

# **BIOLOGICAL EFFECTS OF RADIATION**

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# Beneficial Effects of Exposure to Radiation

## Low-level radiation

- Cellular Rejuvenation
- Stress
  
- Suppression of diseases
  - Diabetes
  - Hypertension
  - Cancer
  
- $1 \text{ Gy} = 100 \text{ rad}$

Courtesy of Dr. Sadao Hattori



# PROOF- RESEARCH ON RADIATION HORMESIS

## Hiroshima and Nagasaki:

- Low dose of radiation
- Suppression of Leukemia

## Radiation in Spas:

- Misasa Villages
- Higher Levels of Radon
- Suppression of Cancer

## Treatment of Cancer:

- Tohoku University
- 10 cGy 3 times per week
- Suppression of disease



# PROOF CONTINUED...

## Rejuvenation of Cells:

- 25 to 50 cGy
- Cells rejuvenated for up to six weeks because of increase of certain enzymes

## Moderation of Stress:

- 10 days of 5 to 10 cGy for male mice
- Moderation in response from central nervous system = less stress

## Repairing of genes:

- 10 to 25 cGy doses
- Production of p53 protein
- Enhanced gene repairing activities



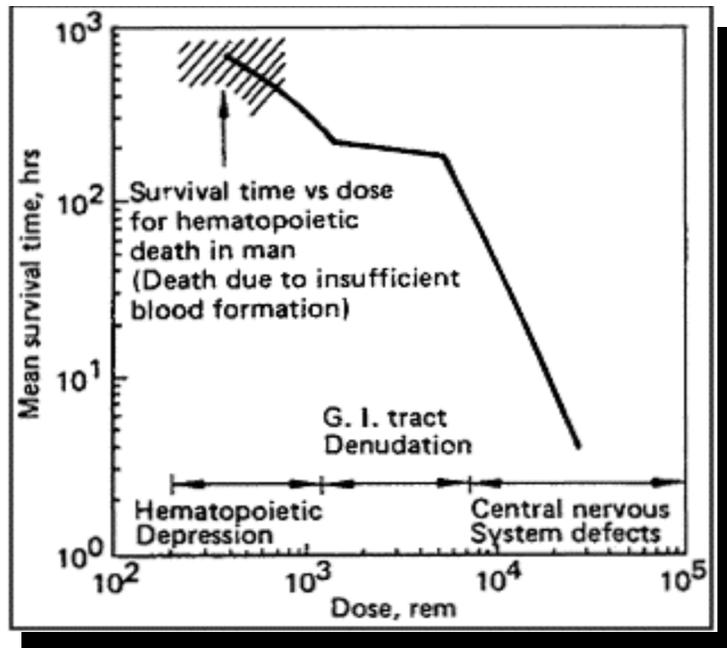
# LEVELS OF RADIATION

1 Gy = 1 Sv (sievert)

Chest X-ray	0.1 mSv
Average background exposure in one year	3 mSv
Abdominal X-ray	4 mSv
Living on the Colorado Plateau for one year	4.5 mSv
Typical yearly dose for a uranium miner	5-10 mSv
Full-body CT scan	10 mSv
Lowest dose for any statistical risk of cancer	50 mSv
Mild radiation sickness (headache, risk of infection)	0.5-1 Sv
Light radiation poisoning (mild to moderate nausea, fatigue, 10% risk of death after 30 days)	1-2 Sv
Severe radiation poisoning (vomiting, hair loss, permanent sterility, 35% risk of death after 30 days)	2-3 Sv
Severe radiation poisoning (bleeding in mouth and under skin, 50% risk of death after 30 days)	3-4 Sv
Acute radiation poisoning (60% fatality risk after 30 days)	4-6 Sv
Acute radiation poisoning (bone marrow destroyed, nearly 100% fatality after 14 days)	6-10 Sv
Acute radiation poisoning (symptoms appear within 30 minutes, massive diarrhea, internal bleeding, delirium, coma)	10-50 Sv
Coma in seconds or minutes, death within hours	50-80 Sv
Instant death*	>80 Sv

# DETRIMENTAL EFFECT OF RADIATION

# ACUTE RADIATION SYNDROME



## Causes:

- High Radiation (>0.7 Gy)
- Radiation reaches internal organ

## Symptoms:

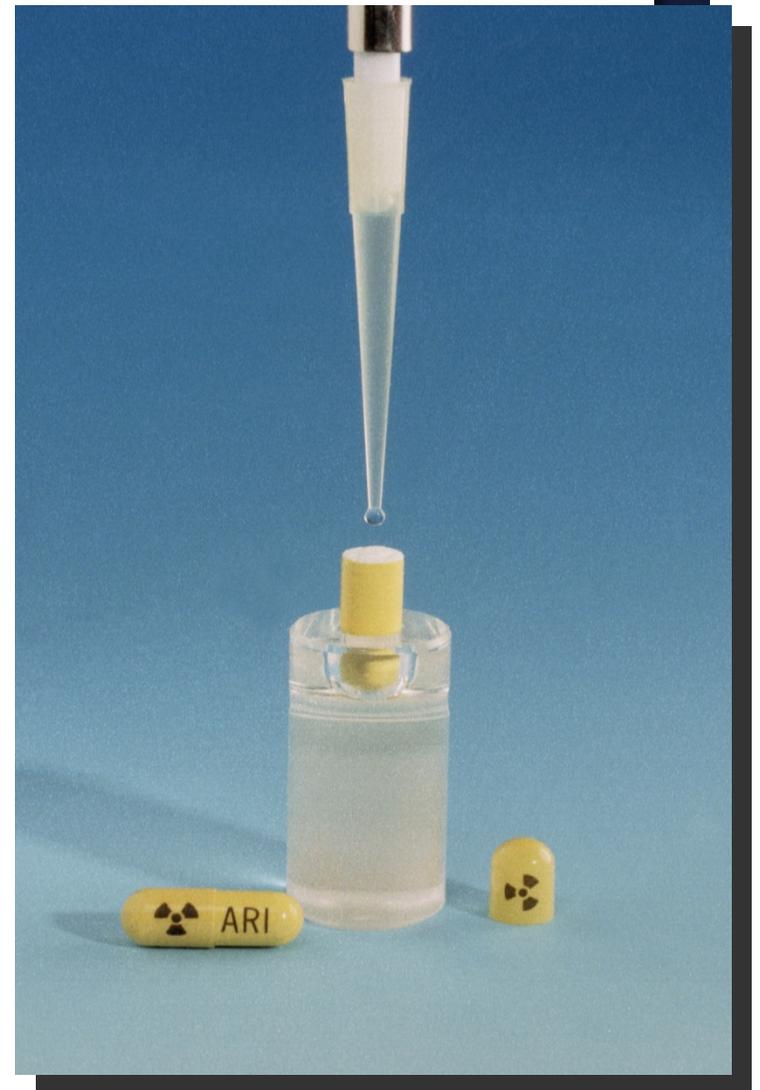
- Skin damage
- Nausea, vomiting, hair-loss

## Three Different Syndromes:

- Bone Marrow, Gastrointestinal, and Cardiovascular.

# IODINE-131

- Milk Products
  - Children
- Thyroid Gland
  - Hyperthyroidism
  - Grave's Disease

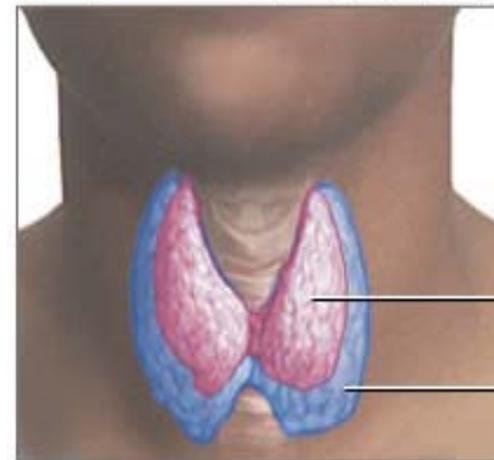


# GRAVE'S DISEASE

- Thyroid Gland Inflammation
  - Auto-antibodies (TSHR-Ab)
- Type: auto-immune disease
- Scientific Research
  - Research for Cures
  - Current Treatment



Exophthalmos (bulging eyes)



Diffuse goiter

Graves' disease is a common cause of hyperthyroidism, an over-production of thyroid hormone, which causes enlargement of the thyroid and other symptoms such as exophthalmos, heat intolerance and anxiety

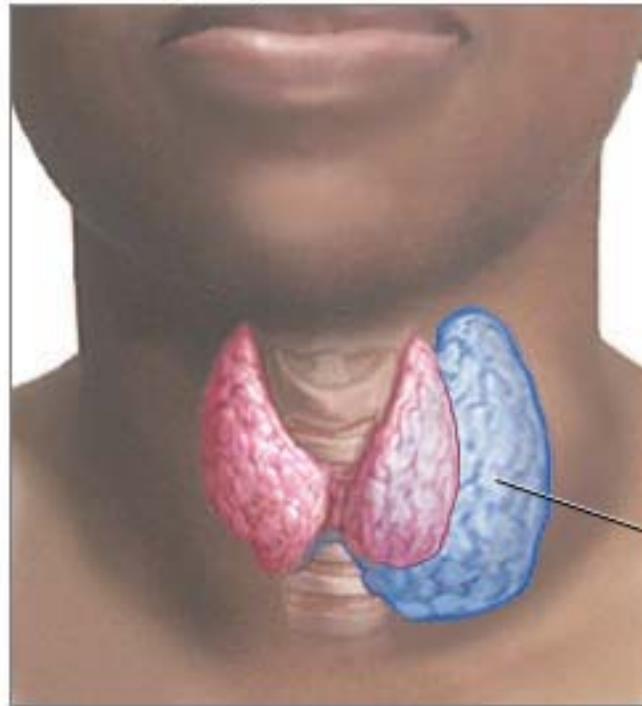
Normal thyroid

Enlarged thyroid

# THYROTOXICOSIS (HYPERTHYROIDISM)

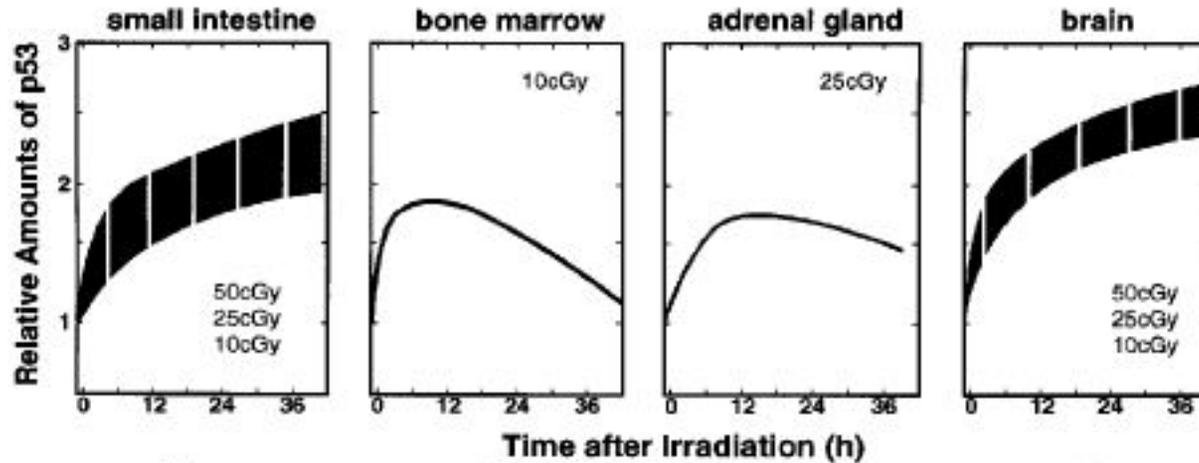
- Overactive Thyroid
  - Increased hormone secretion
  - Sometimes lethal
- Increased Metabolism Rate
  - Blood-sugar level
- Symptoms:
  - Fatigue
  - Heat Intolerance
  - Increased Appetite

Hyperthyroidism caused  
by thyroid adenoma



Hyperfunctioning  
thyroid (goiter)

# P53 GENE



## Information

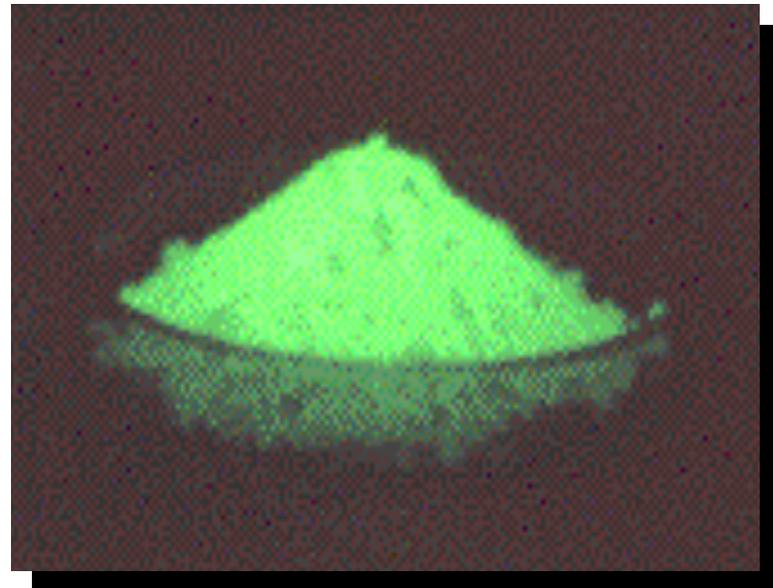
- Maintains cell growth
- Increased agitation leads to cell disintegration

## Japan incident

- Increased p53
- In small intestine and brain

# CESIUM 137

- Affects the muscles, kidneys, liver, bones, lymph nodes and blood.
- Catalyst for Cancer
  - Effects 9x greater than that of iodine-131.
- Children: Heart Attack
  - Myocardial muscle
- Creation of "free radicals"
  - Alters genetic code



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