中國醫藥大學
CHINA MEDICAL UNIVERSITY

認識毒化物與解毒劑

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常見致死之中毒物質

中毒物質	死亡個案數	死亡率
巴拉刈	485	54.4%
有機磷農用殺蟲劑	204	11.0%
年年春除草劑	53	5.4%
濫用藥物-安非他命	48	3.5%
氨基甲酸鹽農用殺蟲劑	42	5.8%
氰化物	40	24.1%
其他農用殺蟲劑	91	6.3%
浴廁清潔劑	31	1.9%
殺鼠劑	28	1.1%
鎮靜安眠藥	20	1.1%
有機溶劑	20	1.1%
動物咬傷及螫傷	18	1.9%
一氧化碳及其他毒性氣體	18	4.2%

資料來源：台北榮總毒藥物諮詢中心 1985-1993年 資料

"保力達蠻牛" drink contain: complex vitamin, protein, sugar.

台中縣梧棲鎮臨海路與中棲路交界口，四月三日下午三時許，一輛滿載卅五噸有毒化學液體的化學槽車，因後輪脫離，造成液體大量外洩，消防單位與各救難協會均派員趕到現場

化學武器的種類

1. 神經戰劑（Nerve Agent）易於合成，液體型態為多

2. 皮膚糜爛戰劑（Vesicants）

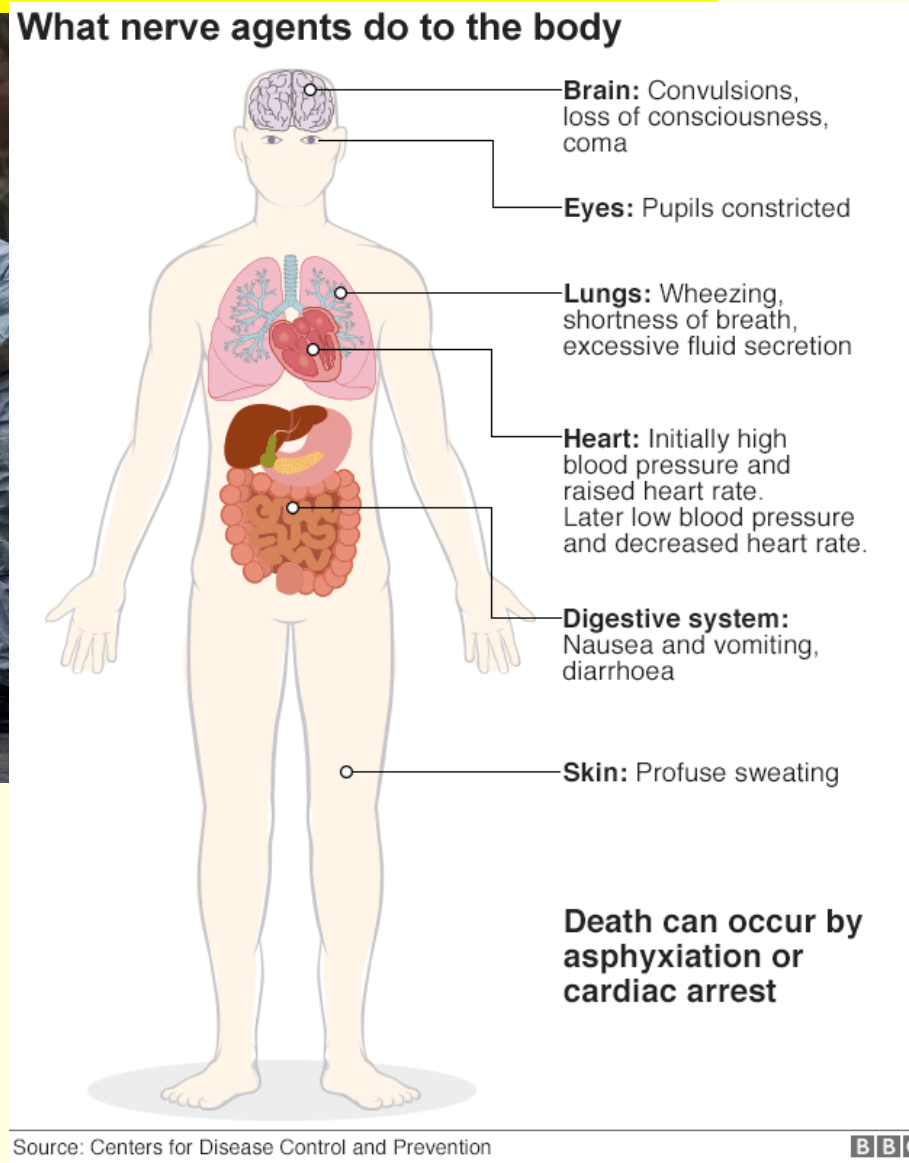
3. 氰化物（Cyanide）

4. 暴動驅散劑（Riot Control Agent）

5. 肺窒息劑(Pulmonary Agent)

Why the nerve agent that poisoned the ex-Russian spy is so mysterious

The group of chemical weapons collectively known as Novichok originated in a secret Cold-War era weapons program



化學災害暴露中毒的特性

- 暴露途徑以呼吸道吸入及皮膚黏膜為主
- 大量化學品的暴露
  - --減少污染
  - --嚴重中毒
- 大量人員的暴露
  - --檢傷分類
  - --解毒劑儲備
- 易有二次污染的狀況

Paracelcus (1493-1541, 現代毒物學之父)：
所有的物質都是毒物，劑量決定是藥物或毒物。
Everything is a poison, there is nothing which is not. Only the dose differentiates a poison from a remedy.

化災意外處理的主要目標

- 保護化災緊急處理人員的安全
- 預防二次污染
- 降低化災罹災人員的傷害

達成上述目標的不二法門

1. 個人防護裝備
2. 適當除污

現場應變及除污

- 立即打電話或請人幫忙打電話求助。
- 將患者搬離暴露源：不論何種暴露途徑，應先由高危險區移至空氣新鮮的地方或給予氧氣，並在安全與能力所及之情況下，儘可能關閉暴露來源。
- 馬上進行除汙

現場除污

- 眼睛暴露：若有隱形眼鏡要盡速完整移除；低壓清水沖洗至少15分鐘。
- 皮膚暴露：大量清水沖洗至少15分鐘；一面沖洗，一面小心脫除被污染的衣物、手錶、腰帶、鞋等，且勿觸及身體其他部位，沖洗除污後須注意傷者之保暖。
- 吸入暴露：將患者移至空氣新鮮的地方；若呼吸困難，給予氧氣；若無呼吸則給予人工呼吸，但不建議以口對口方式進行。

Decontamination

- the reduction or removal of chemical agents.
- physical removal : imperative
- chemical neutralization or detoxification

The most important and most effective decontamination of any chemical exposure is that decontamination done within the first minute or two after exposure.

Chemical Decontaminants

- water/soap wash: mechanical force & slow hydrolysis
- Oxidation: oxidative chlorination by 0.5% Hypochlorite solution(the half time for destruction of VX by hypochlorite at a pH of 10 is 1.5 minutes), use on skin and soft tissue wounds only
- acid/base hydrolysis.

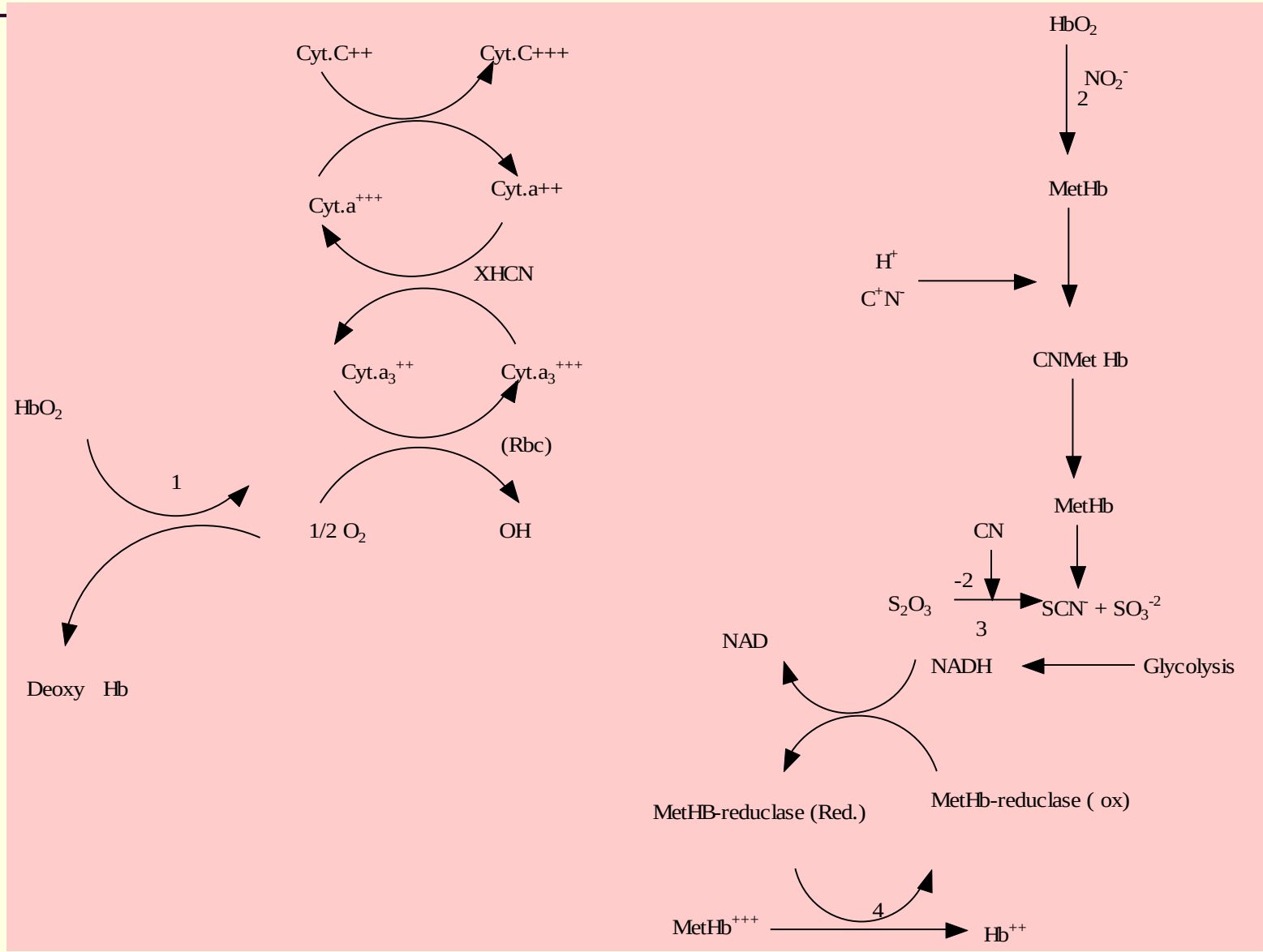
解毒劑是什麼?

- 能夠抵消毒物的作用的藥劑
- 解毒劑是具明確作用機轉，能夠改變毒物的毒物動力學或毒物致病機轉，且給予中毒病患後確實會產生相當益處的藥物。

毒物致病機轉(Toxicodynamic)

- 毒物如何傷害人體
- 細胞及分子層級
- 毒物在何處及如何產生它有害的作用
- 氰化物(cyanide) 與細胞色素氧化酵素(cytochrome oxidase) 結合 → 阻斷氧的利用→細胞缺氧

CN- 中毒機轉

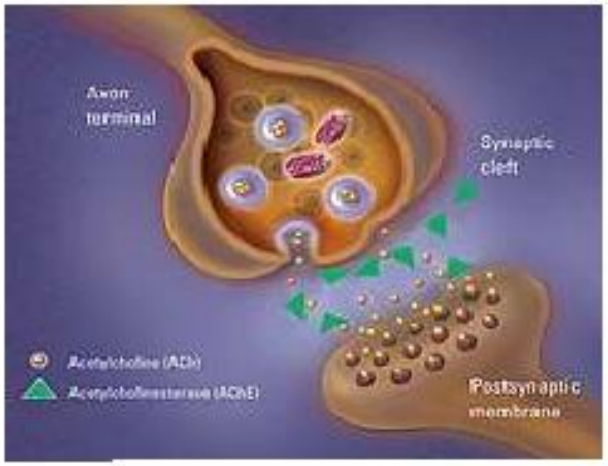

Cyt.C++
Cyt.C+++
Cyt.a+++
Cyt.a++
XHCN
Cyt.a3++
Cyt.a3+++
(Rbc)
HbO2
1
1/2 O2
OH
Deoxy Hb
HbO2
NO2-
2
MetHb
H+
C+N-
CNMet Hb
MetHb
CN
-2
S2O3
SCN- + SO3-2
3
NAD
NADH
Glycolysis
MetHB-reduclase (Red.)
MetHb-reduclase (ox)
MetHb+++
4
Hb++

Organophosphate(insecticide)

organophosphate poisoning accounts for nearly one third of hospital admissions from poisoning in Sri Lanka.

Commonly using trades are follows.

Malathion, parathion, diazinon, fenthione, chlorpyrifos.



Action

inhibit acetylcholine esterase enzyme at nerve endings by phosphorylation

↓

↑ acetylcholine at receptor sites

clinical features

depends on route of entry

↙ ↓ ↘

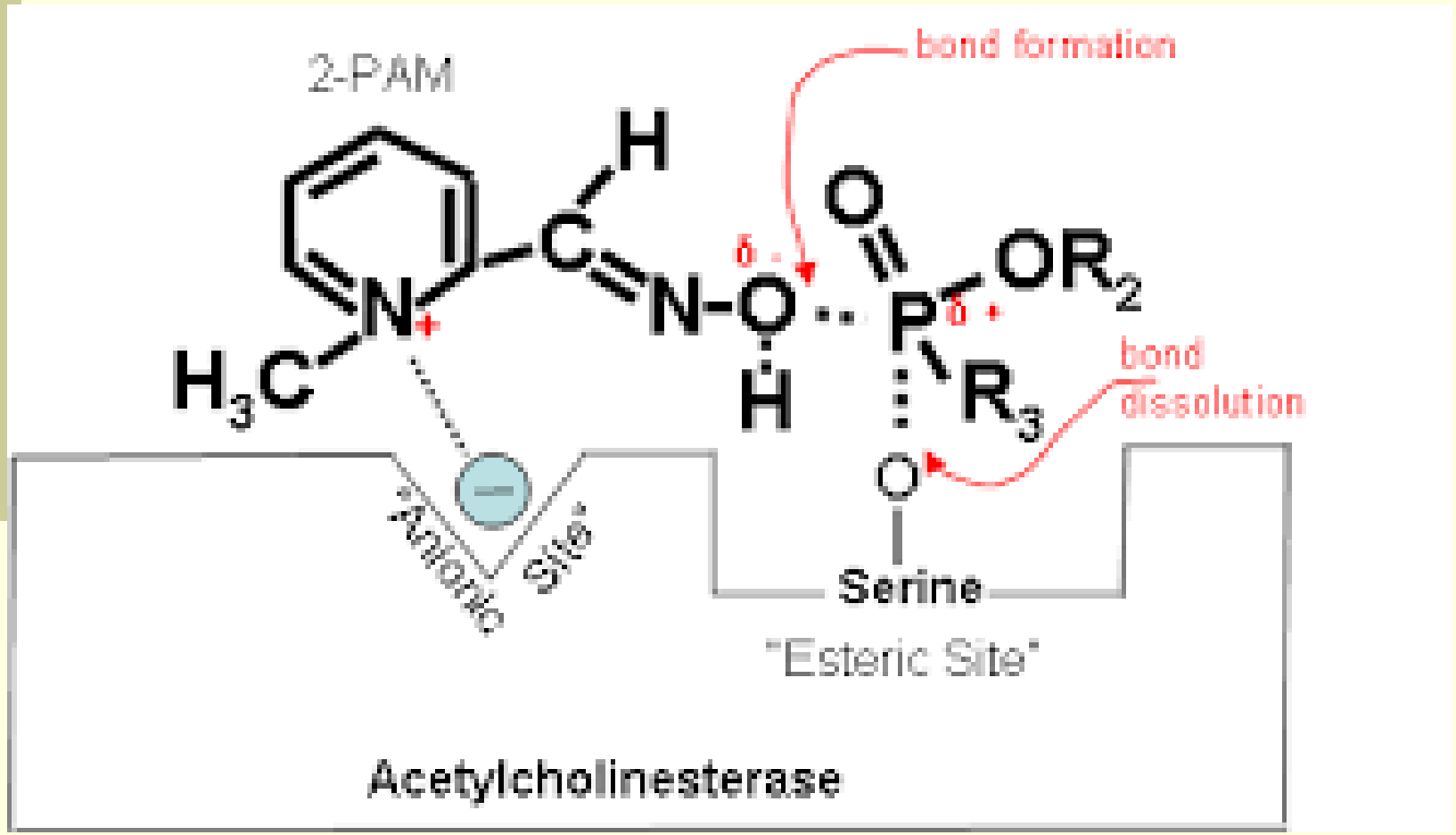
ingestion inhalation eye contact

毒物動力學(Toxicokinetics)

- 身體如何處理毒化物
- 吸收 (Absorption)
- 分佈 (Distribution)
- 異化作用 (Catabolism)
- 排除 (Elimination)
- 例：一氧化碳經由肺的肺泡微血管膜吸收，分佈到全身的血液中，沒有經過異化作用，藉著呼氣經由肺泡微血管膜排出人體。

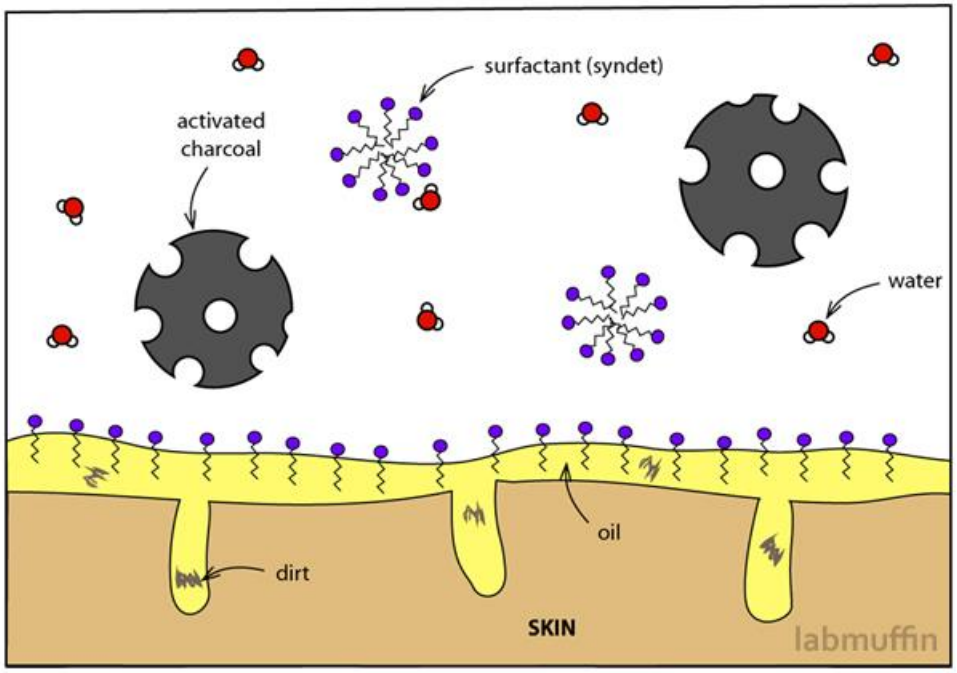
解毒劑如何改變毒物致病機轉

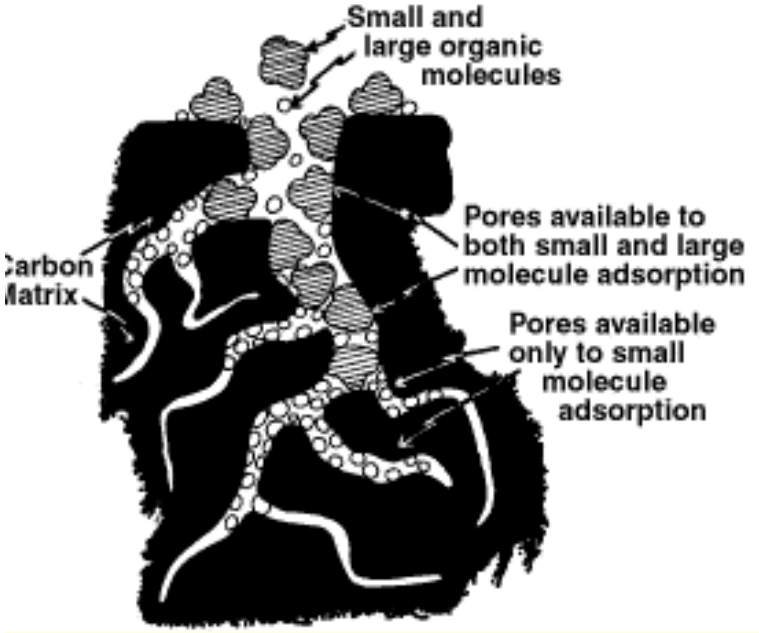
- 迫使毒物離開結合處(競爭或非競爭)
- 使毒物無法與接受器結合
- 矯正毒物的周邊影響

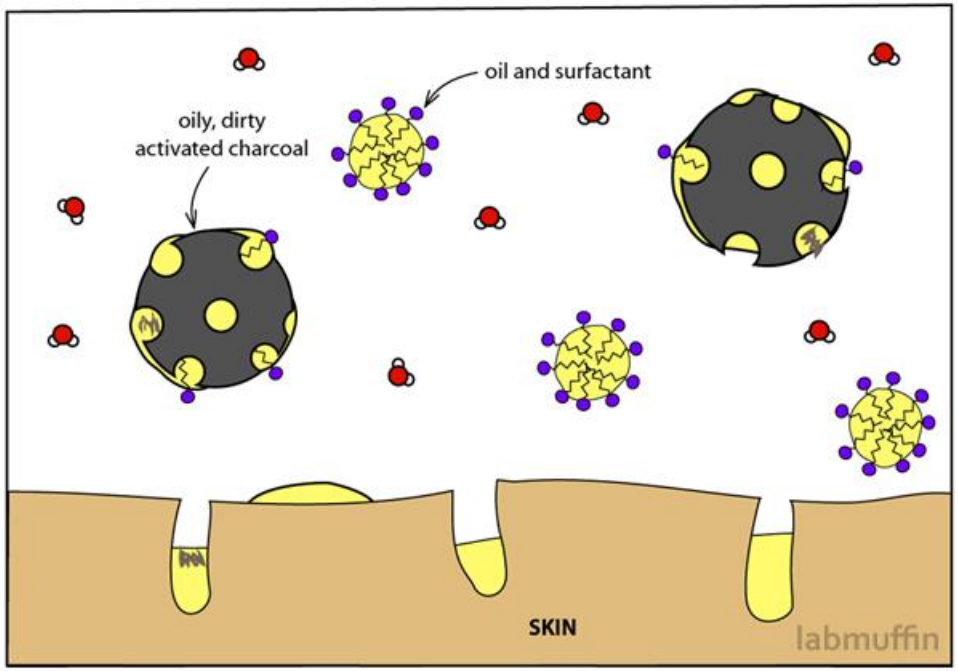

2-PAM
bond formation
bond dissolution
"Anionic Site"
Serine
"Esteric Site"
Acetylcholinesterase

解毒劑如何改變毒物動力學

- 降低生物體可用率(bioavailability)
- 改變細胞的重新分佈
- 減緩代謝活化途徑
- 加速代謝去活化途徑
- 促進未改變的毒物排除


surfactant (syndet)
activated charcoal
water
oil
dirt
SKIN
labmuffin


Small and large organic molecules
Pores available to both small and large molecule adsorption
Pores available only to small molecule adsorption

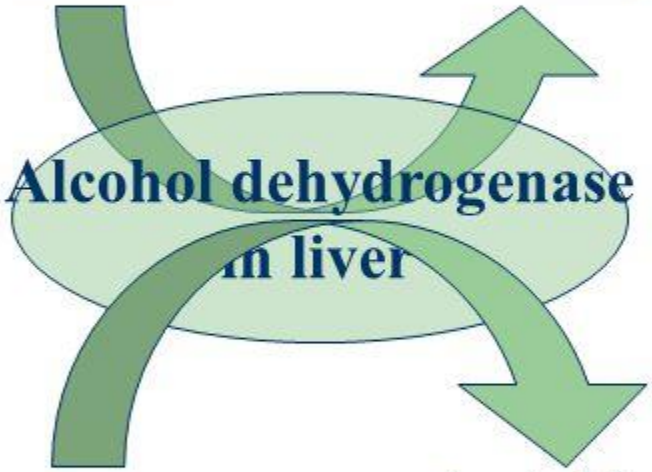

oil and surfactant
oily, dirty activated charcoal
SKIN
labmuffin

Competitive inhibition

- Medical application

Methanol → Formaldehyde → Tissue damage

e.g. blindness



Ethanol

$CH_3CH_2OH + NAD^+ \rightarrow CH_3CHO + NADH + H^+$

Acetaldehyde

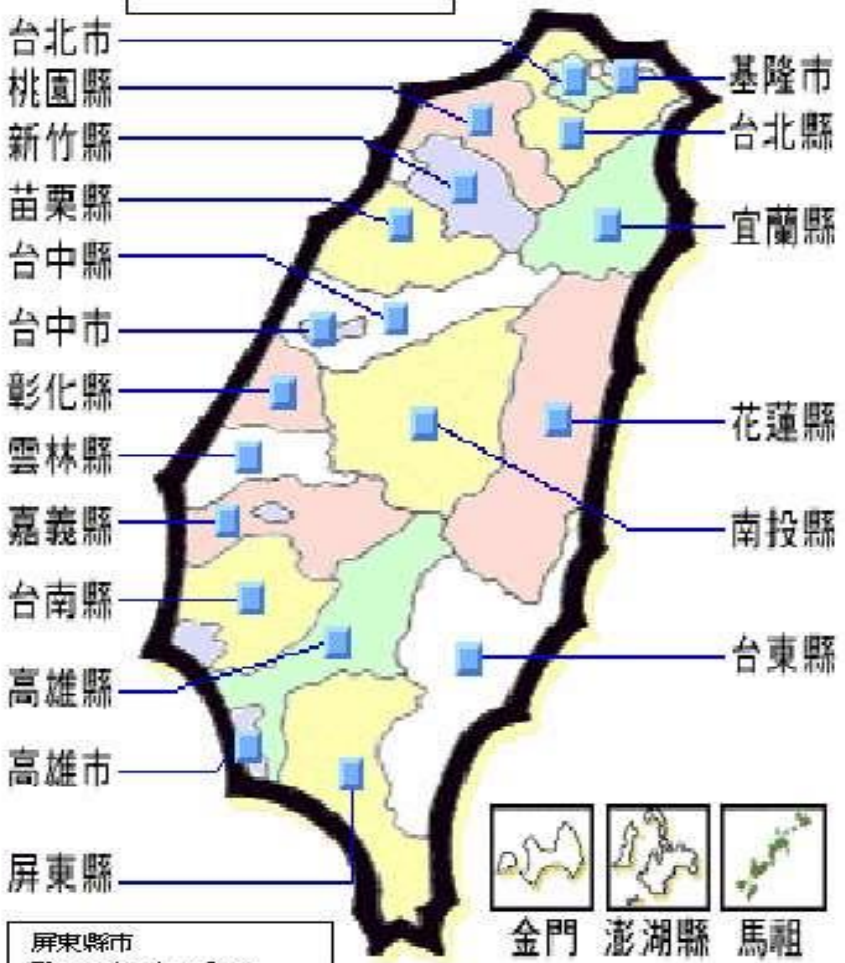
Acetaldehyde dehydrogenase

- Mitochondrial: low K_m
- Cytosolic: high K_m

$CH_3COO^- + NADH + 2H^+$

常 用 解 毒 劑

Drug or Class	Antidote
Opiates	Naloxone
Benzodiazepines	Flumazenil
Acetaminophen	N-acetylcysteine
Organophosphates	Atropine, Pralidoxime
Iron	Deferoxime
Lead	DMSA
Methemoglobin	Methylene Blue
Ethylene glycol, Methanol	Fomepizole
Isoniazid (INH)	Pyridoxine (B_6)
Digoxin	Digibind®
Cyanide	Na-nitrite, Na-thiosulfate
	Hydroxocobalamine



桃園縣市
Physostigmine: 20amp
Methylene Blue: 20 vial
Cyanide: 5pk
Ca-EDTA: 16box
DMSA: 20box
DMPS(Cap): 2box
DMPS(Amp): 8box

台北市
Physostigmine: 45amp
Methylene Blue: 45vial
Cyanide: 6pk
Hydroxocobalamin: 2set
Ca-EDTA: 56box
DMSA: 70box
DMPS(Cap): 6box
DMPS(Amp): 24box

基隆市
Physostigmine: 10amp
Methylene Blue: 10vial
Cyanide: 1pk

新竹縣市
Physostigmine: 5amp
Methylene Blue: 5vial
Cyanide: 1pk

台中縣市
Physostigmine: 30amp
Methylene Blue: 30vial
Cyanide: 4pk
Hydroxocobalamin: 2set
Ca-EDTA: 24box
DMSA: 30box
DMPS(Cap): 2box
DMPS(Amp): 8box

苗栗縣市
Physostigmine: 5amp
Methylene Blue: 5vial
Cyanide: 1pk

彰化縣市
Physostigmine: 15amp
Methylene Blue: 15vial
Cyanide: 1pk
Ca-EDTA: 8box
DMSA: 10box
DMPS(Cap): 1box
DMPS(Amp): 4box

雲林縣市
Physostigmine: 5amp
Methylene Blue: 5vial
Cyanide: 1pk

嘉義縣市
Physostigmine: 5amp
Methylene Blue: 5vial
Cyanide: 1pk

台南縣市
Physostigmine: 15amp
Methylene Blue: 15vial
Cyanide: 2pk
Ca-EDTA: 8box
DMSA: 10box
DMPS(Cap): 1box
DMPS(Amp): 4box

高雄縣市
Physostigmine: 30amp
Methylene Blue: 30vial
Cyanide: 4pk
Hydroxocobalamin: 2set
Ca-EDTA: 32box
DMSA: 40box
DMPS(Cap): 3box
DMPS(Amp): 12box

屏東縣市
Physostigmine: 5amp
Methylene Blue: 5vial
Cyanide: 1pk

台北縣
Physostigmine: 15amp
Methylene Blue: 15vial
Cyanide: 2pk

宜蘭縣市
Physostigmine: 5amp
Methylene Blue: 5vial
Cyanide: 1pk

花蓮縣市
Physostigmine: 10amp
Methylene Blue: 10vial
Cyanide: 2pk
Hydroxocobalamin: 2set
Ca-EDTA: 16box
DMSA: 20box
DMPS(Cap): 1box
DMPS(Amp): 4box

南投縣市
Physostigmine: 5amp
Methylene Blue: 5vial
Cyanide: 1pk

台東縣市
Physostigmine: 5amp
Methylene Blue: 5vial
Cyanide: 1pk

► 配置完成日期：2001 年 1 月 31 日

Sources of Cyanide

Cyanide Derivatives	Utilization and Availability
Hydrocyanide acid (prussic acid)	Fumigation of ships and large; dwellings invaded by mice, rats,
HCN	moths, bedbugs, and cockroaches.
	Control of insects on citrus trees
	Fumigation in vacuum containers of cotton and certain seeds
Cyanide salts	Photographic chemicals
KCN	Metallurgy for gold and silver extraction
NaCN	Electroplating;Metal cleaning; Organic synthesis
	Dehairing hides; Partial soil sterization
Organic nitriles	Synthetic rubber, fumigant gases
iminodipropionitrile	
Glyconitrile	
Acetonitrile	
Acrylnitrile	
Cyanamide	Fertilizer, cyanide-releasing substance
Cyanogen chloride	Chemical synthesis
Nitroprusside* (5 CN group/molecule)	Chemical synthesis, cardiovascular drug: vasodilating and antihypertensive
Amygdalin	Herbal pharmacotherapy
laetrile (6%)	Unorthodox cancer therapy
Apricap	
Bee-seventeen	
Aprikern	

*Short-term therapy(<1 week) had not produced toxic level of cyanide

"保力達蠻牛" drink contain: complex vitamin, protein, sugar.

Toxins-induced Collapse Suddenly

- Hypoxic agents
- Cardiac toxins: aconitine
- Acetylcholinesterase inhibitors
- Toxic gases: CO, Cyanide, H_2S, ---
- Nerve agents
- Anesthetics: On October 2002, the Russian military used a mysterious “gas” to incapacitate Chechen rebels at a Moscow theater

空氣中氰酸濃度對人體的影響

濃度(ppm)	臨床觀察
270	立即死亡
181	10 分鐘內死亡
135	30 分鐘內死亡
110~135	30~60分鐘內死亡
45~54	20~60分鐘內尚無立即之作用
18~36	停留數小時，有輕微症狀
10	可停留8小時，而無症狀

The Conditions of Suspected Cyanide Intoxication

- Sudden collapse of Lab or Industrial worker
- Fire victim with coma or acidosis
- Suicide or unexplained coma or acidosis
- Ingestion of artificial nail remover, metal cleaner
- Seeds or pits ingestion of Prunus species
- Altered mental status, acidosis & tachyphylaxis after nitroprusside therapy

Cyanide Intoxication—Case History

* 33 years old male, labor
* Time of exposure: 2:30pm,July 5,1990
* Cause: cyanide mixed with weak acid.
  fainting 2~3mins later.
* Finding: deep coma, sweating, foaming
  saliva, limbs cyanosis,
  no BP& HB.


'90 -7 -7

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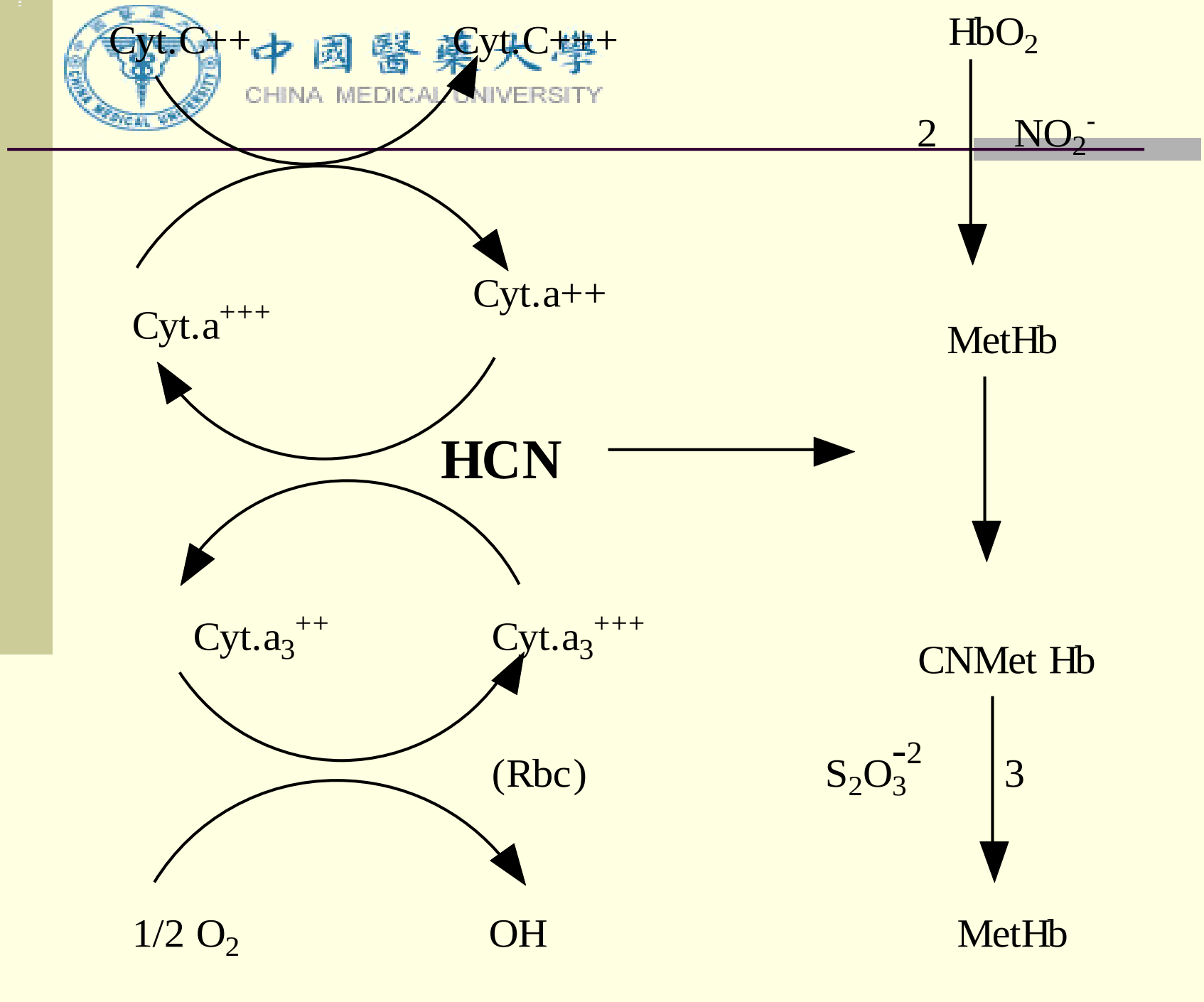
HCN Intoxication: ABG

Time	pH	$PaCO_2$	PaO_2	HCO_3^-	BE	SAT	Methb
15:43	6.795	79.5	79.8	11.2	-23.1	20.1%	--
16:05	6.840	60.5	135.5	9.5	-26.8	94.3%	10.7%
18:04	7.248	40.0	60.5	16.9	-9.7	85.8%	10.2%
20:56	7.336	43.4	413.9	22.5	-3.1	99.9%	--


Cyt.C++
Cyt.C+++
HbO2
2
NO2-
Cyt.a++
Cyt.a+++
MetHb
HCN
Cyt.a3++
Cyt.a3+++
CNMet Hb
(Rbc)
S2O3-2
3
1/2 O2
OH
MetHb

Antidotes for Cyanide Poisoning

1. **Cyanide antidote kits**

   Amyl nitrite, Sodium nitrite

   Sodium thiosulfate

2. **Dicobalt edetate + CN^-**

   → **Cobalticyanide (CO(CN))**

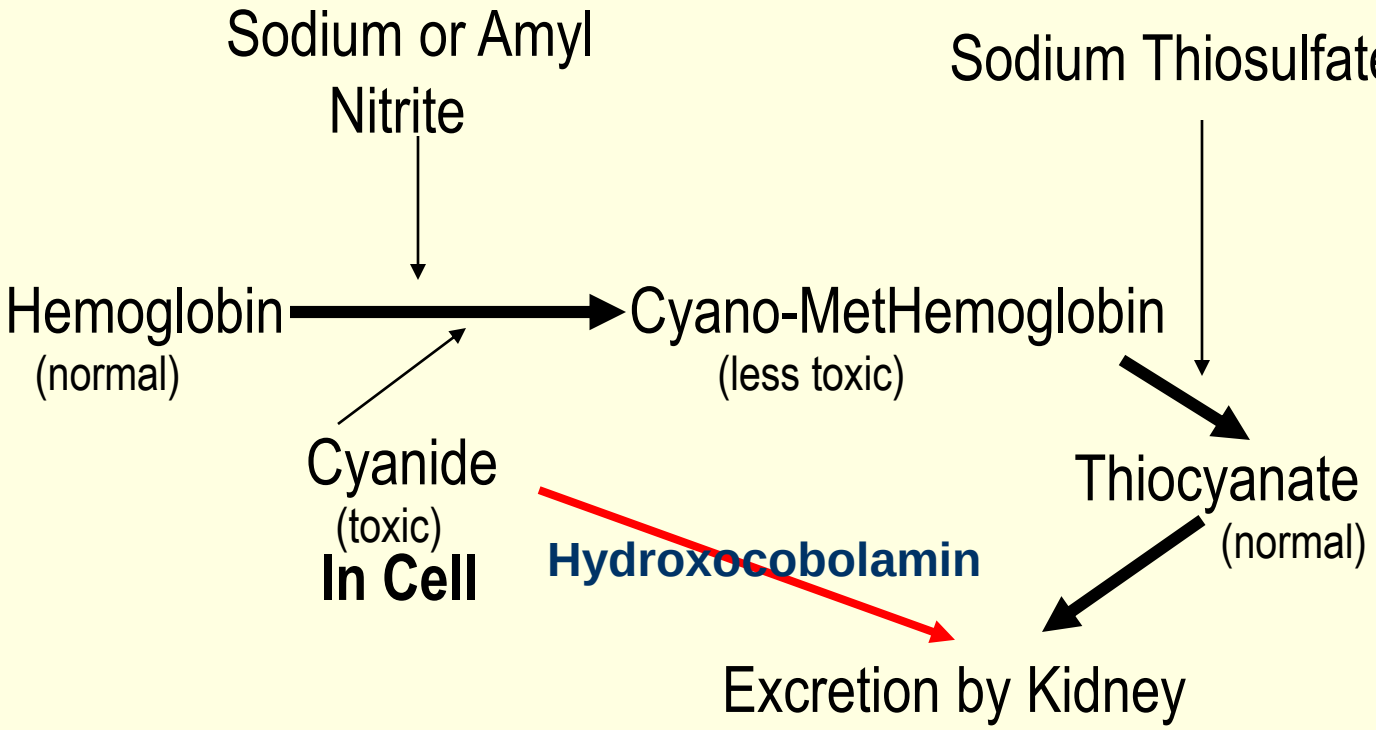
   + monocobalt edetate

3. **Hydroxocobalamin + CN^-**

   → cyanocobalamin (Vit. B_{12})

(Mushett et al., *Proc Soc Exp Biol Med* 1952; 81, 234-7)

氰化物中毒的解毒治療



Removal of cyanide from cytochrome a3 by use of nitrite and Sulfur-containing antidotes


CYANOKIT® 2,5 g
HYDROXOCOBALAMINE
LYOPHILISAT ET SOLUTION POUR USAGE PARENTÉRAL VOIE INTRAVEINEUSE
FREEZE-DRIED AND SOLUTION FOR PARENTERAL USE INTRAVENOUS ADMINISTRATION
LIPHA SANTE
MERCK

CYANOKIT


25°
30°
35°
40°
45°
50°
55°
APPROXIMATE ML
2000
1800
1600
1400
1200
Closed Urinary


民視新聞台
大高雄
中石化工安意外
FTV NEWS
閥門外洩毒液噴出 工人一死三傷


cti 中天新聞
死者:
黃 40歲
傷者:
陳 58歲
蔡 28歲
詹 25歲
最新
:53 中石化大社廠毒氣外洩 工人1死3昏迷

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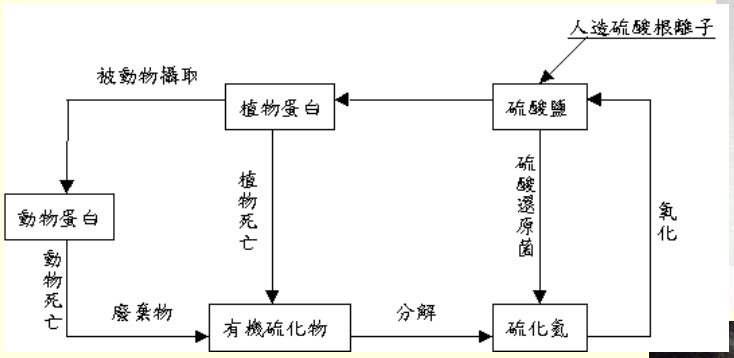
Sources of Hydrogen Sulfide

- 有機物分解作業—污水廢水處理 垃圾
- 硫酸及含硫鹽類
- 用於農業 釀造
- 重水製造
- 膠水製造
- 皮革製造—廢水池可達940 ppm
- 硫化橡皮
- 油氣探勘



petroleum refining, nautral gas, waste management, food procesing, fishing, asphalt production, rayon production, processing of dyes & sugar

警方指出，陳男把含有硫化氫的溶劑倒入桶子和臉盆內，腳邊則擺了清潔劑、鹽酸、硫酸等開封瓶罐，並緊閉車內門窗，靠在椅背上等氣體揮發，最後吸入過多有毒氣體身亡。**男吸硫化氫自殺 驚悚封街移毒 車窗留「毒氣」警語 怕傷無辜 一警吸入即吐**
2009年03月13日

樹林帝盟科技驚傳意外 回收廢液突冒毒氣 瞬間奪兩命

May 21, 2007	14:40	搶救氯氣波及 亞東醫院急診室封閉

May 22, 2007	9:30	Several health care workers complained of subjective discomfort.
	15:30	More workers complained the same symptoms. (sore throat, skin itching and bitter feeling in their mouth)

Figure 1. Exposure–response curves for hydrogen sulphide by species, adapted from an unpublished report by Dr Robert Rogers for the Alberta Energy Resources Conservation Board, 1990.

Occup. Mad. Vol. 46, No. 5. pp. 367-371.1996

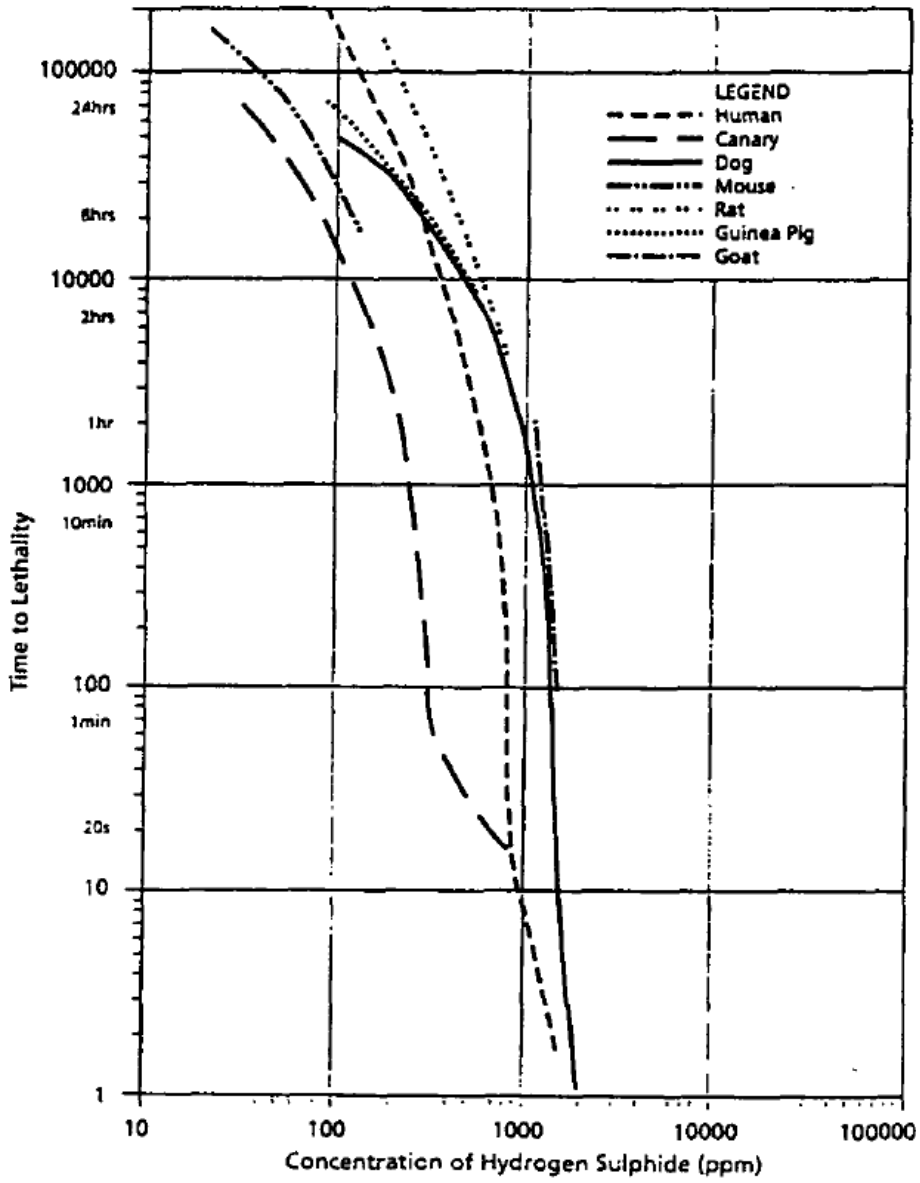
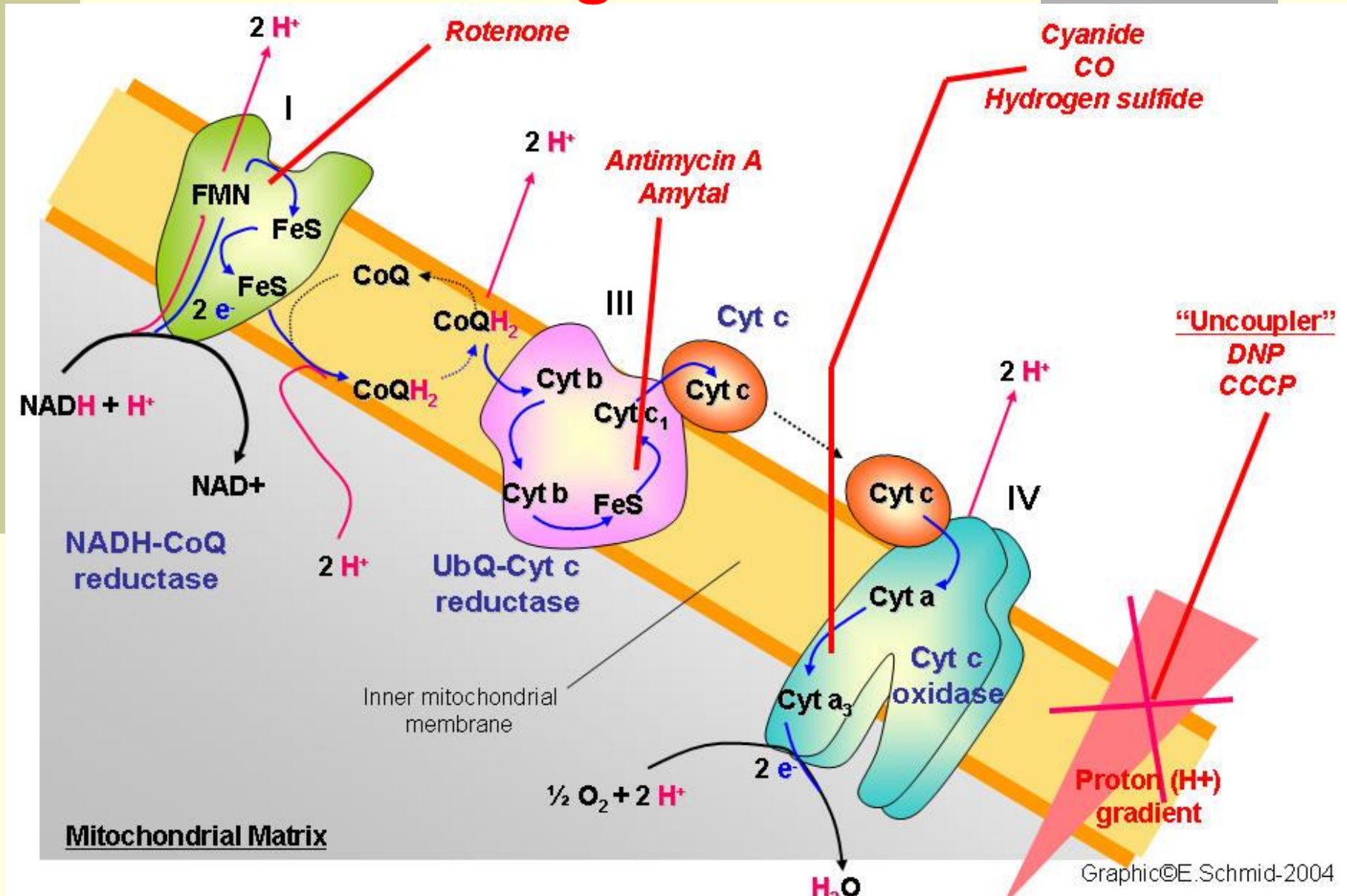


Table 1. Health effects of hydrogen sulphide at various exposure levels

Concentration (ppm)	*Effects*
0.01–0.3	Odour threshold (highly variable)
1–5	Moderate offensive odour, may be associated with nausea, tearing of eyes, headaches or loss of sleep with prolonged exposure; healthy young male subjects experience no decline in maximal physical work capacity
10	8 hour occupational exposure limit in Alberta
15	15 min occupational exposure limit in Alberta
20	Ceiling occupational exposure limit evacuation level in Alberta, odour very strong
20–50	Keratoconjunctivitis (eye irritation) and lung irritation. Possible eye damage after several days of exposure; may cause digestive upset and loss of appetite
100	Eye and lung irritation; olfactory paralysis, odour disappears
150–200	Sense of smell paralyzed; severe eye and lung irritation
250–500	Pulmonary oedema may occur, especially if exposure is prolonged
500	Serious damage to eyes within 30 min; severe lung irritation; unconsciousness and death within 4–8 hours; amnesia for period of exposure; 'knockdown'
1,000	Breathing may stop within one or two breaths; immediate collapse

Probable Mechanism of Hydrogen Sulfide Poisoning



硫化氫的中毒症狀

- 眼睛:角膜結膜炎導致流淚燒灼感，疼痛及紅腫, **Gas eyes**
- 低血壓 心律不整
- 呼吸抑制 發紺 及肺水腫
- 神智昏迷
- 噁心 嘔吐
- **Rotten egg smell on clothes or body fluid**

Table 2 Clinical symptoms after H_2S exposure[a]

"Felt ill"	Headache	Depression
Visual "fogging"	Insomnia	Irritability
Conjunctivitis	Sore throat/cough	Amnesia
Photophobia	Chest pain	Disequilibrium
Tearing	Dyspnea	Convulsions
Eye pain	Hemoptysis	Pulmonary edema
Nausea	Lethargy	Cyanosis
Vomiting	Abnormal peripheral reflexes	Unconsciousness
Anorexia	Weakness of extremities	Bradycardia

[a] Compiled from several sources (2, 7, 108).

Table 6. Odors That Suggest A Diagnosis.

Odor	Possible source
Bitter almonds	Cyanide
Carrots	Cicutoxin (water hemlock)
Fruity	Diabetic ketoacidosis, isopropanol
Garlic	Organophosphates, arsenic, dimethyl sulfoxide (DMSO), selenium
Gasoline	Petroleum distillates
Mothballs	Naphthalene, camphor
Pears	Chloral hydrate
Pungent aromatic	Ethchlorvynol
Oil of wintergreen	Methylsalicylate
Rotten eggs	Sulfur dioxide, hydrogen sulfide
Peanut butter	Vacor (rodenticide)

硫化氫中毒的除污

呼吸的除污

- 最重要的方法是適當換氣。
- 將病患救離暴露來源，給予適當換氣和充足 的100%氧氣

眼睛的除污

- 硫化氫氣體對眼睛會引起極度的刺激，且硫化物會形成對眼睛具腐蝕性的鹼性水溶液。
- 應立即除去隱形眼鏡並用大量的清水或生理食鹽水持續沖洗結膜囊，在運送途中和在醫院時仍應持續沖洗。假如情況不允許至少在現場沖洗20分鐘以上

皮膚的除污

- 硫化氫(氣體)的暴露通常不需要皮膚的除污。
- 病患衣服像腐臭的蛋臭味(rotten egg)，可脫除病患的衣服並用大量清水和溫和清潔劑沖洗。

硫化氫中毒的治療

- 除污
- 初步檢視和復甦
  - **A**irway(呼吸道+頸椎保護)
  - **B**reathing(呼吸)
  - **C**ardiovascular(心臟血管)
  - **D**isability(神經系統)
  - **E**xposure(暴露)

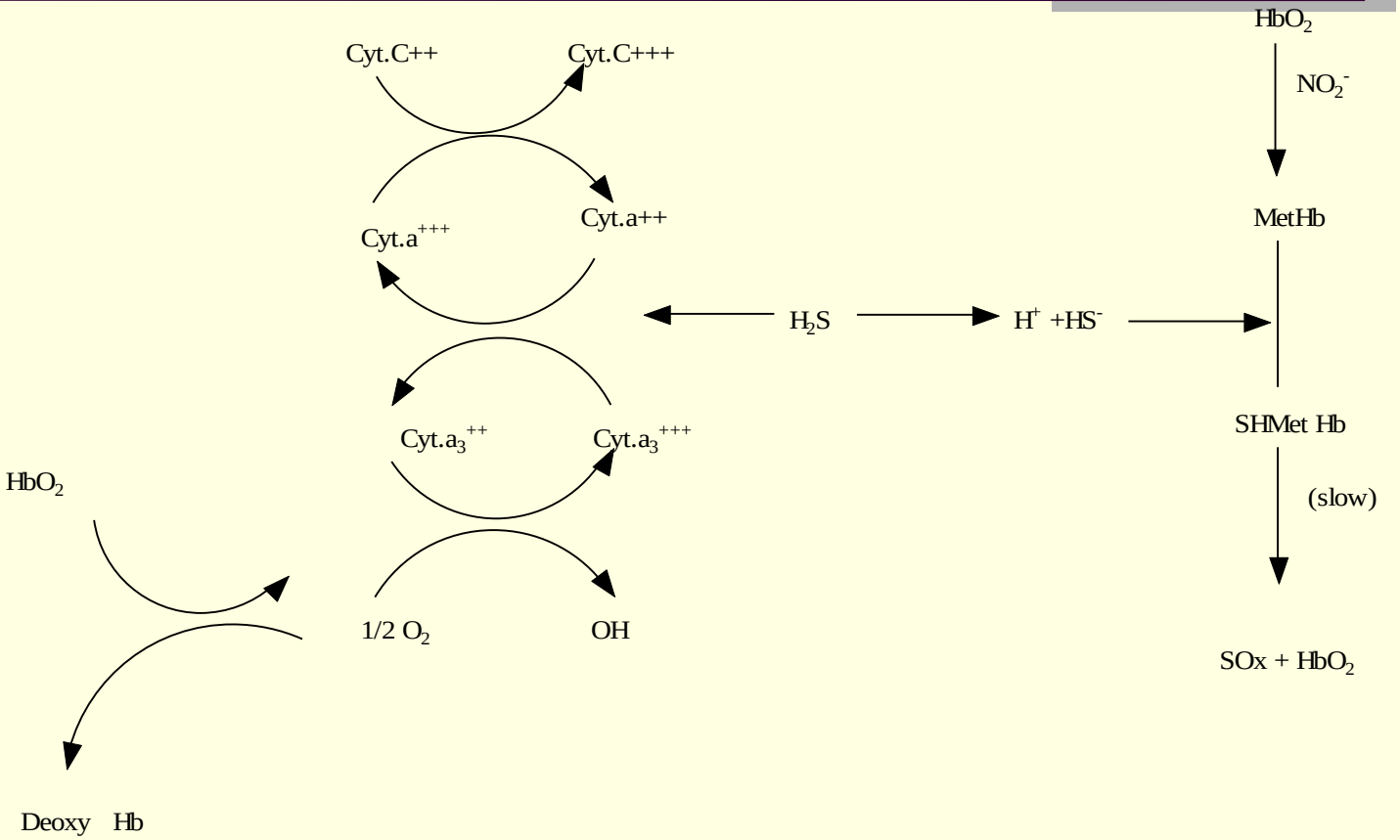
硫化物(sulfides)中毒的解毒劑

- 亞硝酸戊酯(amyl nitrite)
- 亞硝酸鈉(sodium nitrite)
- 高壓氧(HBO)？

硫化氫中毒的治療

- 100% 氧氣及洗胃
- 以 $NaHCO_3$ 調整酸中毒
- Amyl nitrite，置於鼻旁吸入15-30秒/次(可連續使用5分鐘)
- 3% Sodium nitrite 依量靜注 大人或大於25Kg小兒: 300mg (10ml)小兒 10mg/Kg
- 高壓氧治療

Probable Mechanism of Hydrogen Sulfide Poisoning



H_2S Rx Mechanism

Adapted from Smith RP, Gosselin RE: Hydrogen sulfide poisoning. J Occup Med 1974,21:94. Used with permission

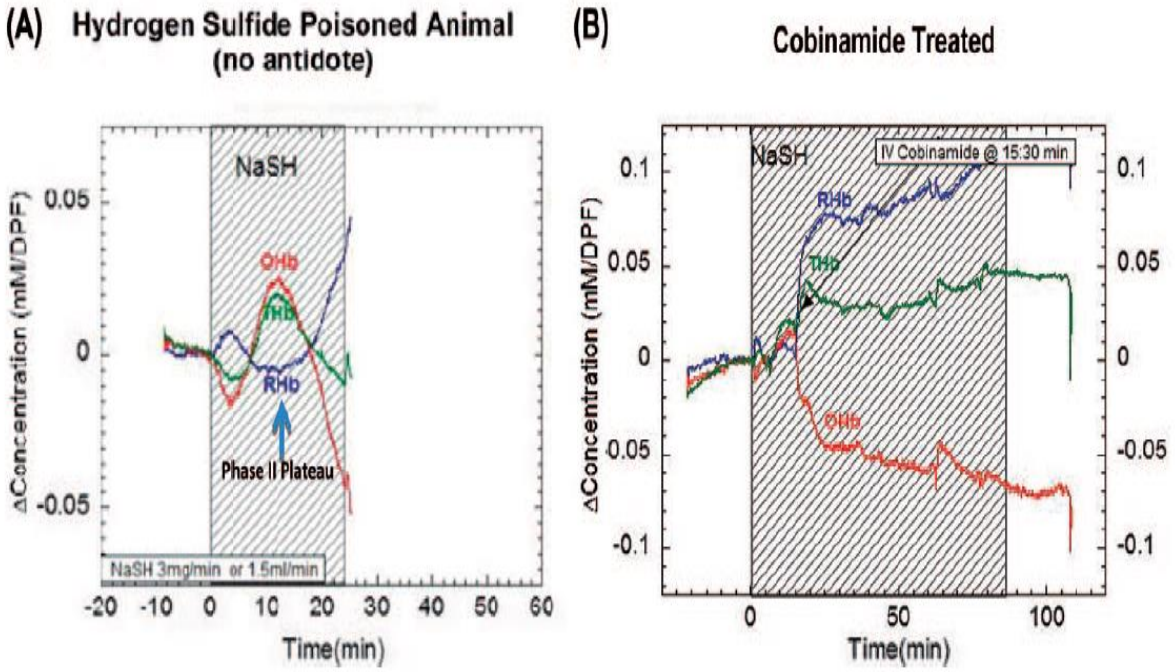
Utilization of Hyperbaric Oxygen Therapy and Induced Hypothermia After Hydrogen Sulfide Exposure

Mir J Asif DO and Matthew C Exline MD

Hydrogen sulfide is a toxic gas produced as a by-product of organic waste and many industrial processes. Hydrogen sulfide exposure symptoms may vary from mild (dizziness, headaches, nausea) to severe lactic acidosis via its inhibition of oxidative phosphorylation, leading to cardiac arrhythmias and death. Treatment is generally supportive. We report the case of a patient presenting with cardiac arrest secondary to hydrogen sulfide exposure treated with both hyperbaric oxygen therapy and therapeutic hypothermia to achieve full neurologic recovery. *Key words: hydrogen sulfide; hyperbaric oxygen; therapeutic hypothermia.* [Respir Care 2012;57(2):307–310. © 2012 Daedalus Enterprises]

The vitamin B12 analog cobinamide is an effective hydrogen sulfide antidote in a lethal rabbit model

Clinical Toxicology (2014), **Early Online:** 1–8



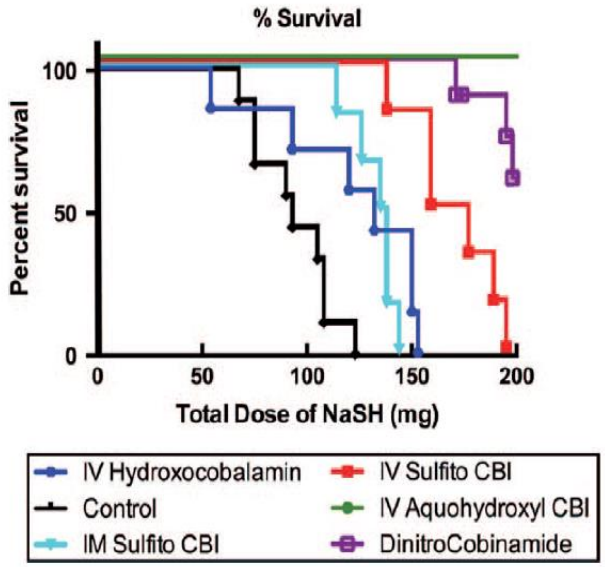


Fig. 3. Survival curve for animal groups receiving continuous infusion of NaHS at 3 mg/min until expiration.

Table 1. Experiment summary.

Group #	Treatment Group	*N*	mg of NaHS (mean) ± SEM	range (mg)	*p* vs. control	*p* vs. IV cobalamin
1	Control (NaHS alone)	9	93.8 ± 6.2	67.5–123	–	0.1 = NS
2	IV Hydroxocobalamin	7	121.7 ± 13.9	54–153	0.1 = NS	–
3	IV Aquohydroxocobinamide	6	261.5 ± 2.4	252–270	< 0.0001	< 0.0001
4	IV Sulfitocobinamide	6	170 ± 8.8	138–195	< 0.0001	< 0.02
5	IM Sulfitocobinamide	6	133 ± 4.4	114–144	< 0.0003	0.48 = NS
6	IM Dinitrocobinamide	8	165.4 ± 19.4	87–267	< 0.01	0.09

毒化物災害緊急醫療應變處理原則

A. 確保救護人員及其他公眾不受污染。

B. 確實且完整的病人除污，減少二次污染。

C. 中毒救命123

1 除污—暴露途徑

2 救命術--檢視和復甦

3 解毒劑—積極治療

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

White to slightly yellow crystalline solid. Toxic if swallowed or dust is inhaled. Oxidizer: May ignite organic materials and react with other materials.

Can decompose if mixed with acids or exposed to fire conditions, releasing toxic nitrogen oxides.

NO_2 can irritate the lungs and lower resistance to respiratory infection. Sensitivity increases for people with asthma and bronchitis. NO_2 chemically transforms into nitric acid and, when deposited, contributes to lake acidification. NO_2, when chemically transformed to nitric acid, can corrode metals, fade fabrics and degrade rubber. It can damage trees and crops, resulting in substantial losses.

- 列管毒性化學物質燃燒衍生污染物資訊手冊
- 彙編單位：國立雲林科技大學

列管編號	(1)	CAS NO.	(2)	UN NO.	(3)
中文名稱	(4)【同義名】				
英文名稱	(5)【同義名】				
毒性分類	(6)		防護等級	(7)	
文獻蒐集火場燃燒後可能分解物	(8)				
推估火場燃燒後可能分解衍生物	(9)				
完全燃燒 (O_2＞21%)	(10)				
不完全燃燒 (O_2≦21%)	(11)				
特殊危害衍生物	(12)				
特殊注意事項	(13)		防護建議	(14)	
急救方法	(15)		解毒劑或吸附劑	(16)	
火災處理	(17)		火災疏散半徑	(18)	
洩漏處理	(19)		洩漏疏散半徑	(20)	

列管編號	078—01	CAS No.	74—87—3	UN No.	1063
中文名稱	氯甲烷				
英文名稱	Chloromethane (Methyl chloride; Chloromethane; Monochloromethane)				
毒性分類	4			防護等級	A級
文獻蒐集火場燃燒後可能分解物	鹽酸、甲醇、含氯的高毒性蒸氣、光氣、氯氣和一氧化碳				
推估火場燃燒後可能分解衍生物	氯、一氧化碳、二氧化碳、氯化氫、光氣 ， 碳氫化合物				
完全燃燒（O_2＞21%）	氯、二氧化碳、氯化氫、光氣				
不完全燃燒（O_2≦21%）	氯、一氧化碳、二氧化碳、氯化氫、光氣、碳氫化合物				
特殊危害衍生物	氯、氯化氫、光氣				
特殊注意事項	1. 極度易燃氣體，避免吸入燃燒產物 2. 衍生物具毒性及腐蝕／刺激皮膚特性			防護建議	建議使用最高防護等級（A級）
急救方法	1. 將患者移至新鮮空氣處，若患者呼吸困難時，立即供應氧氣 2. 當患者停止呼吸時立即施以人工呼吸 3. 若衣物凍結到皮膚時，應先解凍後再脫除衣物，接觸到液化氣體時，結凍部份以溫水解凍之 4. 脫除並隔離污染之衣服及鞋襪			解毒劑 吸附劑	解毒劑： benzodiazepine IV
火災處理	1. 滅火材料：二氧化碳、化學乾粉、噴水或水霧 2. 在不危及人員安全的情況下，將容器自火場中移離 3. 以大量水霧滅火，位於上風處以避免危險的蒸氣和有毒的分解物			火災 疏散半徑	1600（公尺）
洩漏處理	1. 排除所有引火源（在附近區域不可有吸煙、閃火、火花或火燄） 2. 使用所有的設備操作時，必須先接地以消除靜電 3. 不要接觸或穿越洩漏污染區，隔離區域至氣體驅散 4. 如果可以的情況下，將容器洩漏破損的孔處朝上，寧可以氣態形式逸散，而不要以液體形式逸散 5. 灑水減少蒸氣或驅離蒸氣雲，避免逕流水接觸洩漏物，不可直接用水噴灑外洩源 6. 注意:當接觸冷藏/冷凍液時，有許多物質會變的易碎並且多半是無預警情況下破裂			洩漏 疏散半徑	少量洩漏： 50—100（公尺）


OXYGEN
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