MANCHESTER 1824

The University of Manchester

Blended and Experiential Learning

European Association of Schools of Occupational Medicine
(EASOM) 10th Annual Summer Meeting
"Virtual Patients in Training for Occupational Medicine"
26th – 28th August 2010
Herrsching am Ammersee, Munich, Germany

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http://www.medicine.manchester.ac.uk/oeh

Structure of presentation

- Introduction and Background

Part 1. **'Beyond the Virtual Patient … to the Real One'**

Electronic Experiential Learning, Audit and Benchmarking

- Drivers & objectives
- Methods - demonstration

Part 2. **'Besides the Patients'**

Face to face teaching of 'heart sink' subjects – Toxicology

- Objectives
- Methods
- Interactive Examples
- Evaluation

Conclusion and Discussion

Introduction and Background

- The 'Virtual Patient' is very important but should be kept in context
  - Students like 'blends' of learning methods
  - Different objectives may require different methods
  - It can be more motivating to learn from Real Patients
    - and can help in self audit and in clinical governance
    - but this can be difficult to develop
  - Some 'heartsink' subjects e.g. toxicology and statistics are not easily learnt from individual patients
    - but they need to be taught in innovative and interesting ways nevertheless

Part 1. Beyond the Virtual Patient to the Real One

Electronic Experiential Learning, Audit and Benchmarking

= EELAB

- Developed based on about 5000 cases of real patient data collected over the last 5 years
- Some pilots carried out
- Limited evaluation so far
- Planned launch in 2011

‘Our’ Drivers for this project:

- **Educational:**

To further enhance the quality and innovation of the Manchester programme of MSc, Advanced Diploma and other postgraduate education in Occupational Medicine, through experiential learning with formative assessment.

- Contribution to clinical governance:

To provide tools for self-audit against standards and benchmarking against peers.

- Research:

To recruit, motivate, teach, retain, reward and improve the quality of participation of doctors in research e.g. reporting to The Health and Occupation Reporting Network (THOR).

The Health & Occupation Reporting Network (THOR)

• Research and surveillance programme

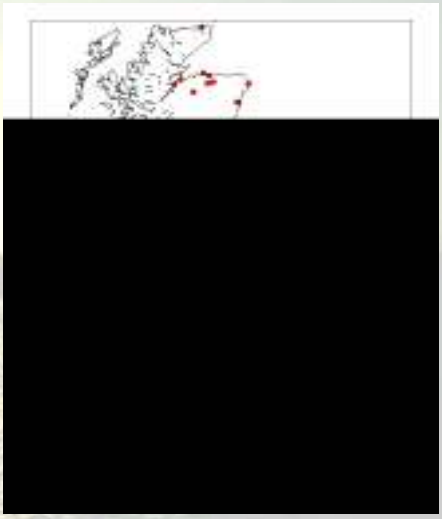
• Medical observatory function, for occupational disease, work related ill health and sickness absence

• >2000 doctors participated in 2009

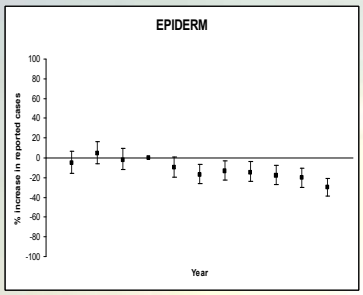
• Reports from clinical ‘system’ specialists account for an estimated 11,000 new UK cases of work-related ill-health per annum

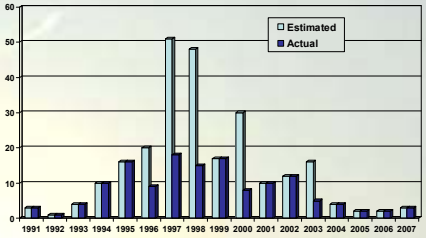
• Reports from occupational physicians and GPs (Figure) account for a further estimated 12,000 UK cases per year

• ~£2M current budget

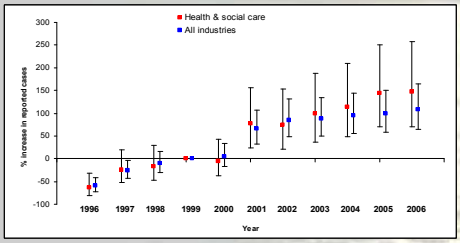


Trends in occupational contact dermatitis, … and in latex asthma

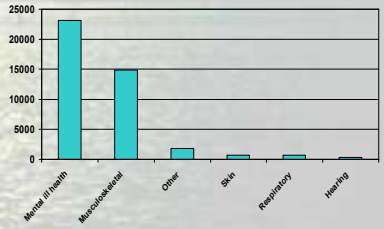




Trends in work related mental illness



Economic burden of sickness absence



Participants' drivers and motivators…

- Principal Drivers:
  - Educational
  - Audit
  - Benchmarking
  - … hence appraisal, revalidation etc
  - … other
- Aids to motivation and ease of engagement:
  - Their own actual cases
  - Comparison with peers
  - Secular trends
  - Easy participation and certification

How EELAB will work …[1]…

Actual case seen by physician with a networked PC:

• Physician enters data (e.g. as per a THOR report) in a secure webform with a physician-specific pre-approved login

e.g.:

• Age and gender of patient
• Industry
• Occupation
• Relevant exposure
• Diagnosis
• Duration of symptoms / date of onset
• Sickness absence
•

How EELAB will work …[2]…

Physician would be **invited** to enter additional information (usually in response to a 'drop down' menu).

This would follow on from the earlier 'core' data set, and might include for example:

• Further information about the job, exposures etc
• Whether diagnosis was based on history, specific tests [e.g. PEF] etc
• What action was taken / advice given [e.g. onward referral]

How EELAB will work …[3]…

Physician would be **offered** the following:

• [L] Learning / CPD unit (stand alone online) -extant from our extensive resources, and specific to the case in question, or 'virtual patients', but also including descriptive data from our research

• [A] Audit of physician's responses against standards eg evidence reviews (BOHRF) on Occupational Contact Dermatitis and Occupational Asthma, Faculty of Occupational Medicine guidelines for the management of Low Back Pain

• [B] 'Benchmarking' against the responses of other physicians who were presented with a similar case. Database from 5 years' data being constructed, relevant feedback already piloted with samples of physicians. Aiming to cover > 80% of cases (eventually) .

How EELAB will work …[4]…

On completion of whatever of the above the physician chose, they would be given:

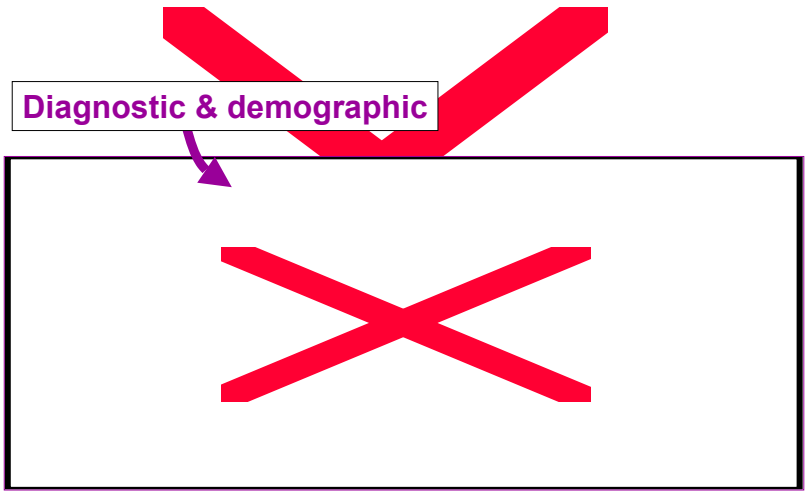
• An 'e-certificate' of whatever they had done

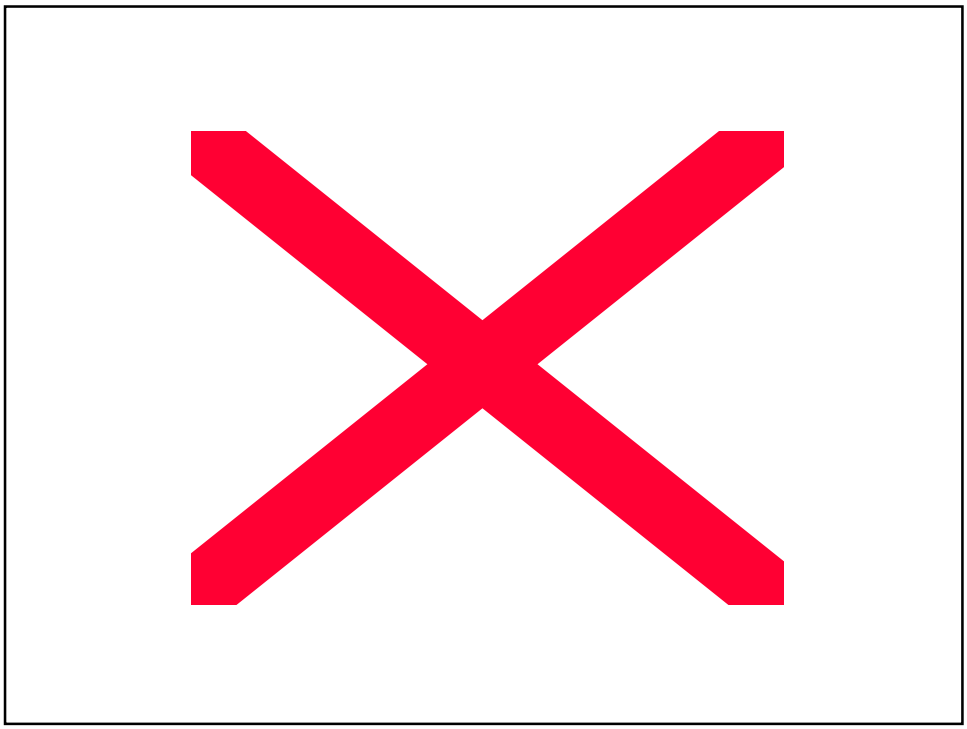
• Access to their online 'record' / 'account' so they can follow up progress, download certificates later etc

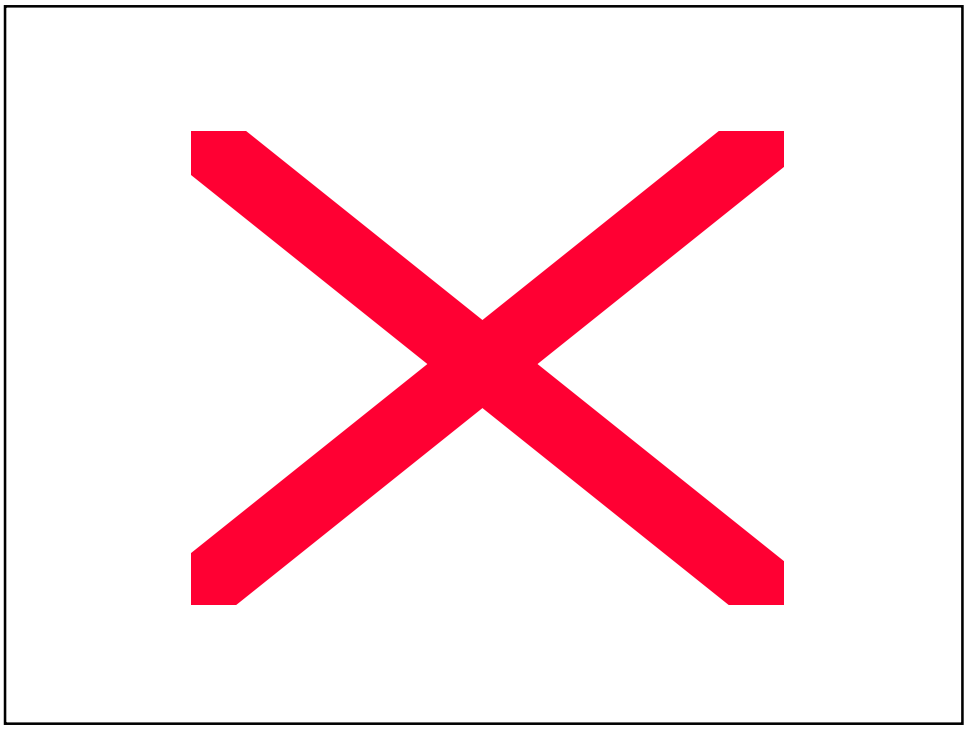
• The opportunity to feedback to us so we can continue to improve

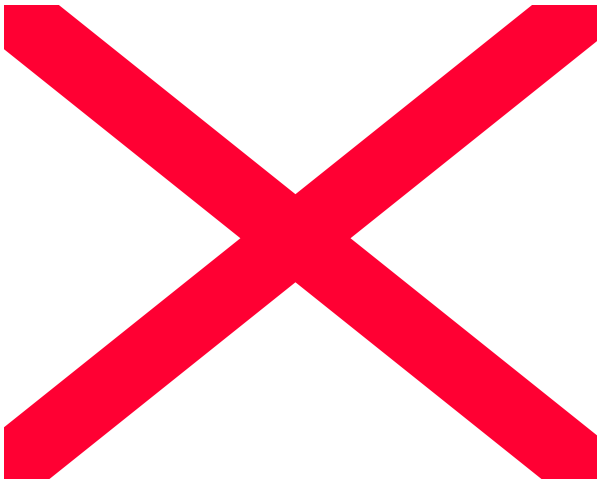
EELAB Online Demonstration

http://www.coeh.man.ac.uk/thor/thorgp/form/gpform_demo.php





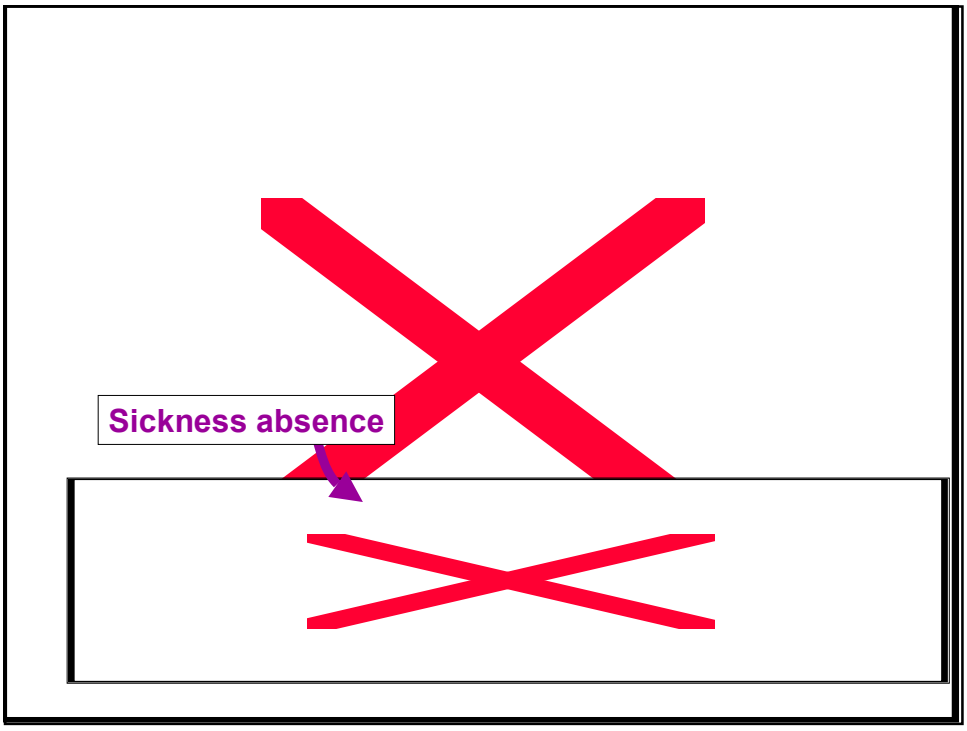


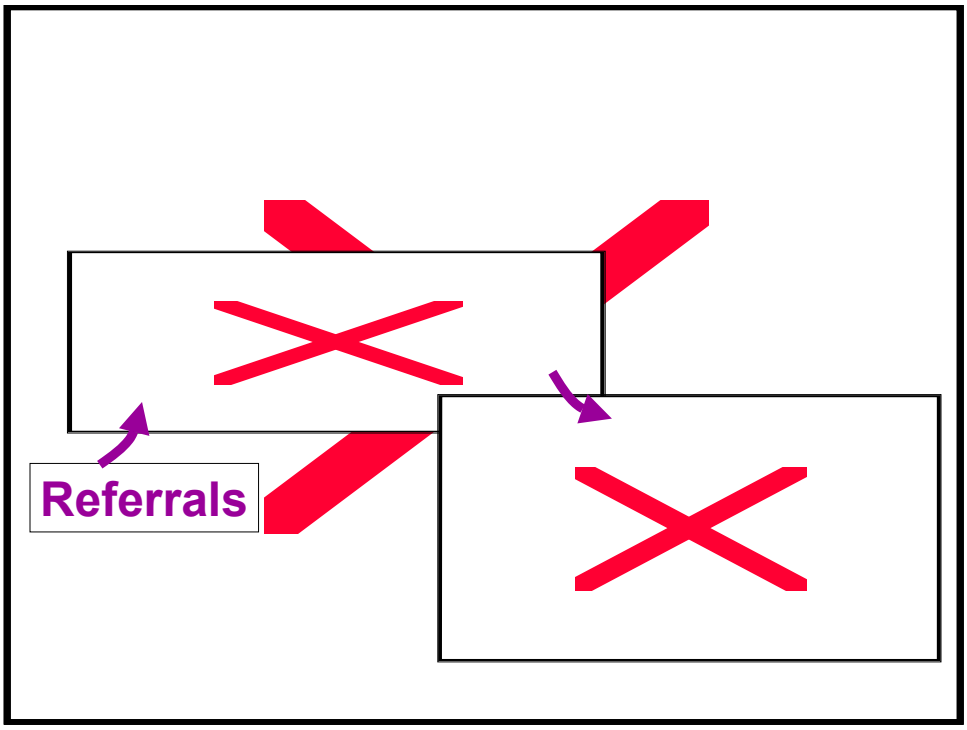


Example of options following clinical case prompt …

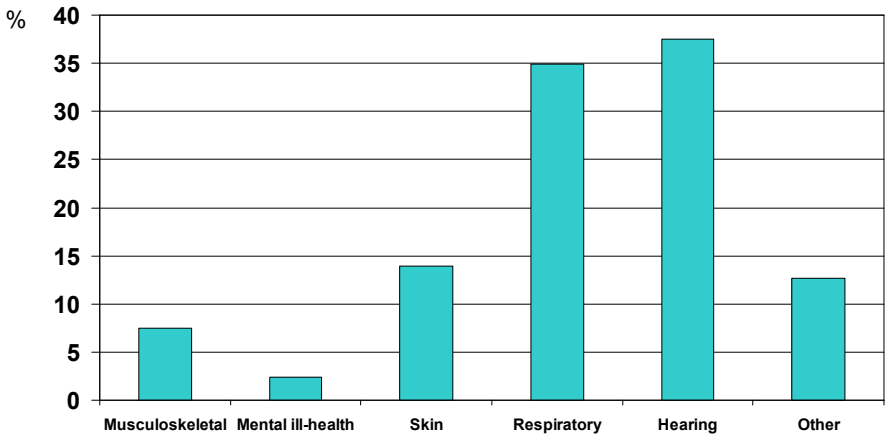
- LEARNING: Access our online learning unit on **back pain**
- AUDIT your actions with this patient by reference to guidelines on back pain (e.g. those from the Faculty of Occupational Medicine)
- BENCHMARK your actions and practice against other GPs. Data from our database shows that over the last 5 years, ***when presented with cases like yours, 58% of GPs have certified sickness absence***, and done so with a mean duration of 19.5days. But are these figures changing with time? Click here for our database to tell you more

NB: Can ‘save’ and again access cumulative online experiential learning, audit and benchmarking record


Sickness absence


Referrals

Proportion of GP cases referred to hospital specialists by diagnosis (database: 2006 to 2009)



% all cases referred = 7.4%

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Part 2. Besides the Patients
Face to face teaching of Toxicology
('Chemical structures and health')

- Excellent student feedback for a usually 'heartsink' subject
- Face to face, low technology
- Innovative but simple
- Developed >10 years ago, tried and tested
- You can go ahead and use it next week

Classical 'Didactic' Approach

- Aims / Objectives
- 'Learning Principles'
  - Toxicokinetics (What the body does to the chemical)
  - Toxicodynamics (What the chemical does to the body)
- Applying to examples
- Hopefully understanding concepts to apply in real life

Case / Problem Based Approach (today)

(Assumes some prior knowledge)

- Aims / Objectives
- Analysing examples (especially real and common)
- Understanding principles
- Applying to other contexts

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Intended Learning Outcomes

Attitude:

- To accept the purpose and importance of toxicology in occupational health practice.
- To achieve the motivation and confidence to learn this subject and apply the lessons

Skills:

- To be able to collate and build on past or experiential knowledge in relation to toxicology and related problem solving
- To be able to learn the subject more easily in future

Knowledge:

- Not so much.

Method

Chemical formula or structure is provided …

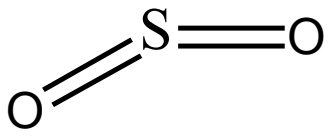
- Name it and/or identify chemical groups in it
- Comment on its application or occurrence
- Speculate on its toxicokinetic fate (what the body does to it)
  - Relevance to Biological Monitoring
- Speculate on its toxicodynamic behaviour (what it does to the body)
  - Relevance to Health Surveillance and Diagnosis

(Relevance to practical application)

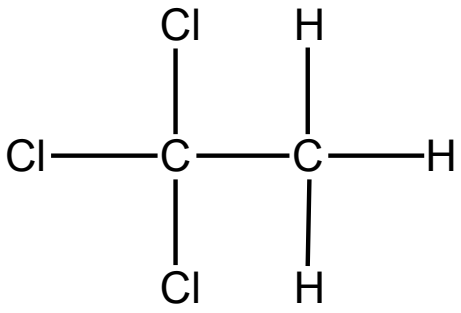
- Work out ‘rules of thumb’ for both toxicokinetics and toxicodynamics

CO

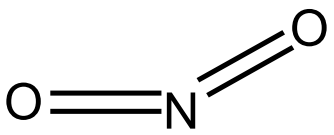
Carbon Monoxide



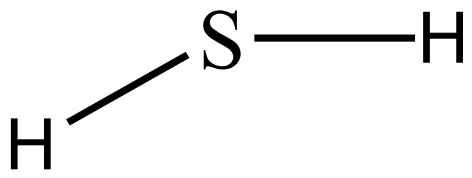
Sulphur dioxide



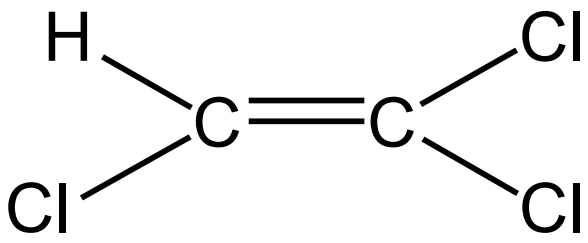
1,1,1: Trichloroethane



Nitrogen Dioxide



Hydrogen Sulphide



Trichloroethene / Trichloroethylene

NH_3

Ammonia

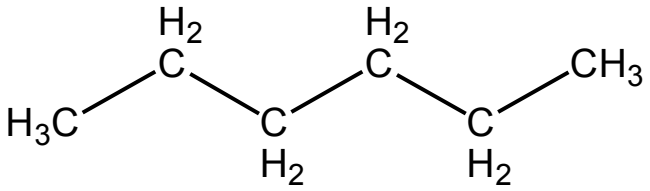
CH_2O

Methanal / formaldehyde

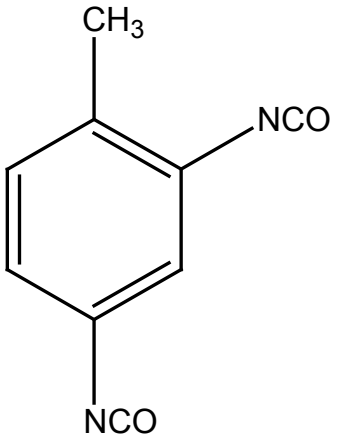
HCH
Ö

HCN

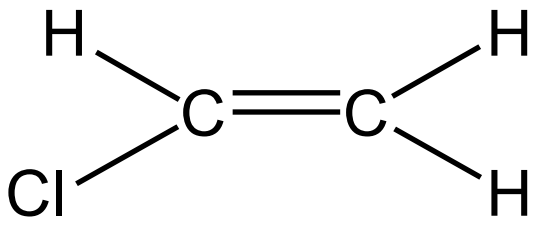
Hydrogen cyanide / hydrocyanic acid



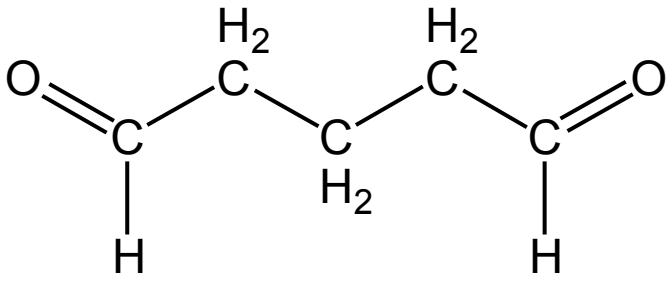
N-hexane



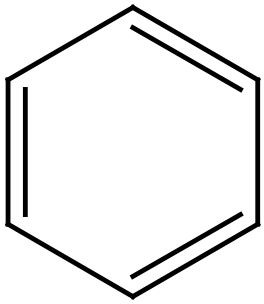
2,4: toluene diisocyanate



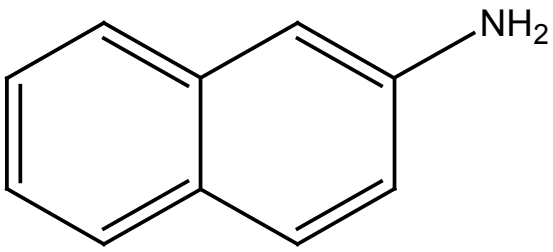
Chloroethene / vinyl chloride



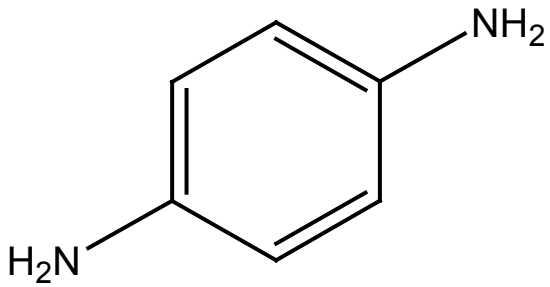
Pentan-di-al / glutaraldehyde



Benzene



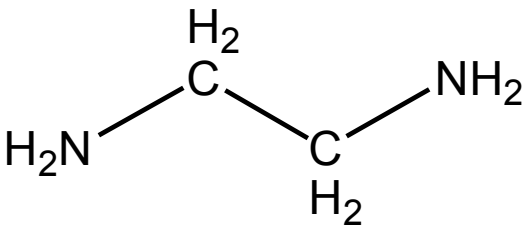
2-naphthylamine / beta naphthylamine



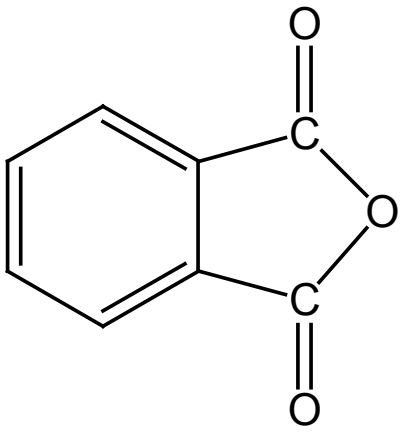
1,4: Diaminobenzene / para-phenylene diamine

$Cl_2C{:}CCl_2$

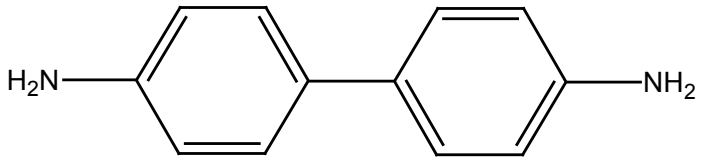
Tetrachloroethene / perchlorethylene



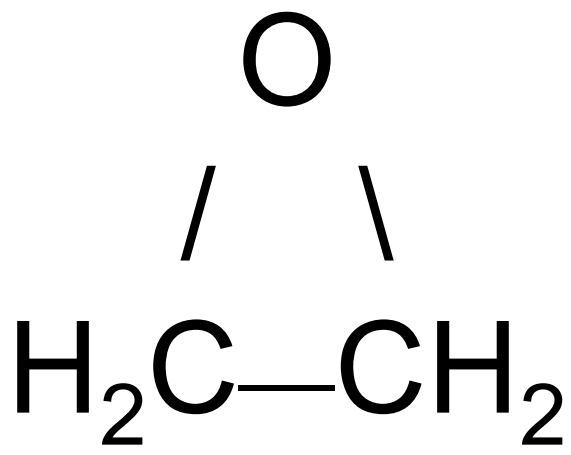
Di-aminoethane / ethylene diamine



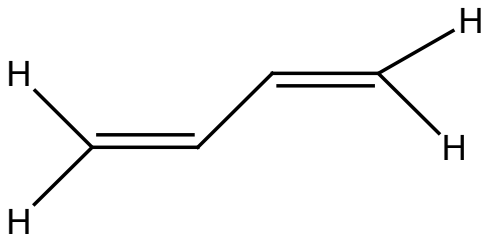
Phthalic anhydride



‘Benzidine’



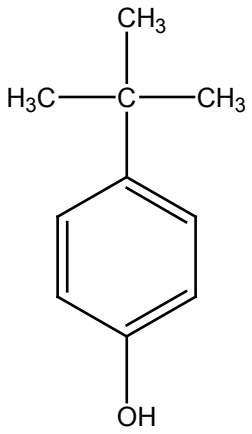
Oxirane / ethylene oxide



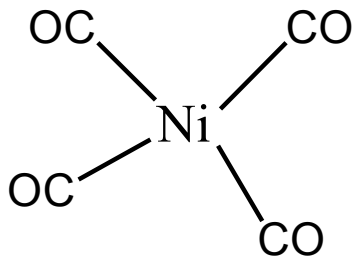
1,3: butadiene

Cl_2

Chlorine



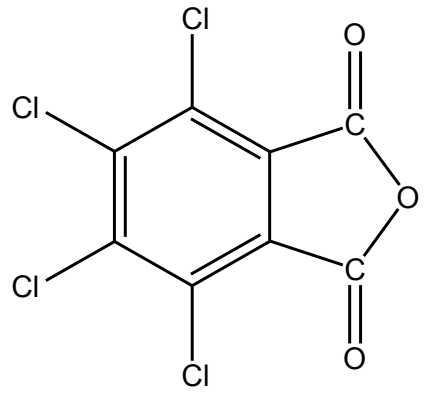
'P-tertiary butyl phenol'



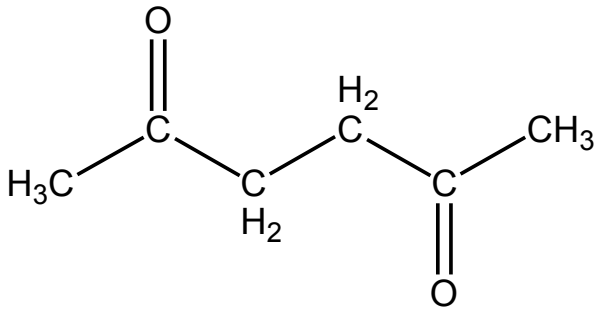
Nickel tetracarbonyl

$ClCH_2OCH_2Cl$

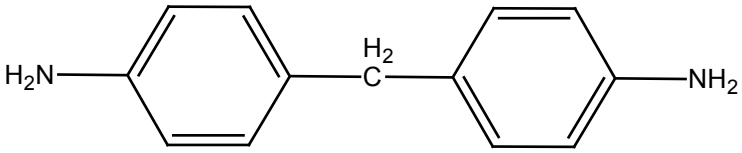
Bis-chloro methyl ether



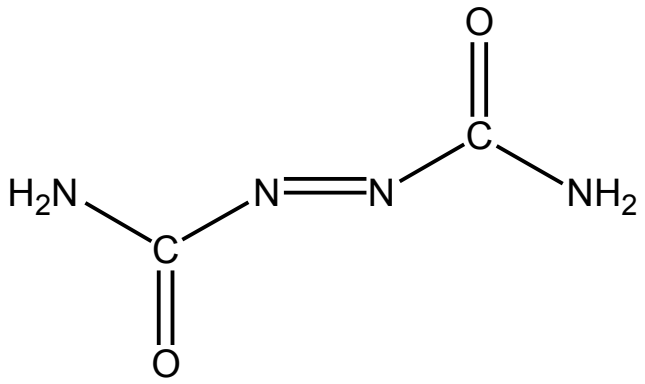
Tetrachlorophthalic anhydride



2,5: hexanedione



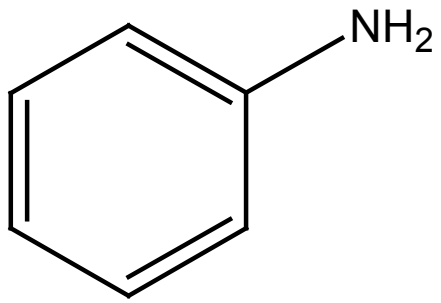
‘Diaminodiphenyl methane’ / ‘methylene dianiline’



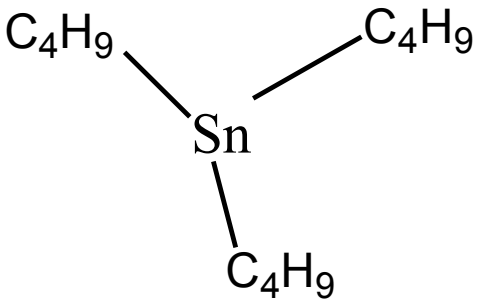
Azodicarbonamide

$ClC_2H_4SC_2H_4Cl$

‘dichlorodiethylsulphide’ / ‘mustard gas’



Aminobenzene / ‘aniline’



Tributyl tin

Tips on ‘sequence’ and delivery

- Appearance of being random (so all students equally ‘primed’)
- But actually start with chemicals (e.g. CO)
  - Of simple chemical structure
  - Whose toxicology they are likely to be familiar with

(thus building up confidence)

- Constantly emphasise how much useful information they have learnt in the past and are now remembering and applying
- Introduce concepts of toxicokinetics (relevant to surveillance) and toxicodynamics (health effects and treatment) for each chemical
- Slowly introduce new mechanisms and ‘harder’ chemicals
- Do not repeat chemicals but repeat ‘mechanisms’ – to reinforce learning and to permit deep understanding ‘by analogy’.

Finally summarise what they have learnt about Toxicokinetics and Toxicodynamics

Toxicokinetics: What the body does to the chemical
(Relevant to biological monitoring etc)

Toxicokinetic 'rules of thumb' – examples:1

- CO, H_2S, HCN, combine with Fe in Hb –can be used for monitoring
- Hydrocarbons and halogenated hydrocarbons are fat soluble
  - if low in molecular weight, they tend to be volatile, are exhaled in breath (can be used for monitoring), distributed in fat [eg brain].
  - The body tries to make them water soluble by oxidation e.g to alcohols, and ketones, or to aldehydes and acids

Toxicokinetic ‘rules of thumb’ – examples: 2

•Oxygen containing organics tend to be ‘polar’ and therefore water soluble and so distribute less into fat and more into aqueous compartments

•Unsaturated C=C bonds might be oxidised to epoxides (oxiranes) or else free radicals *(which can be more toxic than the original agent eg benzene, vinyl chloride)*

• *etc*

Toxicodynamics: What the chemical does to the body
(Relevant to health surveillance etc)

Toxicodynamic 'rules of thumb' – examples: 1

•Hydrocarbons or halogenated hydrocarbons if volatile (low molecular weight) have an anaesthetic effect, drowsiness, unsteadiness and inco-ordination, nausea, even fits and coma and death

•CO, CN-, H_2S, combine with Fe in Hb &/or cytochromes and therefore cause chemical asphyxia

•NO_2, SO_2, dissolve in water – form acids which are respiratory irritants (also Cl2, -> H+, OCl-)

Toxicodynamic 'rules of thumb' – examples: 2

•Toxic metals like Pb, Hg, Cd ('heavy metal') often bind to SH groups in enzymes

•Some metabolic products are more toxic than the original agent! eg the epoxide of benzene; hexane di-one from n-hexane or from 'MBK'.

•Aromatic amines with another 'aromatic' group in the para [ie opposite to] the amine = bladder carcinogens

•Organic compounds with two reactive (~irritant) groups eg dialdehydes,diamines and di-isocyanates (especially) tend to be asthmagenic

• *etc*

Student feedback

EVALUATION

Student feedback. University of Manchester Sept 2007 (MSc / Adv. Diploma 'practical course')

Scores of feedback as %**	Toxicology	Mean of all others*	Min. of all others*	Max. of all others*
Relevance	100%	84%	63%	97%
Quality of content	100%	80%	57%	95%
Degree of coverage	100%	81%	54%	97%

**Feedback scores are converted into % as follows:

Numerator = ('excellent'x 5) + ('very good'x 4) + ('good'x 3) + ('fair'x2) + ('poor'x 1)

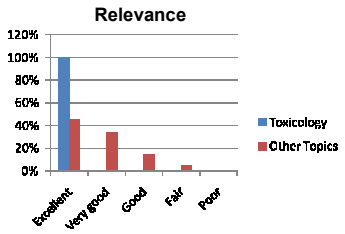
Denominator = No of students completing feedback x 5

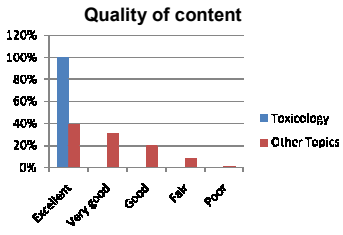
i.e. theoretical range of feedback scores: 20%-100%

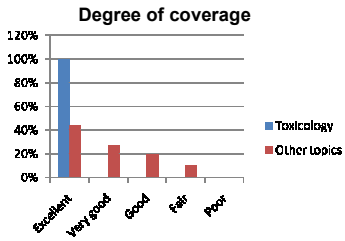
*compared to 8 other topics: Introduction; Law & Ethics; Epidemiology I, and II: Online Searching; Occupational Risk; Occupational Hygiene Lecture; and Practical.

Student feedback from University of Manchester (MSc / Adv. Diploma) teaching in Sept. 2007

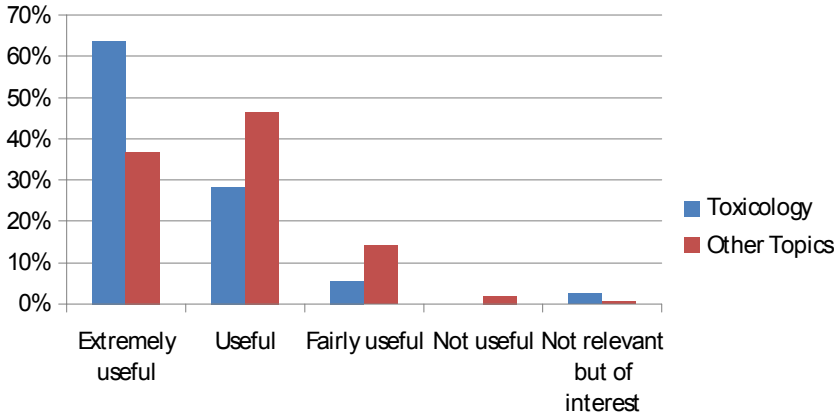
- Based on 13 (out of 17) students who returned the feedback form
- Other topics were: Introduction, Practical Law & Ethics, Epidemiology I and II, Online Searching, Occupational Risk Exercise, Occupational Hygiene Lecture and Practical







Average student feedback from University of Manchester (MSc and Adv. Diploma) teaching in Nov. 2008, July 2009, Nov. 2009 & June 2010



Based on 124 (out of 214) students who returned the feedback form

*Other topics were: Ethics, 'Beyond the individual patient', UK wide Occ. Health, Occ. Health Law, Introduction to Occ. Hygiene, Risk assessment & health surveillance.

Student feedback
(Other University - as guest lecturer)

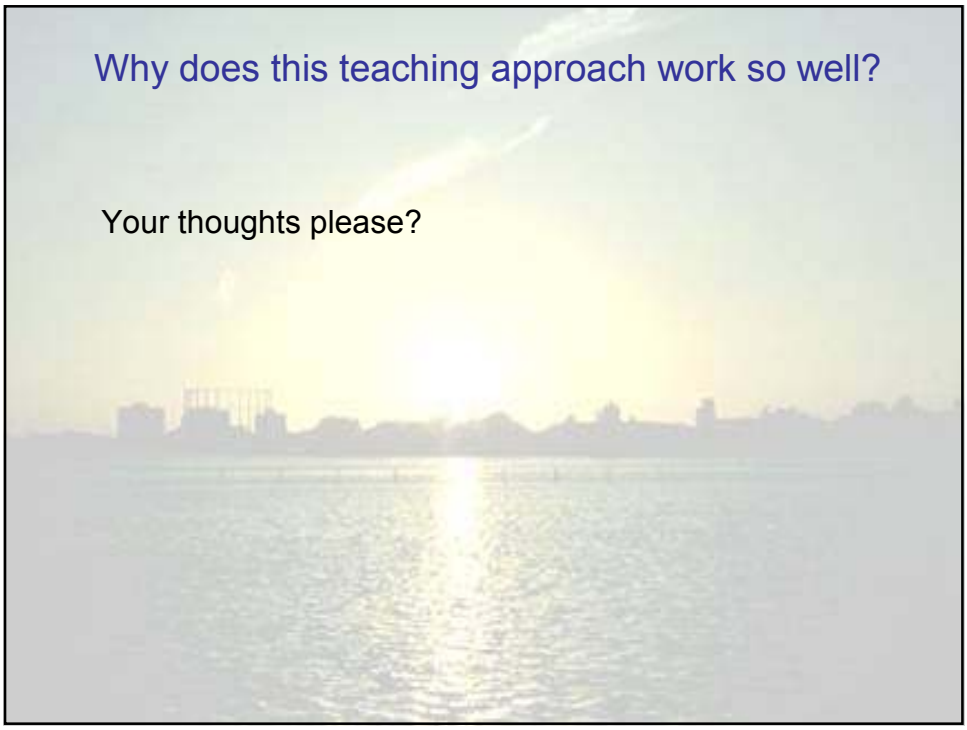
These 'face to face' interactive sessions in toxicology:

- Had also been delivered to approximately 59 postgraduate (MSc) students at another University over a period of 8 years.
- The last 2 rounds of formal anonymous feedback from these students (in 2006/07 and 2007/08) gave the following quality score (n:15+19=34):
  - 97% to this teaching on Chemical Structures and Health

  compared to a mean of:
  - 78% for the other 14 teaching sessions in the same module on Toxicology

Why does this teaching approach work so well?

Your thoughts please?



Why does this teaching approach work so well?

Some responses to this question:

- Face to face ‘icebreaker’ for ‘heartsink’ subject
- Interactive
    - > Individual engagement
    - > but group support & involvement
- Builds on past knowledge of chemistry, pharmacology etc
- Patterns begin to emerge and are reinforced..
    - > Deep learning
    - > Removes the ‘fear factor’
- Other …

Discussion welcome

Thank you for listening

Please comment or ask questions