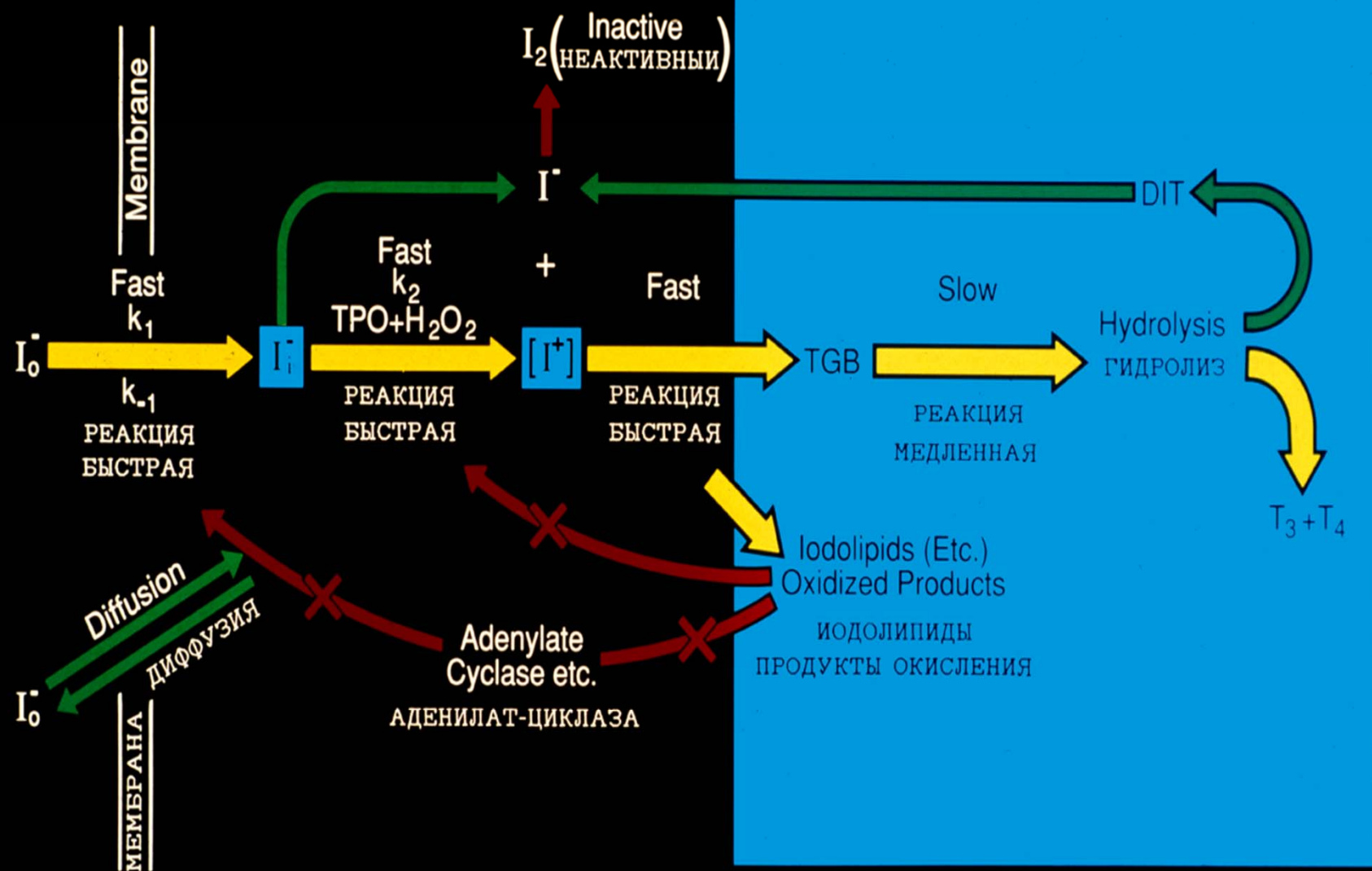


POTASSIUM IODIDE – MECHANISM OF ACTION

J. Wolff MD, PhD
NIH (Emeritus)



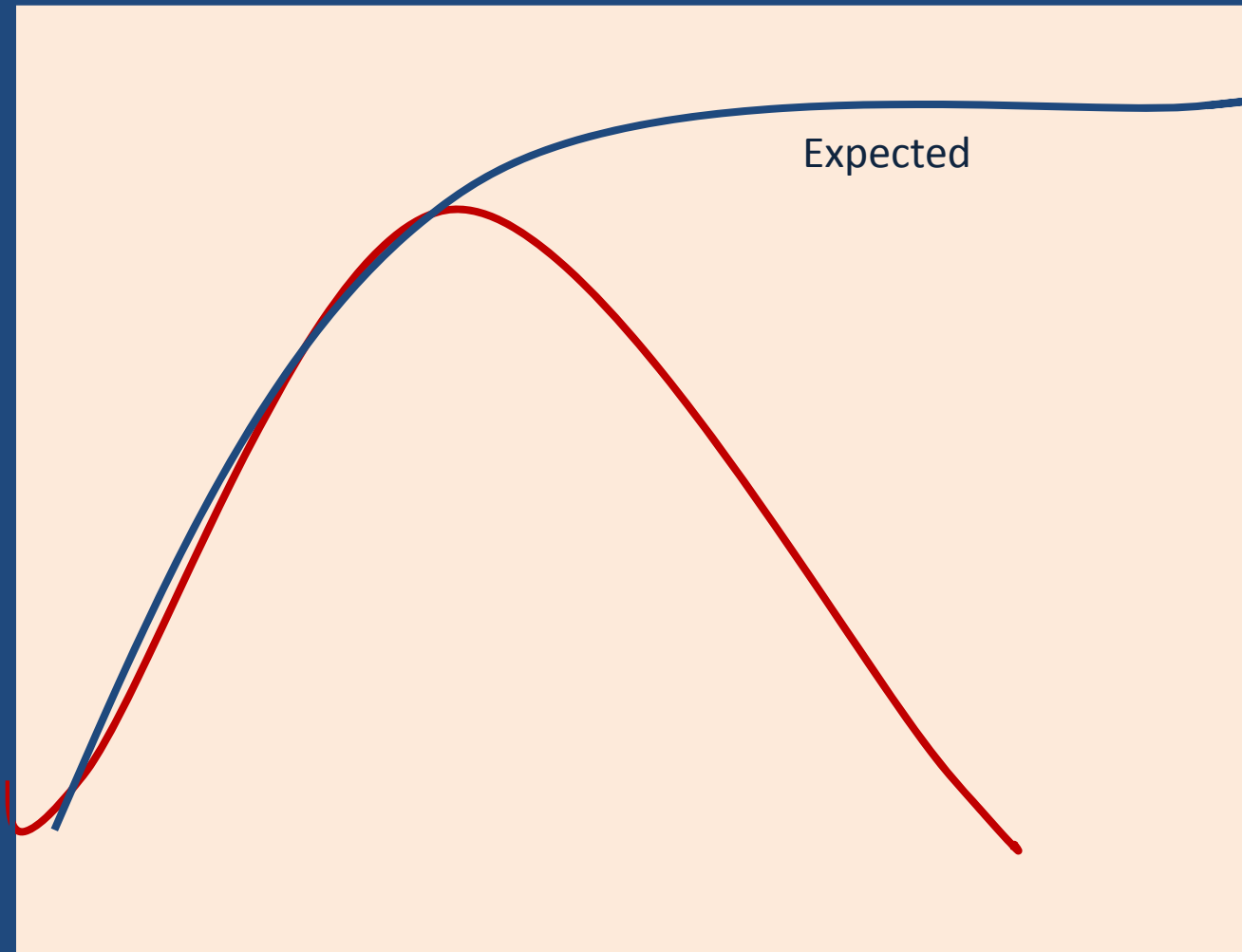
*Increased Retention of thyroidal ^{131}I is not a problem
because of the long biological half-life !*

THYROID EFFECTIVE IODINE HALF-LIFE

$$t_{1/2}(\text{eff}) = t_{1/2}(\text{phys}) \times t_{1/2}(\text{biol}) / t_{1/2}(\text{phys}) + t_{1/2}(\text{biol})$$

ISOTOPE $t_{1/2}(\text{phys})$	DIET	$t_{1/2}(\text{biological})$ days	$t_{1/2}(\text{effective})$ days
^{131}I (8d)	$I_{\text{def.}}$	40	6.7
^{131}I (8d)	$I_{\text{def.}} + \text{KI}$	80	7.3
^{131}I (8d)	$I_{\text{suff.}}$	80	7.3
^{131}I (8d)	$I_{\text{suff.}} + \text{KI}$	120	7.5
^{133}I (0.87d)	$I_{\text{def.}}$	40	0.85
^{133}I (0.87d)	$I_{\text{def.}} + \text{KI}$	80	0.86

T4 Formed



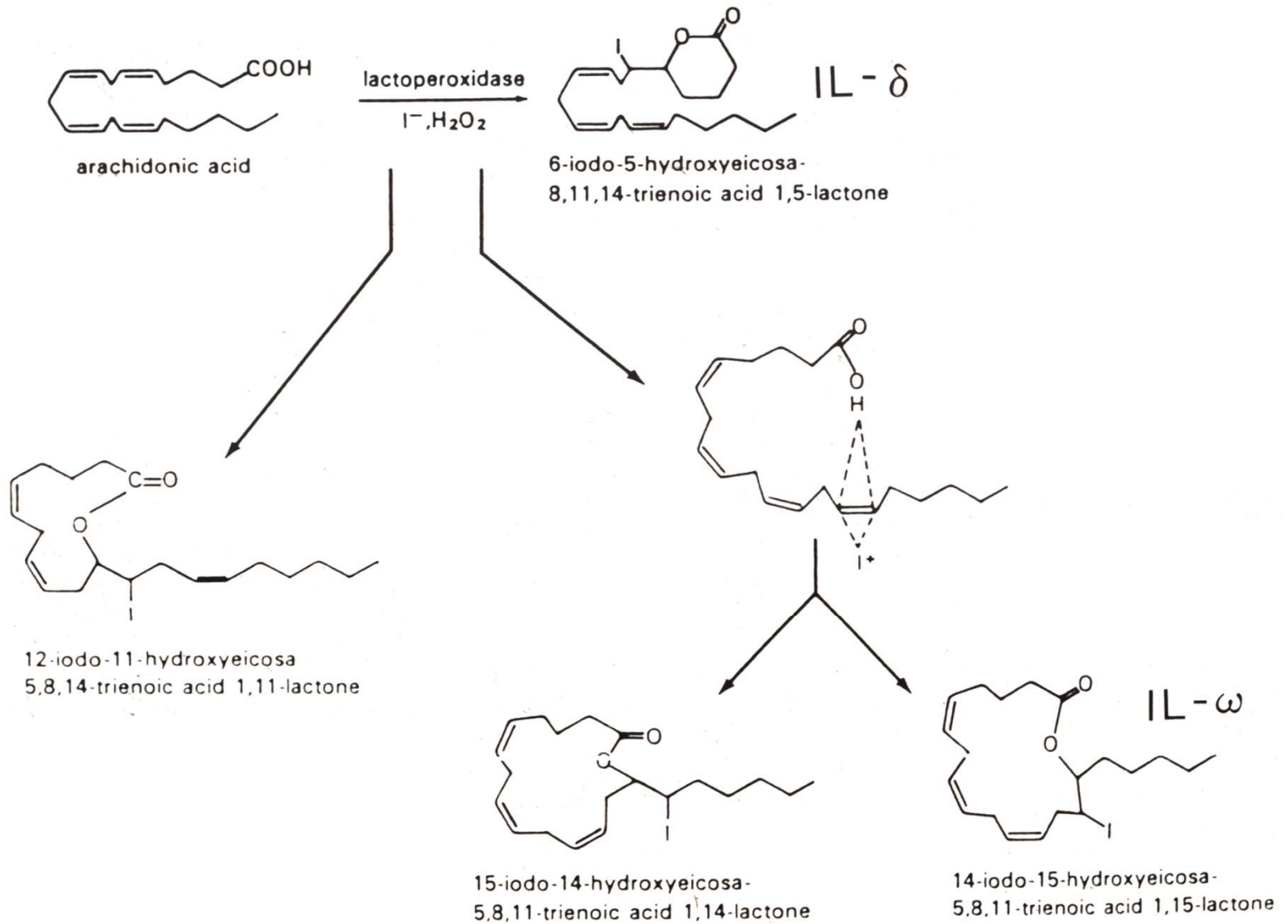
Expected

Iodide Administered
 $[I^-] \mu M$

COMPARISON OF THE INHIBITION OF THYROID FUNCTIONS BY IODIDE, IODOLACTONES, AND 2-iodohexadecanal

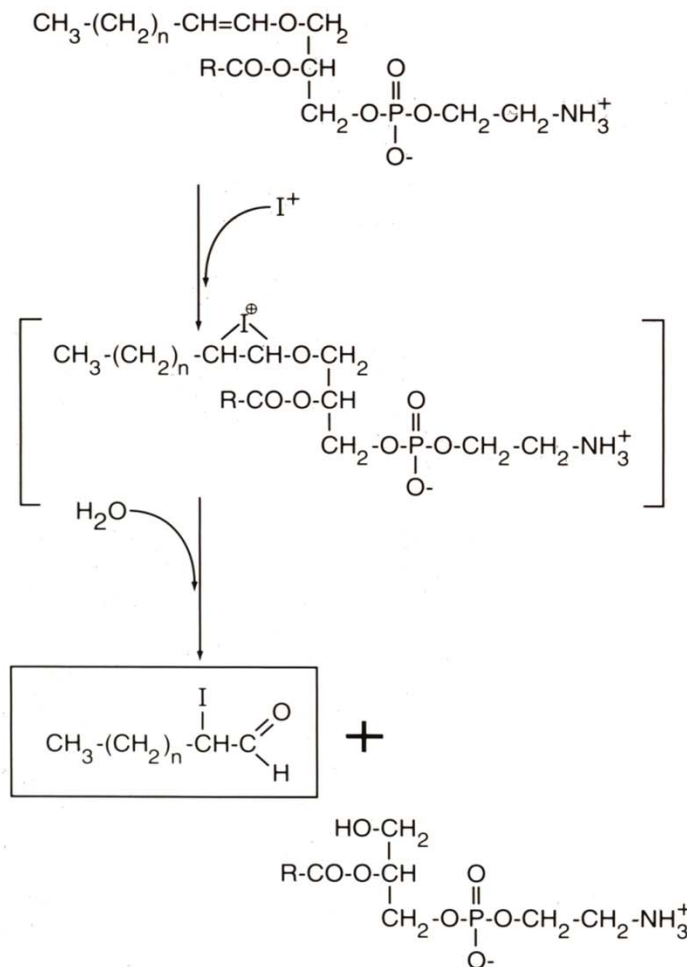
FUNCTION	INHIBITION BY IODIDE	INHIBITION BY IODOLACTONE	INHIBITION BY 2-iodohexa- decanal
Iodination	+	+	+
H ₂ O ₂ Generation	+	+	+
TPO Activity	+		+
cAMP Generation	+	+	+
RNA Synthesis	+	+	
Protein Synthesis	+	+	
Thyroid Cell Proliferation	+	+	
IP ₃ Formation	+	+	+
Goitrogenesis	+	+	

Iodolactones

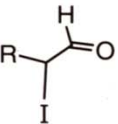
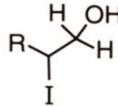
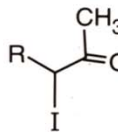
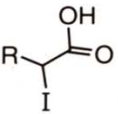


From Plasmalogens

A



B

$\text{R}=\text{CH}_3-(\text{CH}_2)_{13}$		Percent* Inhibition
Control: no lipid		—
2-Iodoheptadecanal (IHDA)		65
2-Iodo-1-hexadecanol		9
3-Iodo-2-heptadecanone		6
2-Iodoheptadecanoic acid		13

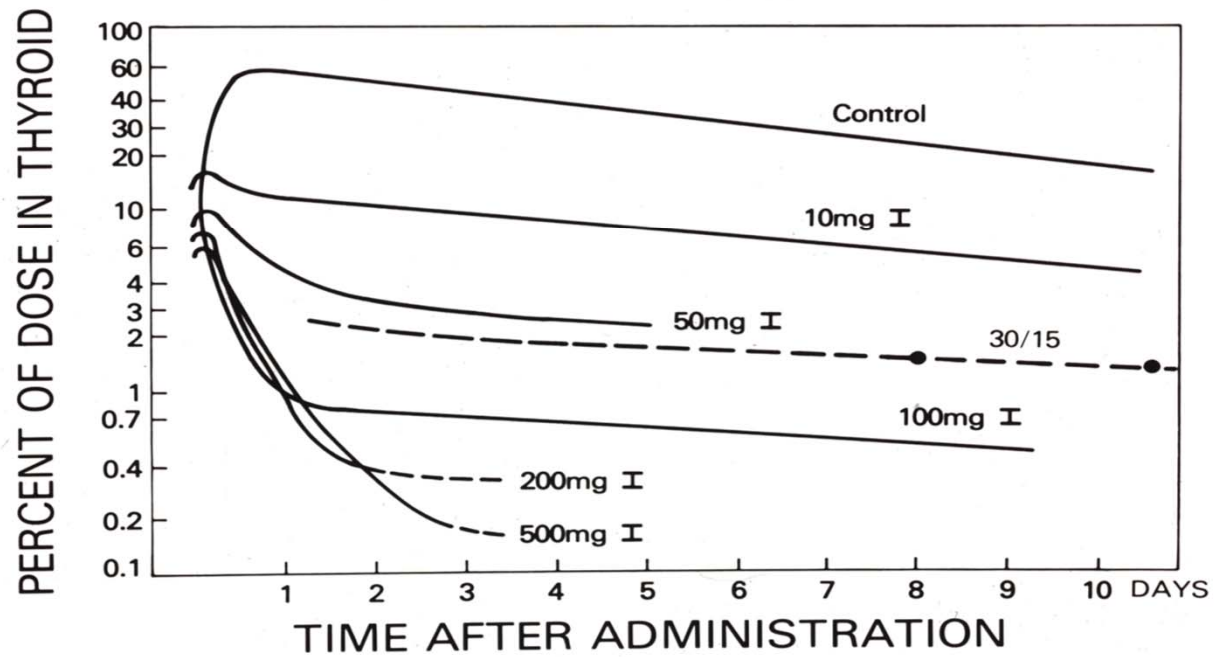
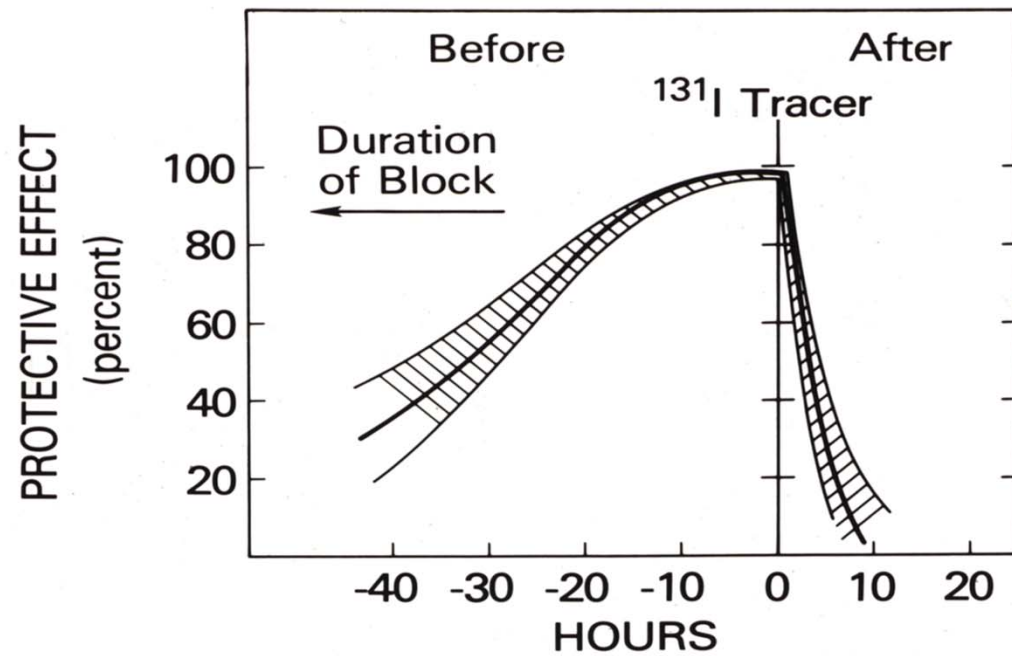
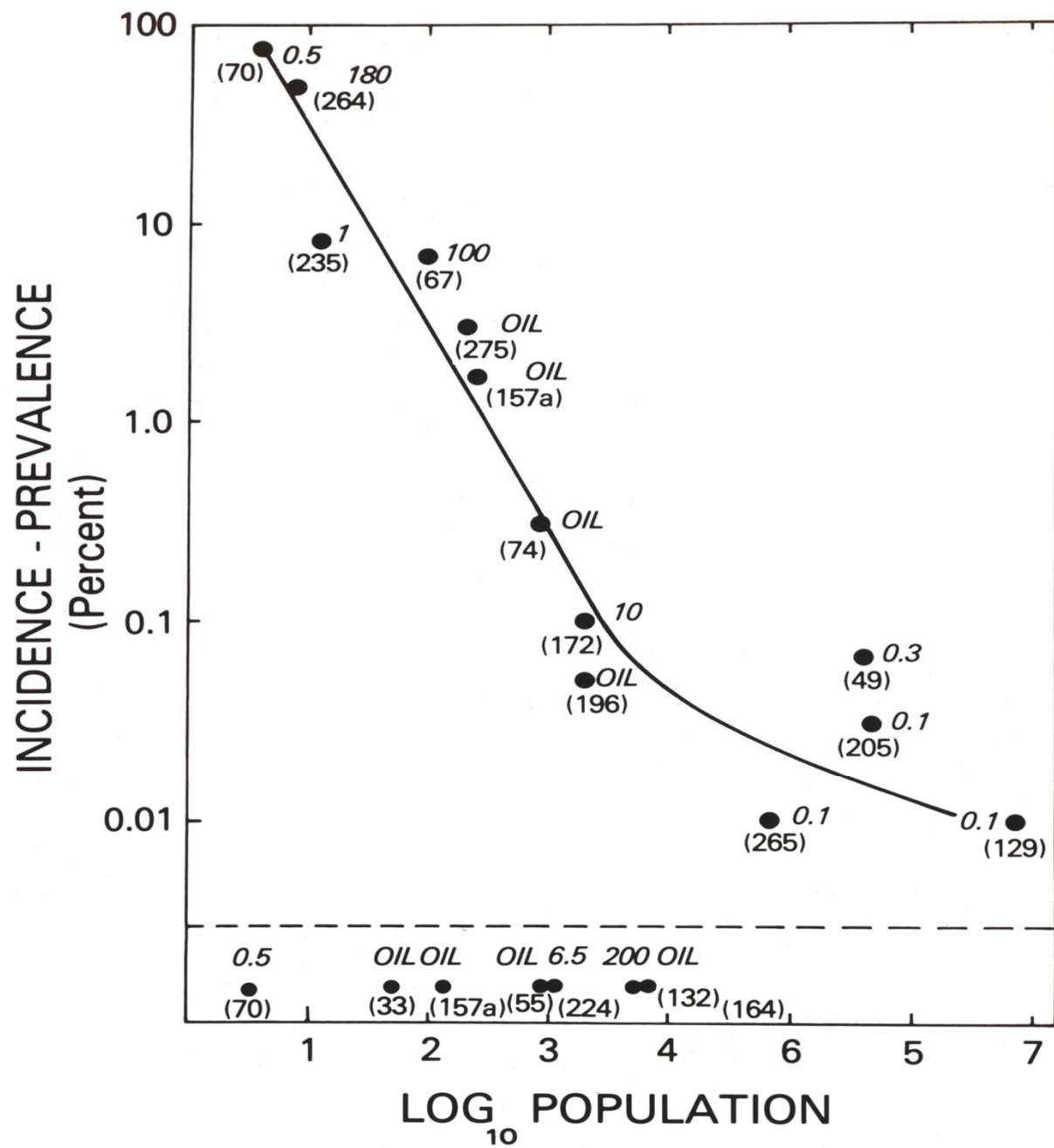


Table 4.9 Absorbed Doses in Thyroid Gland and E_d for Various Schedules of Administration of Stable Iodine

Schedules	Amount of iodide (mg) and schedule of administration	Absorbed dose (rad) per μCi of daily intake of I^{131}	E_d , %
1	10, daily	3.0 ± 1.3	87.6 ± 4.1
2	100, daily	0.75 ± 0.18	96.6 ± 2.4
3	100, twice a day	0.50 ± 0.02	97.7 ± 1.2
4	200, daily	0.30 ± 0.05	98.6 ± 1.1
5	200, once every other day	1.00 ± 0.12	95.5 ± 1.5
6	200, once every third day	2.50 ± 0.35	88.6 ± 3.4
7	Control (without KI)	22.0 ± 1.50	-

FREQUENT OBJECTIONS TO KI

Cost	Low (Maine Yankee - 5K)
Shelf-Life (98% after 11y- US Pharm)	Long (Foil Wrapped)
Side Reactions (Without Denominator)	Mostly Case Reports
Prolonged Biological Half-Life	Minor



KI Distribution (18 million doses)

Newborns	15 mg
Children <5y	50 mg
Others	
incl. Pregnant Women	70 mg
Adults	no Rx

Extrathyroidal side effects after KI prophylaxis

Symptoms	Children		Adults	
	No	%	No	%
None	11,482	95.4	4,833	95.5
Iodine mumps	0		0	
Headache	22	0.18	35	0.69
Stomachache	43	0.36	32	0.63
Diarrhea	23	0.19	6	0.12
Vomiting	286	2.38	43	0.85
Shortness of breath	13	0.11	32	0.63
Skin rashes	129	1.07	63	1.24
Others	42	0.35	10	0.20
Total prophylaxis	12,040		5,061	

RARE SIDE REACTIONS

SUBACUTE THYROIDITIS

4 CASES (0.08%)

SEVERE ALLERGIC REACTION

**2 CASES REQUIRED
HOSPITALIZATION**

**TINCTURE OF IODINE
GASTROENTERITIS**

MANY

Iodide Can Block Radioiodine Uptake by the Thyroid Virtually Completely

- Not by Lowering Specific Activity – Capacity of Thyroid Too Great
- By Producing Iodinated Inhibitors – Requires Higher Iodide Levels than for Protein Iodination

CONCLUSIONS

KI EFFECTIVE - 40% DOSE REDUCTION.

COULD BE 90% IF INSTITUTED EARLY

NO INCREASE IN CANCER AFTER 15 YEARS

NO PERMANENT THYROID DAMAGE AFTER 4 YEARS

**SPEED, I.E. PRE-PLANNED DISTRIBUTION, ESSENTIAL
LATE DISTRIBUTION BETTER THAN NOTHING**

**SHORT - TERM KI SAFE - BENEFITS OUTWEIGH RISKS
WATCH NEWBORNS, MULTINODULAR GOITER,
SENSITIVITY**

TCHERNOBYL:

la population n'a
pas cédé à la
panique !

