Score**

Comparison Groups	Mean Changes from Baseline	p-values*
Iodine vs. Placebo	-23.9 vs. -2.6	<0.001
Iodine (C) vs. Placebo (C)	-29.1 vs. -2.6	<0.001
Iodine (C) vs. Iodine (I)	-29.1 vs. -18.7	0.01
Iodine (I) vs. Placebo (C)	-18.7 vs. -2.6	<0.001
Placebo (C) vs. Placebo (I)	-2.6 vs. -2.7	0.99

\* F test

C: Compliant Patients

I: Patients with Treatment Interruptions

The Virginia Mason Randomized Controlled Trial  
Report sponsored by Mimetix, Inc.

# Iodine Prevents Breast Cancer

## Animal Studies

Reduces incidence in rats given carcinogens

## Human Studies

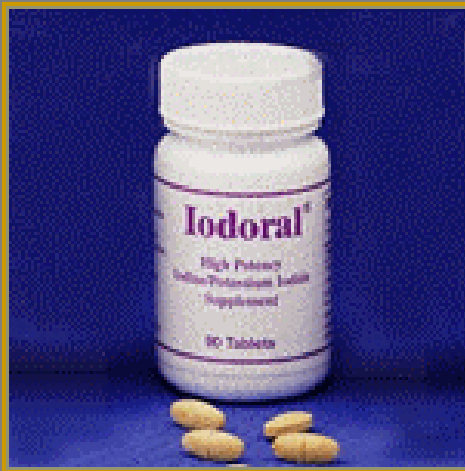
Kills cancer cells grown *in vitro*

Absorbed by cancer-prone ductal epithelium

## Epidemiological Studies

Increased incidence with goiter

Lower incidence in people who eat seaweed and fish



# The Iodine Project

**Hypothesis:** Whole body sufficiency of iodine requires mg (12.5 mg), not  $\mu\text{g}$  (150  $\mu\text{g}$ ) daily amounts

## Principle Investigators

Guy Abraham MD, 1997: Optimox Corp., Torrance, CA

Jorge Flechas MD, 2000 (1,000 pts.): Flechas Family Practice, Hendersonville, NC

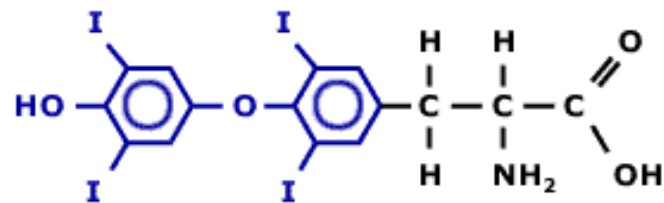
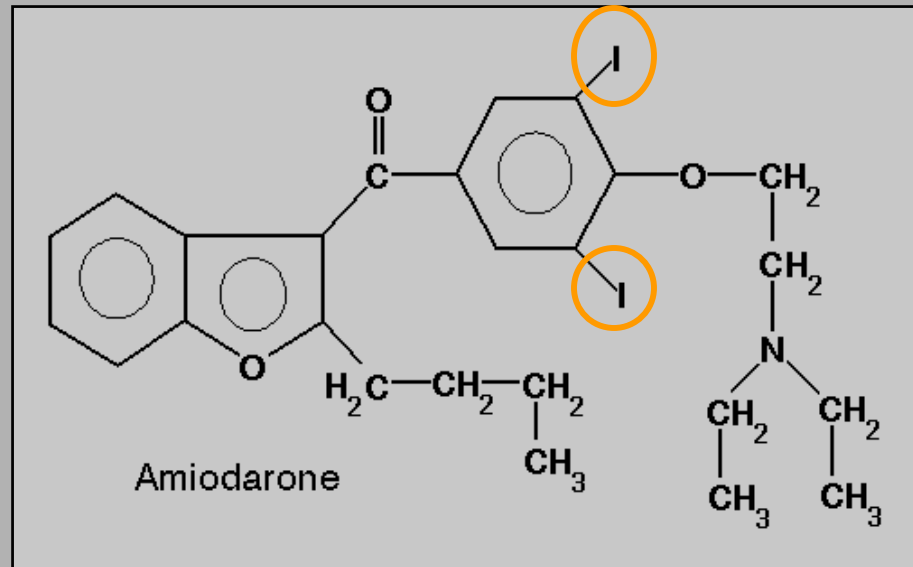
David Brownstein MD, 2003 (3,000 pts.): Center for Holistic Medicine, West Bloomfield, MI

## Iodine Loading Test

Take 50 mg iodine, urine collected for 24 hours

Less than 90 % excretion indicates iodine insufficiency

# Amiodarone



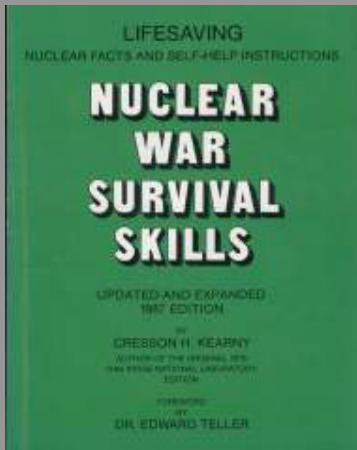
3', 5', 3, 5-tetraiodothyronine  
thyroxine, T4



# Isotopes of Iodine

<u>Isotope</u>	<u>Half Life</u>	<u>How Made</u>	<u>Radioactivity</u>	<u>As Radiotracer</u>	<u>Radiotherapy</u>
<b>123</b>	13 hours	Cyclotron	<b>Gamma rays</b>	SPECT scans for Thyroid	-----
<b>124</b>	4.2 days	Cyclotron	<b>Beta positrons</b>	PET scans	-----
<b>125</b>	60 days	Cyclotron	<b>Gamma rays</b>	Immunoassy	<b>Brachytherapy for prostate cancer</b>
<b>127</b>	Stable	Naturally Occurring	None	-----	-----
<b>131</b>	8 days	Nuclear Fission	<b>Beta electrons</b> <b>Gamma rays</b>	Thyroid scans Other imaging	<b>Hyperthyroidism</b> <b>Thyroid cancer</b> <b>Hodgkin's lymphoma</b>

# Iodine in Civil Defense



Trans-Pacific  
Radioactive  
Fallout after a  
Chinese 300-  
Kiloton  
Atmospheric  
Nuclear Explosion  
at their Test Site  
near Lop Nor in  
1966

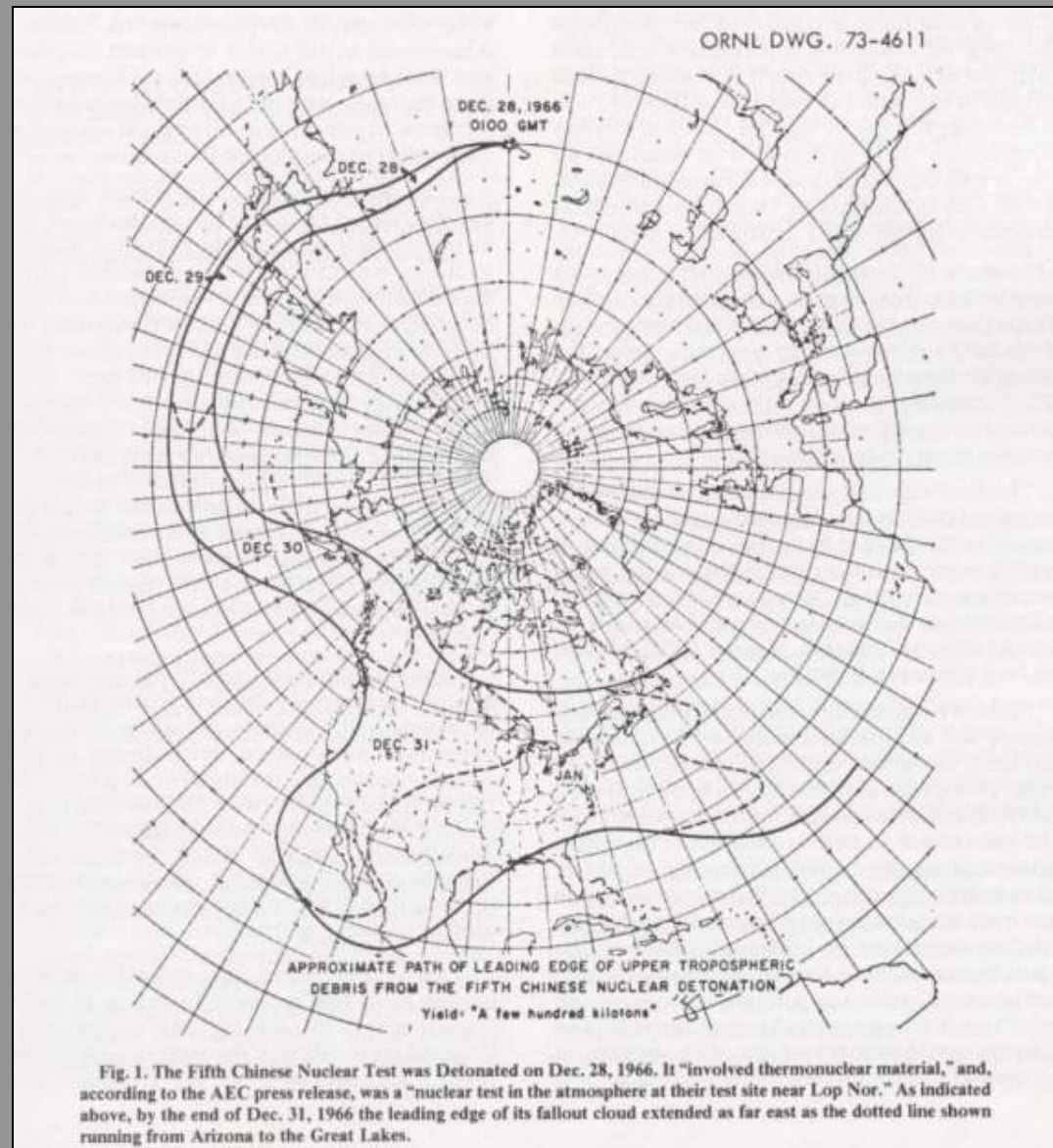
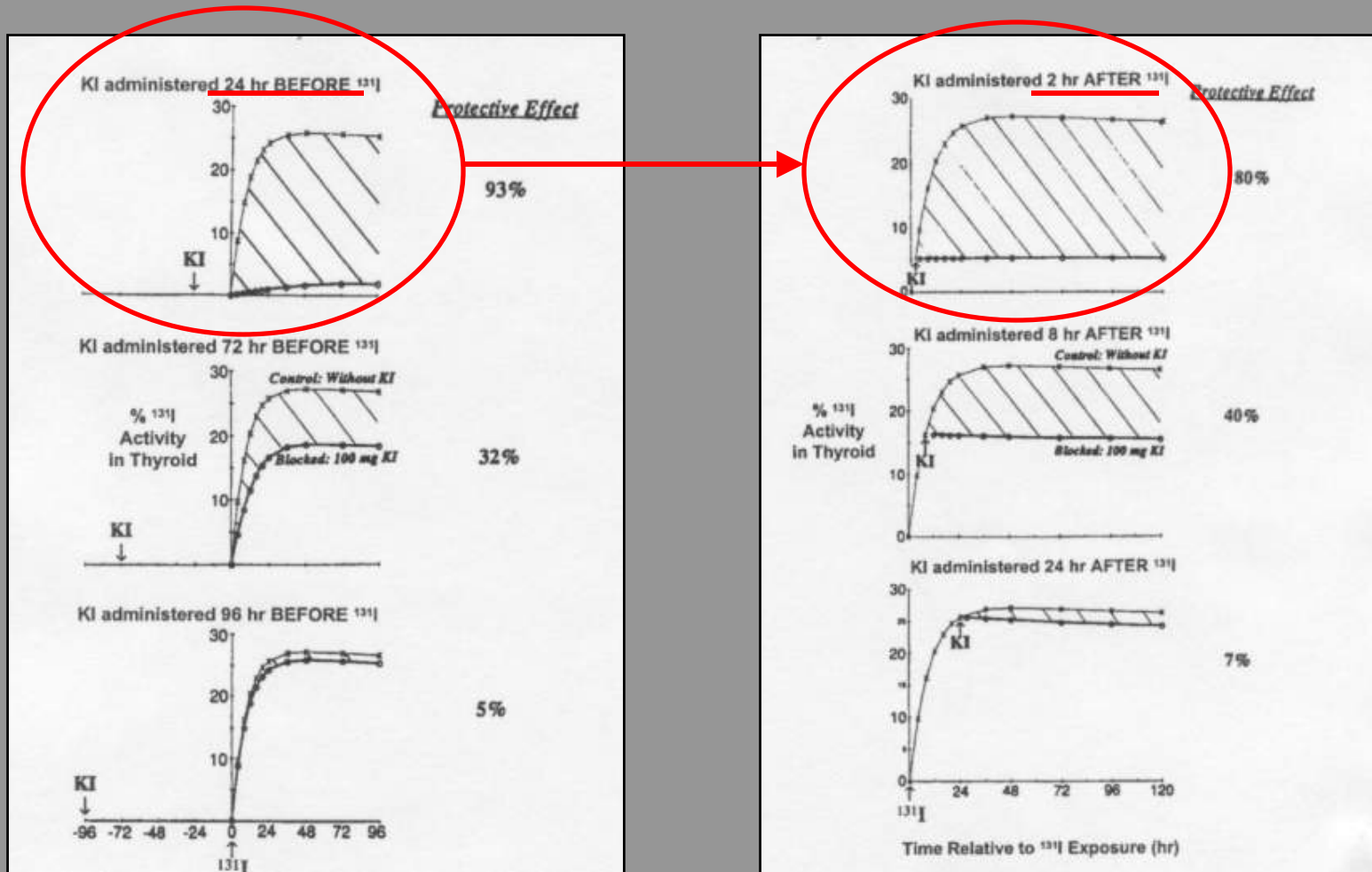


Fig. 1. The Fifth Chinese Nuclear Test was Detonated on Dec. 28, 1966. It "involved thermonuclear material," and, according to the AEC press release, was a "nuclear test in the atmosphere at their test site near Lop Nor." As indicated above, by the end of Dec. 31, 1966 the leading edge of its fallout cloud extended as far east as the dotted line shown running from Arizona to the Great Lakes.

# KI Blockade of Thyroid Irradiation by $^{131}\text{I}$



Zanzonico PB, Becker DV. Effects of Time of Administration and Dietary Iodine Levels on Potassium Iodide (KI) Blockade of Thyroid Irradiation by  $^{131}\text{I}$  from Radioactive Fallout. *Health Physics* 2000;78(6):660-667



[www.nukalert.com](http://www.nukalert.com)

[www.radmeters4u.com](http://www.radmeters4u.com)



# OF CHIRPS	R/hr	TIME TO 100R EXP
1	0.1	41.6 d
2	0.2	20.8 d
3	0.4	10.4 d
4	0.8	5.2 d
5	1.6	2.6 d
6	3.2	1.3 d
7	6.4	15.6 h
8	12.8	7.8 h
9	25.6	3.9 h
10	50+	< 2.0 h



# Chernobyl April 26, 1986



# Sound Science and Iodine

## Then -- 2 centuries ago

1779: The Coventry Remedy: Burnt sponge for goiter

1811: Iodine discovered (Bernard Courtois)

1816: Sea sponge found to contain high quantities of Iodine (Andrew Fyfe)

1819: Tincture of Iodine shrinks goiter (Jean Coindet)

## Now

Thyroid-centered Consensus view on Iodine intake,  
limited to 100-150 ug/day

Endocrinologists decree Iodine >1 mg/day is excessive

1993 study showing that Iodine in mg doses cures  
fibrocystic disease of the breast ignored



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# Io-Gen

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“Symbollon is enrolling patients in a national multi-center, placebo-controlled, double-blinded, randomized Phase III clinical trial for the treatment of moderate or severe breast pain associated with fibrocystic breast disease. The trial drug, IoGen, may help relieve breast pain. The study has been registered with FDA under the Protocol Registration System at [ClinicalTrials.gov](https://clinicaltrials.gov).”

# Health Benefits of mg-Dose Iodine at 100x the RDA

- ❖ Feel Healthier
  - ✓ Sense of Well-Being
  - ✓ Lifting of Brain Fog
  - ✓ Increased Energy - Achieve More in Less Time
- ❖ Feel Warmer in Cold Environments
- ❖ Need Less Sleep
- ❖ Regular Bowel Movements
- ❖ Improved Skin Complexion
- ❖ Strengthens Immune System
- ❖ Prevents Cancer
- ❖ Blocks  $^{131}\text{I}$  Absorption from Radioactive Fallout



