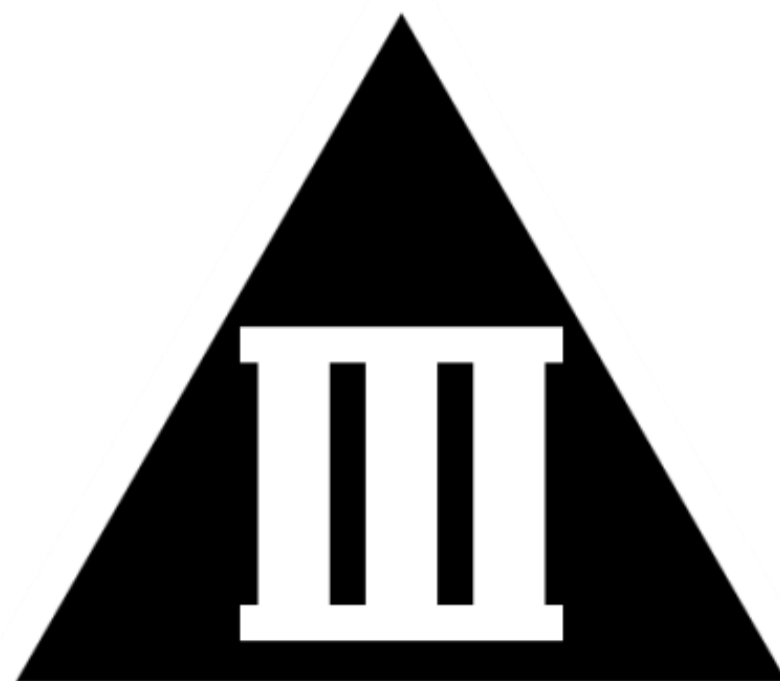


香港青年協會創新科學中心  
法證毒理學專題講座

# 毒藥、毒品－法證毒理學及毒品化驗

林漢華  
城市大學化學系



# A Brief History of Forensic Science

## 法證科學發展簡史



1248 CE 宋慈著洗冤集錄

**1300 CE**  
Southern Song Dynasty  
南宋時期



1530 CE Paracelsus established chemical medicine studies from alchemy



1597 CE Andreas Libavius published *Alchemia* – the first chemistry textbook

**1600 CE**



1840 CE The Lafarge murder case, Paris  
拉法基謀殺案、法國巴黎

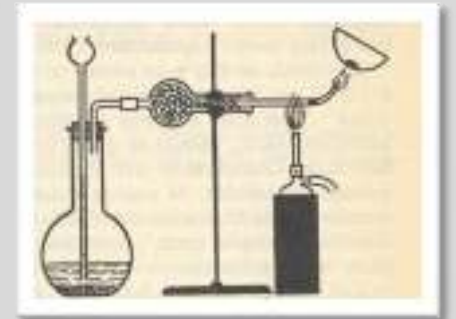
**1900 CE**



1910 CE  
Edmond Locard established the world first forensic laboratory in Lyon, France



Arsenic trioxide  
三氧化砷、砒霜  
LD<sub>50</sub> 14 mg/kg b w



Marsh's test for arsenic



# The Marsh's Test for Arsenic

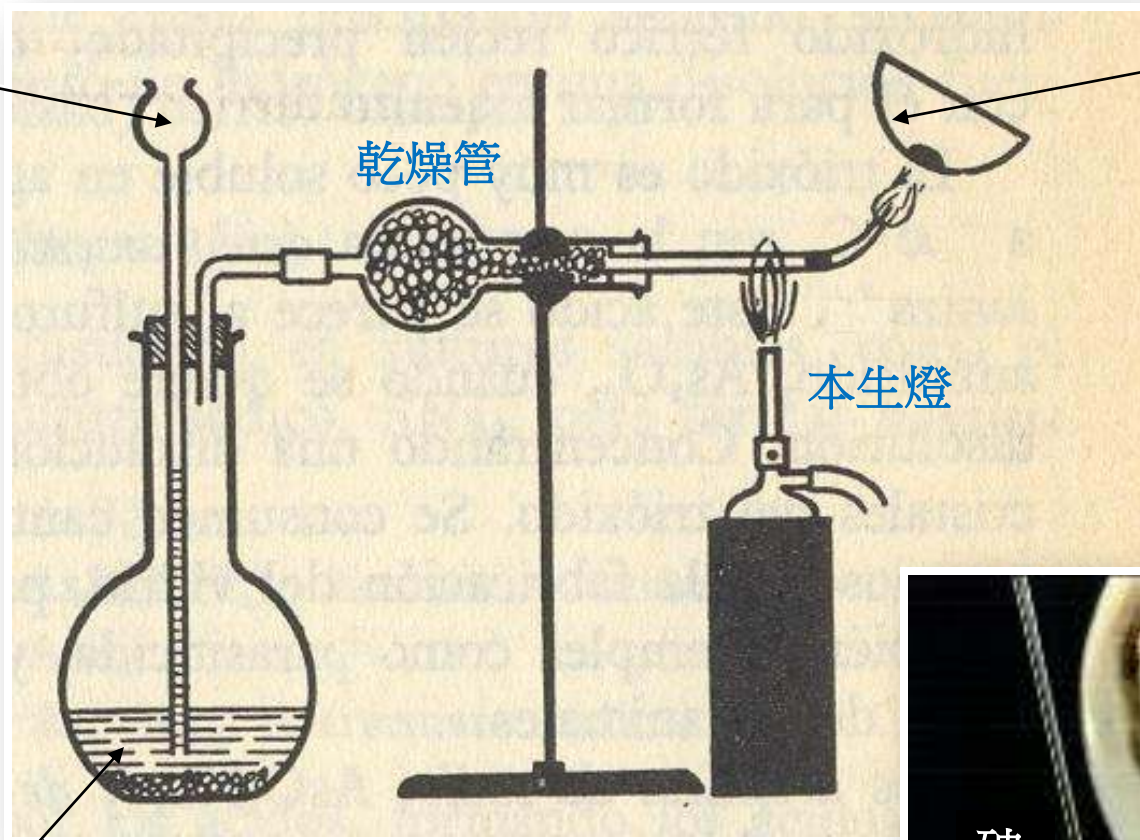
濃氫氯酸

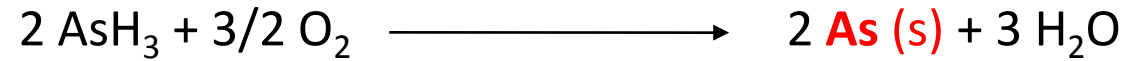
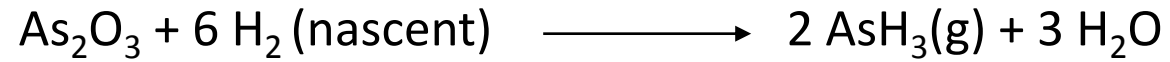
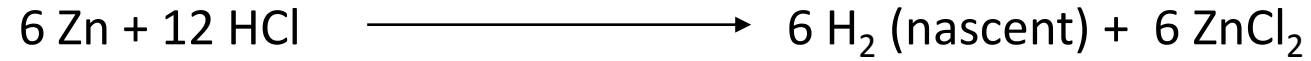
乾燥管

瓷碟

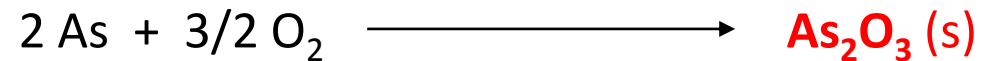
本生燈

樣本、鋅、硫酸銅催化劑





Formation of black stain on white substrate  
在白色平面上產生黑色鏡面

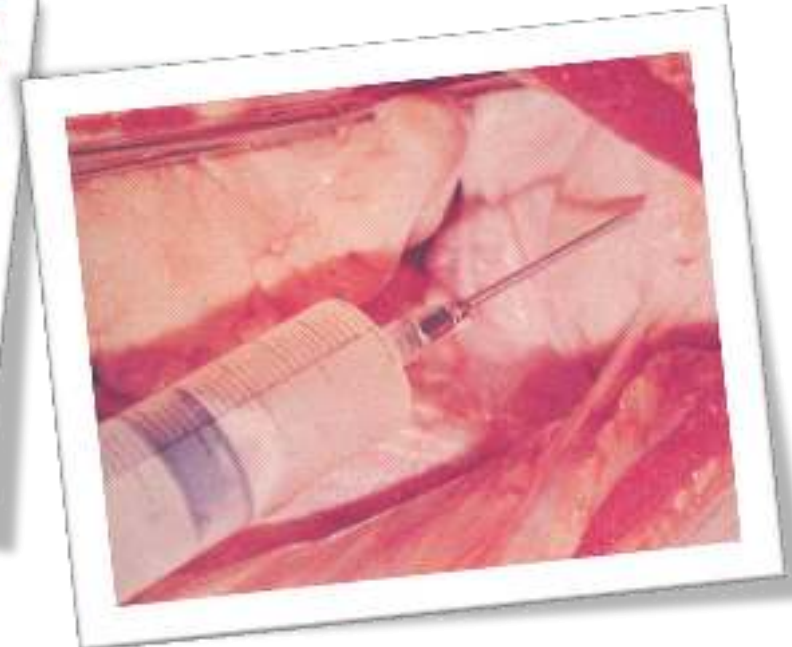


Black stain turns white upon heating  
黑色鏡面遇熱變回白色

## Forensic toxicology 法證毒理學

Forensic toxicology is the use of toxicology and other disciplines such as analytical chemistry, pharmacology and clinical chemistry to aid medical or legal investigation of death, poisoning, and drug use.

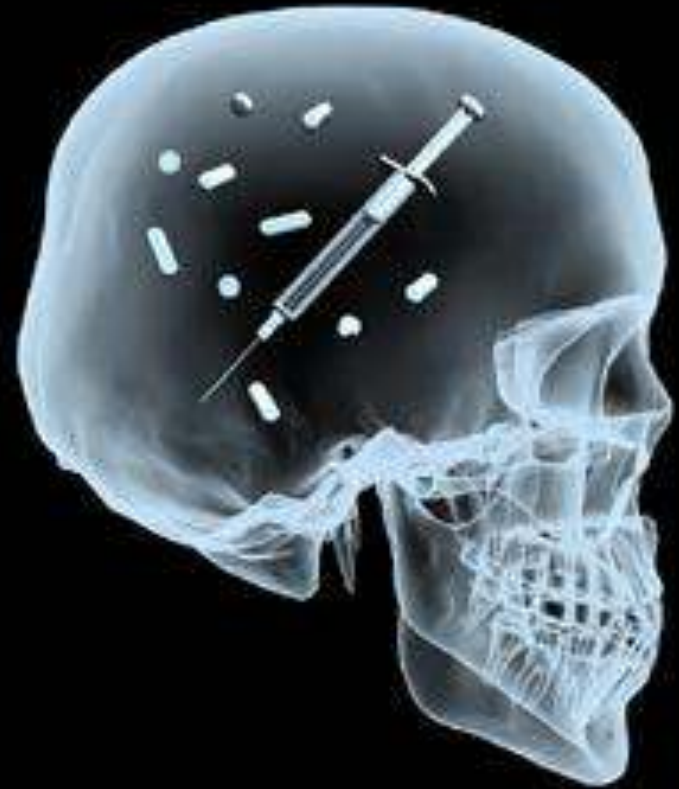
法毒理學是利用毒理學和其他學科如分析化學，藥理學和臨床化學來幫助對死亡，中毒和藥物使用進行醫學或法律調查。



## Lethal toxicants 致命毒物

- ❖ Carbon monoxide 一氧化碳
- ❖ Central nervous system depressants 中樞神經壓抑劑
- ❖ Dangerous drugs 毒品
- ❖ Poisons 毒藥 – cyanide 氰化物(山埃), arsenic oxides 砒霜, rodenticides 老鼠藥
- ❖ Pesticides 農藥
- ❖ Medicine 醫療藥物 – insulin 胰島素, potassium chloride 氯化鉀
- ❖ Chemical warfare 化學武器 (神經毒素) – VX, Sarin 沙林毒氣, Saxitoxins 麻痺性貝類毒素, Tetrodotoxin 河豚毒素, Ricin 蓖麻毒素

- ❖ **Drugs** 藥物
- ❖ **Poisons** 毒藥
- ❖ **Drug abuse** 濫用藥物
- ❖ **Drug dependence** 藥物依賴
- ❖ **Withdrawal symptoms** 戒斷症狀
- ❖ **Social acceptability** 社會接受程度
- ❖ **Dangerous drugs** 危險藥物
- ❖ **Overdose** 服用過量藥物





# Laws of Hong Kong, Chapter 134: Dangerous Drugs Ordinance

## PART II

### CONTROL OF IMPORT, EXPORT, PROCURING, SUPPLY, DEALING IN OR WITH, MANUFACTURE AND POSSESSION OF DANGEROUS DRUGS

#### Trafficking in dangerous drug

- (1) Save under and in accordance with this Ordinance or a licence granted by the Director (*of Health*) hereunder, no person shall, on his own behalf or on behalf of any other person, whether or not such other person is in Hong Kong-
- (a) traffic in a dangerous drug;
  - (b) offer to traffic in a dangerous drug or in a substance he believes to be a dangerous drug; or
  - (c) do or offer to do an act preparatory to or for the purpose of trafficking in a dangerous drug or in a substance he believes to be a dangerous drug.
- (2) Subsection (1) shall apply whether or not the dangerous drug is in Hong Kong or is to be imported into Hong Kong or is ascertained, appropriated or in existence.
- (3) Any person who contravenes any of the provisions of subsection (1) shall be guilty of an offence and shall be liable-
- (a) on conviction on indictment, to a fine of \$5000000 and to imprisonment for life; and
  - (b) on summary conviction, to a fine of \$500000 and to imprisonment for 3 years.
- (4) This section does not apply to-
- (a) a preparation specified in Part II of the First Schedule; or
  - (b) a dangerous drug which is in transit and-
    - (i) is in course of transit from a country from which it may lawfully be exported to another country into which it may lawfully be imported; and
    - (ii) was exported from a country which is a party to the Conventions and is accompanied by a valid export authorization or diversion certificate, as the case may be.

**Trafficking in purported dangerous drug**

- (1) No person shall, on his own behalf or on behalf of any other person, whether or not such other person is in Hong Kong-
  - (a) traffic in any substance represented or held out by him to be a dangerous drug but which is not in fact a dangerous drug;
  - (b) offer to traffic in any substance represented or held out by him to be a dangerous drug but which is not in fact a dangerous drug; or
  - (c) do or offer to do an act preparatory to or for the purpose of trafficking in any substance represented or held out by him to be a dangerous drug but which is not in fact a dangerous drug.
- (2) Subsection (1) shall apply whether or not the substance represented or held out to be a dangerous drug is in Hong Kong or is to be imported into Hong Kong or is ascertained, appropriated or in existence.
- (3) Any person who contravenes any of the provisions of subsection (1) shall be guilty of an offence and shall be liable-
  - (a) on conviction on indictment, to a fine of \$500000 and to imprisonment for 7 years; and
  - (b) on summary conviction, to a fine of \$100000 and to imprisonment for 1 year.
- (4) No prosecution for an offence under this section shall be instituted without the consent in writing of the Secretary for Justice, but this subsection shall not prevent the arrest, or the issue of a warrant for the arrest, of a person for any such offence, or the remand in custody or on bail of a person charged with such an offence.

**Dangerous drug not to be supplied except to person authorized or licensed to be in possession thereof**

(1) No person shall supply or procure, or offer to supply or procure, a dangerous drug to or for any person in Hong Kong unless-

- (a) the latter person is authorized by or licensed under this Ordinance to be in possession of that dangerous drug;
- (b) the dangerous drug is to be supplied or procured in accordance with this Ordinance; and
- (c) in the case of a person licensed under this Ordinance to be in possession of the drug, the dangerous drug is to be supplied or procured in accordance with the conditions of his licence.

(2) Any person who contravenes subsection (1) shall be guilty of an offence and shall be liable-

- (a) on conviction on indictment, to a fine of \$100000 and to imprisonment for 15 years; and
- (b) on summary conviction, to a fine of \$10000 and to imprisonment for 3 years.

(3) For the purposes of this section, the administration of a dangerous drug-

- (a) by or under the direct personal supervision of, and in the presence of, a registered medical practitioner;
- (b) by or under the direct personal supervision of, and in the presence of, a registered dentist in the course of dental treatment;
- (c) by a sister for the time being in charge of a ward, theatre or other department in a prescribed hospital or in a health centre or clinic maintained by the Crown acting on the instructions of a registered medical practitioner, to a patient of that ward, theatre, department, health centre or clinic; or
- (d) which is a specified dangerous drug, by or under the direct personal supervision of, and in the presence of, a specified person in the course of medical treatment in a specified clinic, shall be deemed not to be the supplying of the dangerous drug.

**Manufacture of dangerous drug**

- (1) Save under and in accordance with this Ordinance or under and in accordance with a licence granted by the Director thereunder and on the premises specified in such licence, no person shall-
- (a) manufacture a dangerous drug; or
  - (b) do or offer to do an act preparatory to or for the purpose of manufacturing a dangerous drug.
- (2) Any person who contravenes subsection (1) shall be guilty of an offence and shall be liable on conviction on indictment to a fine of \$5000000 and to imprisonment for life.

**Possession of dangerous drug otherwise than for trafficking, and consumption of dangerous drug**

- (1) Save under and in accordance with this Ordinance or a licence granted by the Director thereunder, no person shall-
- (a) have in his possession; or
  - (b) smoke, inhale, ingest or inject, a dangerous drug.
- (2) Any person who contravenes any of the provisions of subsection (1) shall be guilty of an offence and shall be liable-
- (a) on conviction upon indictment to a fine of \$1000000 and, subject to section 54A, to imprisonment for 7 years; or
  - (b) on summary conviction to a fine of \$100000 and, subject to section 54A, to imprisonment for 3 years.



### **Cultivation of and dealing in cannabis plant and opium poppy**

- (1) No person shall cultivate any plant of the genus cannabis or the opium poppy, but nothing in this subsection shall prevent the Government Chemist, in his capacity as such, from cultivating a plant of the genus cannabis so far as may be necessary for the exercise of his employment.
- (2) No person shall, on his own behalf or on behalf of any other person, whether or not such other person is in Hong Kong-
  - (a) supply or procure or offer to supply or procure;
  - (b) in any way deal in or with or offer or purport to deal in or with; or
  - (c) import into or export from Hong Kong or do an act preparatory to or for the purpose of such importing or exporting, any plant of the genus cannabis or the opium poppy, whether or not the same is in Hong Kong or is ascertained or appropriated or in existence.
- (3) No person shall have in his possession any plant of the genus cannabis or the opium poppy unless the same is in transit.
- (4) Section 14 shall apply to any plant of the genus cannabis and the opium poppy when the same is in transit as it applies to a dangerous drug which is in transit.
- (5) Any person who contravenes any of the provisions of this section shall be guilty of an offence and shall be liable on conviction on indictment to a fine of \$100000 and to imprisonment for 15 years.

## The five categories of dangerous drugs

- ❖ Opiates 鴉片類 (鴉片、嗎啡、海洛英、美沙酮)
- ❖ Depressants 中樞神經壓抑劑 (巴比通、苯二氮卓類安眠藥)
- ❖ Stimulants 興奮劑 (安非他明、冰毒、可卡因、忘我)
- ❖ Hallucinogens 迷幻藥 (大麻、麥角酸、安非他明)
- ❖ Tranquilizers 鎮靜劑 (氯胺酮 – K仔、苯二氮卓類鎮靜劑)

# Central nervous system depressants 中樞神經壓抑劑

苯二氮卓類安眠藥、鎮靜劑



綠豆仔

藍精靈

正常狀態

心理鬆弛

失去抑制

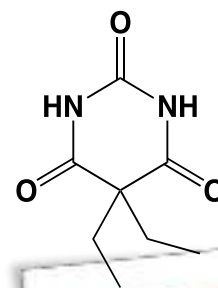
鎮靜狀態

睡眠狀態

麻醉狀態

死亡

中樞神經壓抑



巴比通類安眠藥



酒精



KBr 溴化鉀

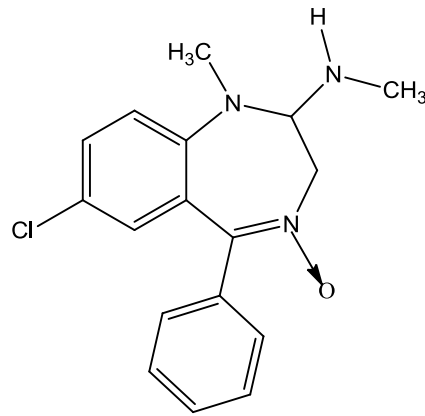
Opium, morphine and heroin 鴉片、嗎啡、海洛英(白粉)







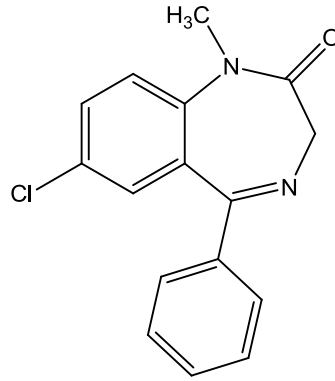
# Benzodiazepines 苯二氮卓類安眠藥、鎮靜劑



Chlordiazepoxide



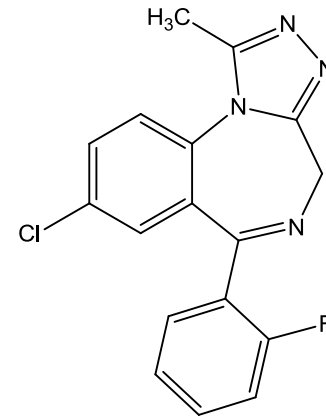
(Green Bean 綠豆仔)



Diazepam



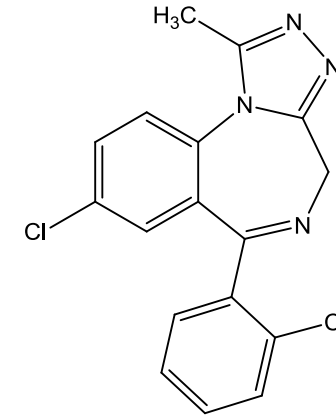
(Valium 安定, 利眠寧)



Midazolam



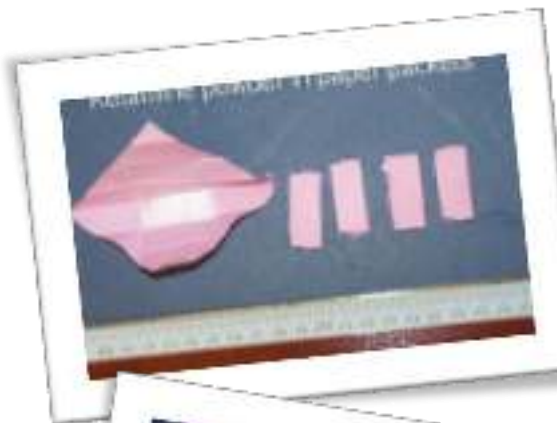
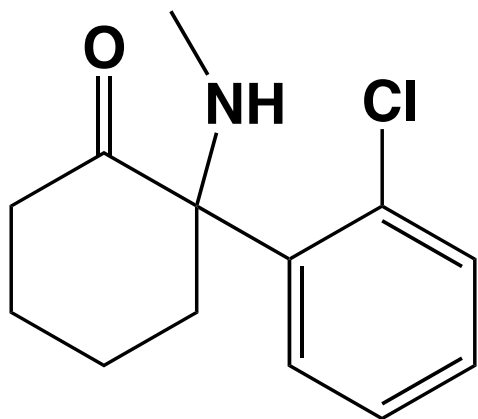
(Blue Gremlin 藍精靈)



Triazolam



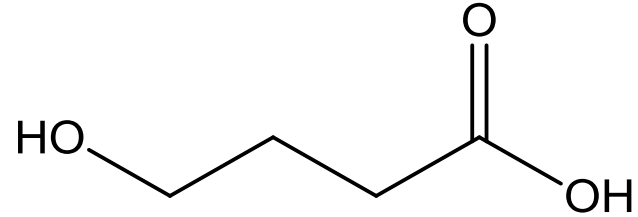
# Ketamine 氯胺酮、K仔



分離性麻醉劑



## Other disassociative anesthetics 其他常見分離性麻醉劑

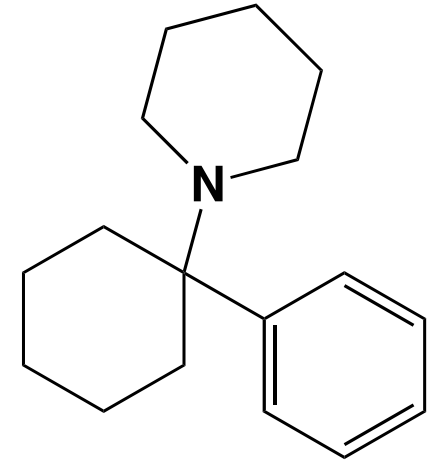
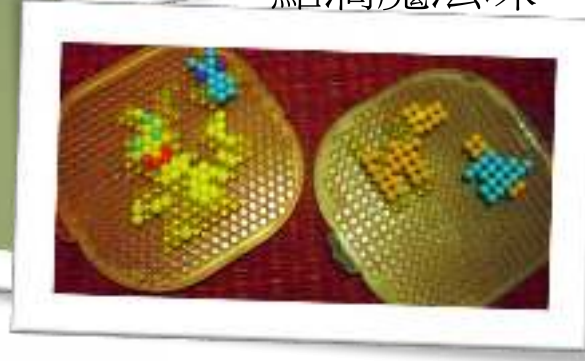


$\gamma$ -Hydroxybutyric acid (GHB)

迷姦水



點滴魔法珠

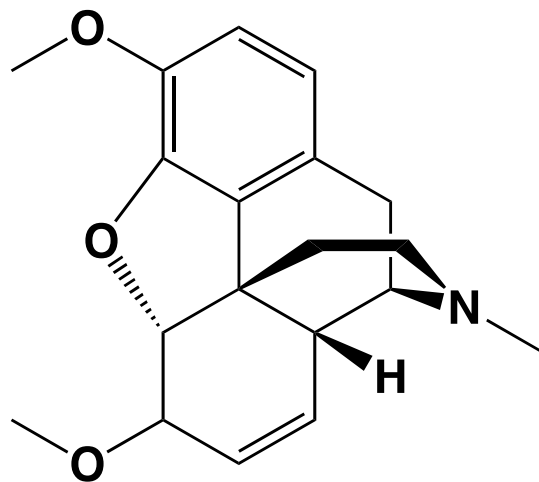


Phencyclidine (PCP)

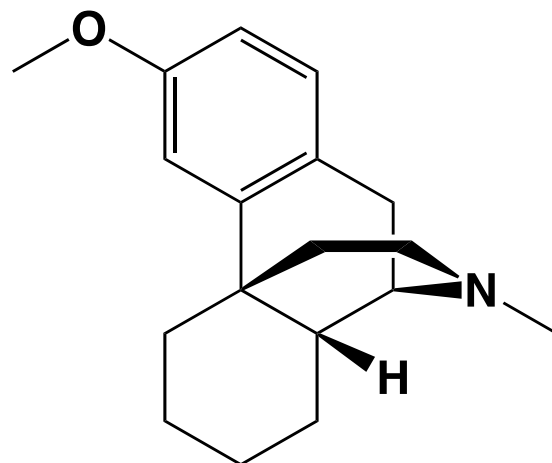
天使塵



## Cough syrups/suppressants 咳藥水



Codeine 可待因



Dextromethorphan  
右美沙芬





製冰毒工場



## Spot tests for dangerous drugs 毒品的快速測試

### Marquis' test

試劑製作: 於一百毫升濃硫酸(鎚水)中添加五毫升福以馬林

陽性反應: 鴉片類毒品 - 紫紅色; 安非他明類毒品(如冰毒) - 橙啡色



# Poisons 毒藥

Median lethal dose LD<sub>50</sub> 半數至死量

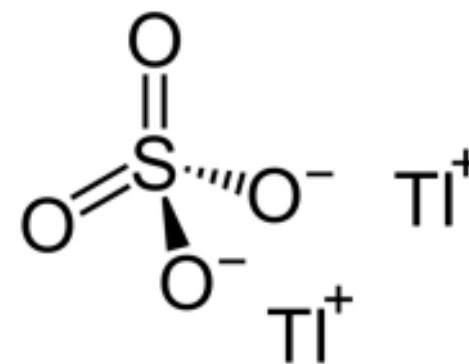
毒藥／毒素	LD <sub>50</sub> 毫克/每公斤體重
食鹽	3,000
巴比通安眠藥	800
DDT (有機氯農藥)	100
海洛英	21.8*
甲胺磷(有機磷農藥)	21
砒霜	14
氰化鉀(山埃)	5
河豚毒素	0.33
沙林毒氣	0.17**
VX	0.14**
蓖麻毒素	0.02*
貝類麻痺毒素	0.01*



\* 靜脈注射

\*\* 吸入





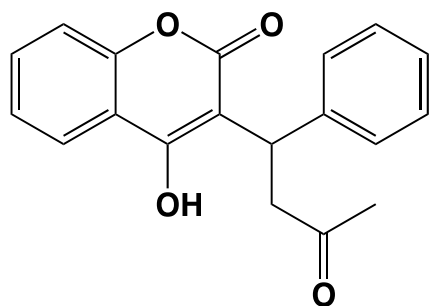
Thallium(I) sulfate 硫酸鉈

LD<sub>50</sub> = 16毫克/每公斤體重

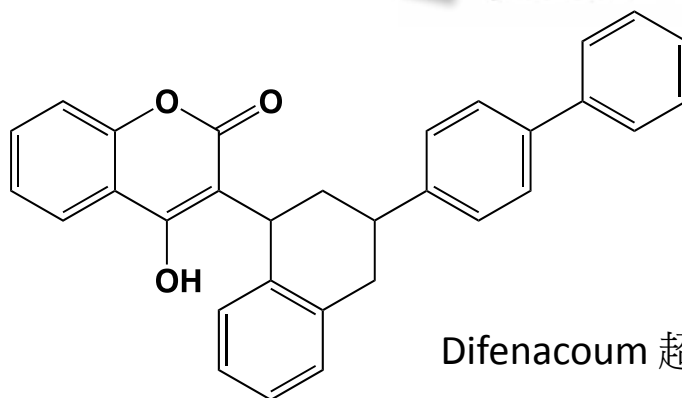


Graham Young (1947 – 1990) – the Teacup Poisoner 茶杯下毒者

# Poisoning by rodenticides 以老鼠藥下毒

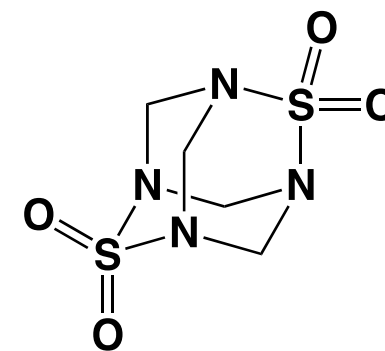


Warfarin 華法林



Difenacoum 超級華法林

Anticoagulants 抗凝血毒藥



Tetramethylene disulfotetramine  
毒鼠強、聞到死

CNS depressant

## Murder by a carbon monoxide balloon 一氧化碳氣球謀殺案

中文大學醫學院副教授妻女2015年5月，於停泊西沙路路邊的座駕內離奇雙亡。兩母女的血液中一氧化碳含量接近百分之五十，疑吸入高濃度一氧化碳致死。鑑證人員和政府化驗師除了對車輛拆解分析外，另循多方面調查，包括對案發時在車尾箱檢獲的一個已洩氣的健身球、紅白藍膠袋等物品進行科學鑑證，追查不尋常的氣體來源，不排除健身球有問題，或牽涉人為因素。

2017年9月11日早上六時，重案組拘捕醫學院副教授該，他隨後被落案控以兩項謀殺罪，12日下午在沙田裁判法院提堂。





## Carbon monoxide poisoning 一氧化碳中毒

空氣中濃度 (ppm, 每百萬份)	症狀
1,600	二十分鐘之內感到頭痛、心跳加速、頭暈，兩小時之內至命。
3,200	十分鐘之內感到頭痛、心跳加速、頭暈，半小時之內至命。
6,400	兩分鐘之內感到頭痛、心跳加速、頭暈，二十分鐘之內至命。
12,800	吸入兩、三口氣之後昏迷，三分鐘之內至命。



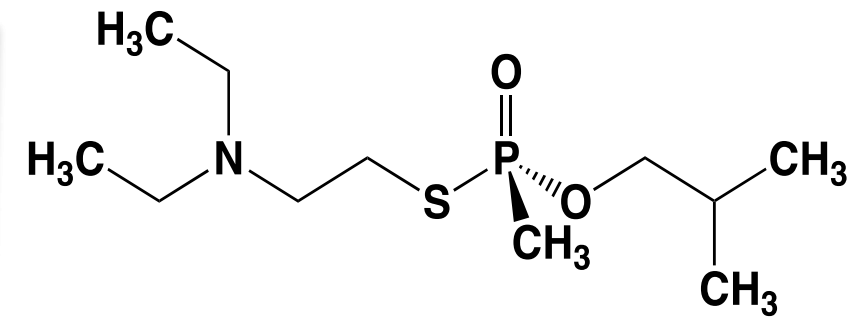
車箱體積約3立方米



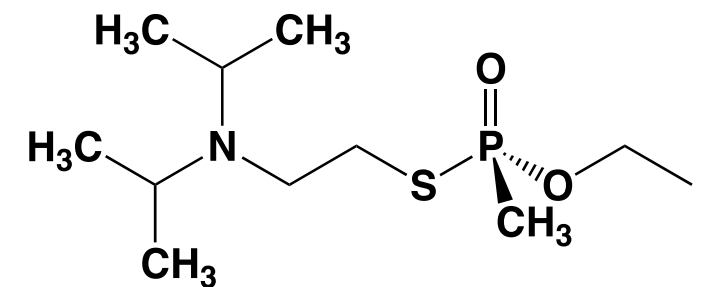
瑜珈健球體積0.3-1.8立方米

若一個**0.3**立方米充滿一氧化碳的氣球爆破，以可  
今車箱中一氧化碳濃度急升至超過**101,000ppm!**

# Forensic toxicology against assassination 法證毒理學與暗殺案偵查

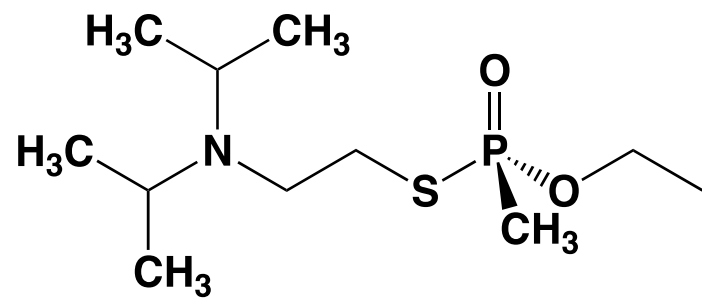
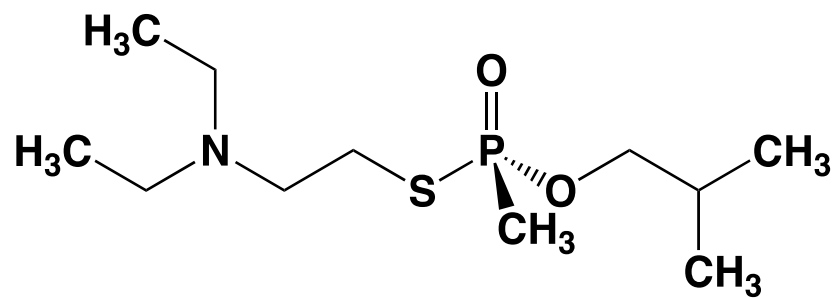


Novichok agent, VR

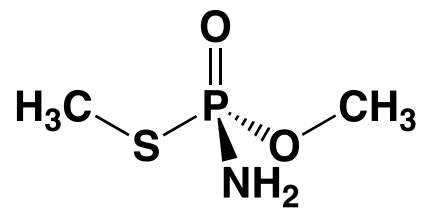


VX

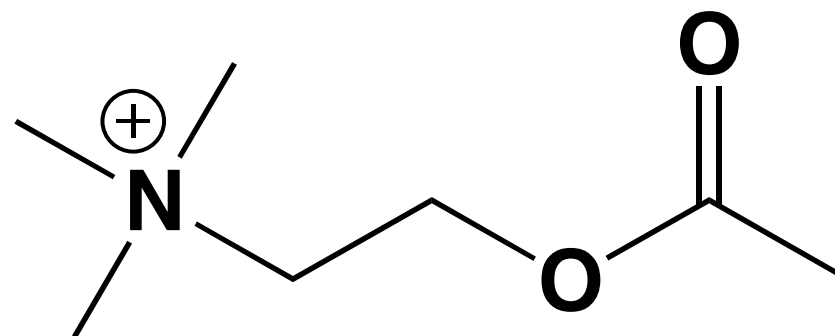
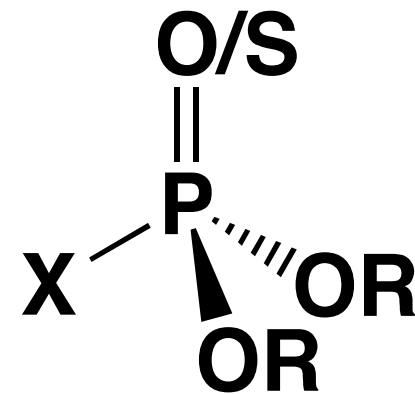




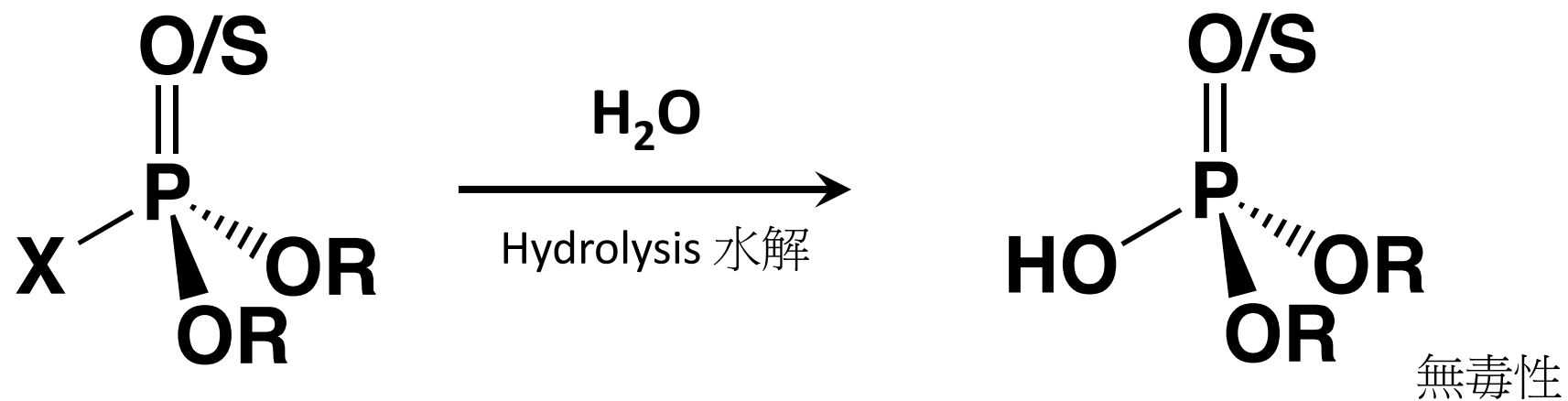
神經毒氣



甲胺磷



Acetylcholine 乙酰胆碱







**Thank you very much for your kind attention.**

**Stay away from dangerous drugs**

**Help to fight dangerous drugs and poison-related crimes**

