

GENERAL REVIEWS

WHO 1976 Mercury	Environmental health Criteria	1
WHO 1990 Methyl mercury	"	101
WHO 1991 Inorganic mercury	"	118

SPECIFIC REFERENCES

Hursh et al 1976 Clearance of mercury vapor inhaled by human subjects Archives Environ Health 31: 302-309

Cherian et al 1978 Radioactive mercury distribution in biological fluids Archives Environ Health 33: 109-114

Sandborgh_Englund et al (1998) The absorption, blood levels and excretion of mercury after a single dose of mercury vapor in humans Toxicol. Appl. Pharmacol. 150:146-153

MERCURY

A. MAJOR PHYSICAL AND CHEMICAL FORMS OF MERCURY

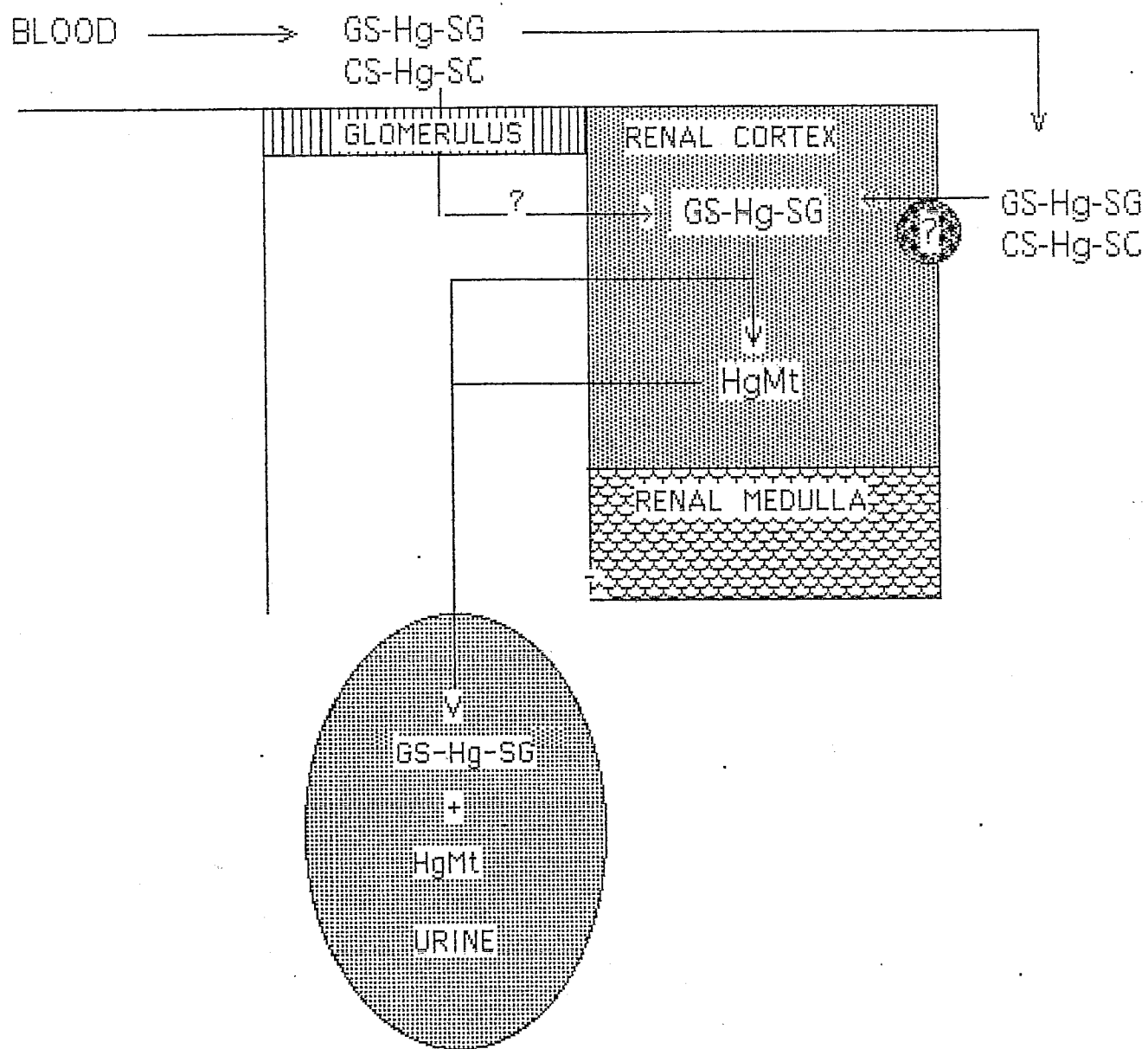
	INORGANIC	
Hg^0 Metallic	Hg_2^{++} Mercurous	Hg^{++} Mercuric
	ORGANIC	
$\text{C}_6\text{H}_5\text{Hg}^+$ Phenylmercuric		CH_3Hg^+ Methylmercuric

- Note
1. Oxidation States
 2. Organic versus Inorganic

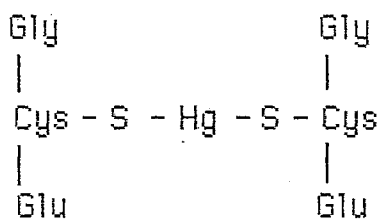
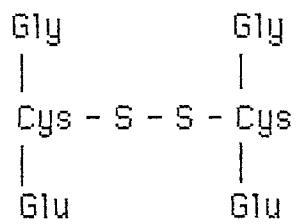
Disposition of mercuric mercury (Hg⁺⁺) in adults

Process	Location	Amount
Absorption	GI tract	5- 10%
newborn rats	"	38%
Deposition	kidney	50%
	brain	low%
	RBC/plasma	0.4
Metabolism		
product	Hg ⁺⁺ → Hg ⁰	<1%
ind. metallothionine	Kidney	?
Biological half-time	whole body	60 days
	blood	2 - 4 days (90%)
		15-30 days
	head	21 days
Excretion	fecal (via bile)	80%
	urinary (kidney tissue)	20%
	expired air	<1%

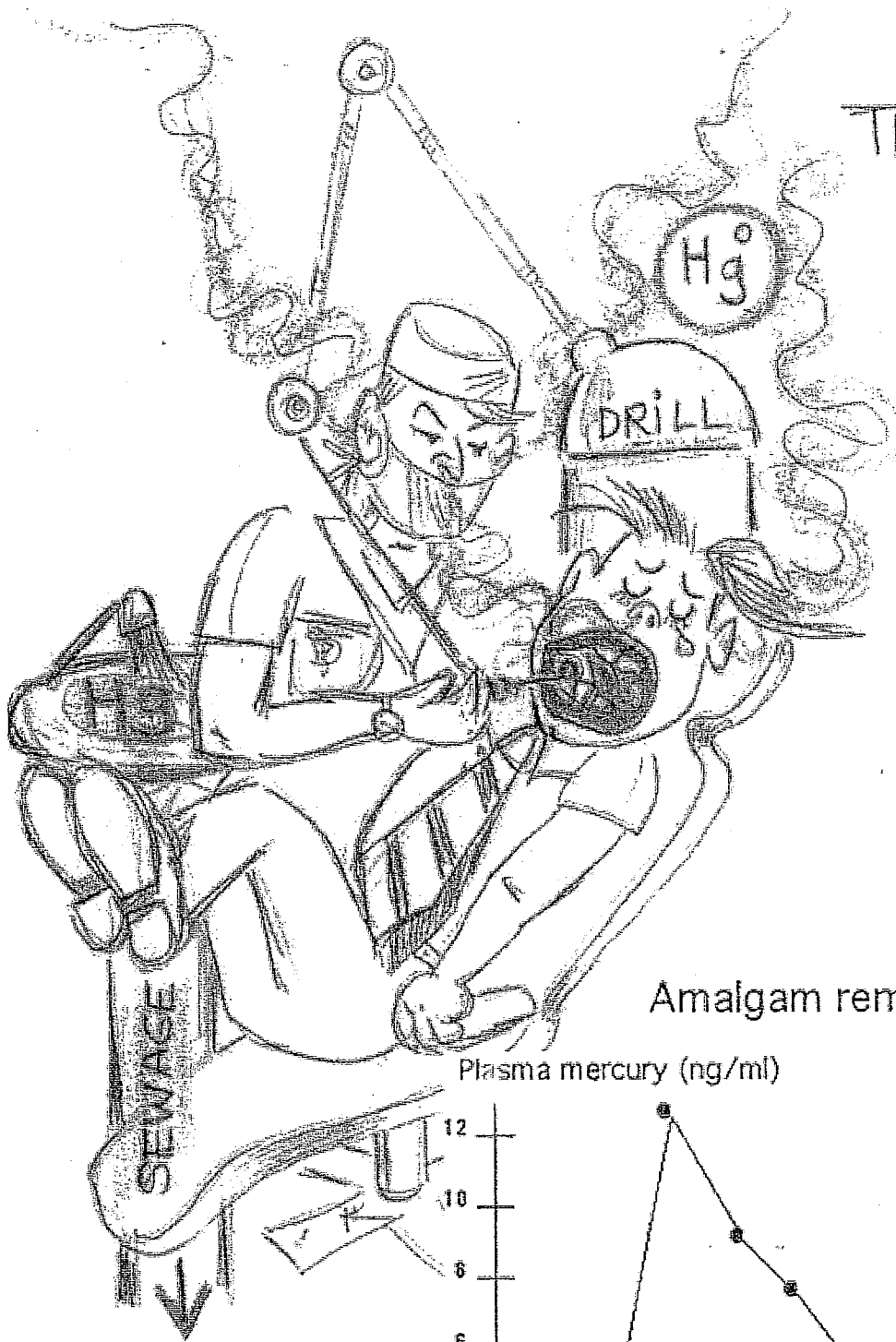
RENAL ACCUMULATION & EXCRETION OF MERCURIC MERCURY



THE GSH CONNECTION _____

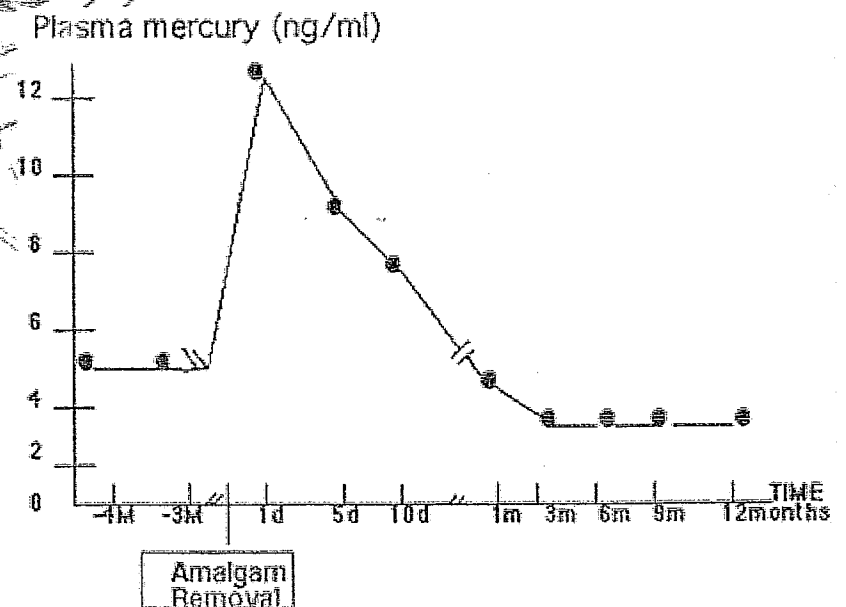


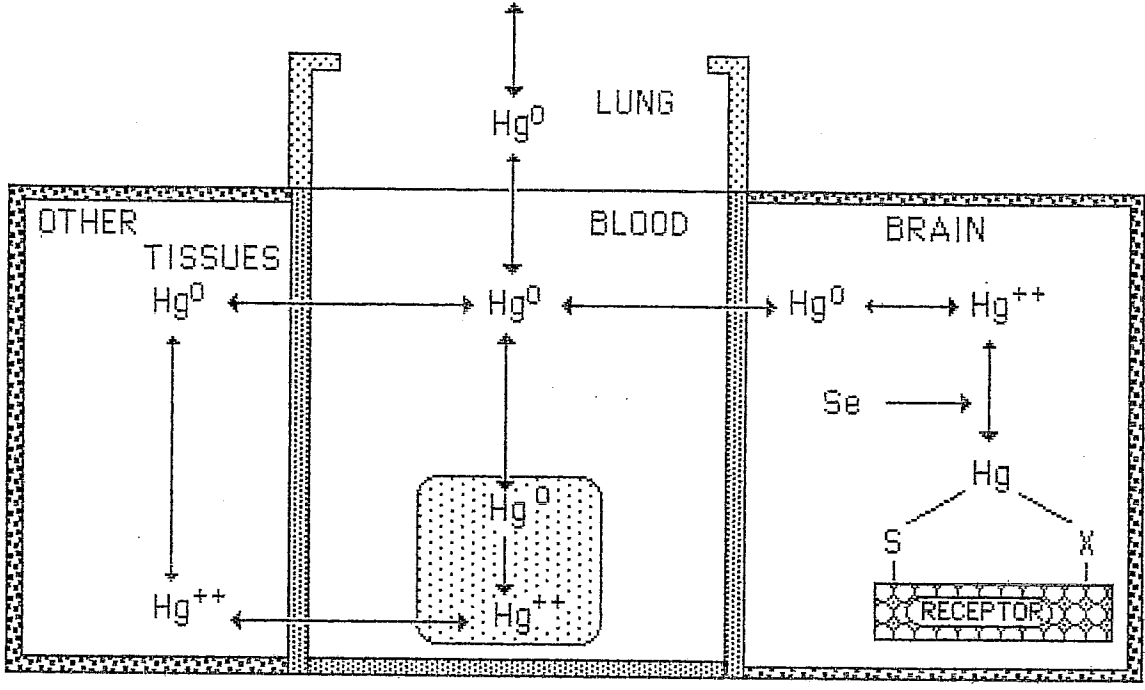
The Dentist's DILEMMA



Amalgam removal

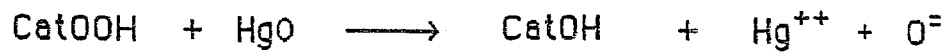
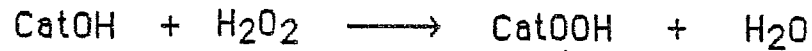
Environmental contamination





MERCURY

Biotransformation

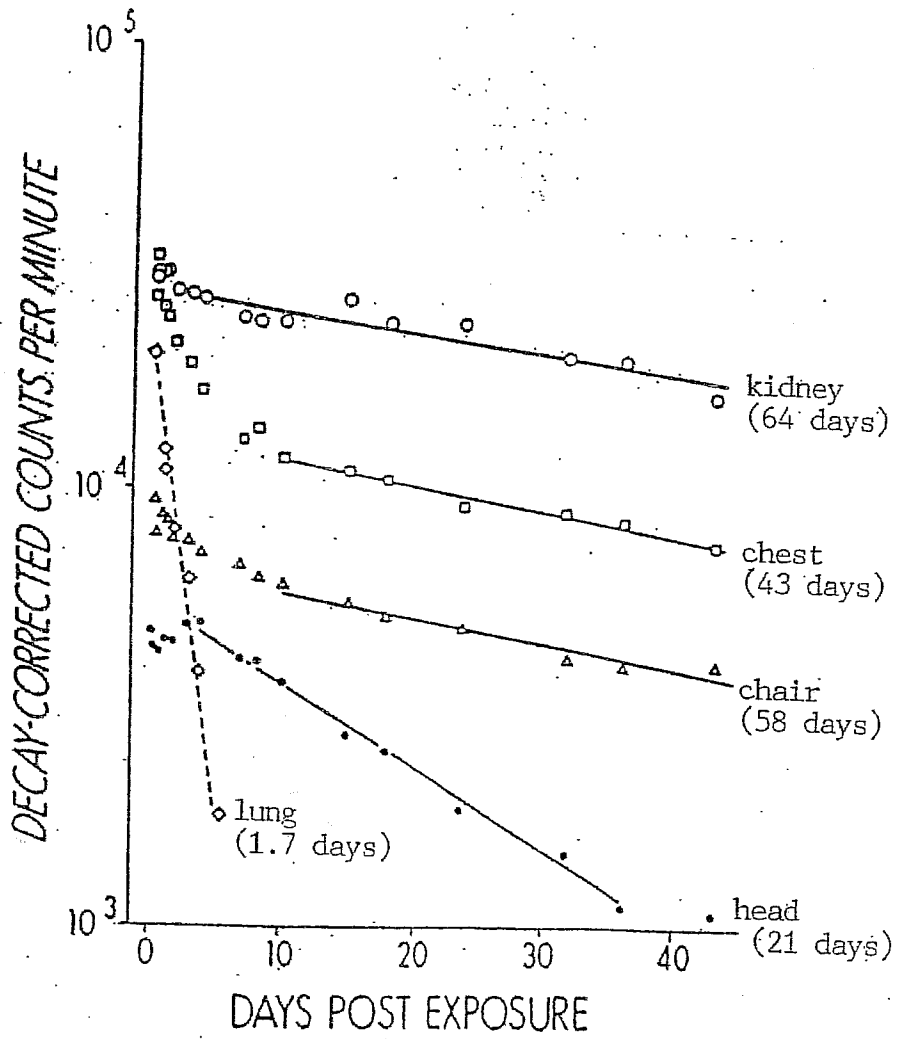


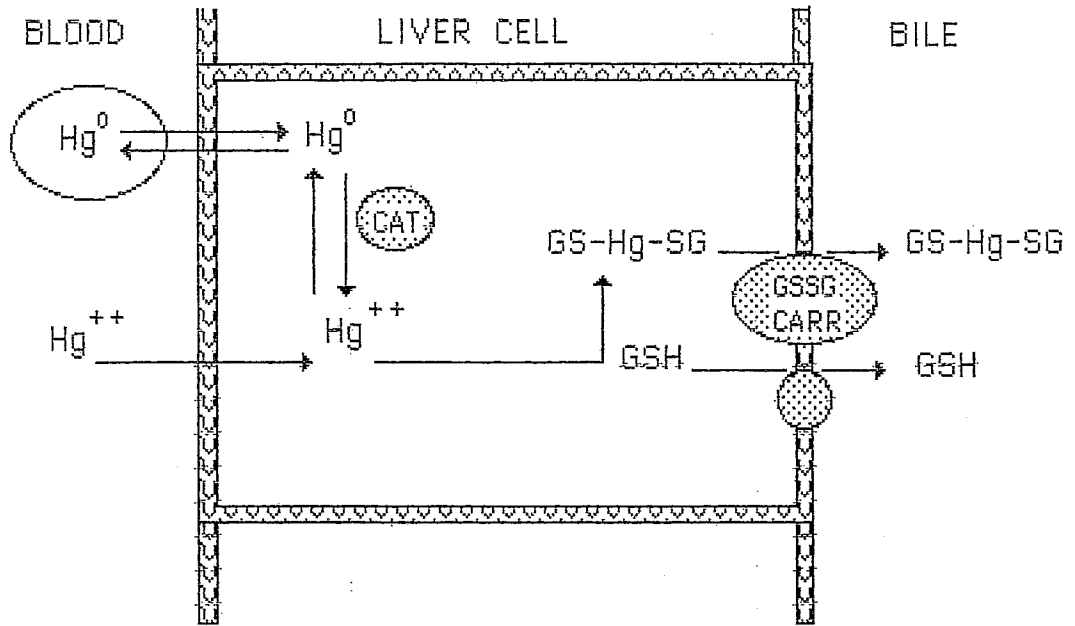
- Note: 1) Oxidation requires both CatOH and H₂O₂
2) Inhibitors of catalase, inhibit Hg⁰ oxidation
3) Other substrates e.g. ethanol, inhibit Hg⁰ oxidation

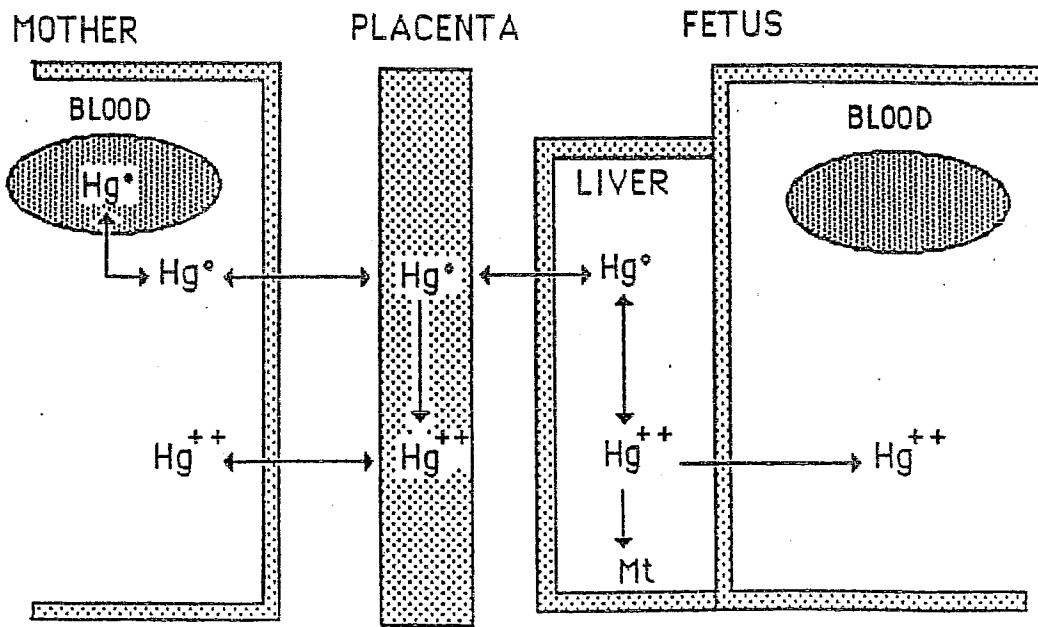
Distribution

Kidney, Brain, Fetus

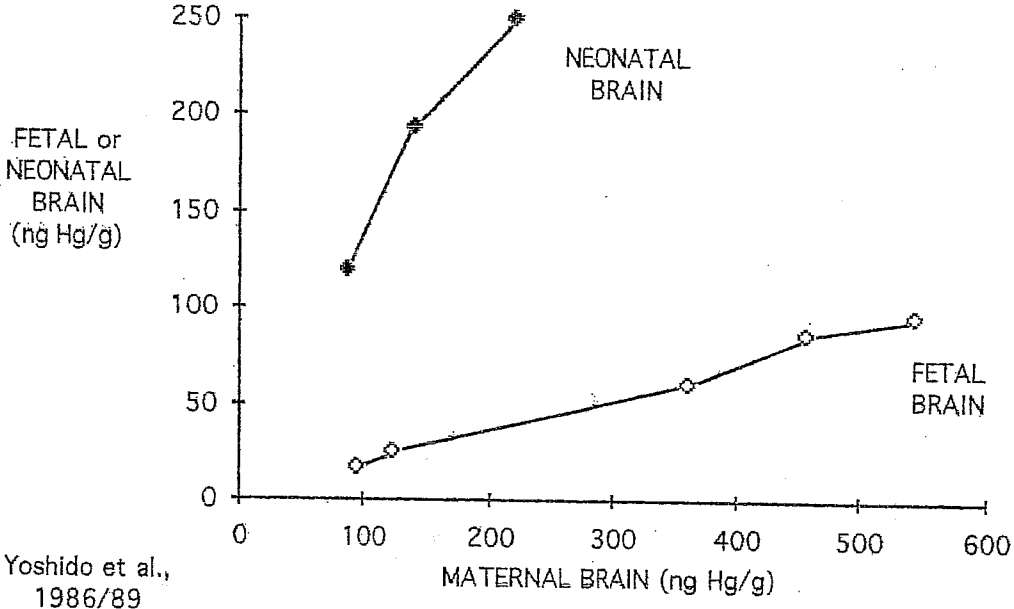
RBC/ Plasma = 2:1



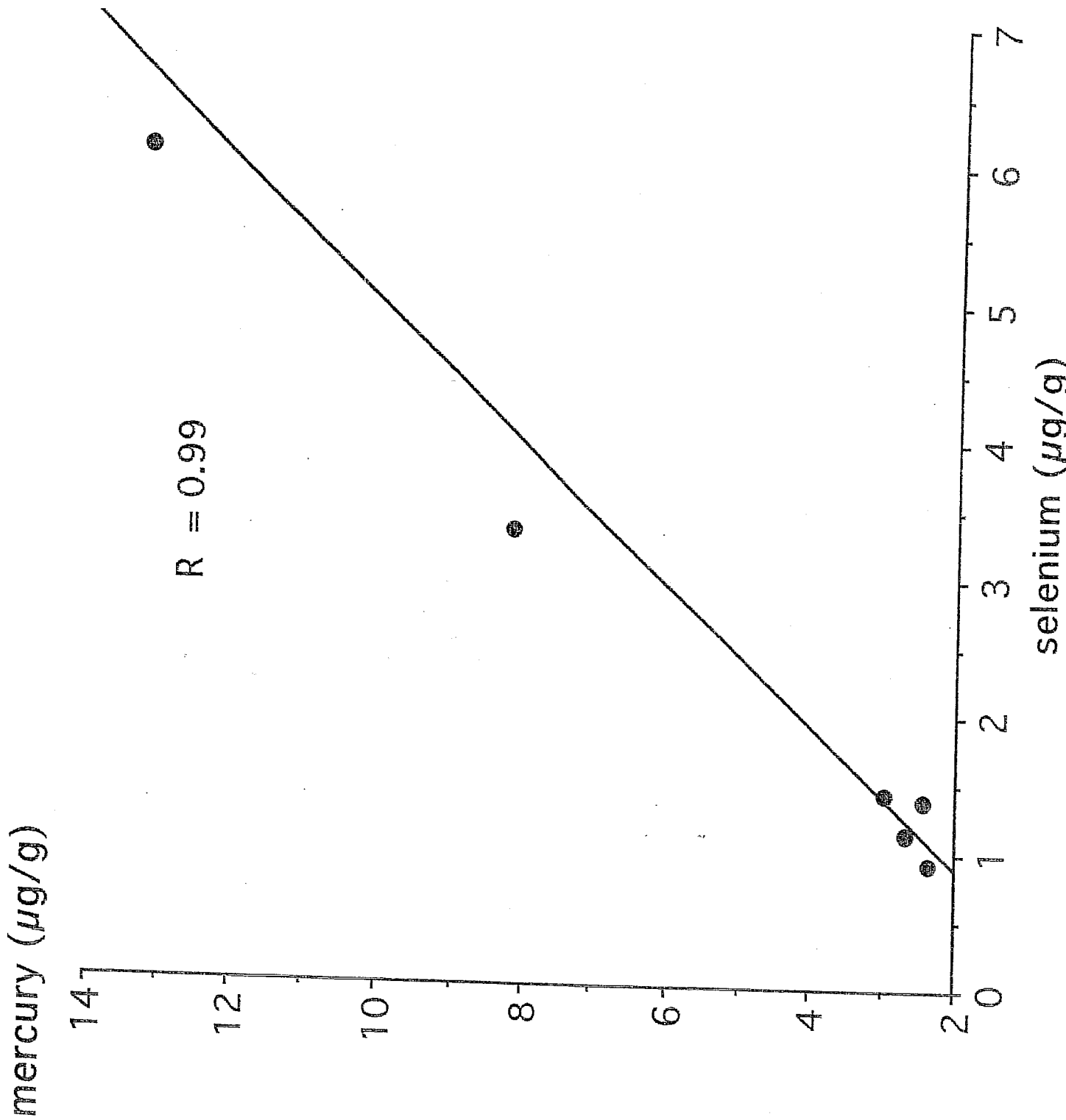




BRAIN LEVELS AFTER VAPOR EXPOSURE

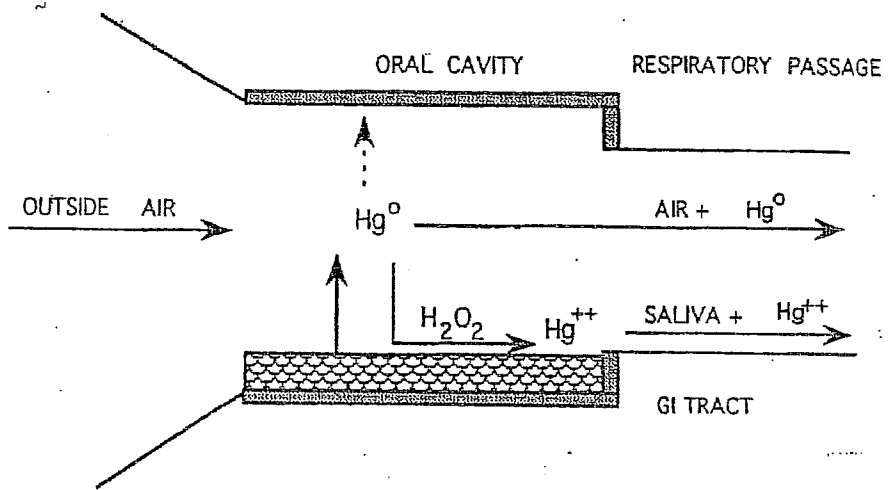


Yoshido et al.,
1986/89

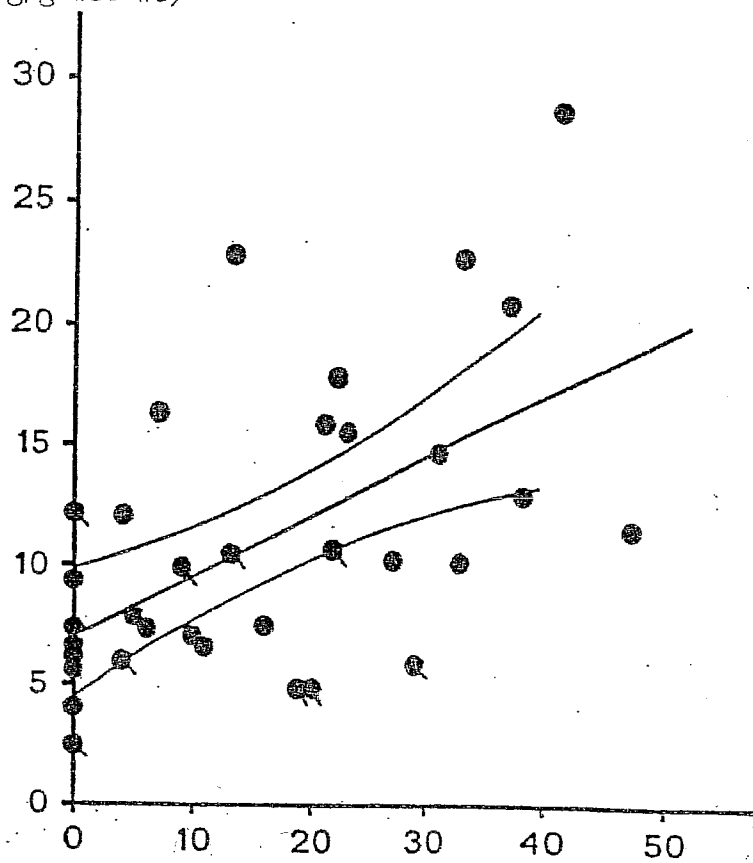


Disposition of inhaled mercury vapor in adults

Process	Location	Quantity
Absorption	lung	69 - 74%
Deposition	kidney	50%
	blood	10%
	plasma	4%
Metabolism	product	100%
	pathway	100%
Biological half-time	whole body	60 days
	blood	2 - 4 days (90%)
		15-30 days
	head	21 days
Excretion	fecal (via bile)	80%
	urinary (kidney tissue)	20%
	expired air	<1%

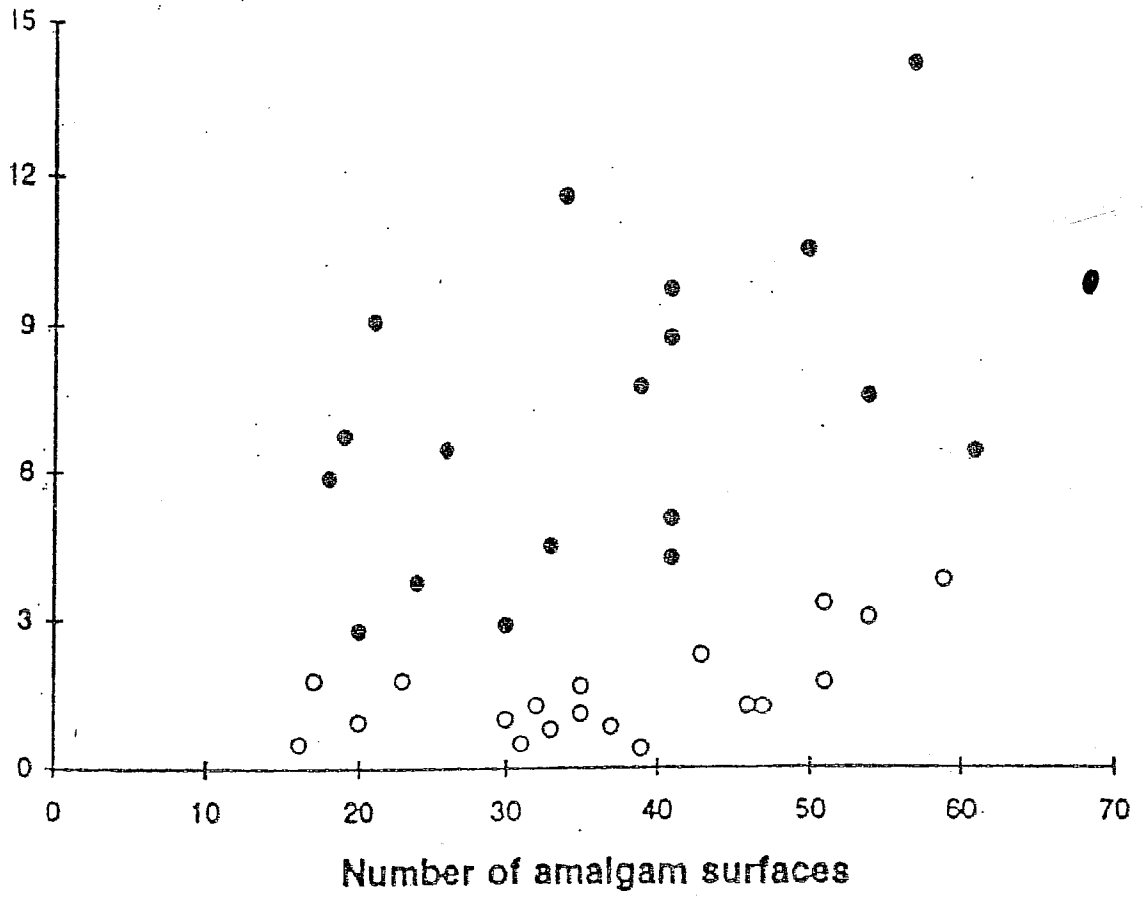


Mercury in brain
(ng/g wet wt)

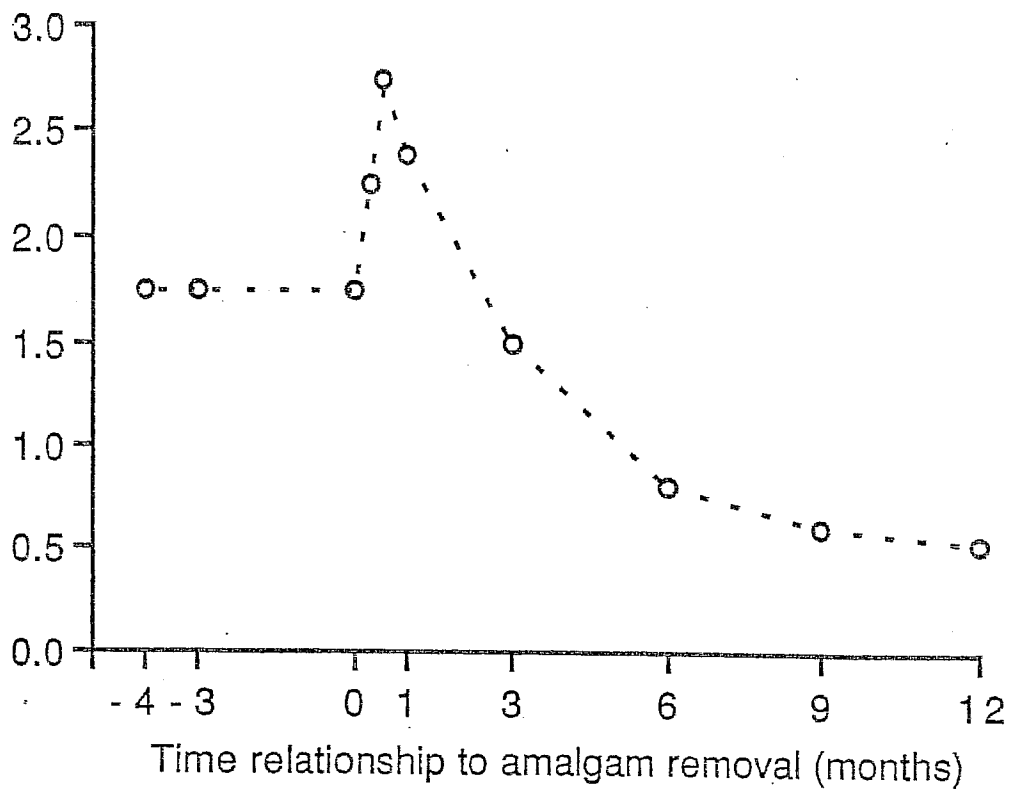


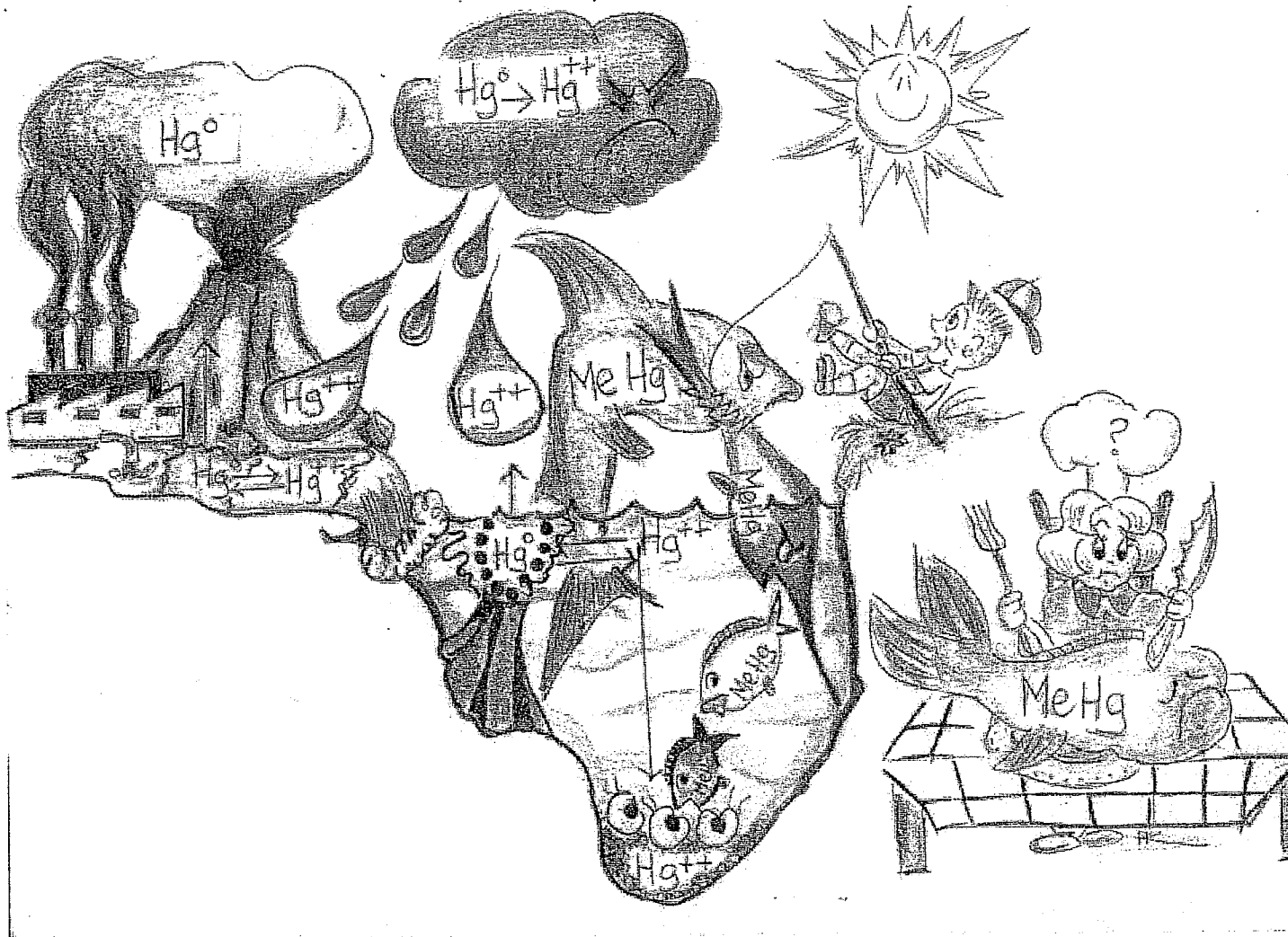
Number of tooth surfaces

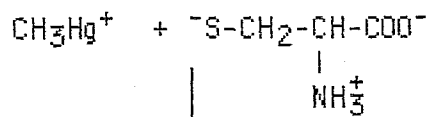
Mercury in urine
 $\mu\text{g Hg/g creatinine}$



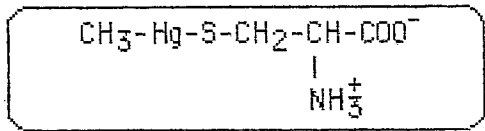
U-Hg ($\mu\text{g/g creatinine}$)



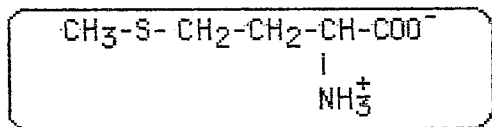




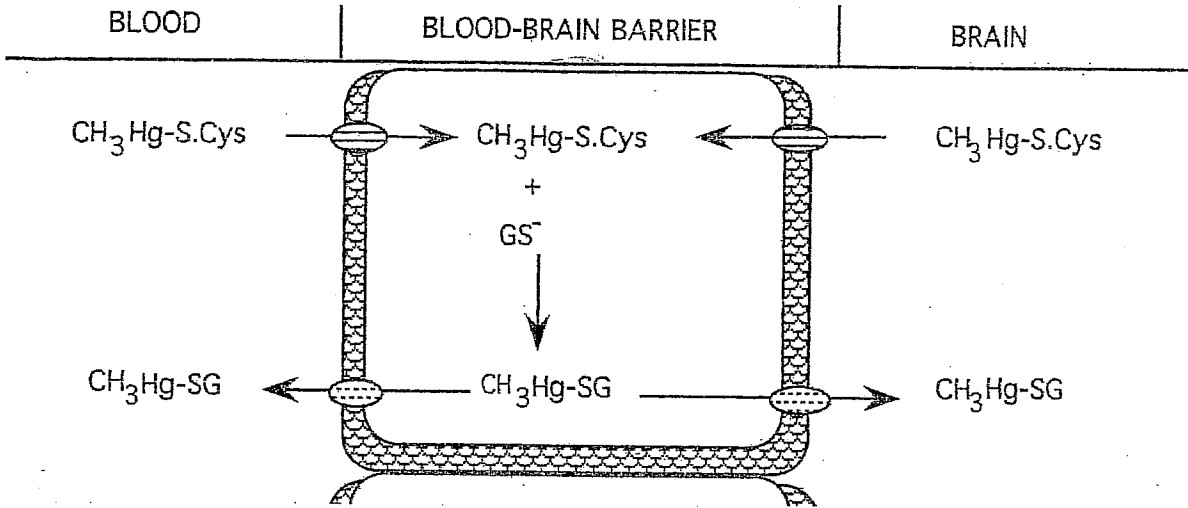
CYSTEINE

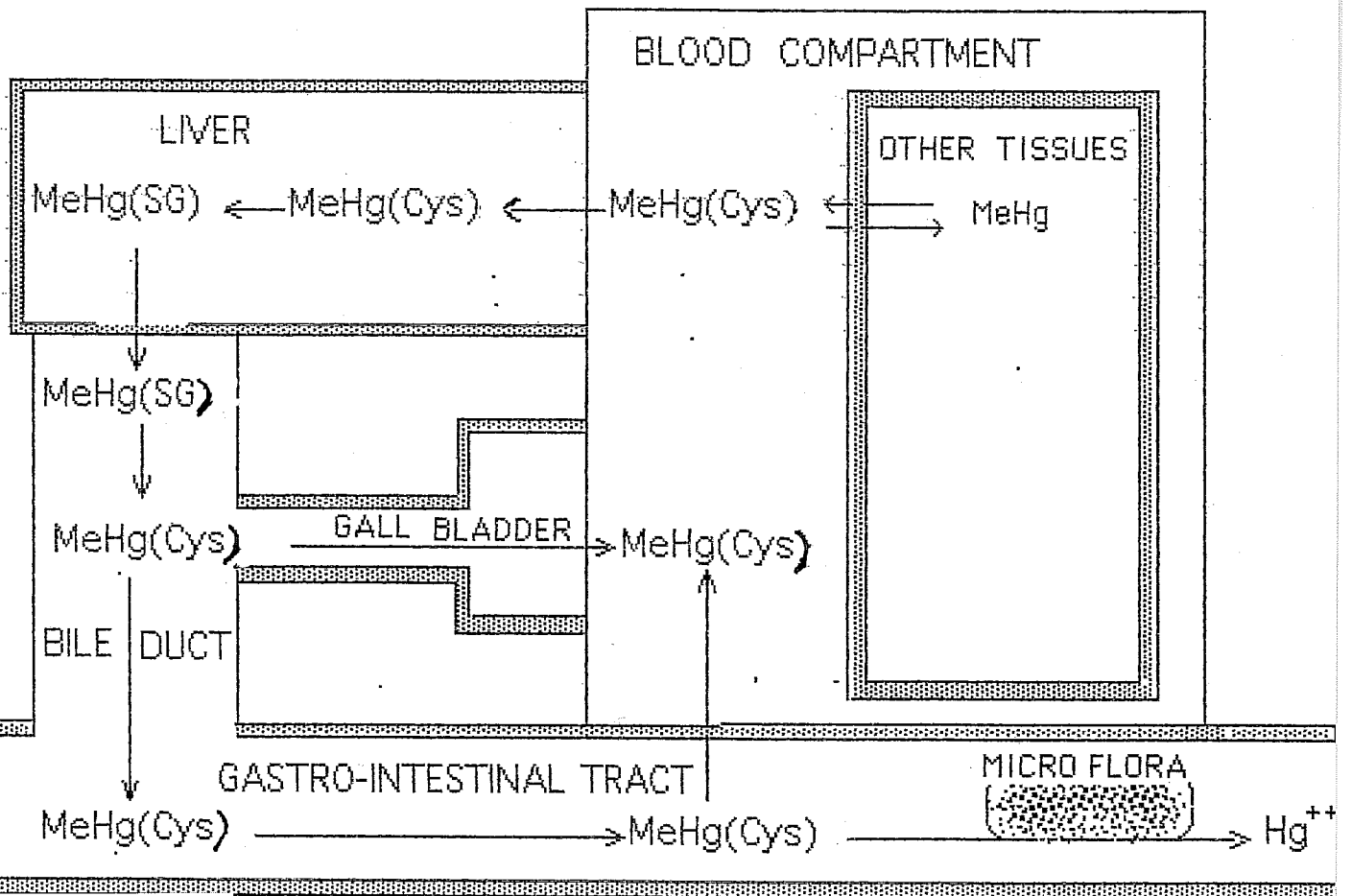


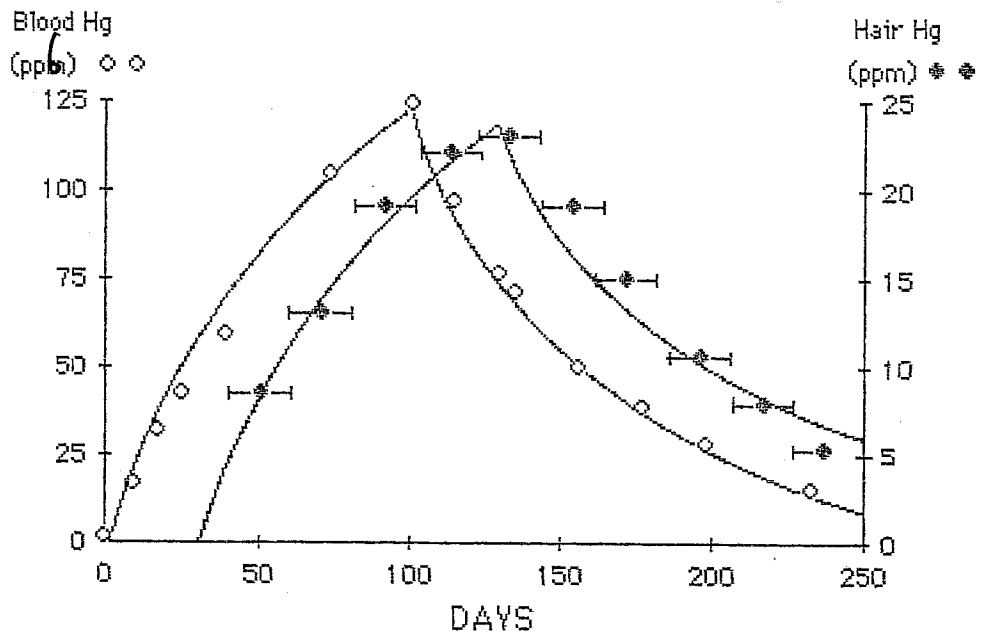
METHYLMERCURY
CYSTEINE
COMPLEX

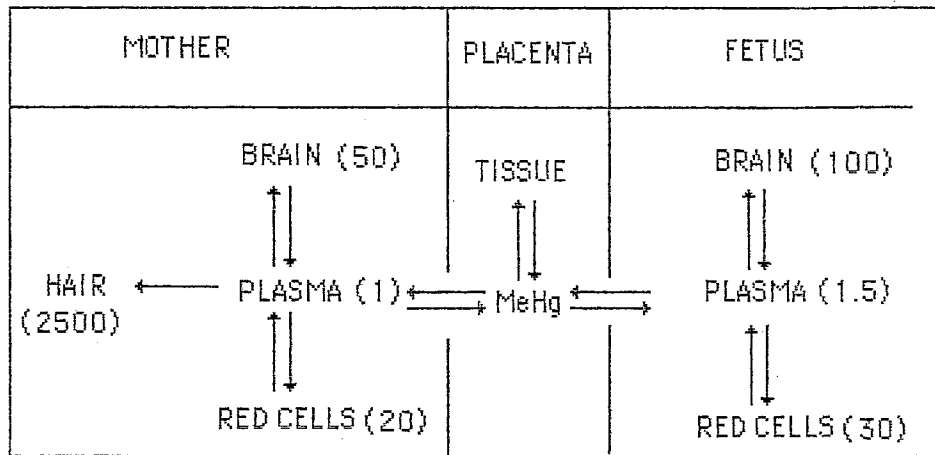


METHIONINE

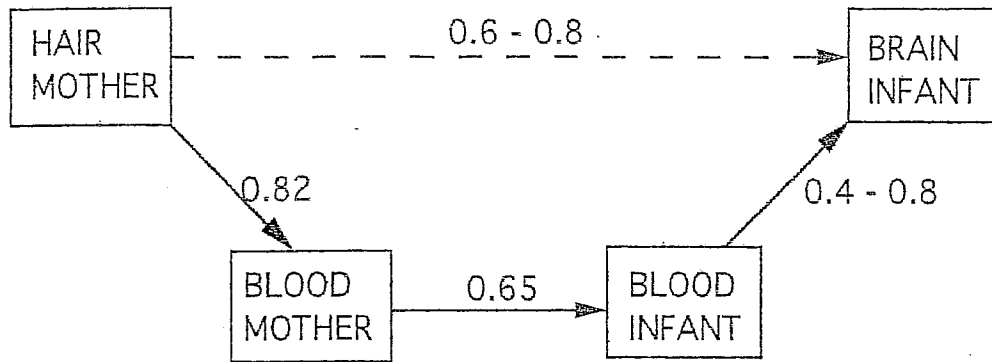




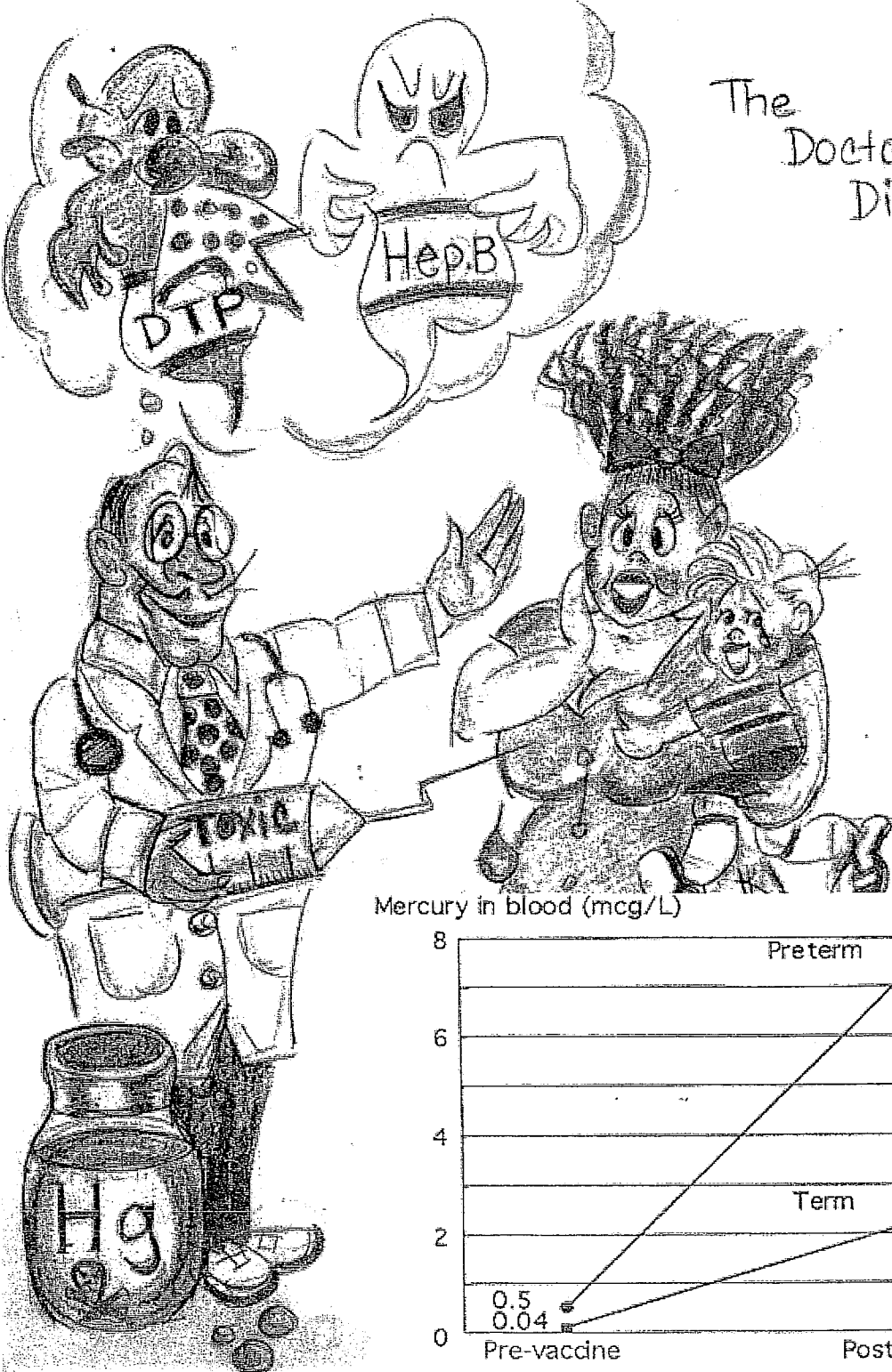




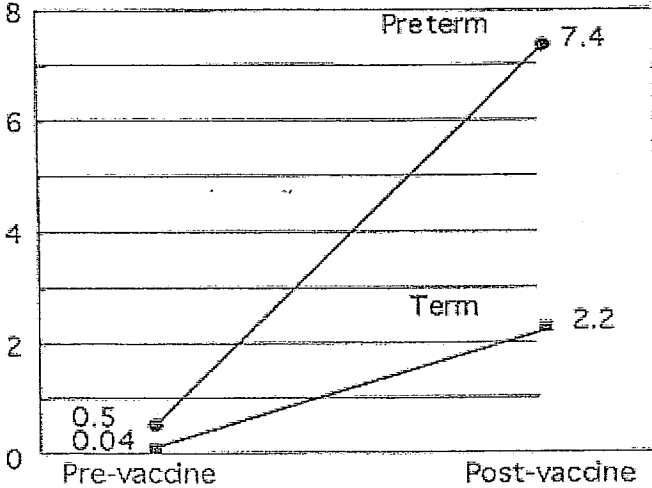
MERCURY LEVELS IN MATERNAL HAIR AND INFANT BRAIN
DIRECT AND INDIRECT ROUTES OF COMPARISON

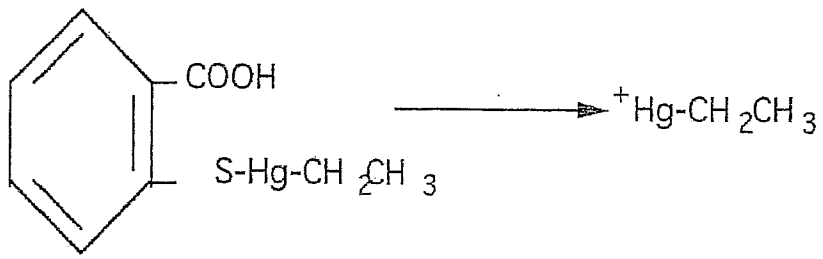


The DOCTOR'S DILEMMA



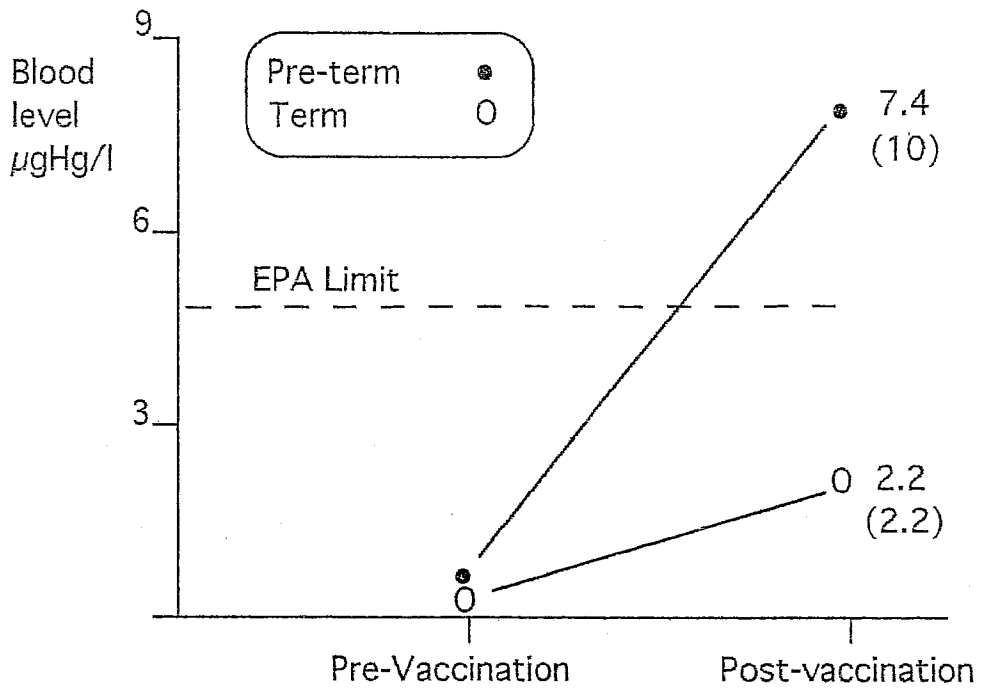
Mercury in blood (mcg/L)





Thimerosal

Ethyl mercuric



adapted from Stajich et al. (2000)

SPECIES DIFFERENCE IN BRAIN TO BLOOD RATIOS

Species	rat	mouse	squirrel monkey	human
Methyl mercury	0.06	1.2	6	6
Ethyl mercury	0.02	0.4	4.6	2.8

Blair et al (1975); Suzuki et al (1963/73); Ulfvarson (1962)

SPECIES DIFFERENCE IN BLOOD HALF TIMES (days)

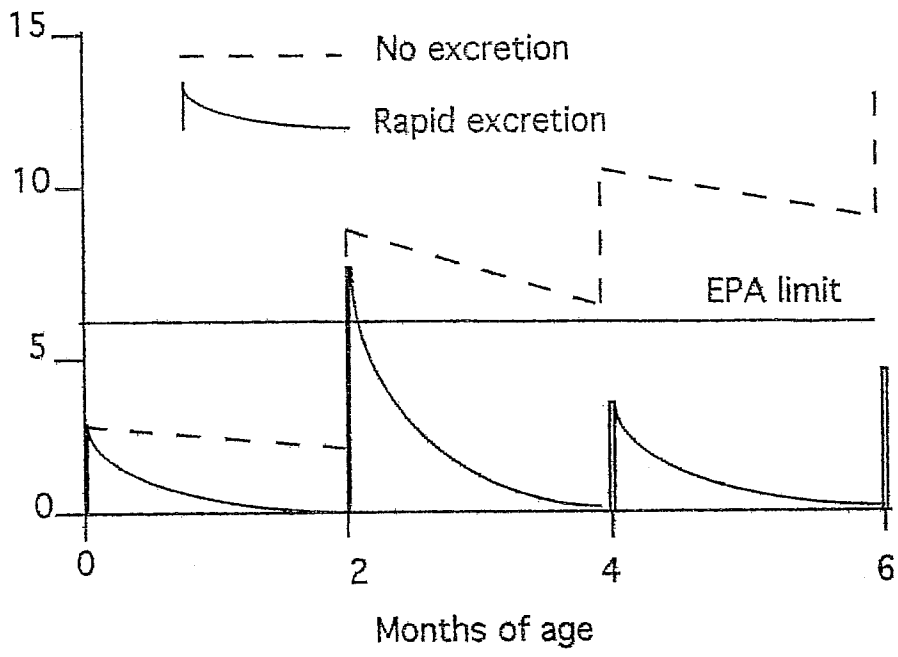
Species	rat	mouse	macaca primate	human
Methyl Mercury	16	6.5	26-60	32-60
Ethyl Mercury	16	3.8	?	7 - 21

Berlin et al (1973); Magos et al (1983); Smith et al (1994):
Sundberg et al (1998); Suzuki et al (1973); Ulfvarson (1962);
Vahter et al (1994)

Common toxicological characteristics

- crosses blood-brain barrier
- crosses placental barrier
- brain is target organ

Mercury
blood
level
(ppb)



ESTIMATED RELEASE RATES AND DAILY UPTAKE OF MERCURY FROM
AMALGAMS

Source	UNSTIMULATED AMALGAM		STIMULATED AMALGAM		Total Daily uptake $\mu\text{g Hg}$
	Hg release rate ng Hg/min	Daily uptake $\mu\text{g Hg}$	Hg release rate ng Hg/min	Daily uptake $\mu\text{g Hg}$	
1	7.4	1.8	163.2	15.7	17.5
2	4.4	1.1	71.6	6.9	8.0
3	3.8	0.9	16.3	1.6	2.5
4	3.3	0.8	21.9	2.1	2.9

1, Svare et al., 1981

2, Abraham et al., 1984

3, Patterson et al 1985

4, Vimy and Lorscheider, 1985 b

Disposition of methylmercury in adults

Process	Location	Quantity
Absorption	GI tract	95%
Deposition	Brain	10%
	Blood	7.7%
	Red cell/plasma	20
	Hair/blood	250
Metabolism product	$\text{CH}_3\text{Hg}^+ \longrightarrow \text{Hg}^{++}$	100%
Biological half-time	Whole body	55 days
	Blood	44 days
Excretion	Feces (via bile)	85
	Urine	15

Biomarkers for methylmercury

Target tissue	Biomarker media	Comments
Whole body	Whole blood	Recent exposure
	"	
Brain	Whole blood Red cells Head hair	A keeper of history!
Fetal brain	Maternal hair " blood Cord blood	Cord bd./mat. bd = 1.7

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