



Forensic Science

Lecture:

Drugs of Abuse



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No recording allowed

What's trending?

Summer (June - July 2021)				
21 June - 9 July	12 - 30 July			
LSM1306 <i>Forensic Science</i>	SP4263 <i>Forensic Toxicology and Poisons</i>			
Semester 1 (Aug - Dec 2021)				
Monday	Tuesday	Wednesday	Thursday	Friday
FSC2101 (old LSM1306) <i>Forensic Science</i> (6-10pm)	FSC5203 <i>Digital Forensic Investigations</i> (6-10pm)	FSC4201 (old SP4261) <i>Articulating Probability and Statistics in Court</i> (12-4pm)	FSC5101 <i>Survey of Forensic Science</i> (6-10pm)	FSC5201 <i>Advanced CSI Techniques</i> (6-10pm)
Semester 2 (Jan - May 2022)				
Monday	Tuesday	Wednesday	Thursday	Friday
FSC3101 (old SP3202) <i>Evidence in Forensic Science</i> (6-10pm)	FSC5205 <i>Forensic Science in Major Cases</i> (6-10pm)	FSC5204 <i>Forensic Psychiatry and Psychology</i> (6-10pm)	FSC4206/LL4362V <i>Advanced Criminal Litigation – Forensics on Trial</i> (10 am-2 pm)	FSC4202 (old SP4262) <i>Forensic Human Identification</i> (6-10pm)
Recess week (21 Feb to 25 Feb 2022) and 19 March 2022				
 FSC4207 (old SP4266) <i>Forensic Entomology (whole day)</i>				
Summer (May - July 2022)				
20 June - 8 July	11 - 29 July			
FSC4204A and FSC4204B (old SP4264 and SP4265) <i>Criminalistics</i>	SP4263 <i>Forensic Toxicology and Poisons</i>			

Updated 14 June 2021 by Prof Stella

For undergrads: 

Forensic Science Minor

- <https://www.dbs.nus.edu.sg/education/minor-in-forensic-science/>

Application

This is a restricted Minor and application is open to undergraduate students from all disciplines. Applicants should have passed or are reading FSC2101/LSM1306 and have obtained or expecting a good grade for the module, and preferably a CAP of at least 3.5. Successful entry to the Minor is subject to approval. The application to join the Minor should be made by the start of the fifth semester of the undergraduate candidature.

Application is via EduRec. Please refer to the Academic Plan Application/Declaration (APAD) [website](#) for more details.

To join the Minor in Semester 2 of AY2021/22, please submit the application start of reading week till end of first week of examinations of Semester 1 during Nov-Dec 2021.



Introducing Assoc. Prof. Stella Tan, the Director of Legal Policy and Prosecution at Health Sciences Authority, Singapore as a speaker at AFSN 2015 KL.

Stella Tan



7th ASIAN FORENSIC SCIENCES NETWORK
ANNUAL MEETING & SYMPOSIUM
16 - 18 NOVEMBER 2015
PULLMAN KUALA LUMPUR

Organized by: FSSM (Forensic Science Society of Malaysia)
In collaboration with: MoSTI, USM, UTM, Universiti Sains Malaysia
Platinum Sponsor: Thermo Fisher SCIENTIFIC
Gold Sponsor: QIAGEN

Illicit Drugs Working Group (IDWG)



Tuesday 17th November 2015

SESSION III :

Workshop II: "Presenting Effective Court Testimony"
*Associate Professor Stella Tan,
Health Sciences Authority, Singapore*



0830 – 0900	Perspective From The Judiciary And Prosecutors And Recent Challenges Opening lecture by <i>Associate Professor Stella Tan</i>	
0900 – 1030	Sharing by AFSN Member Institutes on their experience in Court <i>AFSN Members</i> (i) Mr Helmy Rabaha, Department of Scientific Services, Brunei Darussalam (ii) Dr Huang Xing, Institute of Forensic Science, China (iii) Ms Erlana Nindya Maulida, National Narcotics Bureau, Indonesia (iv) Dr Meejung Park, National Forensic Service, South Korea (v) Ms Maimonah Binti Sulaiman, Department of Chemistry, Malaysia (vi) Ms Neva Duya, National Bureau of Investigation, Philippines (vii) Dr Lui Chi Pang, Health Sciences Authority, Singapore (viii) Bureau of Drug and Narcotic, Thailand	
1030 – 1100	Tea Break	
1100 – 1130	Court Testimony Challenges in the US <i>Mr. Scott R. Oulton</i> <i>Associate Deputy Assistant Administrator, DEA Office of Forensic Sciences, Drug Enforcement Administration, USA</i>	
1130 – 1200	How To Give Effective Testimony In Court <i>Ms Eswarani Farishta Mohammad</i> <i>Head of Narcotics Unit, Prosecution Division, Attorney General's Chambers of Malaysia</i>	
1200 – 1230	Closing Lecture: Winning Strategies In Court Testimony <i>Associate Professor Stella Tan</i>	
1230 – 1300	Questions & Answers Session With Panel Of Speakers	
1300 – 1400	Lunch	

IDWG

Toxicology Working Group (TXWG)



1200 – 1220 **Forensic Toxicological Interpretation of Cohort Case in Association with Heavy Metals Poisoning - A Case Report**

Ekhzan Mat Nasir
Scientific Officer, Department of Chemistry, Malaysia

1220 – 1240 **The Use Of Electrochemical Detection For The Screening Of New Psychoactive Substances (Nps)**

Dr. Ana Flavia Belchior de Andrade
School of Chemistry, University of Lincoln, United Kingdom

1240 – 1400 Lunch

SESSION IV

1400 – 1440 **Court Challenges in Toxicology Cases**

Associate Professor Stella Tan
Attorney-General's Chamber, Singapore



1440 – 1530 **Sharing by members on their experience in Court**

1530 – 1600 Tea break

1600 – 1700 **International Guidelines on Method Validation**

Dr Chen Shao Xing
Quality Assurance Unit, Health Sciences Authority, Singapore

1930 **AFSN Board Members Retreat with WG Chairs & Vice Chairs**

TXWG

The essential skills you need - whether in law, science and other disciplines



ATTORNEY-
GENERAL'S
CHAMBERS

Preparing and Presenting Expert Evidence

10, 12 & 13 May 2016



Lectures on Forensic Science With Chief Justice and Court of Appeal Judges



NUS Forensic Science added 13 new photos.
Published by Tan Shi Yun • October 16 at 7:20 PM • ...

Hear from what our students have to say about FSC4206/LL4362V Advanced Criminal Litigation-Forensics on Trial!
Feature 1: Sheryl Seet (NUS Forensic Science minor programme)
The phrase 'criminal litigation' may sound intimidating at first glance, and even more so with the adjective "advanced". Nonetheless, despite it being daunting, the experience was worthwhile and I did not regret taking this module at all. ... See More



NUS Forensic Science added 8 new photos.
Published by Tan Shi Yun • October 18 at 12:39 AM • ...

Feature 4: Sarah Lu (NUS Law)
This module was a really refreshing take on how criminal litigation works in practice. I really appreciated the exposure it gave me to forensics as well, as learning how forensics is used in trials is an experience we won't get in any other law module. I thoroughly enjoyed both the lessons in the forensics lab (where we learnt about fingerprint, blood splatter analysis and much more) and moot Court (where we honed our skills in conducting cross... See More

nuslawelsa

12 likes
nuslawelsa Sarah Lu, Research Director

Growing up with a passion for nature, Sarah joined her school's Environment Focus Group and organised environmental awareness initiatives for young children and Junior College schoolmates. Her involvement in ELSA's research team takes this passion one step further, as she seeks to better understand how the law, an integral system by which the environment is protected, affects issues ranging from biodiversity to clean energy. As the Research Director, Sarah coordinates the writing and editing of articles published on ELSA's research journal, as well.



NUS Forensic Science added 14 new photos.
Published by Tan Shi Yun • October 16 at 7:24 PM • ...

Feature 2: Timothy Chong (NUS Law)

"Advanced Criminal Litigation: Forensics on Trial" was an eye-opening experience for me which gave me valuable insights as to how forensic evidence is gathered, analyzed, and used in trials to prosecute/defend the accused. Apart from really cool and exciting real life CSI scenarios where we get to dust for fingerprints and go to the lab and analyze the fingerprints, I learnt a lot about preparing an expert witness, and how to cross-examine... See More



NUS Forensic Science added 3 new photos.
Published by Tan Shi Yun • October 18 at 12:37 AM • ...

Feature 3: Shi Qing, who is currently working at HTX! (NUS Forensic Science)

"You were cool like a cucumber", said Prof Lei Theng after the mock trial. That was probably the most extraordinary compliment i have ever received. I was drilled by the defence counsel during cross examination but i maintained my calm demeanour though it was no doubt a nerve-racking moment.

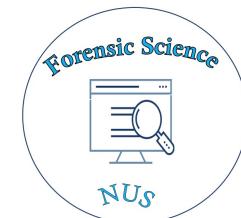
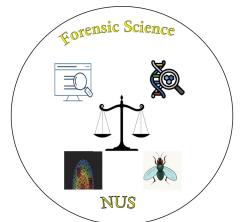
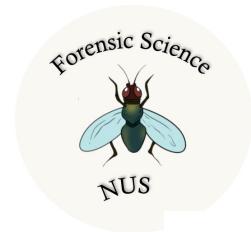
I was so close to not taking this module due to commitments for other modules. So thankful for Prof Stella... See More



Reviews about FSC4206/LL4362V Advanced Criminal Litigation: Forensics on Trial

Want know more? Watch our videos created by our students at our NUS Forensic Science Facebook Page:
<https://www.facebook.com/forensicscienceNUS/videos/222126983094885> (Forensic Science Minor)

- <https://www.facebook.com/forensicscienceNUS/videos/2587614858207985>
(Forensic Human ID)
- <https://www.facebook.com/forensicscienceNUS/videos/840555143211925>
(Forensic Entomology)
- <https://www.facebook.com/forensicscienceNUS/videos/499918751037689>
(Evidence in Forensic Science)
- <https://www.facebook.com/forensicscienceNUS/videos/1181773222027361>
(Advanced Criminal Litigation: Forensics on Trial)
- <https://www.facebook.com/forensicscienceNUS/videos/2073058743010080>
(Global Summer Science Programme)



M.Sc. in Forensic Science



Forensic heroes

NUS' new Master of Science in Forensic Science will help its students step up as the next generation of leaders in Singapore's forensic science sector

BY KENNETH GOH

Fans of television crime shows like *CSI* and *Criminal Minds* may think the study of forensics involves just the analysis of evidence at crime scenes. But Singapore's first — and only — forensic science master's programme will take its students beyond that.

The Master of Science (MSc) in Forensic Science, offered by the National University of Singapore's (NUS) Faculty of Science, will bring together the disciplines of law and science, says Associate Professor Stella Tan, academic director of NUS' Forensic Science Programme.

She adds that it aims to impart knowledge in many areas such as



PHOTO: NATIONAL UNIVERSITY OF SINGAPORE

By collaborating with key industry players, students can learn specialised and transferable knowledge and skill sets to meet the future needs of Singapore's forensic field.

ASSOCIATE PROFESSOR
STELLA TAN
Academic director
NUS FORENSIC SCIENCE
PROGRAMME

forensic digital evidence, and forensic psychiatry and psychology. Introduced to nurture the next generation of leaders in Singapore's forensic science sector, the programme will see its first intake next month.

Multidisciplinary learning

Its robust curriculum harnesses state-of-the-art technology and research that deep-dives into specialised topics like the use of IT in crime scenes and the study of forensic entomology. Students will also get to undergo experiential learning with field experts from law enforcement agencies such as the Singapore Police Force and Ministry of Home Affairs (MHA).

Key modules include Forensic Defense Science, which covers anti-terrorism and countering novel threats such as the ongoing Covid-19 pandemic. The module gives students the rare opportunity of experiencing first-hand MHA's operational forensic laboratories at checkpoints at Singapore's borders.

Another module is Advanced CSI Techniques, which delves into the management of forensic evidence in crime scene investigations.

Prof Tan says the collaborations with key industry players is an important element in the programme. "This graduate programme offers upgrading opportunities to current officers in forensic science or related criminal justice areas," she says.

"By collaborating with key industry players, students can learn specialised and transferable knowledge and skill sets to meet the future needs of Singapore's forensic field."

Visit scale.nus.edu.sg/programmes/graduate/msc-forensic-science for more information about the Master of Science (MSc) in Forensic Science programme.

MSc in Forensic Science



The National University of Singapore's Master of Science (MSc) in Forensic Science is a multidisciplinary graduate degree programme, synergising both law and science.

The knowledge and skills that you acquire will prepare you to stay ahead in the ever-changing world, where scientific-based information plays an important role in evidence admitted in court.



Currently, NUS Department of Biological Sciences offers a minor in forensic science programme for undergraduates. This is one of the more popular programmes in NUS which is consistently oversubscribed.

Recently, an interest survey was conducted on the demand for a Master's programme by coursework. We are pleased to learn that of all the Master's programmes, the forensic science specialisation was one of the most preferred specialisations.

The MSc in Forensic Science was therefore launched, in line with Singapore's national movement of SkillsFuture and the demand for lifelong learning. This offers upgrading opportunities for current enforcement officers and students who wish to equip themselves with the latest forensics knowledge and skills.

The MSc in Forensic Science is a multidisciplinary graduate degree programme which aims to provide students with the understanding of fundamental concepts and principles behind the application of scientific techniques used in forensic investigations, as well as the multidisciplinary knowledge in various branches of forensic science such as forensic digital evidence and forensic psychiatry and psychology.

It will train students to think analytically and strategically about how forensic science can be used to exonerate the innocent and convict the guilty, and equip them with transferable skills, suitable for a wide range of careers.

I look forward to seeing you in the programme.



ASSOCIATE PROFESSOR TAN WEI LING STELLA
ACADEMIC DIRECTOR,
NUS FORENSIC SCIENCE PROGRAMMES

"Widely recognised as Singapore's foremost expert in forensic science, Stella passes on her passion in the subject to her students, and her extensive and diverse experience in the criminal justice system provides real-world examples for her classes. I am working with Stella to develop the forensic science curriculum of NUS, and to strengthen the international collaboration between NUS and forensic science programmes in the US for students to attend summer and exchange programmes."

Dr Henry C Lee

Founder of the Henry C Lee Institute of Forensic Science

Former Director of the Connecticut State Forensic Lab and Chief Criminalist of Connecticut





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The NUS Forensic Science Laboratory

Teo Shun Wen Raymond, Stella Tan Wei Ling, Cuthbert Teo

More info on our FS Lab:

<https://www.facebook.com/forensicscienceNUS/videos/418783839109807>

The NUS Forensic Science Laboratory

Text and photos by Teo Shun Wen Raymond,
A/Prof Stella Tan Wei Ling and A/Prof Cuthbert Teo

FEATURE

Raymond is a Year 4 undergraduate in the NUS Faculty of Science. He is majoring in Life Sciences with a minor in both Forensic Science and Geoscience. Raymond is currently doing his final year internship in the NUS Forensic Science Research Laboratory in collaboration with the Health Products Regulation Group of the Health Sciences Authority.



A/Prof Tan has postgraduate qualifications in science and law from NUS, and also holds a postgraduate qualification from the Henry C. Lee Institute of Criminal Justice and Forensic Science. She is the academic director in charge of the NUS forensic science undergraduate and postgraduate programmes, as well as the principal investigator of the NUS Forensic Science Research Laboratory.



A/Prof Teo is trained as a forensic pathologist, and is an adjunct associate professor of the NUS forensic science programme. The views expressed in this article are his personal opinions.



Introduction

Forensic science and medicine is science and medicine that is in the service of the law. Forensic scientists and pathologists assist in uncovering the truth in the pursuit of justice.

"Every contact leaves a trace" – Locard's principle is one of the most well-known of forensic science. Science analyses trace evidence to answer five important questions: who, what, when, where and how. In our laboratory, our research adds new information to make retrieval and analysis of evidence more efficient and effective.

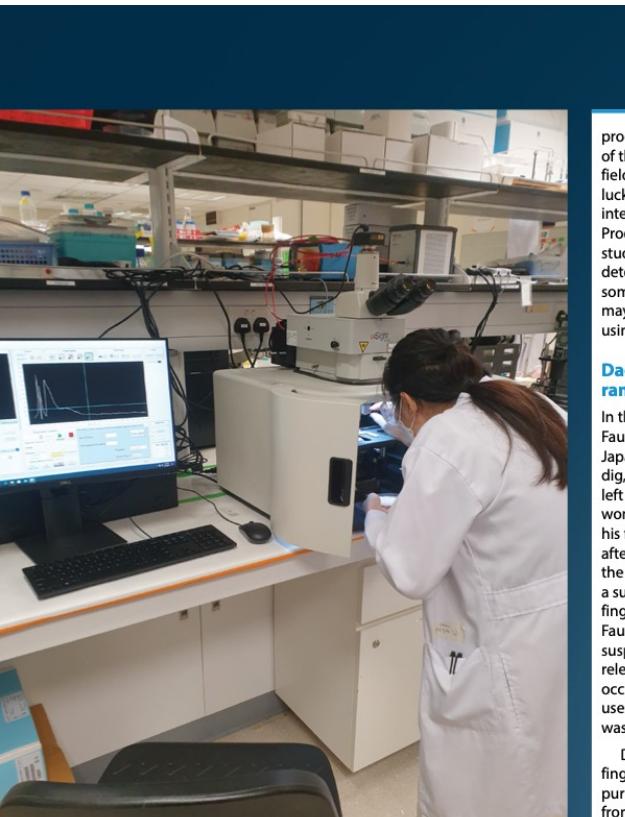
How the laboratory was formed

The National University of Singapore (NUS) Forensic Science Research Laboratory was founded in August 2017. Located at the Department of Biological Sciences, it is the only tertiary institution forensic research laboratory in Singapore. The laboratory started with four branches of study – document examination, fingerprint identification, entomology and paedology – but now includes other fields like toxicology and pathology. Projects usually involve collaborators within NUS as well as external collaborators like the Singapore Police Force (SPF), Health Sciences Authority (HSA) and Central Narcotics Bureau (CNB). Eager students enter the laboratory as "forensic explorers", learning while carrying out projects at the same time. A stringent selection process

selects highly motivated students who conduct preliminary studies before moving on to execute their own projects.

NUS offers both undergraduate and postgraduate forensic science modules. Undergraduate modules include Forensic Toxicology and Poisons, Forensic Entomology, and Articulating Probability and Statistics in Court. These academic modules incorporate fun and interesting practical sessions to help students understand each field. Collaborators include various NUS departments like the Department of Pharmacy, Department of Statistics and Data Science, and other sections in the Department of Biological Sciences.

Students who seek a deeper understanding in forensic science can learn from expert practitioners through hands-on experiential learning in the NUS Master of Science (Forensic Science) programme. For example, in Advanced Crime Scene Investigation Techniques, SPF experts share their knowledge and experiences in crime scene processing, while experts from the Home Team Science and Technology Agency provide insights in areas like forensic defence science and digital forensics. Psychiatrists and psychologists from the Institute of Mental Health and the Ministry of Home Affairs, respectively, help students understand the importance and limitations of psychological evidence in court in Forensic Psychiatry and Psychology.



Paracetamol being placed in the 1064nm Raman Spectrometer. The 1064nm Raman Spectrometer is the newest addition to the NUS Forensic Science Laboratory

Forensic toxicology – the dose makes the poison

Forensic toxicology helps in the detection of harmful substances either in the body or in a medium. Harmful substances can cause harm and death by incapacitating one's mental capability, being abused, and adulterating food and medical products. In the late 1800s, the Singapore Government was concerned about the quality of liquor supplied to sailors. There were also concerns about the safety of food and drugs, and the nature of local plant poisons. In the early

1900s, *chandu* (opium) became a concern. Before World War II, the main poisons of concern included caustic soda, morphine, alcohols, tuba root and arsenic. After the war, other poisons included heavy metals and plant alkaloids. Since independence, pharmaceuticals have become important in toxicology, and instrumentation has become more and more sophisticated.

Students in the laboratory have the opportunity to work with the CNB and HSA to conduct analytical testing on confiscated items, such as illicit drugs and controlled or adulterated health

products. Forensic toxicology is one of the author's (Raymond) favourite fields in forensic science and he was lucky enough to do an insightful internship with the HSA's Health Product Regulation Group. A current student project in the laboratory is determining the limit of detection for some controlled substances, which may be present in minute amounts, using Raman spectroscopy.

Dactyloscopy – tiny mountain ranges on the fingers

In the 1870s, Scottish surgeon Henry Faulds was working as a missionary in Japan. While out on an archaeological dig, he noticed unique impressions left on ancient clay fragments, and wondered whether the ridges on his fingertips were unique. Soon after this, there was a robbery in the hospital where he worked, and a suspect was arrested. Based on fingerprints found at the crime scene, Faulds was able to exonerate the suspect and persuade the police to release him. This remarkable event occurred during a period when the use of fingerprints for identification was not yet established.

Dactyloscopy is the study of fingerprints for identification purposes. Fingerprints are created from the ridges and furrows on the fingers, and everyone has their own unique pattern. Have you ever wondered how fingerprints are formed and why they are unique to even identical twins? The secret lies within the uterus. Epidermal basal cells undergo increased proliferation at around the gestational age of seven to ten weeks. The formation and regression of the volar pads (transient subepidermal mesenchymal eminences) adds stress to the proliferating cells, giving rise to precursors of ridges. Sporadic fetal movements create additional stress from friction against the uterine wall. These processes eventually lead to individualising of fingerprints.

Methods of fingerprint collection include powder dusting and

cyanocrylate (super glue) fuming. Fuming is a technique which greatly enhances the clarity of the deposited latent print. It allows for lifting prints off uneven and difficult-to-dust surfaces, including from the skin of corpses. Lifted prints can then be compared against known prints, based on specific plot points called minutiae, which characterise the ridges. Examples of important minutiae include where ridges end and bifurcate, or where they form dots, islands, lakes, spurs, bridges and crossovers.

Fingerprint matching can be a very tedious process. The laboratory is researching on the use of software that can reliably match fingerprint patterns, and the statistical models of different patterns in relation to ethnicity.

Forensic entomology – ancient creatures that “pronounce” the time of death

Insects, in particular flies, can give a range of time of death in a rather unique way – their life cycle. When animal or human life is extinguished, a panoply of insects, equipped with a keen sense of smell, are able to find a suitable corpse to lay their eggs, which hatch into maggots. These necrophagous flies claim the bodies of the departed for lodging and



A/Prof Stella Tan giving a lecture on forensic science

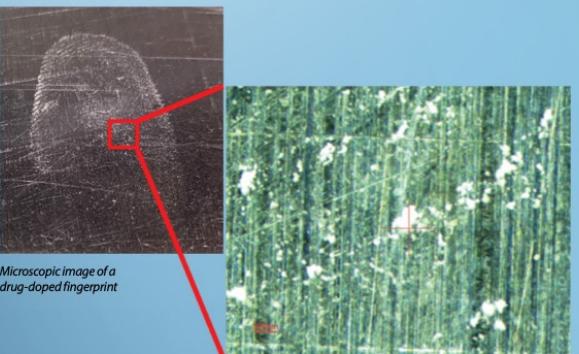
board, making it their personal bed and breakfast. A minimum post-mortem interval can be estimated by studying the population of maggots present. Maggot size is indicative of the fly's life cycle stage. A back-calculation to the day when the flies first laid their eggs corresponds to a likely range of the time of death.

The differences in insect species composition and life cycle time depends partly on environmental conditions. In our laboratory, we research differences such as arrival time, species and number of flies by concealing chicken carcasses

using various objects like cloth, plastic containers and plastic bags. This information, known as carrion ecology, can be applied to actual cases to offer a more accurate estimation of the post-mortem interval. There is still a lot to learn – about how maggots develop, their role in decomposition and the ecosystem surrounding a body, and what they do when they are not feeding. If we don't fully understand what these flying, walking and wriggling critters are up to, we are at risk of making false assumptions regarding a crime scene. The research will help to fill in the blanks.

Conclusion

The story of forensic science and medicine is the story of how each piece of forensic evidence forms a sentence, and we combine the sentences to form a book. The NUS Forensic Science Research Laboratory and the NUS forensic programmes will be the petri dishes which will incubate future generations of forensic scientists and pathologists. In the future, forensic science will comprise powerful tools used to solve crimes, but it is not infallible. Its use needs to be scrutinised with care and objectivity to achieve objective findings, for the prosecution of criminals and to absolve the innocent.



Microscopic image of a drug-doped fingerprint

INTERESTING INSECTOID INSIGHTS

Scanning electron micrograph images are produced by a focused beam of electrons directed at the specimen. Some electrons ionise the specimen while some are reflected as backscattered electrons. Ionised specimens also release secondary electrons. Detectors reconstruct the backscattered and secondary electrons to produce images of high magnification.



Fly egg

Typically, it takes around 23 hours at 21°C for blowfly eggs to hatch. Exposed wounds and natural body openings are more prone to decomposition by bacteria. Hence, these areas are usually prime breeding sites for the flies as the decaying material provides food for the hatched larvae.



Blowfly

Blowflies are usually the “first responders” and arrive at the corpse within a day, which makes them one of the key species to study when estimating the post-mortem interval. Their acute sense of smell allows them to locate a corpse up to 20 km away.



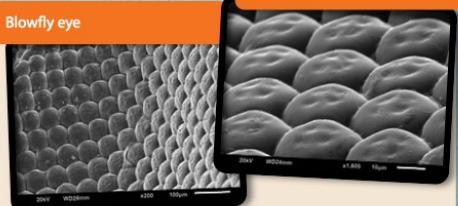
Fleshfly

Fleshflies belongs to the same superfamily of *Oestroidea* as blowflies. They arrive at the corpse later as compared to blowflies at around four days after death, as they pick up the smell of the gas produced from putrefaction of the corpse. Notably, they are territorial and will kick out other flies that compete for the breeding sites.



Maggots

The larvae stage of flies belonging to the suborder *Brachycera* are often referred to as maggots. Maggots can be classified into three stages: instar 1, 2 and 3. The time intervals between each stage are relatively constant, making them useful for estimation of the post-mortem interval. The timespan of each stage is directly influenced by the ambient temperature – the higher the temperature, the shorter the time spent in each instar.



Blowfly eye



Fleshfly eye

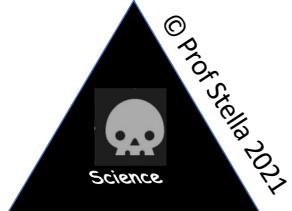
Flies are known to have compound eyes which are made up of thousands of small hexagonal units known as ommatidium. Each unit provides information of just a small area of the whole image. Flies are built to be highly sensitive to any movement across each of these small areas. Male flies make use of this motion sensitivity to look out for potential mates. Mating is crucial as it precedes the laying of eggs on the corpse which subsequently can help us estimate the post-mortem interval. ♦



For every contact, you leave a trace.
Join our FS Family!

Lecture Contents

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Analytical
Methods

2



Bad*** of
Drugs

3

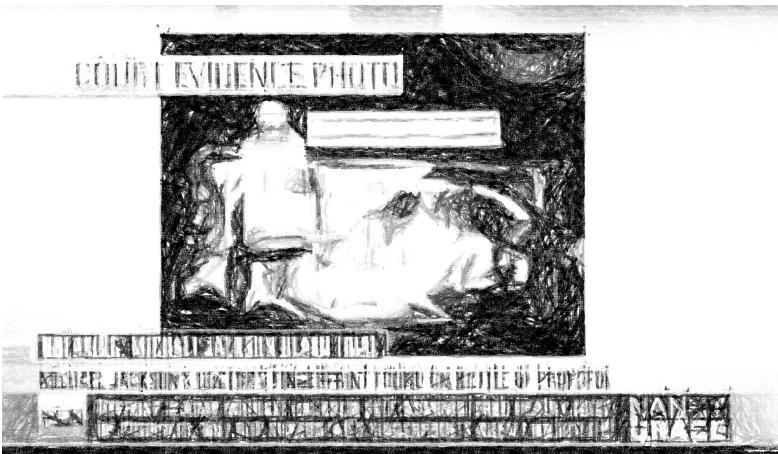


Counterfeit
for a fix

BONUS



Dies (and Flies)



Michael Jackson (acute propofol intoxication)

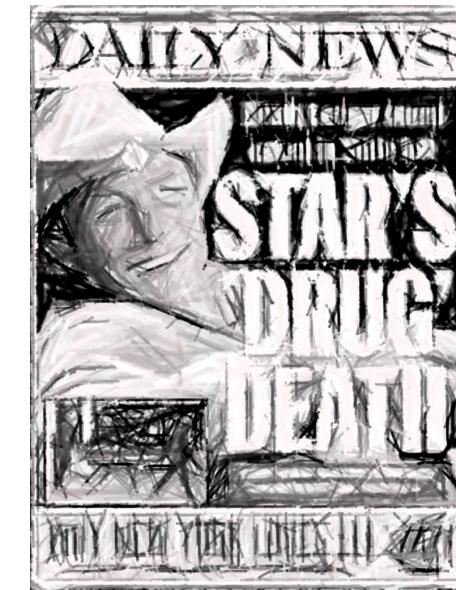
<https://youtu.be/Vgyz3fiaKow>

forensic toxicology

is associated with the medico-legal aspects of toxicology (which is the study of adverse effects of chemicals and drugs on humans and animals); and is relevant in cases involving poisoning, drug use and death, as well as in suspected cases of doping, inhalant or drug abuse.



Amy Winehouse (acute alcohol intoxication)

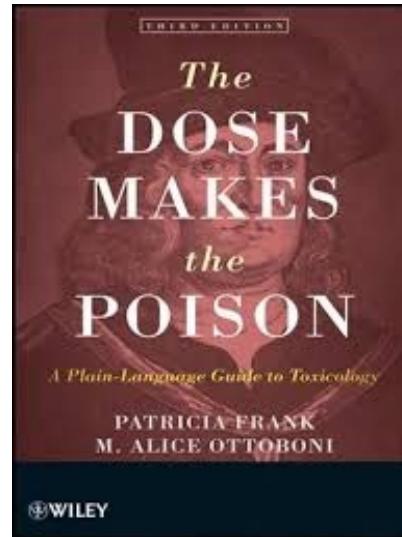


Heath Ledger (toxic combination of prescription drugs)

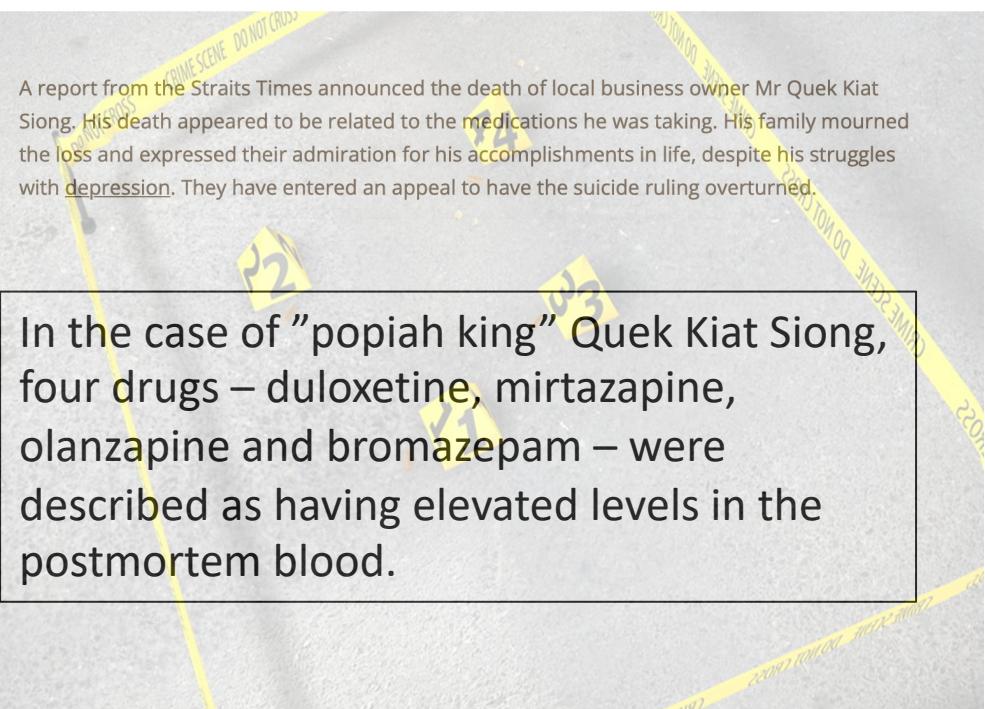
- All substances, including therapeutic drugs, have the potential to be toxic above a threshold.

"All substances are poisons: there is none which is not a poison. The right dose differentiates a poison and remedy." - paracelsus

- Besides the dosage, toxicity also depends on the portal of entry and frequency of administration, the individual's age or developmental stage, gender, weight, kidney and liver functions, and health conditions.

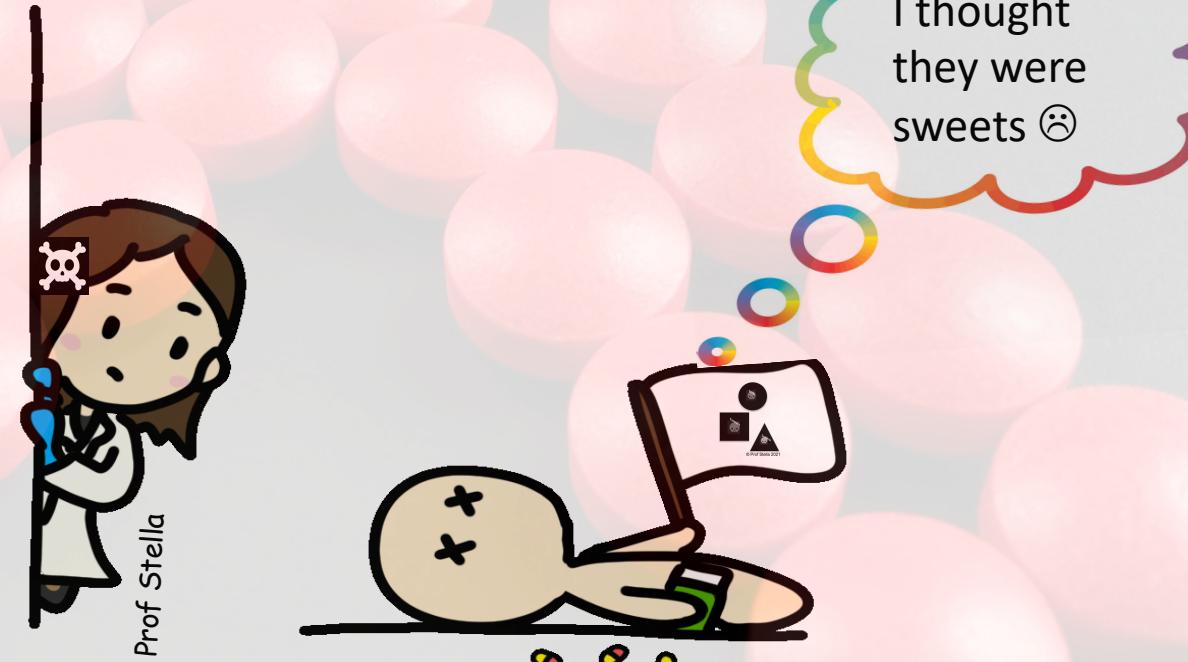


Suicide or Accident?
A Respected Citizen Dies
from Medication



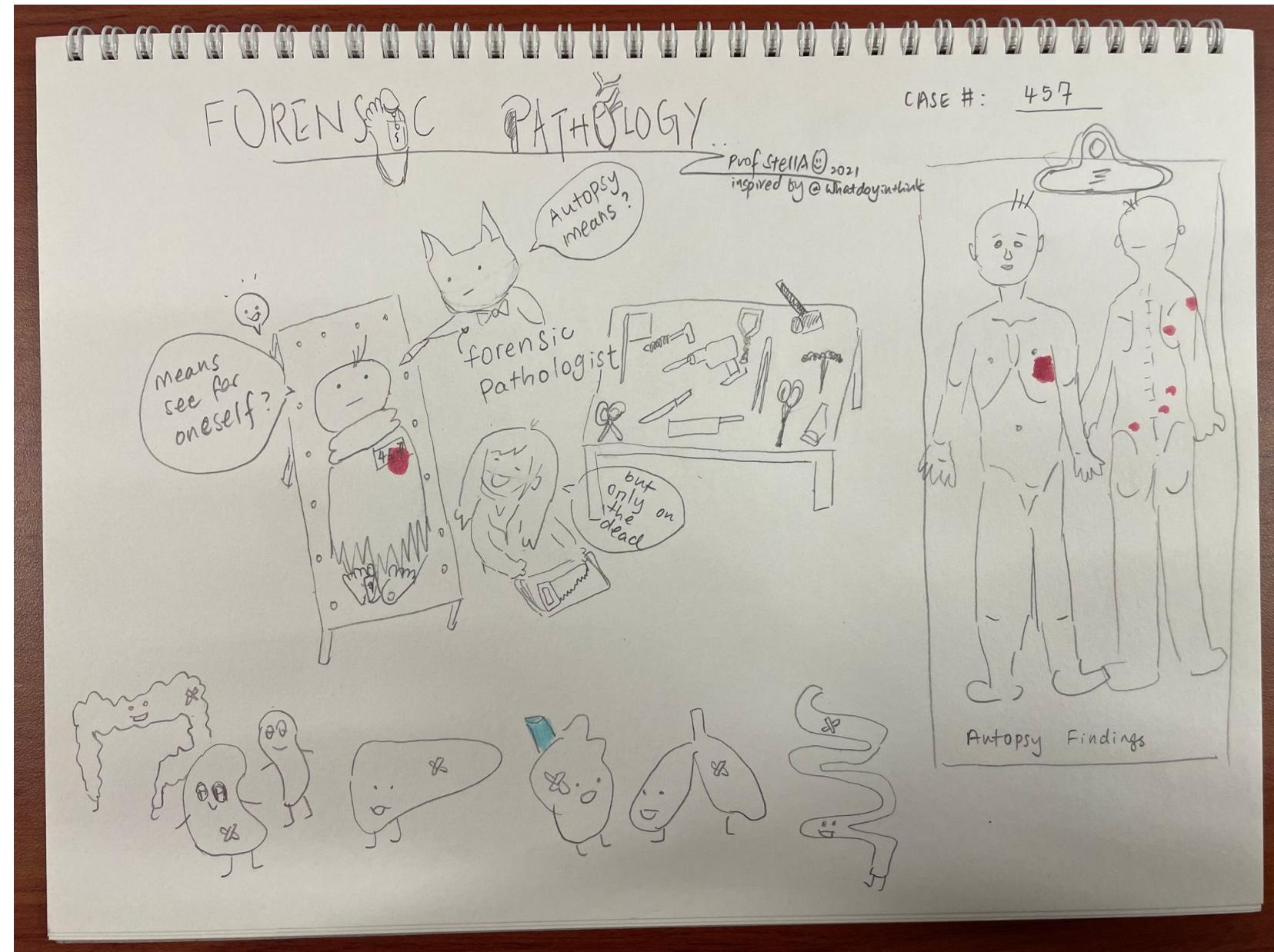
toxicants are chemical substances when administered by accident or design, produce adverse or deleterious responses in biological organisms.

Without metabolism or elimination, many substances would reach harmful or toxic concentrations in the organism.



- Toxicity in the human body may be acute or chronic, and may vary from one organ to another.

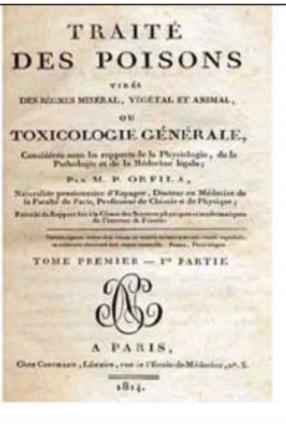
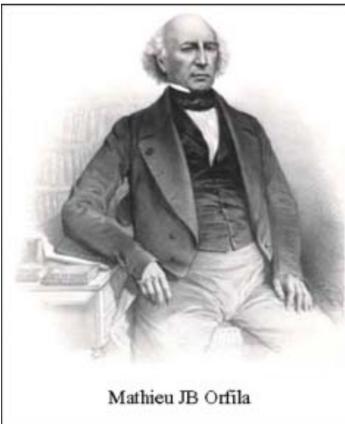
- The organs most frequently affected by toxicants are the liver, kidney, brain, lungs and gastro-intestinal tract.
- Common routes of entry or exposure into the body are orally, through the skin, lungs or eyes.



3 main objectives of forensic toxicology are to establish the presence and identity of:

(a) Toxicants and ascertain whether they contributed or caused harm or death.

Applications: e.g. sus drug intoxication or overdose case; sus poison-related death



(b) Toxicants that may affect a person's performance or behavior and ability to make rational judgement.

Applications: e.g. sus DUI driving under the influence of alcohol &/or drug; drug-facilitated sexual assault; use of performance-enhancing drugs in human and animal sports.



(c) Toxicants that are not compliant with employment regulations or classified as substance of abuse.

Applications: e.g. sus consumption of controlled drugs; workplace screening; custodian and access to young children.

today

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Man appeals against reformatory training for organising illicit drug gathering, which led to NUS student's death

by LOUISA TANG

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64 SHARES



Jones Anderson, 20, was sentenced to six months of reformatory training in November last year and has appealed against the sentence.



What's the role of forensic toxicologist in death investigation? –

State Coroner Marvin Bay (2010s)

In cases involving death investigation, forensic toxicology seeks to answer these 5 questions.



At the HSA's Mortuary

1. Was this person poisoned?
2. If so, what was the poison and how much of it was detected?
3. How _____ was it administered?
4. What were its effects _____?
5. Was it within the therapeutic range or beyond?

CORONERS ACT
(CHAPTER 63A)

(Original Enactment: Act 14 of 2010)

REVISED EDITION 2012

(31st October 2012)

Coroner or Public Prosecutor may direct forensic pathologist to investigate

Appointment of State Coroner and Coroners

3.—(1) The President may, on the recommendation of the Chief Justice, appoint a State Coroner and such other Coroners as are necessary for the proper administration of this Act.

(2) No person shall be appointed a Coroner unless he is a judicial officer appointed under the State Courts Act (Cap. 321) and, in the case of the State Coroner, unless he is a District Judge appointed under that Act.

16.—(1) When a Coroner or the Public Prosecutor receives information about the death of any person, the Coroner or the Public Prosecutor may, if he considers it appropriate to do so, direct —

- (a) a forensic pathologist to investigate the cause of and circumstances connected with the death; and
- (b) that a copy of all medical records, health-care records and such other documents as may be relevant to the case be furnished by the person in charge of the hospital, medical clinic or place of custody referred to in section 8 or any other person in possession thereof to the forensic pathologist.

(2) The forensic pathologist shall regularly inform the police officer investigating the death, the Coroner and the Public Prosecutor about the progress of his investigations and findings.

The State Coroner is a district judge appointed under the Coroners Act (section 3 of CA).

The Coroner or the Public Prosecutor may, if he considers it appropriate to do so, direct a forensic pathologist to investigate the cause and circumstances connected with the death of any person (section 16 of CA).

Stop and Think: What information will the forensic pathologist be providing information on?



Prof Cuthbert Teo: You will get a “piak” on your face by Prof Stella if you don’t remember my lectures.



Conduct of post-mortem examination

19.—(1) A post-mortem examination may only be performed by —

- (a) a pathologist; or
- (b) a medical practitioner under the supervision of a pathologist.

(2) A pathologist who conducts or supervises a post-mortem examination may —

- (a) perform or cause to be performed any operation on the body that he thinks necessary, including causing any part or contents of the body or any other substance or thing to be retained for the purpose of determining the manner or cause of death; and
- (b) where necessary, appoint any person who in his opinion is qualified to make a special examination by way of an analysis, test or otherwise of any part or contents of the body or of any other substance or thing, and send such part, contents, substance or thing to that person for special examination.

(3) The Coroner or the forensic pathologist investigating a case, if any, may direct the person performing a post-mortem examination to cause to be retained any part or contents of the body or any other substance or thing which appears to the Coroner or forensic pathologist to be relevant in establishing the manner or cause of death.

Post-mortem examination report and special examination report

20.—(1) A pathologist who has conducted or supervised any post-mortem examination shall —

- (a) draw up, or cause to be drawn up, a report of the findings of the post-mortem examination and of the conclusions which he draws from it;
- (b) certify as to the medical cause of death; and
- (c) date and sign the report and send it to the Coroner who ordered the post-mortem examination.

(2) Where a person has been appointed under section 19(2)(b), he shall draw up a report of the findings of his special examination, date and sign the report and send it to the Coroner who ordered the post-mortem examination.

(3) The post-mortem examination report made under subsection (1) and any special examination report made under subsection (2) shall be admissible as evidence, and shall be prima facie evidence of the facts stated therein, at any inquiry held under this Act.

(4) The pathologist who conducted or supervised the post-mortem examination or any person appointed under section 19(2)(b), if summoned by the Coroner as a witness in an inquiry, may be asked to give evidence as to his opinion upon any matter arising out of the examination conducted or supervised by him and as to how in his opinion the deceased came by his death.

A post-mortem examination (PM exam) may only be performed by a pathologist
(section 19(1) of CA).

A pathologist who has conducted any PM exam shall draw up a report of the findings and conclusions which he draws from it; certify as to the medical _____ cause of death and send to the Coroner who ordered the PM exam (section 20(1) of CA).



A toxicology report put up by a forensic toxicologist is supposed to contain factual information on toxicants present and their concentrations, with or without interpretation.

“Positive” or “detected” indicates a particular substance was identified using lab protocols.

The list of common drugs which are examined in routine testing is typically included as a standard attachment in toxicology reports.

The forensic pathologist will take in the toxicology report findings before he/she opines on the cause of death.



Sample Tox Report

Lab No. _____

Date _____

One blood sample sealed "Police" and marked "ABC" was submitted to the Analytical Toxicology Laboratory on (date, time) by (who).

On analysis, the following results were obtained:

- Alcohols and Volatiles: XXX
- Basic Drugs: XXX
- Benzodiazepines and Hypnotics: XXX

Please refer to the appendix for the list of drugs/substances tested.

signature _____

name and designation _____

Appendix

- Alcohols and Volatiles:acetone, benzene, isopropanol, methanol, ethanol, toluene,
- Basic Drugs: ...methamphetamine, MDMA, ketamine, lignocaine, orphenadrine, chlorpheniramine, codeine, methadone....
- Benzodiazepines and Hypnotics: ...diazepam, nimetazepam, midazolam, nitrazepam, zolpidem...



Illicit Drugs Laboratory

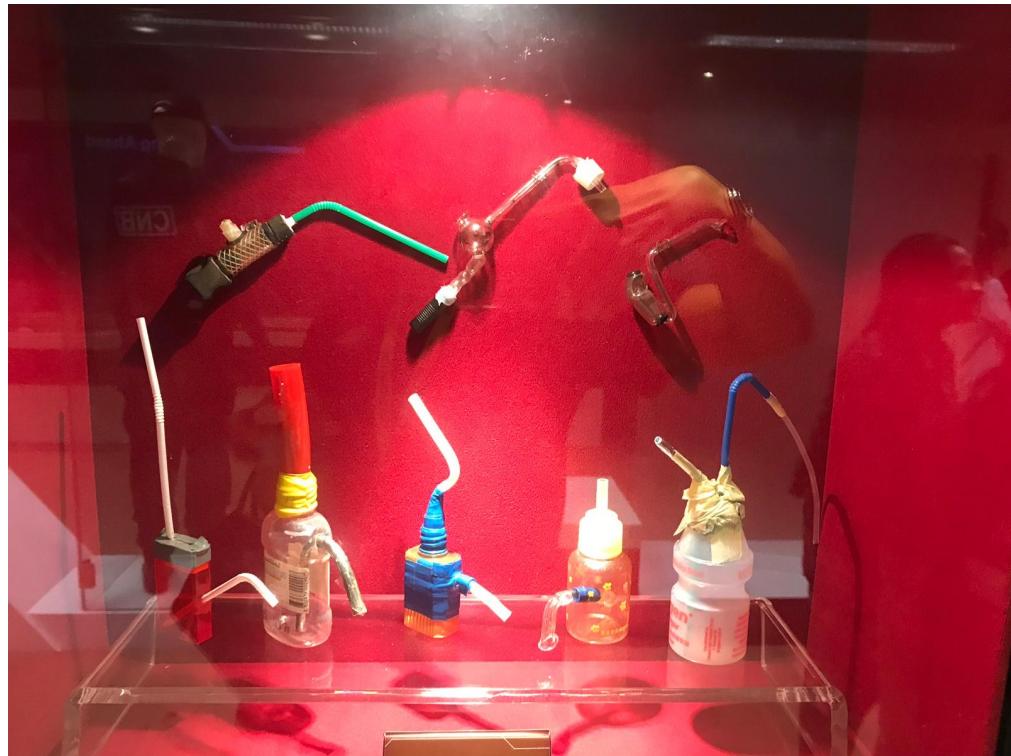
Qualitative & Quantitative
Analysis of drug seizures
Heroin
Cannabis
Ice
Ecstasy Tablets
New Psychoactive Substances
Ketamine
Benzodiazepines





EVIDENCE

paraphernalia



Misuse of Drugs Act (MDA)

Possession of pipes, utensils, etc.

9. Except as authorised by this Act, it shall be an offence for a person to have in his possession any pipe, syringe, utensil, apparatus or other article intended for the smoking, administration or consumption of a controlled drug.

Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG)

SWGDRUG

Categories of Analytical Techniques

The Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG)

requires the use of multiple identification techniques when analyzing drug samples. These techniques are divided into three categories based on their discriminating power.

This reference poster highlights the differences between the three categories and the techniques. (Please reference SWGDRUG recommendations Version 7.1 Part IIIB for more details at www.swgdrug.org)

 To learn more about how you can optimize your forensic analysis, visit www.InvestigateYourLab.com

COLOR TESTS

Uses the colors produced by chemical reactions to presumptively identify a class of compounds.

FLUORESCENCE SPECTROSCOPY

Identifies a compound based on its fluorescent properties. This technique can be used to measure both an excitation spectrum (the light that is absorbed by the sample to result in fluorescence emission) and/or an emission spectrum (the fluorescent light emitted from the sample).

IMMUNOASSAY

Uses an antibody or antigen to measure the presence or concentration of a macromolecule or small molecule in a sample.

MELTING POINT

Determines the temperature at which a solid becomes a liquid at a standard atmospheric pressure. Since all drugs have different melting points, this type of analysis is useful in identifying illegal substances.

ULTRAVIOLET/VISIBLE SPECTROSCOPY

Measures the absorption of light in the ultraviolet-visible spectral region. This technique is often used as a preliminary test to identify unknown compounds for further testing.

<https://www.ssi.shimadzu.com/sites/ssi.shimadzu.com/files/Industry/Images/Shimadzu-Forensics-ePoster-FINAL.pdf>

INFRARED SPECTROSCOPY

Uses absorption of infrared radiation to produce chemical fingerprints of a substance based off of chemical bonds. This technique can be combined with a microscope for more detailed information.

MASS SPECTROMETRY

Uses molecular fragmentation and ion patterns to produce a chemical fingerprint of a substance based off of mass. This technique can be used in conjunction with gas chromatography.

NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

Monitors the splitting of nuclear energy levels of a molecule when it is exposed to oscillating magnetic fields. It can be used to determine molecular confirmation as well as study properties at the molecular level, such as phase changes, solubility and diffusion.

RAMAN SPECTROSCOPY

A vibrational spectroscopic technique used to provide a structural fingerprint by which molecules can be identified.

X-RAY DIFFRACTOMETRY

Determines the structure of a material from the scattering pattern produced when a beam of radiation interacts with it.



CATEGORY A

Provides the best discriminating power.

These techniques are commonly used for the confirmation of suspected substances. If you use a Category A technique, you must also use at least one other technique from any of the three categories.

CATEGORY B

Includes intermediate techniques of analysis, such as gas chromatography, liquid chromatography, and microcrystalline tests.

CATEGORY C

Has the lowest discriminating power. These techniques are often used to screen for the presence of drugs and are combined with Category A and B techniques.

CAPILLARY ELECTROPHORESIS

Enables separation of a variety of molecules—from small inorganic ions to huge biopolymers—through the use of buffer-filled, narrow-bore capillary columns.

GAS CHROMATOGRAPHY

Separates complex mixtures based upon differences in boiling point/vapor pressure. Refers to any chromatographic procedure where the mobile phase is a carrier gas.

ION MOBILITY SPECTROMETRY

Separates and identifies ionized molecules in the gas phase based on their mobility in a carrier buffer gas.

LIQUID CHROMATOGRAPHY

Used to separate ions and molecules in complex mixtures based upon differences in polarity. Refers to any chromatographic procedure where the moving phase is a liquid.

MICROCRYSTALLINE TESTS

Uses the microscopic crystals produced by chemical reactions to identify the substance being tested. In many cases, a series of positive microcrystalline tests is considered a conclusive test.

PHARMACEUTICAL IDENTIFIERS

Determines the identity, manufacturer or quantity of substances present based on the physical characteristics of tablets, capsules or packaging.

THIN LAYER CHROMATOGRAPHY

Uses solvents traveling through a porous medium to separate compounds by their chemical reactivity. Can be documented through photographing or photocopying the developed thin-layer plate.

CANNABIS ONLY

MACROSCOPIC EXAMINATION

A physical identification process of the plant material to determine if the sample has the class and morphological characteristics of cannabis.

MICROSCOPIC EXAMINATION

Observing the plant under magnification in order to identify characteristics that are unique to cannabis.

 SHIMADZU

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- SWGDRUG recommends the following ^{minimum} standards as the criteria for identification of a controlled drug:
 - (a) a Cat. A technique and one other technique from Cat. A, B or C; or
 - (b) At least three different techniques from Cat A, B or C – two of the three shall be based on uncorrelated techniques from Cat. B.

Category A	Category B	Category C
Infrared Spectroscopy	Capillary Electrophoresis	Colour Tests
Mass Spectrometry	Gas Chromatography	Fluorescence Spectroscopy
Nuclear Magnetic Resonance spectroscopy	Ion Mobility Spectrometry	Immunoassay
Raman Spectroscopy	Liquid Chromatography	Melting Point
X-ray Diffractometry	Microcrystalline Tests	Ultraviolet Spectroscopy
	Pharmaceutical Identifiers	



Raman Application in Illicit Drug Identification

Kemberly Kay¹, Ng Wei Bo¹, Amir Atabaki², Shilpi Gupta³, Gajendra Singh³, Eugene Lee¹, Stella Tan^{1,3}, Rajeev Ram^{1,2,3}

¹NUS | ²MIT | ³SMART, DISTAP

Motivation and Objective

Existing drug detection methods require specialist to operate the expensive instruments and have long turnaround time. This study aimed to evaluate the performance of two Raman spectroscopy systems as a screening tool for the accurate and rapid detection of traditional street drugs.

Materials and Methods



Figure 1. Workflow of Raman spectra collection

Results and Discussion

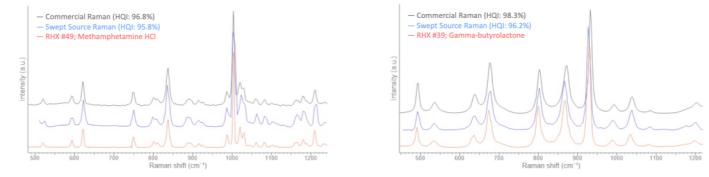


Figure 2. Spectral identification of methamphetamine

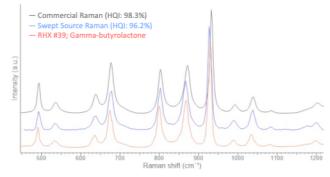


Figure 3. Spectral identification of GBL

Spectrum of methamphetamine and GBL acquired from commercial and Swept Source Raman systems were successfully identified on the reference library with > 95% match.

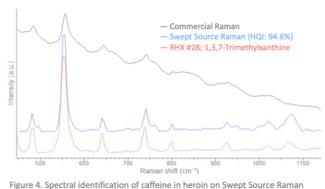


Figure 4. Spectral identification of caffeine in heroin on Swept Source Raman

Measurement by Swept Source Raman found 94.6% match with caffeine which was the cutting agent in heroin.

Conclusion and Future Work

Commercial and Swept Source Raman systems were useful for real-time identification of traditional street drugs. Methamphetamine and GBL could be identified on both systems, while heroin could only be detected in Swept Source Raman. Future work entails the detection of newly emerging drugs such as new psychoactive substances.

Application of Raman Spectroscopy in Food Analysis

Grace Cheng², Amir H. Atabaki¹, Gajendra P. Singh², Shilpi Gupta², Stella Tan^{2,3}, Rajeev J. Ram^{1,2}

¹Massachusetts Institution of Technology (MIT) | ²DiSTAP, SMART | ³National University of Singapore

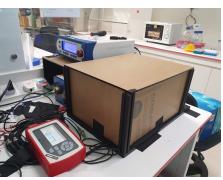
INTRODUCTION

- Singapore is highly susceptible to **food fraud** as it imports >90% of its food and plans to further diversify food sources.
- Food fraud refers to the deliberate substitution, addition, tampering, or misrepresentation of food or packaging for economic gain.
- To address the urgent need to strengthen food safety in Singapore, this project investigates Raman spectroscopy as a **quicker and non-destructive method** of detection of food fraud in food items commonly subjected to substitution, mislabelling and adulteration, compared to traditional methods of analysis which are more complex and destructive.

MATERIALS AND METHODS



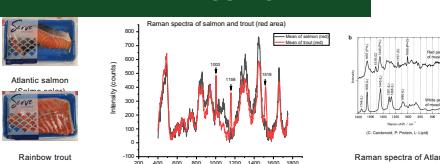
Commercial uRaman-Ci Raman Microspectroscopy system (Technopex, Singapore), with a single mode frequency-stabilised laser source (830nm)



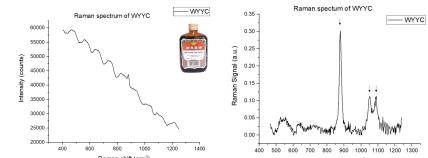
Swept-Source Raman spectrometer (SMART-MIT-NUS), with a laser source of adjustable wavelength (920-985nm)



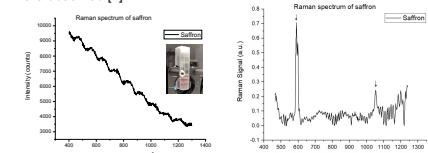
RESULTS



Raman spectra of Atlantic salmon and rainbow trout (red area) and a sample (P2) showing a peak at 615 cm⁻¹ characteristic of heroin. The sample was identified as RDX #42, 1,3,7-trimethylxanthine.



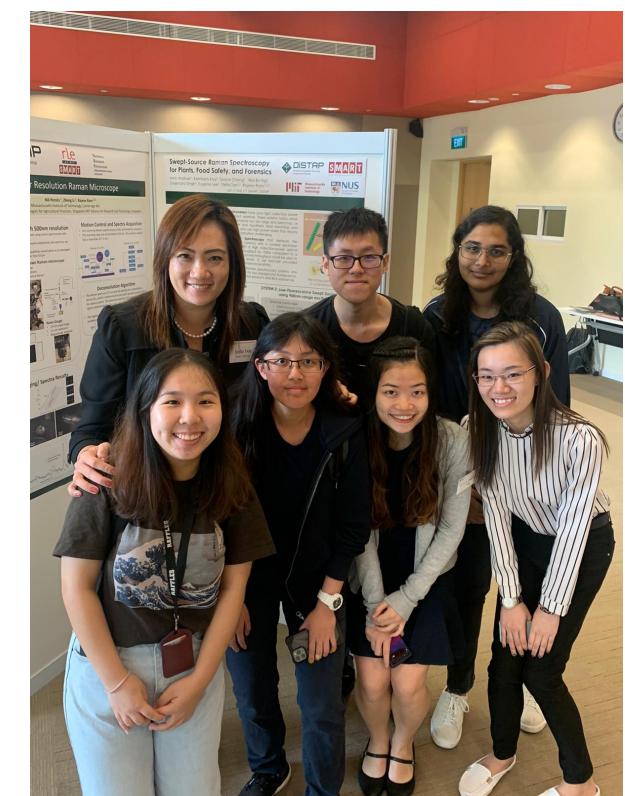
Wei Yuan Yao Chiew (WYYC) is a type of brown-coloured tonic medicated wine. Fluorescence was observed in the Raman spectrum obtained using 830nm-Raman; this problem was overcome through the use of the Swept-Source Raman spectrometer. Ethanol peaks were observed [4].



Saffron threads (crimson-coloured) were investigated. Fluorescence was observed in the Raman spectrum obtained using 830nm-Raman; this problem was overcome through the use of the Swept-Source Raman spectrometer. Saffron peaks were observed [2].

FUTURE WORK

The ability of Raman spectroscopy to distinguish between fish of closely-related species and of similar morphology (e.g. white fish), as well as various types of alcohol and milk powder with the addition of adulterants will be investigated.



General analytical workflow for controlled drugs analysis

(a) General observation



(b) sample preparation



Macroscopic & Microscopic Examination (for plant-type exhibits)

(e) Quantification

(c) Screening Test

(d) Confirmatory Test

Weighing (for solid and plant-type exhibits)

Homogenisation (for solid exhibits if quantitative analysis is required)

E.g. Colour Tests (like Marquis Test – opiates (purple), amphetamines (orange))

E.g. Gas Chromatography- Mass Spectrometry (GC-MS)

General analytical workflow for controlled drugs analysis

(a) General observation: Visually similar samples (e.g. tablets with same shape, colour, size) are grouped together. Their physical form, length, diameter, weight and packaging are documented. Packaging materials such as masking tapes, plastic bags and straws can provide important associative linkages between drug packages and should be removed carefully for further examination.

(b) sample preparation



Often, only part of the submitted items are sampled for analysis. The sampled items are pulverized and homogenized using a mortar and pestle, followed by a blender (if necessary).

For bulk specimens, representative sampling of homogenized sample can be conducted using the coning and quartering method where the sample size is reduced systematically.

(c) Screening Test

The homogenized samples are subjected to microscopy, colour tests, microcrystal tests, immunoassay tests and/or thin layer chromatography to screen for the presence of controlled drugs.

Colour tests are most commonly used as they are easy to use, relatively cheap and produce quick results.



(d) Confirmatory Test

Gas Chromatography coupled with mass spectrometry (GC-MS) is commonly used to identify the controlled drugs. GC-MS can also be used to separate a mixture of drugs,

(e) Quantification

To determine the purity of controlled drugs in the sample.



Metro family scion jailed two years for drug offences



Ong Jenn had pleaded guilty to one count each of attempting to be in possession of 92.68g of cannabis and 385.1g of a cannabis mixture. He started his sentence yesterday. ST PHOTO: WONG KWAI CHOW

PUBLISHED JUL 13, 2017, 5:00 AM SGT

f t ...

For cannabis samples, the vegetative material is examined macroscopically and microscopically for biological features such as glandular hairs (trichomes) and the flowering and fruiting tops of the female cannabis plant.

1. Separation of intact branches from the compressed block

2. Macroscopic & Microscopic Examination

3. Analytical Method

Illicit Drugs Laboratory

Qualitative & Quantitative
Analysis of drug seizures
Heroin
Cannabis
Ice
Ecstasy Tablets
New Psychoactive Substances
Ketamine
Benzodiazepines



Analytical Toxicology Laboratory's Drugs Abuse Testing Unit

To provide testing services for drugs of abuse in urine to law enforcement agencies

- for rehabilitation in DRC or
- prosecution for offence(s) under the Misuse of Drugs Act

To provide testing of drugs of abuse in hair specimens – for supervision purpose





How to prove
consumption of
drug?



Cleared of drug use in 2014, but jailed again

Amir Hussain

PUBLISHED NOV 2, 2015, 5:00 AM SGT



A 50-year-old man, who was acquitted and freed in April last year while serving a six-year jail term for drug use, has been sent back to jail for the same offence.

Noor Amran Ismail was jailed for seven years and four months on Oct 20 on one charge of using morphine illegally. The offence attracts caning but he was spared because of his age. His story started in June 2011, when he was caught at a road block for failing to report for a urine test.

His urine sample later tested positive for morphine, and in February 2013 he was sentenced to six years' jail and six strokes of the cane for using the drug without authorisation.

In August 2013, while in prison, he wrote to the Innocence Project in which law students from the National University of Singapore investigate and evaluate claims of wrongful criminal conviction for follow-up with a pro-bono lawyer.

The students found that he had taken prescription medicine containing codeine, which affects urine tests for morphine.

This had not been revealed during his five-day trial. Noor Amran said his lawyer then had instructed him to remain silent when his defence was called.

JUSTIFIED

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FEATURED

THIS IS JUSTIFIED

Righting an injustice: Innocence Project (Singapore)'s first successful case

by JUSTIFIED_NUSLAW on Jan 15, 2015 - 12:01 am

No Comments

After fresh evidence was found to substantiate his claim that he had taken the prescription medicine, pro-bono lawyer Mervyn Cheong applied for a re-trial for his client in late 2013, without objection from the prosecution.

The prosecution, after assessing the possibility that the medicine had affected the urine test, asked that he be acquitted.

So in April last year he walked free after having spent about three years in remand and jail. In January this year, however, anti-narcotics officers who raided an apartment he was at found two suspicious packets in his possession. One of them tested positive for heroin, but Noor Amran said he did not take the drug. However, his urine sample tested positive for morphine, and he was charged on Jan 28.

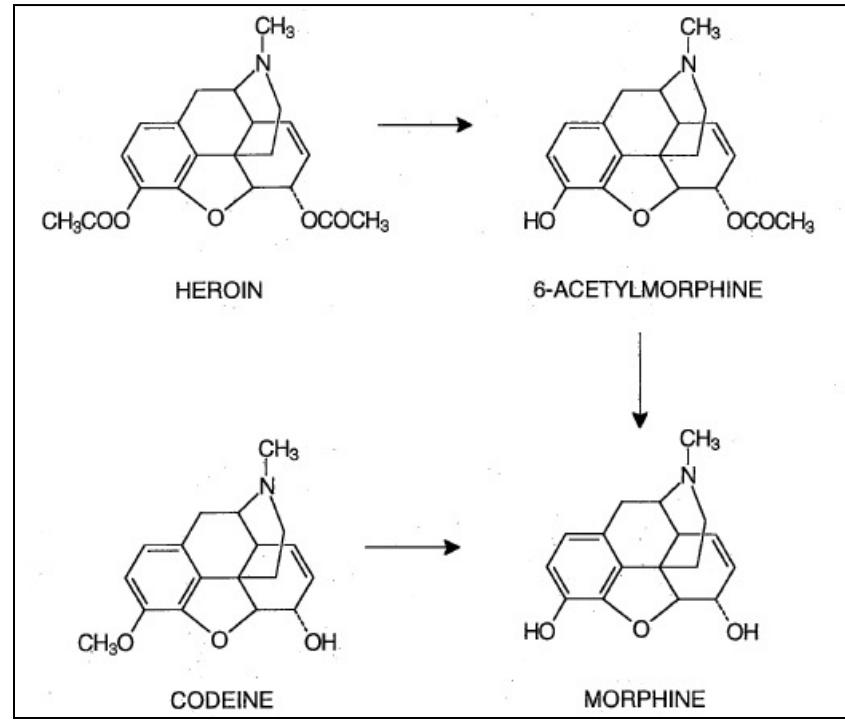
For consuming a controlled drug without authorisation, while having similar previous convictions, Noor Amran could have been jailed for up to 13 years.

<https://justified.nuslawclub.com/featuring-the-innocence-project-part-1/>

METABOLISM

Drugs are typically metabolised in the body after consumption

- Not all parent drugs can be detected in the urine
- Detection of parent drugs and metabolites depends a number of factors, e.g.
 - ✓ amount of drug consumed
 - ✓ metabolic and excretion rates
 - ✓ amount of water consumed
 - ✓ duration between the last consumption and urine procurement



Consumption of both codeine and heroin both lead to the urinary exertion of morphine.

Heroin is metabolized to 6-acetylmorphine before morphine. The presence of 6-acetylmorphine is therefore indicative of heroin consumption. However, the detection time in urine is 2 to 8 hrs.

Misuse of Drugs Act (MDA)

Possession and consumption of controlled drugs

8. Except as authorised by this Act, it shall be an offence for a person to —

- (a) have in his possession a controlled drug; or
- (b) smoke, administer to himself or otherwise consume —
 - (i) a controlled drug, other than a specified drug; or
 - (ii) a specified drug.

[20/98]

Consumption of drug outside Singapore by citizen or permanent resident

8A.—(1) Section 8(b) shall have effect in relation to a person who is a citizen or a permanent resident of Singapore outside as well as within Singapore where he is found as a result of urine tests conducted under section 31(4)(b) to have smoked, administered to himself or otherwise consumed a controlled drug or a specified drug.

[20/98; 2/2006]

(2) Where an offence under section 8(b) is committed by a person referred to in subsection (1) in any place outside Singapore, he may be dealt with as if that offence had been committed within Singapore.

[20/98]

31 (4) A specimen of urine provided under this section shall be divided into 3 parts and dealt with, in such manner and in accordance with such procedure as may be prescribed, as follows:

- (a) a preliminary urine test shall be conducted on one part of the urine specimen; and
- (b) each of the remaining 2 parts of the urine specimen shall be marked and sealed and a urine test shall be conducted on each part by a different person, being either an analyst employed by the Health Sciences Authority or any person as the Minister may, by notification in the *Gazette*, appoint for such purpose.

Instant Urine Test
(IUT)

subject matter of the
high profile trial known
as the Test Case in the
High Court

It is an offence for a person to consume drug (section 8b of MDA) outside as well as within Singapore where he is found as a result of urine tests conducted under s31(4) of MDA (section 8A of MDA).

Drug suspect faces trial in High Court in test case

Prosecutors want court to rule that urine test procedures conform to laws

■ BY KHUSHWANT SINGH

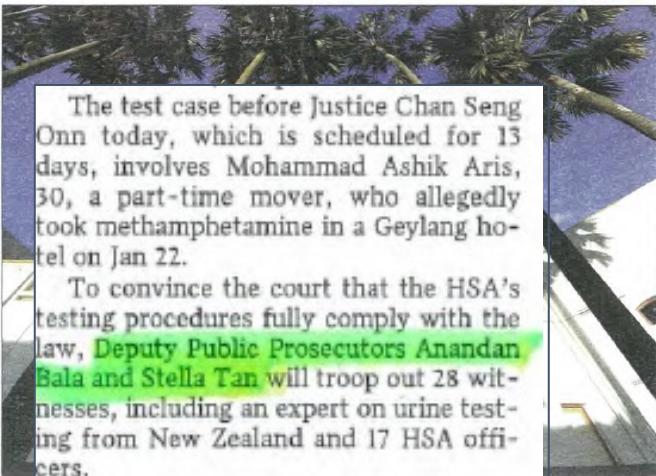
IN AN unusual move, the Attorney-General's Chambers (AGC) will bring a suspected drug abuser before the High Court

6.39 PM

It's that golden time of the day when things start to wind down, people head home, and friends and family start getting together. Straits Times photographers show their take on that moment in the Prime pages every Monday entitled 6.39pm.



A woman walks along a path in Duxton Plains Park as the sun sets, casting an orange glow on the back of a building.



The test case before Justice Chan Seng Onn today, which is scheduled for 13 days, involves Mohammad Ashik Aris, 30, a part-time mover, who allegedly took methamphetamine in a Geylang hotel on Jan 22.

To convince the court that the HSA's testing procedures fully comply with the law, Deputy Public Prosecutors Anandan Bala and Stella Tan will troop out 28 witnesses, including an expert on urine testing from New Zealand and 17 HSA officers.

Mr Kumar, who had managed to get Mr Lim acquitted, will also represent Mohammad Ashik.

He is expected to rely on the same arguments that he gave the court in June – that urine tests had to be conducted by analysts with science degrees instead of laboratory officers who were diploma holders.

He also argued that the analysts must supervise the tests instead of relying simply on the test results for confirming the presence of drugs in urine specimens.

Normally, such cases are prosecuted in a district court.

The unusual move of bringing the test case to the High Court was prompted by the acquittal of suspected drug abuser Lim Boon Keong by Justice Steven Chong in June.

Mr Lim, 27, an odd-job worker, had appealed against his conviction for taking norketamine, a ketamine-type drug.

compliance with the requirements imposed by the Act.

Since the decision, the AGC said, "some cases have been adjourned in the light of Justice Chong's remarks".

The adjournment was "pending the AGC's review of the position and pending its obtaining a definitive ruling on the issue of whether the HSA's urine tests are before the court", its spokesman said.

The test case before Justice Chan Seng Onn today, which is scheduled for 13 days, involves Mohammad Ashik Aris, 30, a part-time mover, who allegedly took methamphetamine in a Geylang hotel on Jan 22.

To convince the court that the HSA's testing procedures fully comply with the law, Deputy Public Prosecutors Anandan Bala and Stella Tan will troop out 28 witnesses, including an expert on urine testing from New Zealand and 17 HSA officers.

They range from the clerks who receive urine samples from the Central Narcotics Bureau to analysts and the head of one of the two urine testing laboratories at HSA.

There will also be a representative each from SciMed, Agilent Technologies and Roche Diagnostics, which are the companies maintaining the machines that test the urine samples for traces of drugs.

Mr Kumar, who had managed to get Mr Lim acquitted, will also represent Mohammad Ashik.

He is expected to rely on the same arguments that he gave the court in June – that urine tests had to be conducted by analysts with science degrees instead of laboratory officers who were diploma holders.

He also argued that the analysts must supervise the tests instead of relying simply on the test results for confirming the presence of drugs in urine specimens.

The prosecution had then said that it would not rely on the HSA analysis but on Mr Lim's confession.

Justice Chong however decided the confession alone could not be relied on without scientific evidence that Mr Lim had taken the drug.

At the preliminary inquiry on Sept 24 to decide if there is enough evidence for today's case to be heard in the High Court, Justice Kwee questioned HSA analysts' ability to tell if urine tests had been conducted properly by merely studying the test results.

Dr Lui Chi Pang, director of HSA's Illicit Drugs and Toxicology Division, told the court at that time that the procedures were internationally accepted.

khush@spa.com.sg

DRUG ABUSE CASE

HSA's urine tests comply with law, court rules

THE High Court yesterday ruled that the urine-testing procedures of the Health Sciences Authority (HSA) are according to the law, when it sentenced a part-time mover to 1½ years in jail for abusing ice.

Justice Chan Seng Onn found that the evidence produced in the 28-day trial "clearly establishes the integrity of the DAT (drug abuse testing) laboratory's drug handling and standard testing procedures and their conformance with the requirements set out in the Misuse of Drugs Act".

Drug consumption cases are typically heard in a district court but the case against Mohammad Ashik Aris, 30, was moved to the High Court, prompted by the acquittal of Mr Lim Boon Keong, 27, by Justice Steven Chong in June last year.

During Mr Lim's appeal against his conviction for taking norketamine, a ketamine-type drug, his lawyer S.K. Kumar argued that the HSA's urine-testing procedures had not conformed to requirements as spelt out under the Act.

While Justice Chong did not make any ruling about the HSA's procedures when he acquitted Mr Lim, he noted that the prosecution of a drug consumption offence should always be supported by expert evidence or certification in strict compliance with the requirements imposed by the Act.

Soon after that decision, the Attorney-General's Chambers had said some drug consumption cases had been adjourned, pending its obtaining a definitive ruling on the issue when all the relevant evidence was before the court.

This evidence in Mohammad Ashik's case was provided by 17 HSA officers among the 28 witnesses.

His lawyer was also Mr Kumar, who argued, as in Mr Lim's case, that the analysts did not have "conduct of tests on urine samples" since they did not perform the tests themselves or supervise the tests, as required by the Act.

In his judgment issued yesterday, Justice Chan said "the word 'conduct' appears to be a chameleon that takes its colour and definition from the context in which it is used".

The judge agreed with Deputy Public Prosecutors Anandan Bala and Stella Tan that "the plain and ordinary meaning of the word 'conduct' does not necessarily entail that the person who 'conducts' has to personally carry out every act..."

Mohammad Ashik's sentence was ordered to start yesterday.

He is presently serving a jail term of six years and six months for trafficking in ice. He was also caned six times.

For drug consumption, he could have been jailed up to 10 years and/or fined up to \$20,000.

KHUSHWANT SINGH

Hair tests

31A.—(1) Any officer of the Bureau, immigration officer or police officer not below the rank of sergeant may, if he reasonably suspects any person to have committed an offence under section 8(b), require that person to provide specimens of his hair for a hair test to be conducted under this section.

(1A) The Director may, for the purpose of ensuring that a relevant person is no longer a drug addict, after the relevant time, order the relevant person —

- (a) to present himself to any officer of the Bureau, immigration officer or police officer not below the rank of sergeant; and
- (b) to provide specimens of the relevant person's hair for a hair test to be conducted under this section as required by such officer.

[Act 1 of 2019 wef 01/04/2019]

(2) A person who fails, without reasonable excuse, to provide specimens of his hair of such type and quantity as may be required by any of the officers referred to in subsection (1) or (1A) shall be guilty of an offence.

[Act 1 of 2019 wef 01/04/2019]

(2A) A person who fails, without reasonable excuse, to comply with an order under subsection (1A) shall be guilty of an offence.

[Act 1 of 2019 wef 01/04/2019]

(3) All specimens of hair provided under this section shall be marked and sealed for hair testing in accordance with the prescribed procedure.

(4) A certificate stating the result of a hair test shall be signed by an analyst employed by the Health Sciences Authority or any other person that the Minister, by notification in the *Gazette*, appoints for such purpose.

(5) The certificate stating the result of a hair test may be signed by an analyst or person appointed under subsection (4) notwithstanding that he did not personally conduct the test to analyse the specimens of hair as long as the test was conducted by another person acting under his direction.

[Act 30 of 2012 wef 01/05/2013]



Drug Testing in Hair -
An Evidence of Drug Exposure
1 June 2016

General analytical workflow for urine tests

A pair of locked security boxes containing the urine specimens are submitted to HSA.

The first and second urine bottles from each subject are separately placed in two different specimen racks.

Sampling of the urine from a bottle with a pipette and transferred to a test tube.

Screening test



A screening test, which is based on immunoassay, is a presumptive test to detect the presence of controlled drugs in the urine specimens. It is a technique based on antibodies to detect specific drugs or their metabolites.

The immunoassay is designed to detect a drug type which consists of one or more drugs within a class of compounds, for example, morphine and codeine detection in the opiates drug type.

Both first set and second set of urine specimens undergo the screening test, performed separately by two different laboratory officers.

Confirmatory
test



A GC-MS instrument
for confirmatory
test.

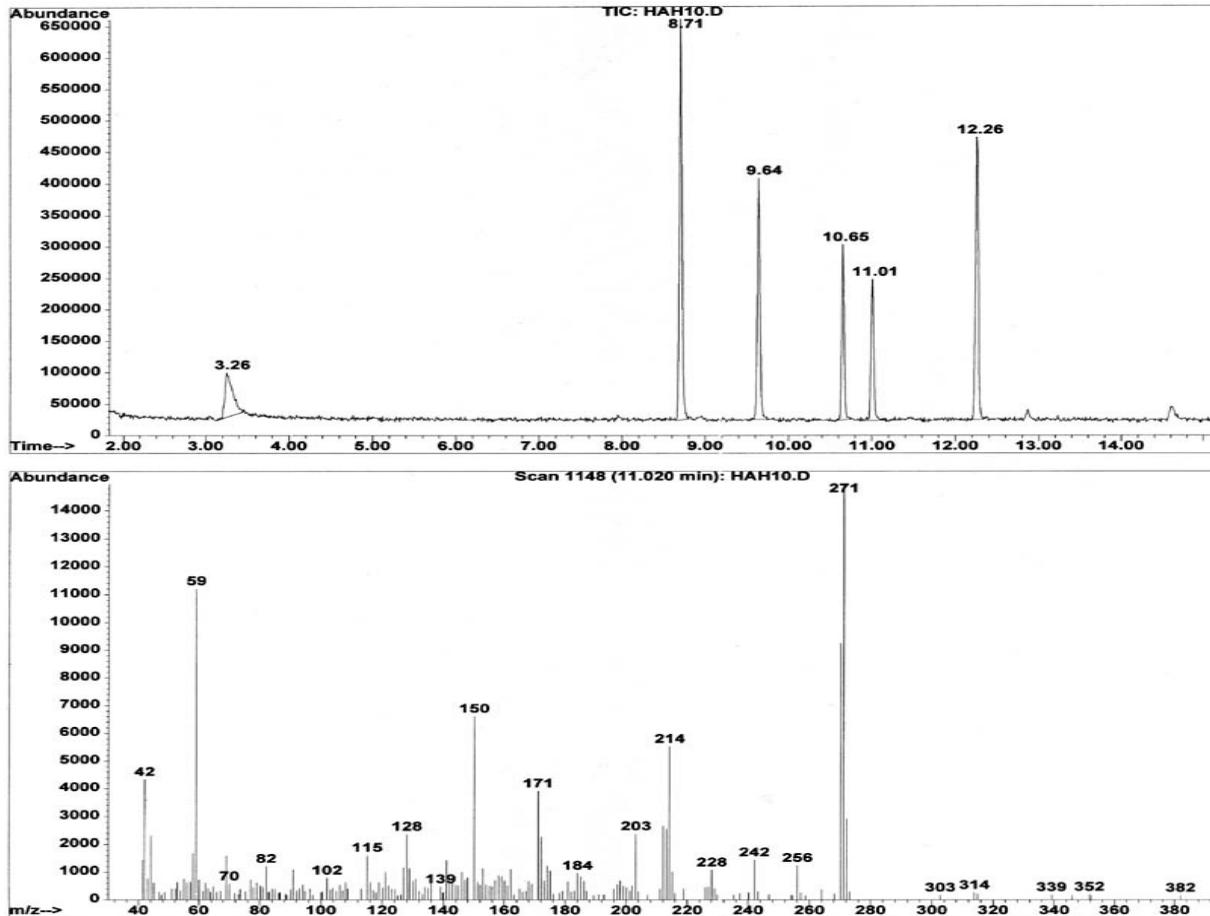
A LC-MS/MS
instrument for
confirmatory test.

The instruments used for the confirmatory test are either gas chromatograph-mass spectrometer ("GC-MS") or liquid chromatograph-tandem mass spectrometer ("LC-MS/MS"). After the drug is introduced into the instrument, it moves through a column, with the aid of a gas in the GC-MS, or a liquid in the LC-MS/MS. This results in the separation of the different drugs and components in the extract. The time a drug takes to pass through the entire column (also known as the retention time) depends on the chemical nature of the drug and its interaction with the column material. This retention time is reproducible for a given drug at the set conditions.

After the separation, the identification of the drug is based on the detection of unique positively charged fragments (or fragmentation pattern) produced by the drug molecule. The fragmentation pattern is characteristic of a drug and the pattern can be used as a molecular fingerprint to identify the drug.

The fragmentation pattern of a drug together with its retention time are compared with a reference drug standard tested under the same conditions in the instrument. This forms the basis in the unequivocal identification of the drug. In quantitative test, one of the fragments is used to calculate the drug concentration.

Analysis and interpretation of the test results



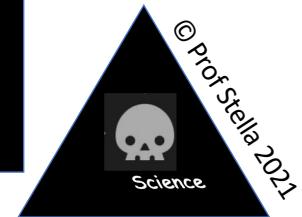
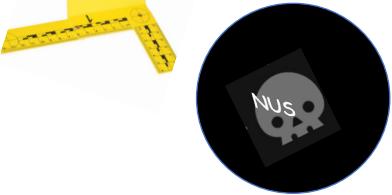
After the screening/initial test and the confirmatory test, individual analyst independently analyses and interprets the test results of one of the two urine specimens from a subject.

The analyst scrutinises and interprets the data and all the documents generated during the testing process.

The analyst will subsequently arrive at his/her conclusion based on the test results and issue a report.

The analyst takes responsibility of the entire testing process in respect of each urine specimen for which he/she carries out the scientific analysis and interpretation.

Lecture Contents



Analytical
Methods



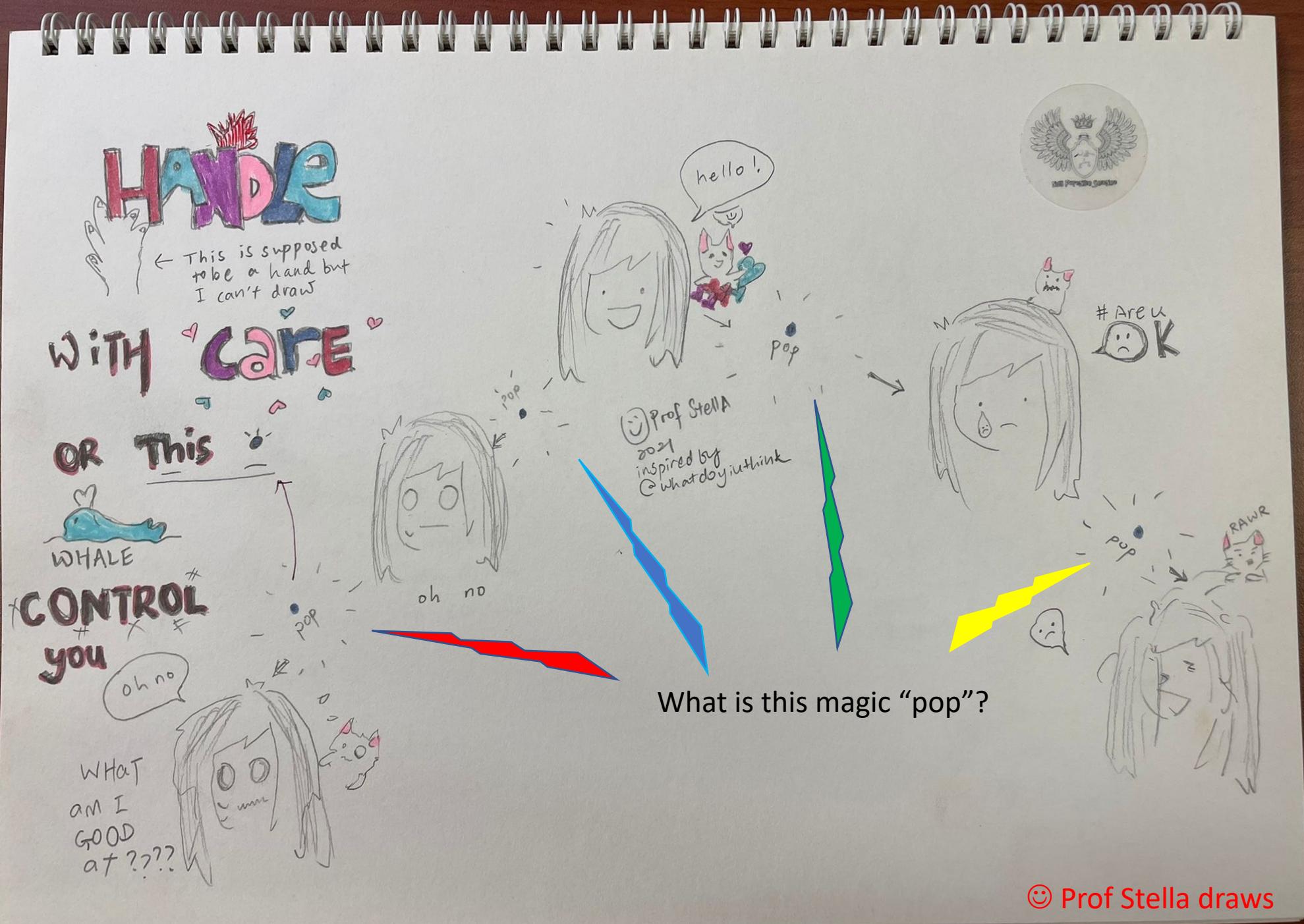
Bad*** of
Drugs



Counterfeit
for a fix



BONUS
Dies (and Flies)



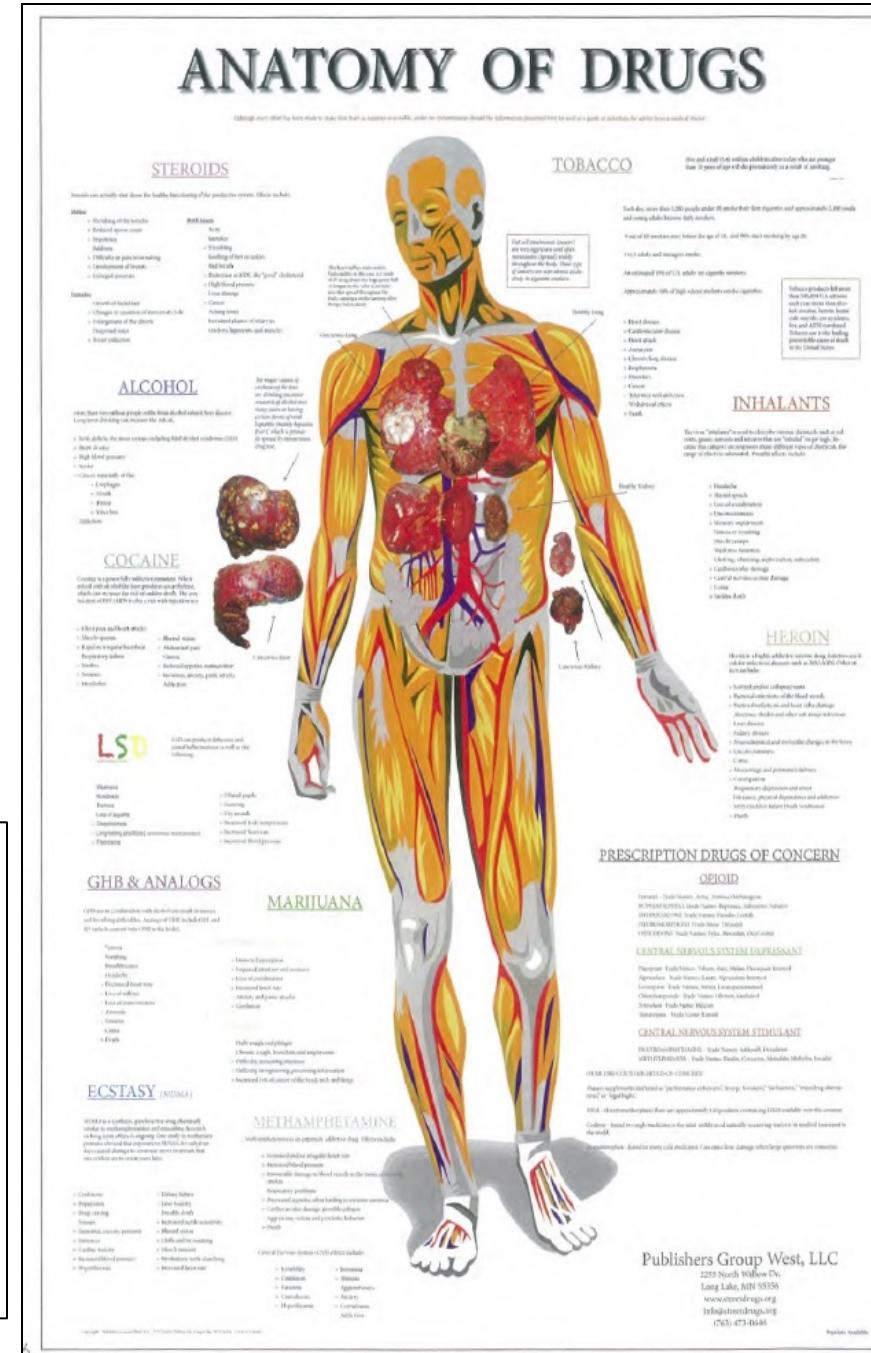
Misuse of Drugs Act (MDA)

- The 1970s saw the introduction of the most sought after drug in the world: heroin. From 1973 to 1975, Singapore experienced an exponential 200-fold increase in the number of heroin addicts.
- The MDA was enacted on 16 Feb 1973 to combat this.
- “Controlled drugs” are any substance which is specified on Part I, II or III of the First Schedule to the MDA.
- The substance can be natural or synthetic.
- The possession, consumption, manufacturing, import, export, or trafficking of controlled drugs in any amount are illegal.

- Working **definition of a drug**: any substance that produces **physiological** or **psychological** effects on the body

- Limited by:
 - Prompt effect
 - Detectable effect

- Abuse of / Dependence (addiction) on drugs:
 - **Physiological** – withdrawal symptoms, physical illness
 - **Psychological** – uncontrollable cravings





- **Street drugs** (i.e. illicit sources):
 - Usually heavily diluted with cutting agents
 - Highly variable dosage levels
 - May contain unknown (toxic?) impurities



Streetdrugs
... a drug identification guide
2016

Flakka

Flakka - a type of synthetic cathinone like bath salts has invaded Florida and other states in the Southeast.

"Cocaine was king, until this year," said a veteran narcotics officer with the Broward County Florida Sheriff's Office.

Wave of heroin deaths stirs fears
... support groups are meeting

CDC calls Heroin "Epidemic"

Addiction Services Overwhelmed

THE DANGERS SINGAPORE FACE

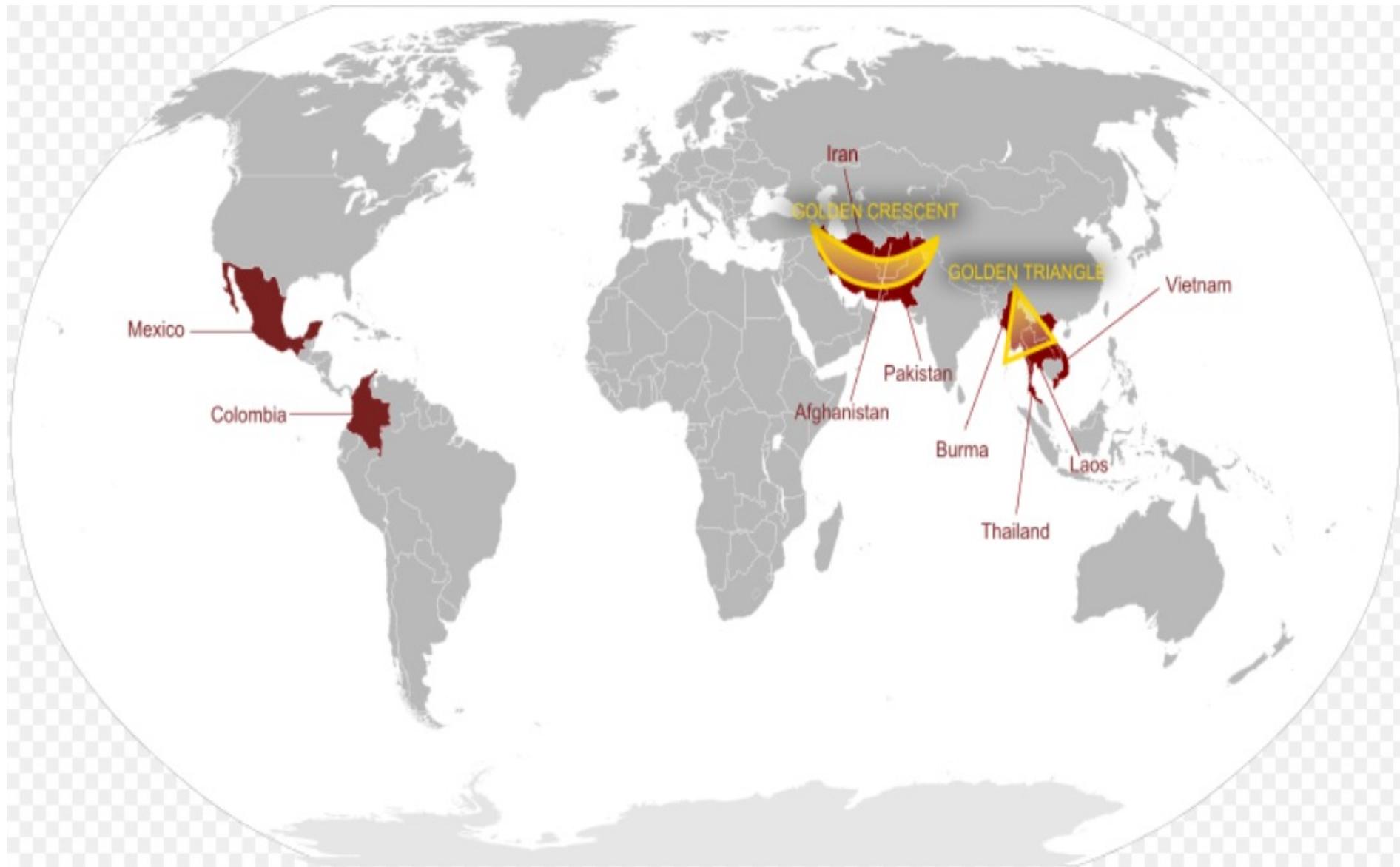
Drugs abuse is widespread in southeast Asia. Within it is the infamous 'Golden Triangle'. Singapore, being near it, could easily become a transit centre or import market for drugs. The amount of opium poppy grown in Southeast Asia has nearly tripled since 2006.

3343 drugs abusers were arrested by CNB: 1309 were new abusers & of these, more than two-thirds were below 30.

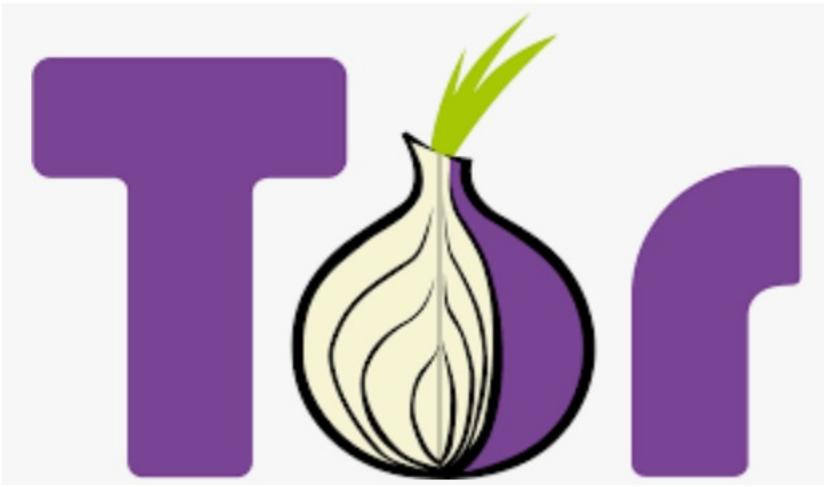
Singapore's Drug Situation in 2015 (CNB Report)

Estimated street value of drugs seized was S\$8.56 million.

Methamphetamine & heroin were the most commonly abused drugs. Notably, methamphetamine has displaced heroin to become the most abused drug.

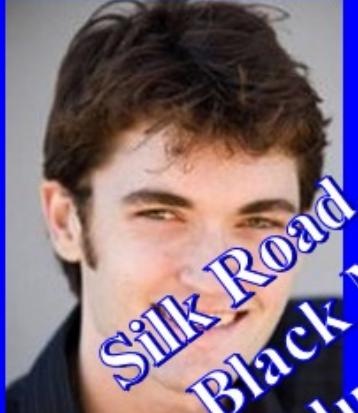


The new business of drugs



Tor (The Onion Router)

Ross Ulbricht, Creator of Silk Road Website, Is Sentenced to Life in Prison

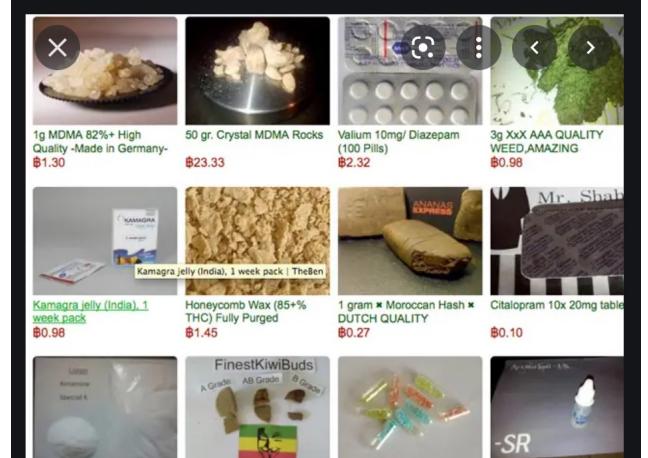


Silk Road, Black Market, Reduced Prices

Ross W. Ulbricht, the founder of Silk Road, a notorious online marketplace for the sale of heroin, cocaine, LSD, and other illegal drugs, was sentenced to life in prison on Friday in Federal District Court in Manhattan.

Mr. Ulbricht's high-tech drug bazaar was novel and full of intrigue, operating in a hidden part of the internet known as the dark web, which allowed deals to be made anonymously and out of the reach of law enforcement. Silk Road's nearly three-year operation, over 1.5 million transactions were carried out on the website involving several thousand seller accounts and more than 100,000 buyer accounts, the authorities have said.

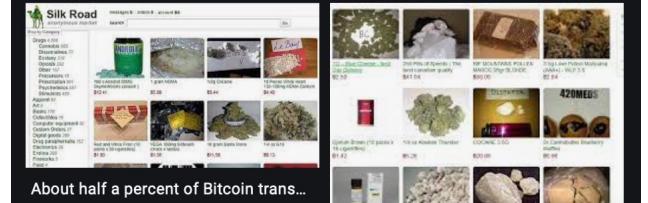
Mr. Ulbricht had faced a minimum of 20 years in prison on one of the counts for which he was convicted. Handing down a much longer sentence, Judge Edward R. Tigar told Mr. Ulbricht that "what you did in connection with Silk Road was terribly destructive to our social fabric."



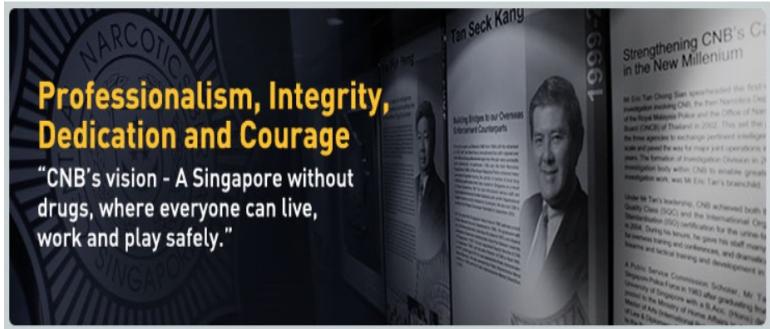
Business Insider
Silk Road Walkthrough

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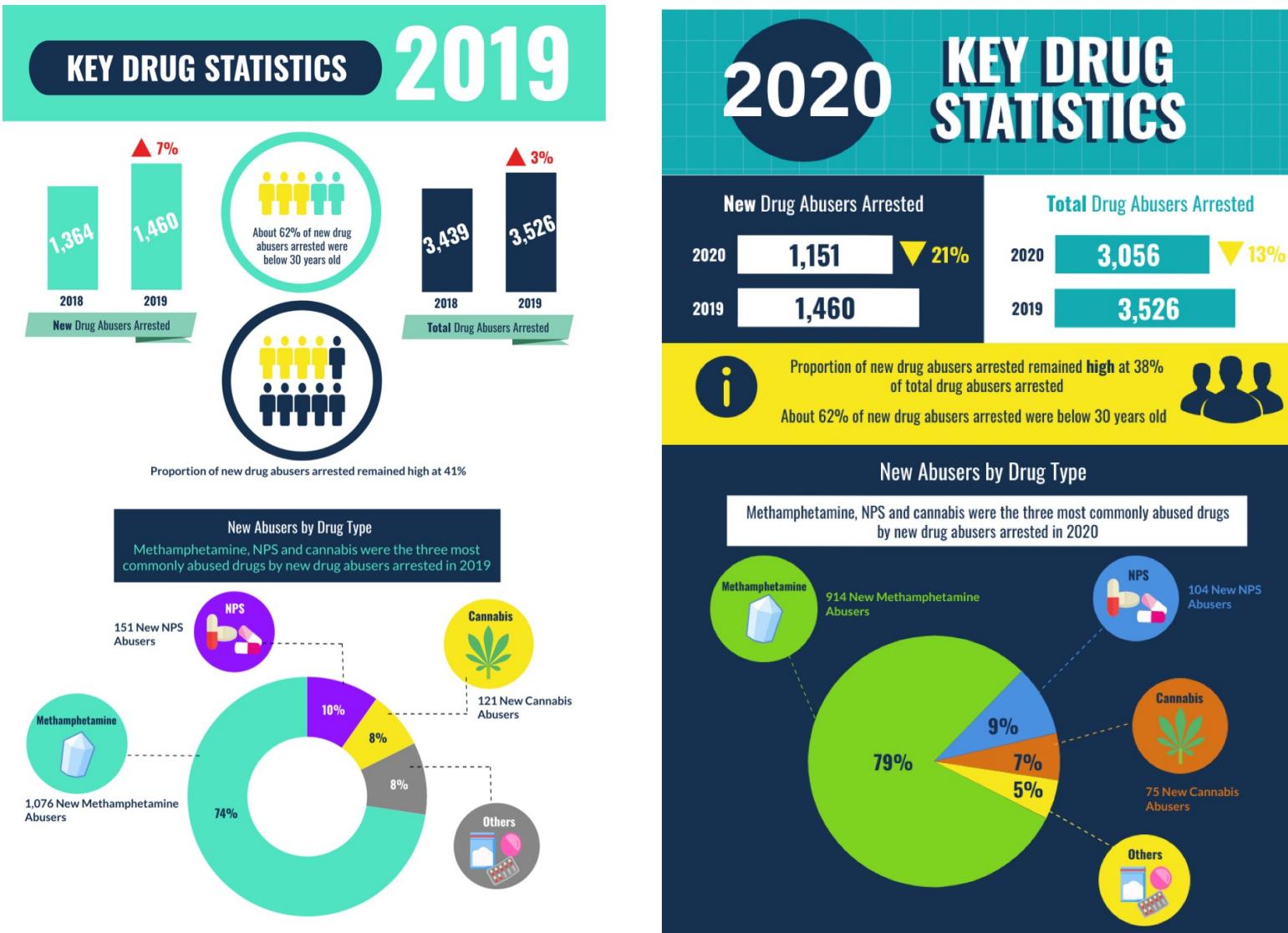


About half a percent of Bitcoin trans...



CENTRAL NARCOTICS BUREAU

NEWS RELEASE



Remember the real victims of drug trafficking



Photo: TNP

By Chai Hung Yin

The New Paper

Saturday, Nov 17, 2012

SINGAPORE - She was slapped and immersed in water until she drowned. An autopsy showed that she was also sexually abused before she died.

Two-year-old Nur Asyura Mohamed Fauzi, fondly known as Nonoi to loved ones, was killed in 2006 by her stepfather, Mohammed Ali Johari, 30, who smoked marijuana and abused cough syrup.

He admitted to using her as a cover when he wanted to smoke marijuana at home, thinking that she would help him avoid detection by the Central Narcotics Bureau (CNB) by bringing her home.

He later confessed to killing her, claiming that it was accidental. He was convicted of her murder and was hanged in 2008.

The tragic story of Nonoi was mentioned in Parliament on Wednesday during the second reading of the Misuse of Drugs (Amendment) Bill.

Law Minister K. Shanmugam was responding to points raised by MPs on Monday.

Several MPs had urged the Government to abolish the mandatory death penalty, citing the ethics of taking a life, its irreversible nature and its effectiveness as a deterrent.

While the intention of showing more compassion towards drug traffickers is good, Mr Shanmugam brought the focus on who the real victims of drugs are.

Besides Nonoi's case, he also highlighted four other real-life cases.

- Tony, 51, was in and out of a drug rehabilitation centre nine times since he was 16. He even often beat up his father, who later killed himself.
- Nelly, aged six, and her newborn sister, Rose, were placed under foster care as their mother, uncle and grandfather were arrested for drug consumption.
- Ricky, aged nine, was admitted to a children's home as his mother and stepfather were jailed for drug offences. He was observed to have emotional issues and suicidal tendencies.
- Girl A, whose mother gave her heroin regularly. Her half-sister and mother's boyfriend also supplied her with drugs. She was arrested for possession of methamphetamine when she was 16.

Killing of Nonoi (2006)

Guilty As Charged: Man dunked stepdaughter Nonoi, 2, in pail of water, killing her

When the two-year-old girl went missing, her stepdad joined the search. But it was he who had murdered her, and hidden the body



Madam Mastura Kamsir refusing to leave her daughter Nonoi's side after she was buried. ST FILE PHOTO

Amir Hussain

PUBLISHED MAY 18, 2016, 5:16 AM SGT

f t ...

<https://www.straitstimes.com/singapore/courts-crime/guilty-as-charged-man-dunked-stepdaughter-nonoi-2-in-pail-of-water-killing>

It was there that they found the nude body of a female toddler with shoulder-length hair.



After searching under the flyover, police finally find a partially decomposed body matching the description of the missing Nurasyura. — ST FILE PHOTO



Nurasyura's body was buried under some rubbish under the Aljunied flyover. — POLICE FILE PHOTO

Bad*** #1: Narcotics



Narcotics:
Includes opium, opium derivatives and their semi-synthetic/totally synthetic substitutes.
E.g. heroin, morphine, methadone, fentanyl.

Uses: lessen pain by depressing the CNS.



Narcotics - Opium

19th Century:

Drug abuse began in Singapore:
Chinese immigrants mostly labourers,
worked long hours, lived in crowded
quarters. Opium was regarded as an
effective medicine for aches and pains &
relief from their miseries.

1929:

Over 40,000 registered opium-smokers in
Singapore.

1946:

A Proclamation was enacted which made the
use of opium illegal.

1955:

Establishment of treatment centre.
Lesser young persons took to opium
smoking.
Opium smoking population declined.

1990s:

Number of opium abusers small (majority being
in their 50s or 60s),



Narcotics - Heroin ('Peh Hoon')

1972:

Abuse of heroin first recorded in 1972 when four heroin offenders were arrested.

1977:

Heroin addict population grown to about 130,000.
Majority below 30 years old.
Common mode of administration was and still is, chasing the dragon (i.e. by heating the drug on aluminum foil and inhaling its fumes).

1967-77:

Confronted with heroin epidemic, two-pronged strategy of reducing both the supply and demand for the drug:

1. Arrest of drug traffickers;
2. Arrest of heroin addicts (through mass screening programme involving urine tests and detention for treatment and rehabilitation).

1 April 1977:

Operation Ferret launched:
heroin abusers were identified by positive urine tests & detained for compulsory treatment and rehabilitation at Drug Rehabilitation Centre.

Heroin

Also known as:
White / Smack / Junk /
Powder / Putih / Medicine / Ubat



WHAT'S this?

Heroin is a powerful and very addictive drug that comes in granular, powder or solution form. Heroin No. 4 is white in colour while Heroin No. 3 is more yellowish.

Heroin abusers feel dull and tired very easily.
They cannot work properly as they are not able to concentrate.

"Chasing the Dragon", a common method of abuse used by heroin abusers here, involves heating the heroin powder and sniffing the fumes through a rolled note.

Heroin

... growing epidemic.
Source: CDC



Painkillers actually kill more Americans than heroin and cocaine combined, according to the Centers for Disease Control, but heroin is still one of the top killers of illegal drug users.

"We've had too many kids die of heroin, here in the village," said one New York High School teacher. "Too many kids that we know are addicted, and we're worried about them, and trying to get the help we can."

Between 2002 and 2013, the rate of heroin-related overdose deaths nearly quadrupled, and more than 8,200 people died in 2013 (latest statistics).

Source: CDC

- Also known as: white, smack, jink, powder, putih, medicine, ubat.
- Form: granular, powder or solution form.
 - heroin no 4 is white in colour while heroin no 3 is yellowish in colour.
- Common consumption method: injection, snorting lines of it in powdered form or smoking it ("chasing the dragon") by heating the heroin on aluminum foil and inhaling the smoke and vapours.
- Narcotic analgesics prepared from morphine which can be extracted from the opium poppy.
- Active ingredient: diamorphine.
(Purity: usually 2-5 %)



By Chai Hung Yin
The New Paper
Saturday, Nov 17, 2012

Mr Shanmugam also mentioned that being a rich country, Singapore is a highly attractive destination - thus the need for comprehensive measures against both supply and demand.

He also said that the death penalty serves as a strong deterrent, which acts as an element of fear for drug traffickers.

He asked whether Singapore is willing to take the risk of more willing couriers, if the element of fear is removed.

Mr Shanmugam also cleared the misconceptions surrounding couriers. He said that couriers traffic drugs for money and that they know what they are doing is wrong.

The threshold for capital punishment is 15g of diamorphine, which is equivalent to 2,200 straws worth \$66,000 in street value and can feed 300 abusers for a week.

Public Prosecutor v Jafar Shatig bin Abdul Karim
[2015] SGHC 189

Case Number : Criminal Case No 24 of 2014

Decision Date : 27 July 2015

Tribunal/Court : High Court

Coram : Choo Han Teck J

Counsel Name(s) : Eugene Lee Yee Leng and Sanjna Rai (Attorney-General's Chambers) for the prosecution; Johan bin Ismail (Johan Ismail & Company), Skandarajah s/o Selvarajah (S Skandarajah & Co) and Sim Jin Simm Alina (Axis Law Corporation) for the accused.

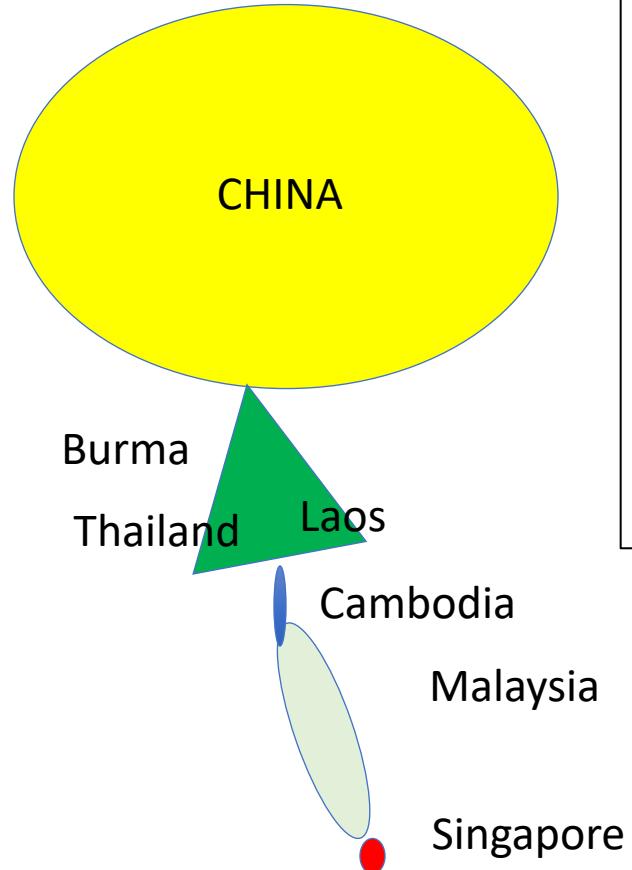
10 In my view, it was important to find that the accused had hidden the drugs in seat A and seat B. Although no one saw him place the drugs there, Tanaletchumi testified that she saw the accused pressing down on seat A. This supports the prosecution's submission that the accused knew this spot had the hidden parcels. Importantly, the first statement by the accused, which had been admitted, contained a confession by him that he was the one who put the ten bundles into seats A and B. He admitted that he did it for RM10,000. The details set out in paragraph 10 of the accused's first statement as to how he removed the sponge material from the two seats in Parameswaran's bus and placed the bundles there are information that is only within the knowledge of the courier of those drugs. The accused also admitted in the subsequent statements that he had brought the bundles to Singapore. Further, there was other important evidence corroborative of this. One was the seizure of the "Adidas" sling bag (P93) with the empty plastic bag in it. More importantly, the sponge material from the seats was found in the "Adidas" sling bag that the accused admitted belonged to him. Forensic evidence confirmed that the sponge material came from the seats. I was therefore satisfied that the accused had been in actual possession of the drugs and had placed them in the two seats after removing the sponge material.



The black bundles of heroin recovered at Tuas Checkpoint on 3 Jan 13



Some of the straws of heroin recovered from a car at a CNB follow-up operation on 3 Jan 13



The infamous 'golden triangle' - located in an area where Burma, Laos and Thailand meet

- One of the **largest** illicit **opium poppy-growing** regions in the world.
- **Raw opium** is converted to **morphine base** at jungle refineries and clandestine laboratories and later processed into **heroin**.
- Through Thailand and the surrounding countries such as **Malaysia and Singapore**, heroin finds its way into the Far East, Europe and the USA.



10 bundles of heroin recovered from a residential unit in the vicinity of Rivervale Drive
(Photo: CNB)

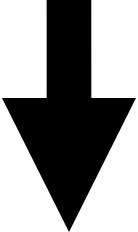


Heroin Production



The infamous 'golden triangle' - located in an area where Burma, Laos and Thailand meet

- One of the largest illicit **opium poppy-growing** regions in the world.
- **Raw opium** is converted to **morphine base** at jungle refineries and clandestine laboratories and later processed into **heroin**.
- Through Thailand and the surrounding countries such as **Malaysia and Singapore**, heroin finds its way into the Far East, Europe and the USA.



COLLECTION OF THE OPIUM GUM/LATEX



EXTRACTION OF
morphine **FROM**
OPIUM



PRODUCTION OF
HEROIN BASE



PRODUCTION OF HEROIN HYDROCHLORIDE

The street name for Diacetylmorphine and diamorphine is heroin.



Raw Opium is refined into a morphine base and the morphine base is converted into heroin by a simple chemical reaction with acetic anhydride, followed by a varying degree of purification.



Semi-synthetic opioids like heroin, oxycodone, hydrocodone, and hydro-morphone are synthesized from naturally occurring opium products, such as morphine and codeine.

Raw Opium is refined into a morphine base, a sticky brown paste and the main psychoactive chemical in opium.



There are many synthetic and semi-synthetic narcotics. Some of the more popular include:

Codeine - Tylenol 3
Darvon
Darvocet
Demerol
Empirin
Fiorinal
Methadone
Hydrocodone - Lorcet, Lortab, Vicodin
Hydromorphone - Dilaudid
Oxycodone - OxyContin, Percocet, Endocet

马国青年贩毒判死刑

侯启祥 报道

20岁马来西亚籍青年被控贩卖47.27克海洛英，他辩称不知道那是毒品，口口声声说自己无辜。不过，法官认为控方证据确凿，裁决他罪成，判处死刑。

被告杨维光案发时年仅19岁，在运送毒品给客户被肃毒员逮捕时，还慌张地高喊“妈妈”求救。法官昨天宣判后，他眼眶泛红，哭丧着脸。庭警将他押走，他向法官鞠躬。

被告是散工，父亲几年前逝世，母亲体弱多病。去年6月12日晚上约10时，他受一名男子指示送包裹到新加坡。

进入新
通知

被捕时大叫“妈妈”

但他一入境，便被肃毒员开车跟踪。他先去义顺，将14克海洛英交给林福成（51岁），对方付给他5000元。他最后来到乌节路一家酒店，在将毒品交给魏锦祥（22岁）后被捕。他被捕时惊魂失措，在肃毒员面前高喊“妈妈”求救。

肃毒员将从他车上，及逮捕林福成和魏锦祥后搜出的40多包物质与1700多颗药丸送往化验。结果显示，那些



被告杨维光被捕时仅19岁，现在20岁。他在庭上听到法官宣判他死刑时眼眶泛红。

THE STRAITS TIMES SATURDAY, NOVEMBER 15 2008

Drug runner to hang

■ BY KHUSHWANT SINGH

A MALAYSIAN odd-job worker has been ordered to hang for having been a drug mule in June last year.

Yong Vui Kong, 20, was found guilty yesterday of trafficking in 47g of heroin by Justice Choo Han Teck, who imposed the mandatory death sentence for deals involving more than 15g of heroin.

During the two-week trial, Yong's lawyers argued that their client, then 19, was unaware of the contents in the packages as he drove into Singapore, and that

he was merely following the instructions of his boss in Johor Baru to deliver the "presents" to people here.

The packages were gift-wrapped and Yong, who said he was under orders not to open them, had been assured by his boss he would not land in trouble.

He had told police he stood to receive \$2,000 for running the errand, but denied this in court; he said he had lied because the police were unlikely to believe he was doing his boss a favour. The identity of his boss, who Yong said drove a Singapore-registered car, is unknown.

Dismissing Deputy Public and Stella Tai had their ends not have been i

What was p evidence came Reggie Gwee C fied that he h Yong on five t May and June even came unw

The court l drive into Singa then receive an phone numbers

On the last Yong asked his 24, to accompa

<https://www.bing.com/videos/search?q=first+drug+offender+Yong+Vui+Kong&&view=detail&mid=88AD5CEF292FF3E3066288AD5CEF292FF3E30662&FORM=VRDGAR>

Narcotics - Methadone

- First synthesized in Nazi Germany before WWII.
- Used to treat heroin addiction and chronic pain.
- Usually dispensed as a liquid or tablet.



Bad*** #2: Stimulants

Stimulants:
Includes amphetamine,
methamphetamine,
amphetamine variants (MDMA,
MDA), cocaine.

Uses: stimulate the CNS, increase
alertness, attention, energy.
Induce sense of euphoria, improve
mood.

Methamphetamine

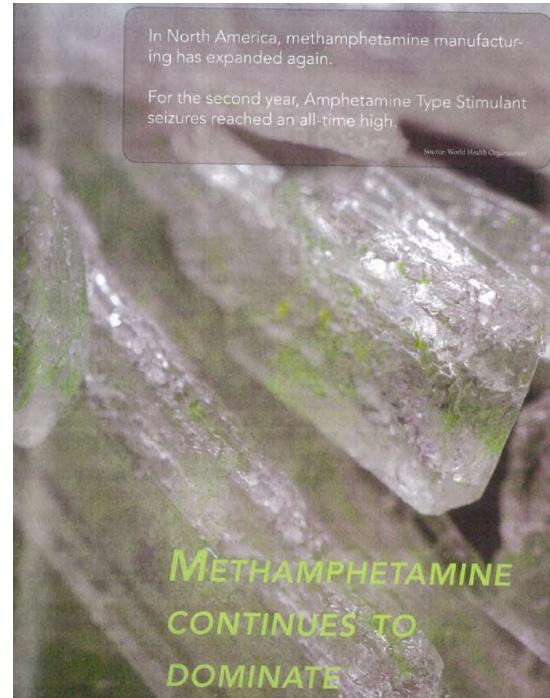
Also known as:
'Ice' / Glass / Crystal /
Speed / 'Ya ba'

WHAT'S this?

Methamphetamine usually comes in crystallised form known as Methamphetamine Hydrochloride. It is more commonly known as 'Ice' in Singapore. It is a strong stimulant, which is odourless and colourless.

Methamphetamine also comes in tablet form known as: 'Ya ba'. The stimulant powder in 'Ya ba' is produced from the *ephedrine* plant. Most of the 'Ya ba' tablets found are embossed with the 'WY' logo and are green or orange in colour.

Methamphetamine has a very strong effect on the central nervous system and is highly addictive. The abuser feels anxious and restless which can lead to violent behaviour.



- Also known as: ice _____, glass, crystal, speed, ya ba, shabu, syabu, crazy horse pill.
- Form: tablet, chunky crystalline substances, colourless crystals resembling glass fragments or shiny blue-white rocks of various sizes.
- Common consumption method: oral consumption, injection, smoking.

Trainee doctor entrapped for drug possession

source: Straits Times, 8 and 9 June 2006

▼ 8 June 2006
The Straits Times

Young doctor jailed eight months for possessing Ice

Downward spiral began when he experimented with gay sex and drugs

By Elena Chong

Taxi driver's son Adrian Yeo See Seng had a bright future as a doctor but the 27-year-old threw it all away when he experimented with sex and drugs.

A district court heard yesterday that he spiralled downwards after he started engaging in homosexual sex with strangers he met over the Internet, and taking drugs.

He was caught when a man he chatted with online invited him for a sex session with a third man at a Bencoolen Street hotel.

But the two strangers turned out to be undercover anti-narcotics officers who found drugs on Yeo when he arrived, and arrested him.

He was yesterday jailed for eight months after he had admitted to having a packet of 0.16g of methamphetamine or Ice at the Bencoolen Street hotel room on April 1.

Three charges of possessing Ecstasy and ketamine were taken into consideration during his sentencing.

He was initially charged with three counts of drug trafficking and one of possession.

Yeo attended The Chinese High School and Hwa Chong Junior College and, after national service, trained to become a doctor at the National University of Singapore.

He signed a five-year bond for \$400,000 to serve the Government and took a \$66,000 bank loan to pay his way through university.

But his world came crashing down on April Fool's Day when Central Narcotics Bureau officers arrested him at Hotel 81 at about 3.45pm, and took an envelope containing crystalline substances in a plastic bag from his haversack.

In his written plea for leniency, counsel Kertar Singh hoped his client could get probation and a second chance.

He said Yeo was consumed with a deep sense of guilt and shame.

Mr Singh said Yeo's descent into sex and drugs began after he failed one of his final examination papers in March last year and had to re-sit the paper.

He was devastated at failing. While anxiously awaiting the result of his second try, the counsel said, he poured out his sorrows to strangers over an Internet chatline for homosexuals.

Mr Singh said Yeo, who had been attracted to males since he was a teenager, began engaging in gay sex with different partners - including strangers - and also started taking synthetic drugs for the first time.

About a week before he was caught, Yeo chatted online with a man named Joe about sex and drugs.

On March 31, Mr Singh said, Joe said he had a friend named Jacob and asked if Yeo would be keen on having three-way sex.

Joe also said he had some drugs and asked if Yeo had any.

Yeo went to the hotel, but Joe and Jacob turned out to be undercover narcotics officers and he was arrested.

District Judge Wong Keen Onn ruled out probation, saying Yeo was a mature adult who was not suffering from any mental disorder.

Mr Singh had objected to the manner in which Yeo was lured and arrested, but the judge said there was nothing to suggest that CNB officers had acted illegally or had gone beyond the boundary of the law.

Yeo could have been jailed for up to 10 years or fined up to \$20,000 or sentenced to both a jail term and fine for having drugs.

Several family members, including his father and housewife mother, were in court yesterday, but they declined to speak to reporters.

* * * * *

Pimp Forced 17-year-old Girl To Work As Prostitute @ Geylang

Callgirl from China forced to work for pimp or risk being hurt

HE FORCED her to work here as a prostitute, earning about S\$9,000 (RM22,751) from providing sexual services on about 150 occasions over 15 days.

And he made sure that the underage China girl did not see a cent of it.

Pimp Tang Huisheng took all the money and blew it as part of a S\$19,000 (RM48,031) gambling spree at the Marina Bay Sands casino.

But such bravado was missing yesterday. The 37-year-old pleaded guilty to four out of seven vice-related charges, reversing an earlier intent to claim trial – to the surprise of prosecutors.

He had flown the 17-year-old here to work the streets of Geylang, where she serviced around 100 clients who paid about S\$60 (RM151) a time.

Deputy public prosecutors Stella Tan Wei Ling and Elizabeth Chua told Community Court Judge Shaiffudin Sarwan the horrific tale of how the minor – who cannot be named – ended up leaving China to become a prostitute in Singapore.

Tang's sister lured the teenager to the city of Zhuhai where he drugged her with methamphetamine, or Ice, and had sex with her while she was in a stupor.

If she refused his demands for sex he would beat or threaten her.

When Tang told her he was going to take her to Singapore where he would be her pimp, she refused, knowing Tang had worked as a pimp for many years and had other girls working for him.

He locked her up for more than a week in a fifth-floor unit in Zhuhai. She tried to escape but hurt her waist and was caught by Tang and his sister, who then assaulted her and threatened to harm her family.

Tang's sister also threatened to splash acid on her face if she did not listen to them and tried to run away again.

Tang kept all her belongings, including her passport.

He and the minor flew to Singapore on May 16. Two days later he took her to Geylang to start work.



Combating Clandestine Meth Labs With US DEA



Joint Clandestine Laboratory
Training & Exercise, Singapore
3 - 11 May 2016

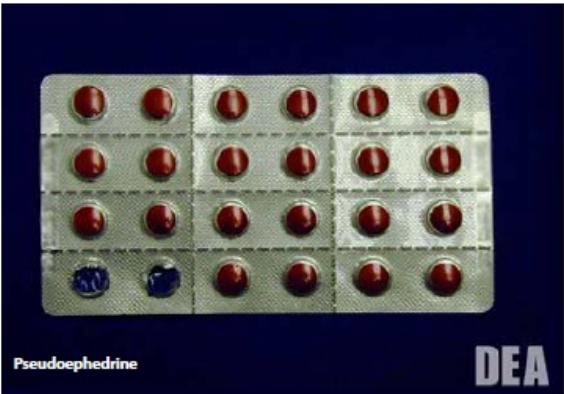
Methods used to manufacture meth are directly impacted by the availability of precursor chemicals and ease of synthesis.

Meth is produced by utilising pseudoephedrine and common house-hold chemical products like anhydrous ammonia from fertilizers and lithium batteries, using the one pot (the ingredients are mixed by shaking the container) and regulating the pressure created by the chemical reaction.

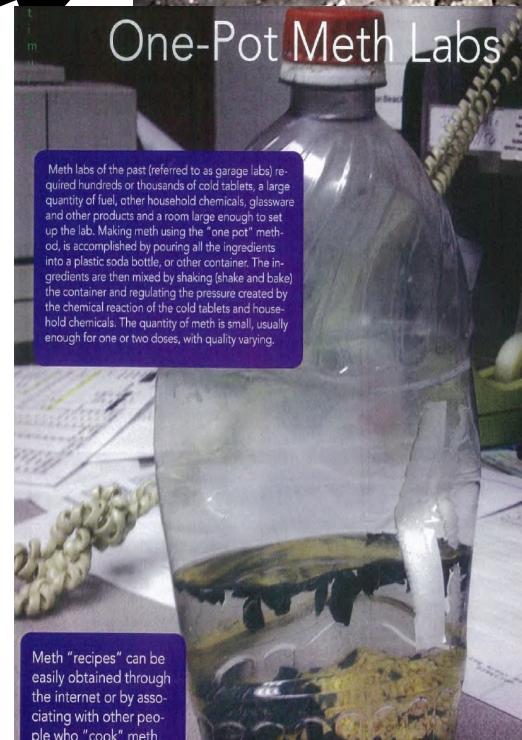
cooking meth – & the chemical mixture could burst into flames when exposed to oxygen - can result in explosions and fires that could injure and kill.

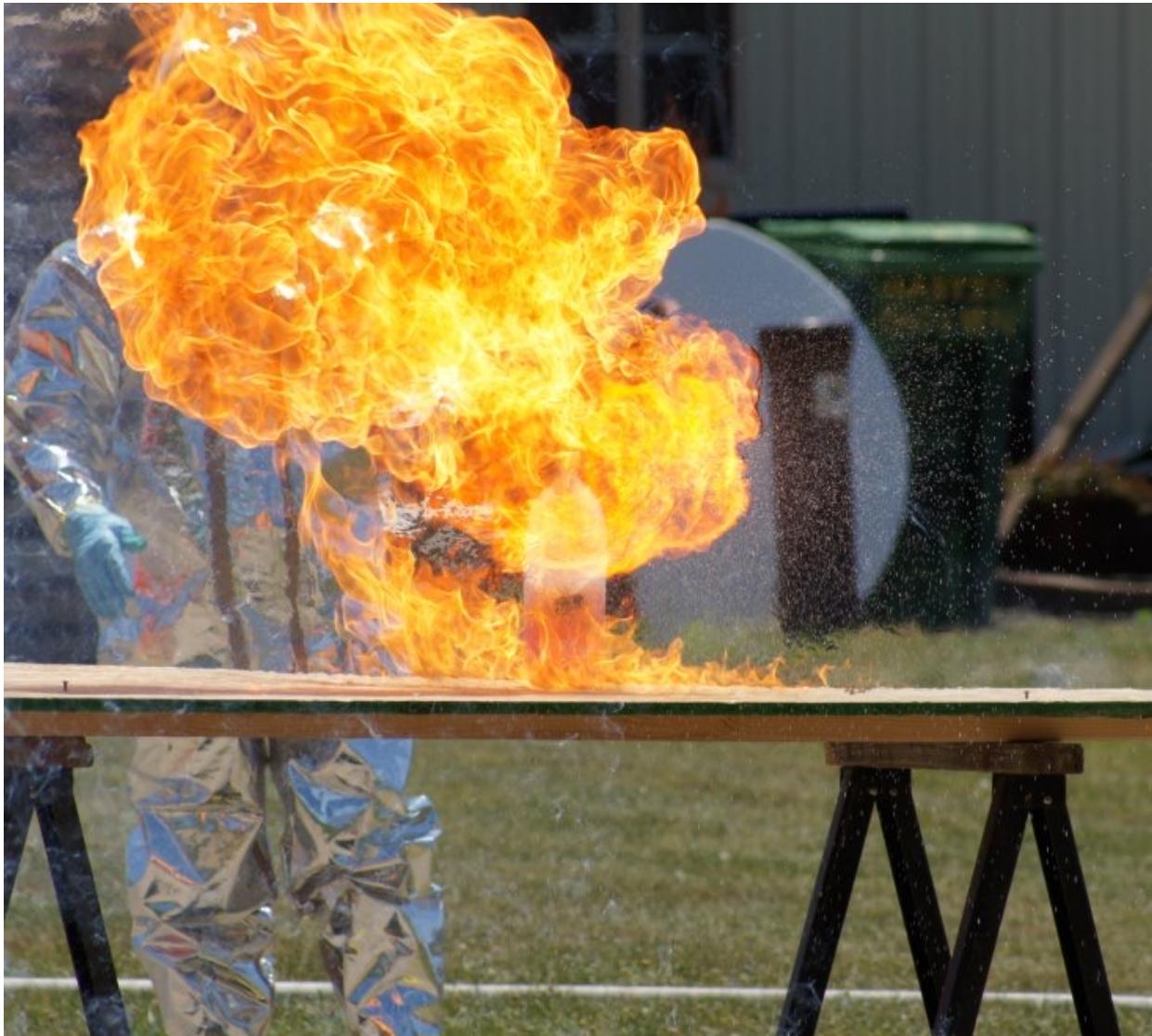


Pseudoephedrine



Precursors





'Ecstasy'

Chemical term:
Methylenedioxymethamphetamine (MDMA) /
Methylenedioxymethylamphetamine (MDEA) /
Methylenedioxymphetamine (MDA)

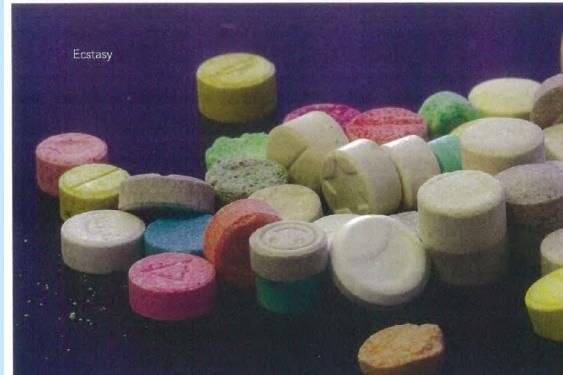
WHAT'S this?

'Ecstasy' refers to tablets containing MDMA, MDEA and MDA. These tablets come in different colours with different logos stamped on them. They are often sold in discos as well as night joints. People take them to enable them to dance all night and sometimes they die from exhaustion and dehydration.

Other controlled drugs such as Ketamine and Methamphetamine, and chemicals such as paracetamol and calcium carbonate are often mixed with 'Ecstasy'. This may cause bad reactions to the body.



Ecstasy



Methylenedioxymethamphetamine (MDMA)

Often sold in discos and nightspots, 'Ecstasy' is mixed with chemicals such as paracetamol and calcium carbonate, causing adverse reactions to the body.

Also known as: 'Ecstasy' / Pink / Pink Lady / Snow White / Playboy / Apple / XTC

- Also known as: MDMA, MDEA, MDA.
- Form: tablets of various colours, shapes and sizes with different logos stamped on them.
- Common consumption method: oral consumption.

Cocaine

Also known as:
Crack / Coke / Snow



WHAT'S this?

Cocaine is derived from the leaves of the *Erythroxylum Coca* plant. In its pure form, Cocaine is a white crystalline powder and it is either sniffed in powder form or injected into the body in liquid form.

Cocaine is both a central nervous system stimulant and an anaesthetic. The chronic Cocaine abuser is socially dangerous because of the mental abnormalities caused by the drug.

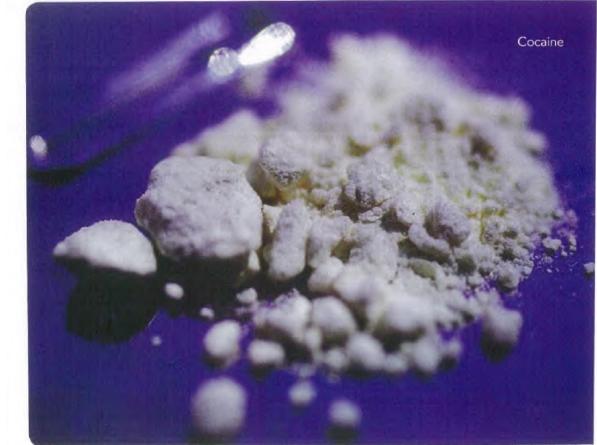
Former actress on drug charge

A FORMER Television Corporation of Singapore (TCS) actress was charged yesterday with possession of 0.46g of cocaine last year.

Low Lin Lin (right), 27, better known as Michelle Low, was a Star Search finalist and had a role in Channel 8's 40-episode *Return of the Condor Heroes*

series. She was allegedly found with the drug on Sept 30 last year at Velvet Underground.

Low's case will be mentioned again on Aug 15. She faces up to 10 years in jail and a \$20,000 fine if convicted.



Cocaine

Scientific research is constantly discovering new things about drugs, such as the health benefits and risks of using (or misusing) them. Sometimes, these discoveries lead to changes in the way a drug is used.

For example, did you know that the original recipe for Coca-Cola contained cocaine?

Coca-Cola's history has been well-documented. The drink was invented in 1885 by John Pemberton, a pharmacist from Atlanta, Georgia, who made the original formula in his backyard. Pemberton's recipe contained **cocaine** in the form of an extract of the coca leaf, which inspired the "Coca" part of the beverage's name. The "Cola" comes from the kola nut (which contains caffeine, another stimulant).

When Coca-Cola was invented, cocaine was legal and a common ingredient in medicines. People thought it was safe to use in small amounts.



- Also known as: crack, coke, snow.
- Form: crystalline powder.
- Common consumption method: sniffed in powder form or injection in liquid form.

Cocaine overdose killed Meriden woman

By Thomas Pelton
Register Staff

WALLINGFORD — The 34-year-old former Lyman Hall High School homecoming princess found dead in a park on New Year's Eve died of a cocaine overdose and was probably not the victim of a homicide, as police first believed.

Michelle Snavely, a mother of two who lived on Webb Street in Meriden, died with cocaine and a legally intoxicating

amount of alcohol in her blood after dosing, Curran said.

Snavely's family members said Friday they knew Snavely had a drinking problem, but not that she used cocaine.

"The evidence does not suggest a crime," Sgt. Thomas Curran said. "We don't have any indication of a homicide."

Police still don't know whether Snavely's death was accidental or a suicide, Curran said. Nor do they know how her body ended up in secluded Lufbery Park.

Police are investigating the possibility that someone who was with Snavely that night left her in the park after she over-

Turn to Overdose, Page 10



COCAINE TRACE WIPES (50/BOX)

Price: **price on request**
Code: COCOW50SS

Contact us for price info

[view larger image](#)

[E-mail to a friend](#)

Delivery: "1-2" weeks (depending on your location en selected shipping method)

The MMC Cocaine Trace Wipes presumptively detect the presence of Cocaine by simply wiping over the suspected surface.

Test results are immediate. A blue result presumptively identifies the presence of Cocaine and may be sufficient cause for further investigation.

These convenient Cocaine ID "Wipes" can presumptively identify cocaine from trace amounts of residue present on surfaces that have been in contact with cocaine.

Each wipe is sensitive to trace amounts of residue; far less than could be collected for regular field testing. Each wipe is hermetically sealed in single-use foil envelopes. Unlimited shelf life assures these wipes will provide dependable results when you need them.

Great for use by narcotics officers in the field and investigators at the crime scene.

Contents: **50 Wipes.**
Size wipe: **4.3 x 6.30 inch (110mm x 160mm)**

Bad*** #3: Hallucinogens



Hallucinogens:

Includes cannabis and semi-synthetic/synthetic like Lysergide (LSD), phencyclidine, psilocin, ketamine.

Uses: Alter an individual's perceptions and may result in illusions and sensory distortions.

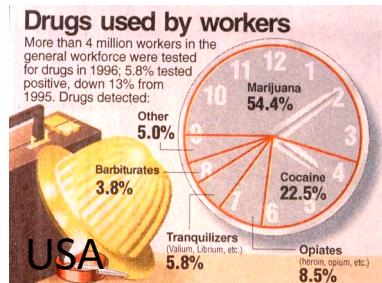


Hallucinogens - Cannabis



19th Century: —— Cannabis was brought into Singapore by Indian immigrant workers (commonly known as 'ganja') at about the same time as opium.

Late 1950s: —— Abuse of cannabis became widespread among Malay youths and most common method of consumption was to smoke it with tobacco



2015: —— CNB revealed that *among new abusers, cannabis* has replaced heroin as the second most abused drug in Singapore behind methamphetamine.

March 2016: —— "Other countries have, in recent years, decriminalised or legalised the use of cannabis, both for medical as well as recreational purposes. We will not do the same."
- Senior Minister of State (Home Affairs & National Development) Desmond Lee reinforced Singapore's zero-tolerance stance against drugs at a United Nations 59th session of the Commission on Narcotics Drugs

Cannabis

Also known as:
Marijuana / Pot / Grass / Joints / Ganja

WHAT'S this?

Cannabis comes from the *hemp* plant. The whole plant is dried and compressed into blocks until it looks like dried herbs or tea.

Cannabis causes a person's mind to become addicted.

It contains a chemical that affects one's mood and the way one sees and hears things. Cannabis affects one's concentration and memory, hence it weakens the abuser's ability to learn. Cannabis abusers are likely to move on to stronger and deadlier drugs.



- Also known as marijuana, pot, grass, joints, ganja, hashish (resin), weed, sinsemilla.
- Form: loose cannabis leaves, compressed blocks.
- Common consumption method: smoking or oral consumption.
- Comes from the hemp plant and contains tetrahydrocannabinol (THC) which affects one's mood – causing euphoria, and also anxiety, disorientation or paranoia.
- means any part of a plant of the genus *Cannabis*, or any part of such plant, by whatever name it is called
- “Cannabis mixture” means any mixture of vegetable matter containing tetrahydrocannabinol (THC) and cannabinol (CBN) in any quantity
- Cannabis, THC (a cannabinol derivative) and CBN – All 3 are Class A Controlled Drugs under the Misuse of Drugs Act

How Does Marijuana Affect a User's Life?

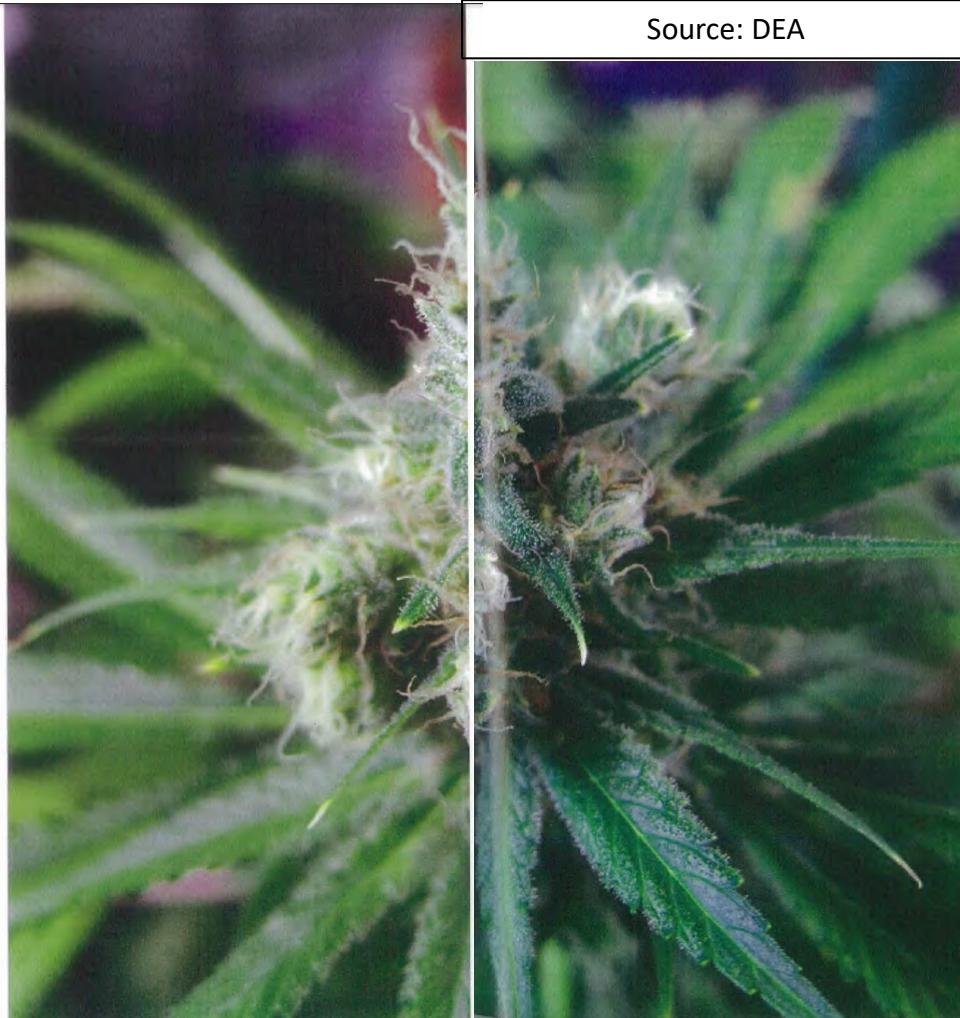
Compared to nonusers, heavy marijuana users more often report the following:

- lower life satisfaction
- poorer mental health
- poorer physical health
- more relationship problems

Users also report less academic and career success. For example, marijuana use is linked to a higher likelihood of dropping out of school. It is also linked to more job absences, accidents, and injuries.

Is marijuana addictive?

Contrary to common belief, marijuana can be addictive. Research suggests that about 1 in 11 users becomes addicted to marijuana. This number increases among those who start as teens (to about 17 percent, or 1 in 6) and among people who use marijuana daily (to 25-50 percent).



Source: DEA

"Student jailed 6 months for taking drugs while abroad and for having cannabis" -
Straits Times, 13 Oct 2015

- Trevor Soh Li Wen, 24, admitted to taking a cannabinol derivative in Amsterdam on or before May 26 2015, and having a container with at least 4.22 g of vegetable matter found to contain cannabis at his home in Woodlands on May 29.
- Investigations revealed that he started smoking weed, a street name for cannabis, when he was first introduced to it during his JC days.

Ketamine

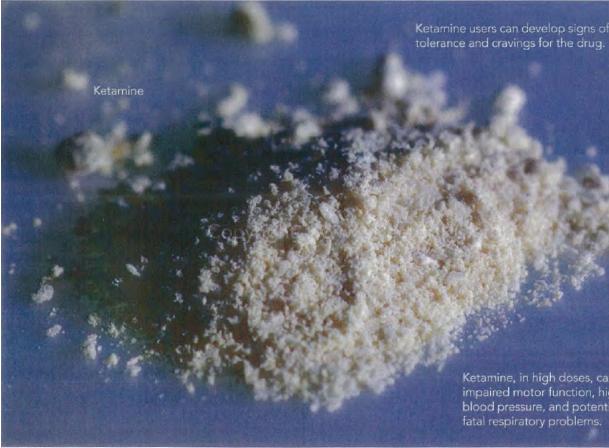
Also known as:
K / Special K / Vitamin K / Kit Kat

WHAT'S this?

Ketamine is an anaesthetic for veterinary as well as human use. The drug takes the form of white crystalline powder, liquid or a tablet. As a drug of abuse in Hong Kong, the United States and Australia, Ketamine has become common at dance parties or 'raves'.



Ketamine produces a progression of effects on the abuser, from a state of dreamy intoxication to delirium accompanied by the inability to move, feel pain or remember what has occurred under the drug's influence. The effects of Ketamine last an hour or less but the drug can affect the senses, judgement and co-ordination for 18 to 24 hours.



Ketamine is a dissociative anesthetic that has some hallucinogenic effects.

- Also Known as: K, Special K, Vitamin K, Kit Kat
- Form: White fine crystalline powder, liquid or tablet.
- Common consumption method: oral consumption, injection, consumed in drinks or added to cigarettes, sometimes mixed with other drugs like ecstasy tablets.
- Use as anesthetics.

Bad*** #4: Depressants and Hypnotics



Depressants & Hypnotics:
Includes benzodiazepines like Valium, Rohypnol (roofies), GHB.



Uses: Depress the CNS, resulting in Drowsiness and slowed responsiveness.

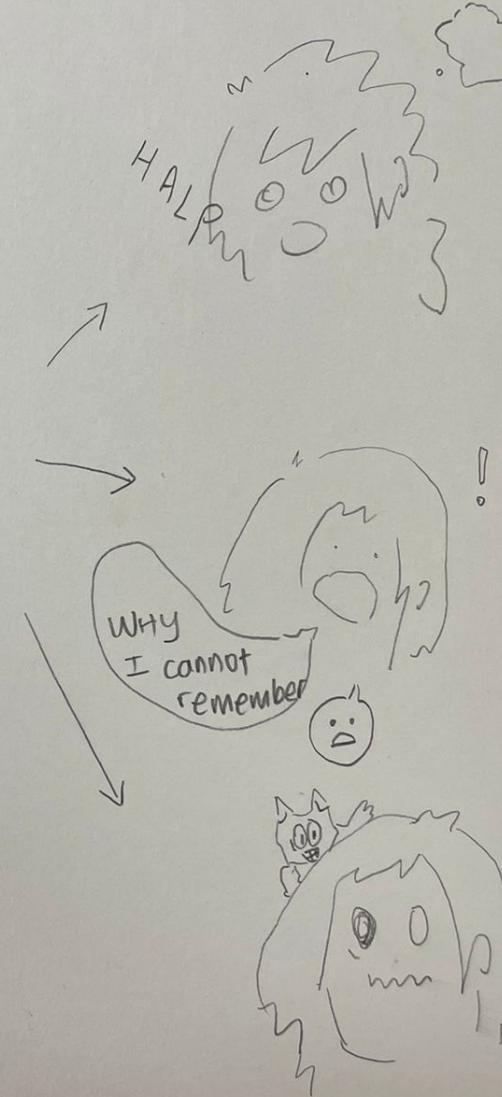


2021 © Prof Stella
inspired by @whatdoiyithink



MSD
Shaking
drinking
mixing

Prof Stella,
I know
you
don't
drink a lot
so
have a sip
I'm making
you drink
in comics



Nimetazepam

Also known as
'Erimin-5'

WHAT'S this?

'Erimin-5' is a type of depressant taken orally by the user in tablet form. Depressants are drugs which help a person to calm down and sleep. However, excessive use will lead to harmful effects.



- Also known as: erimin-5.
- Form: Tablet.
- Common consumption method: Oral consumption.
- Tranquilizers and sleeping pills – available only with doctor's prescription.
- Can be misused as date rape drug.
- Note: Tablets under various brand names, including:
erimin-5 (nimetazepam), rohypnol (flunitrazepam), dormicum/valium (midazolam).

Drug Facilitated Sexual Assault: Detection and Stability of Benzodiazepines in Spiked Drinks Using Gas Chromatography-Mass Spectrometry

Lata Gautam*, Sarah D. Sharratt, Michael D. Cole

Department of Life Sciences, Faculty of Science and Technology, Anglia Ruskin University, Cambridge, United Kingdom

Abstract

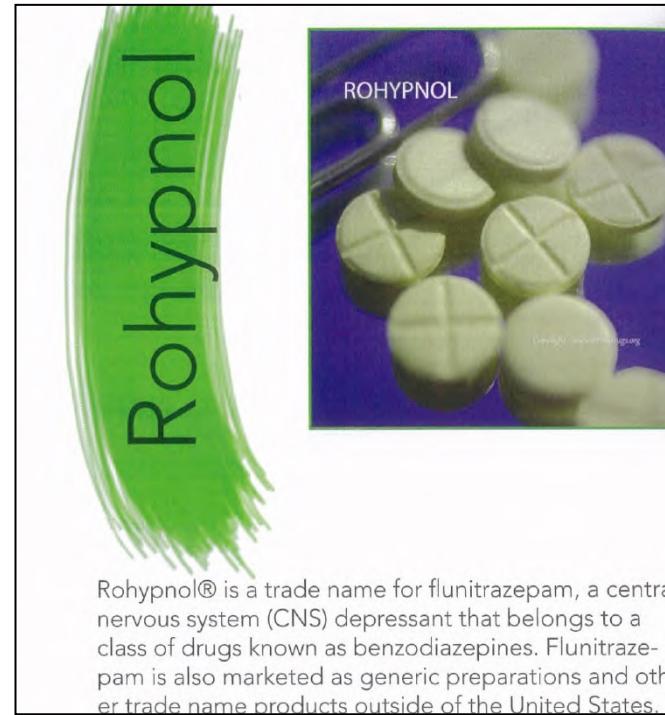
Benzodiazepines are detected in a significant number of drug facilitated sexual assaults (DFSA). Whilst blood and urine from the victim are routinely analysed, due to the delay in reporting DFSA cases and the short half-lives of most of these drugs in blood and urine, drug detection in such samples is problematic. Consideration of the drinks involved and analysis for drugs may start to address this. Here we have reconstructed the 'spiking' of three benzodiazepines (diazepam, flunitrazepam and temazepam) into five drinks, an alcopop (flavoured alcoholic drink), a beer, a white wine, a spirit, and a fruit based nonalcoholic drink (J2O) chosen as representative of those drinks commonly used by women in 16–24 year old age group.

Using a validated GC-MS method for the simultaneous detection of these drugs in the drinks we have studied the storage stability of the benzodiazepines under two different storage conditions, uncontrolled room temperature and refrigerator (4uC) over a 25 day period. All drugs could be detected in all beverages over this time period. Diazepam was found to be stable in all of the beverages, except the J2O, under both storage conditions. Flunitrazepam and temazepam were found not to be stable but were detectable (97% loss of temazepam and 39% loss of flunitrazepam from J2O). The recommendations from this study are that there should be a policy change and that drinks thought to be involved in DFSA cases should be collected and analysed wherever possible to support other evidence types.

Citation: Gautam L, Sharratt SD, Cole MD (2014) Drug Facilitated Sexual Assault: Detection and Stability of Benzodiazepines in Spiked Drinks Using Gas Chromatography-Mass Spectrometry. PLOS ONE 9(2): e89031. doi:10.1371/journal.pone.0089031

Editor: Partha Mukhopadhyay, National Institutes of Health, United States of America

Received September 16, 2013; Accepted January 19, 2014; Published February 19, 2014



Rohypnol® is a trade name for flunitrazepam, a central nervous system (CNS) depressant that belongs to a class of drugs known as benzodiazepines. Flunitrazepam is also marketed as generic preparations and other trade name products outside of the United States.

Like other benzodiazepines, Rohypnol® produces sedative hypnotic, anti-anxiety, and muscle relaxant effects. This drug has never been approved for medical use in the United States by the Food and Drug Administration. Outside the United States, Rohypnol® is commonly prescribed to treat insomnia. Rohypnol® is also referred to as a "date rape" drug.

US student in SG took drugs before death

By Chong Shin Yen

CONTENTS of a "date rape" drug were found in the body of a US exchange student who collapsed in his hostel room and later died in hospital. American Scott Jared Monat, 20, who was studying at the National University of Singapore (NUS), also had four other drugs and alcohol in his system.

Yesterday, at the coroner's inquiry into his death last year, it was revealed that one of the drugs found in his system included GHB.

The "date rape" drug, also known as gamma hydroxybutyric acid, is a Class A controlled drug here and is banned.

Dr Wee Keng Poh, the forensic pathologist who conducted the autopsy, said that Mr Monat had ingested GHB about half an hour before he collapsed.

He said that the drug is used recreationally for its intoxicating effects such as euphoria, reduced inhibitions and sedation.

He explained that it is considered a "date rape" drug because it can be mixed with liquids, including water, and the victim would not notice its presence by smelling or looking at the drink.

Dr Wee said: "GHB can interact very dangerously with alcohol, drastically increasing the chance of vomiting and unconsciousness."

Dr Wee also found traces of prescription drugs such as alprazolam, also known as Xanax, sertraline, zolpidem and oxycodone in Mr Monat's system.

He said: "These drugs, if consumed one after another with alcohol, can give rise to a sudden heart failure or what we call a mixed drugs reaction."

Mr Monat's cause of death has been identified as acute mixed drug reaction with acute alcohol intoxication. Dr Wee also said that the moderately high alcohol level would magnify the effects of GHB, oxycodone, Xanax and zolpidem.

Mr Monat was in his NUS hostel room with a friend, Mr Jason Ho Zhi Yuan, 27, when he collapsed in his room at the Prince George's Park Residences at about 5am on March 4 last year.

Mr Monat arrived in Singapore in January last year on an exchange programme from the University of Miami in Coral Gables, where he was a top student.

He would have spent a semester here as a second-year neurobiology student.

Fri, Apr 09, 2010

The New Paper

Gamma Hydroxybutyrate (GHB):

- First synthesized in 1874.
- Used to treat insomnia and alcoholism.
- Also used by weight lifters - increases Human Growth Hormone.
- Side effects include amnesia, depressed breathing, death.



Bad*** #5: New Psychoactive Substances



New psychoactive substances (NPS) - e.g. K2 or "spice" (also known as synthetic cannabinoids like JWH-018), "bath salts" (mephedrone, MDPV) and other synthetic cathinones.



In September 2020, the First Schedule to the MDA was further amended. The Synthetic Cannabinoid generic groups were revised and expanded, and a new generic description to deal with Lysergic acid and diethylamide analogues was introduced to strengthen our enforcement levers against new psychoactive substances.

CENTRAL NARCOTICS BUREAU
NEWS RELEASE



CNB conducted a review of the MDA to tackle the challenge of many variants of new psychoactive substances (NPS) entering the drug market. These variants were designed to evade control by having chemical structures that lie outside the scope of the MDA. The First Schedule to the MDA was amended in September 2020 which introduced three new generic groups for Synthetic Cannabinoids and a new generic description to deal with Lysergic acid and diethylamide analogues. These changes have strengthened CNB's enforcement levers against NPS.

New Opioids 2019 NPS DISCOVERY

 Piperidylthiambutene 09/18/2019 DOWNLOAD REPORT	 AP-237 09/16/2019 DOWNLOAD REPORT
 2-Methyl AP-237 06/21/2019 DOWNLOAD REPORT	 2',5'-Dimethoxyfentanyl 04/30/2019 DOWNLOAD REPORT
 para-Methoxyfuranylfentanyl 04/23/2019 DOWNLOAD REPORT	 ortho/meta/para- Fluorofuranylfentanyl 01/23/2019 DOWNLOAD REPORT

- In recent years, the rapidly emerging use of new psychoactive substances (NPS), also known as “designer drugs”, “legal highs”, and “bath salts” have drawn global concern. These substances mimic the effects of illicit drugs.
- They are produced by modifying the chemical structure of controlled drug to circumvent drug controls.
- The most reported category of NPS is synthetic cannabinoids, which mimic the effects of the main psychoactive substances in cannabis, tetrahydrocannabinol (THC).
- NPS were added to the list of Class A controlled drugs in the First Schedule to the MDA on 1 May 2014.

Man appeals against reformatory training for organising illicit drug gathering, which led to NUS student's death



By LOUISA TANG

Published FEBRUARY 14, 2020

Updated FEBRUARY 14, 2020

SINGAPORE — After taking “acid” with a group of friends, a 19-year-old medical student from the National University of Singapore began fidgeting violently and behaving unusually, hitting his hands and legs against the ground.

He was eventually pronounced dead in the hospital a few hours later.

The cause of death: the toxicity from 25B-NBOMe, a novel psychedelic substance and controlled drug, also known by its street name “acid”.

FIRST SCHEDULE

Sections 2 and 58A
[Act 30 of 2012 wef 01/03/2013]

CONTROLLED DRUGS

PART I

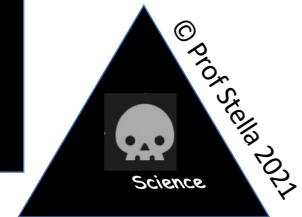
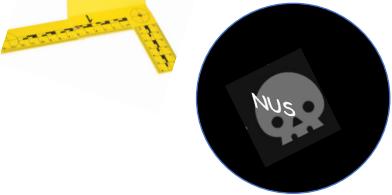
CLASS A DRUGS

18. The following compounds, including any salt or stereoisomeric form of such compounds, and any preparation or product containing such compounds:

(6D) 2-(4-Bromo-2,5-dimethoxyphenyl)-N-(2-methoxybenzyl)ethanamine (also known as 25B-NBOMe) and its bromo, dimethoxy and methoxy positional isomers in the respective phenyl rings

[S 233/2018 wef 01/05/2018]

Lecture Contents



Analytical
Methods



Bad*** of
Drugs



Counterfeit
for a fix



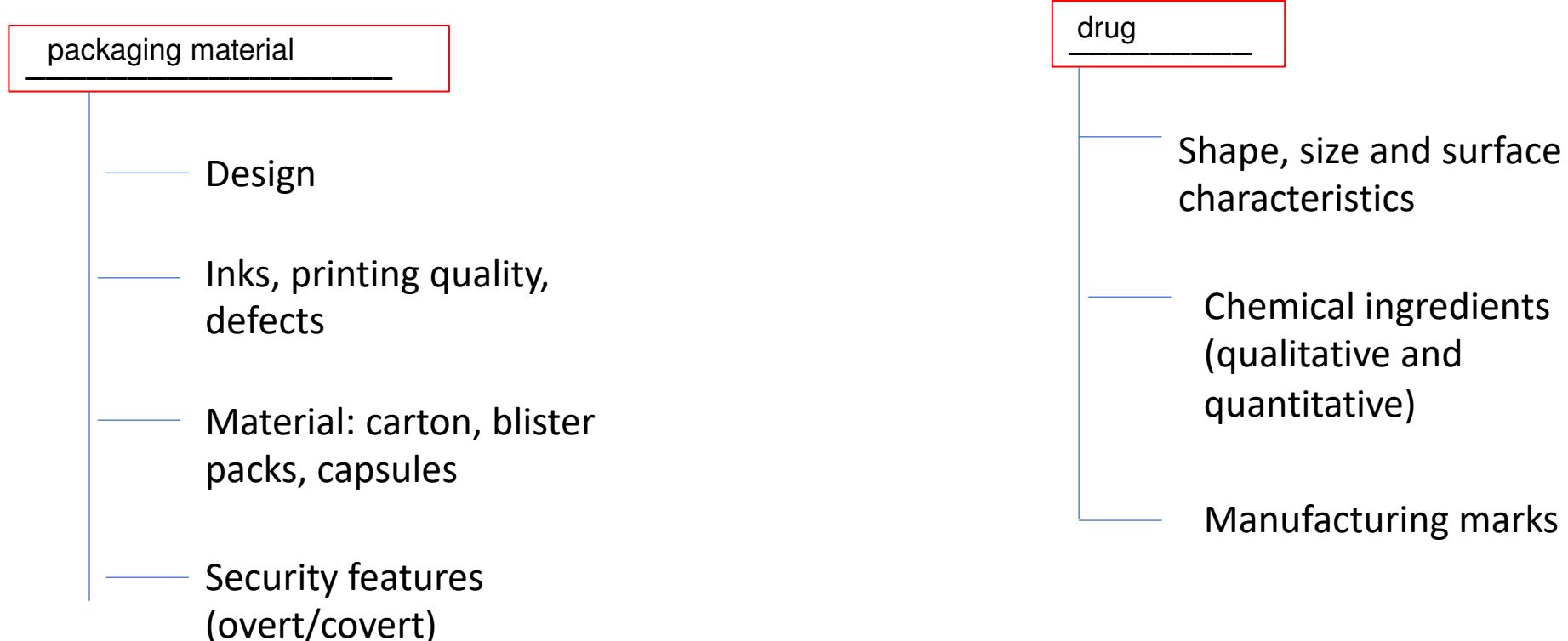
BONUS

Dies (and Flies)

- Counterfeit medicines may include products without their the active ingredient, with an insufficient or excessive quantity of the active ingredient, with the wrong active ingredient, or with fake packaging.
- Given the significant danger that counterfeit medicines pose to public health, many countries work together to combat their spread.



Forensic analysis: a multi-disciplinary approach for the analysis of counterfeit medicines



HOME > CONSUMER SAFETY >



How to identify adulterated, counterfeit and substandard health products, and what you should do

21 Aug 2019

Adulterated health products, General safety

Share    

The sale of adulterated, counterfeit and substandard health products has proliferated in recent years, fuelled by demand and the low cost of such products. This poses a serious threat to public health and safety, as the consumption of these health products can cause adverse effects and even death in some cases.

<https://www.hsa.gov.sg/consumer-safety/articles/identify-adulterated-counterfeit-substandard-health-products>

Dr Shawn Lee will now give a lecture on forensic entomotoxicology.

Prof Stella



Do find out more about our FS Minor Programme, Master Programme, and the mods that you can take next sem and in summer. (read the next few slides)

Continue this exciting journey with us, and may you find a meaningful career.