

UNIVERSITY OF BIRMINGHAM

Pharmacy MPharm (4 year)

e-Practicals: how to develop a virtual (chemistry) lab class

Youcef Mehellou: Lecturer in Medicinal Chemistry

Sam Butterworth: Lecturer in Medicinal Chemistry

Sarah Thomas: Pharmacist, NIHR Doctoral Research Fellow

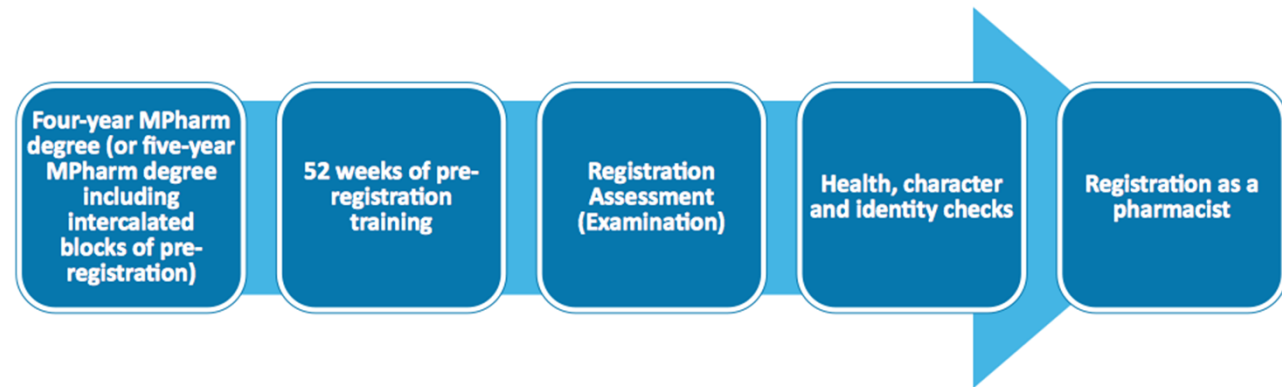
Peter Rainger: Instructional Designer

John Marriott: Professor of Clinical Pharmacy

...to develop an chemistry e-lab practicals for Pharmacy students

Pharmacy: The science and practice of the preparation and dispensing of medicinal drugs

**General
Pharmaceutical
Council**



**UNIVERSITY OF
BIRMINGHAM**

Pharmacy MPharm (4 year)

Challenging 40 years of teaching
practice – *“because we’ve always done
it this way”*



Laboratory teaching – the challenge



Experimental design

Planning

ng

fety

QA

very

Industrial Processes

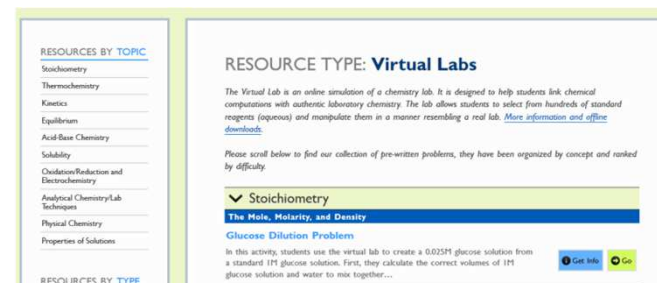
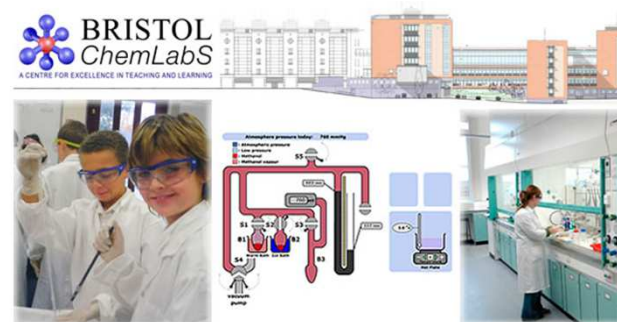
Clinical application

Our approach...

- A collaborative 'agile' team involving:
Instructional Designer, Medicinal Chemists, Pharmacist and a Prof. Clinical Pharmacy
- Pedagogical / Instructional Design
 - Enquiry-based / scenario-based learning + gamification (interactive)
 - Electronic feedback + peer and facilitator support
 - Collaborative team development
- Our challenges
 - University regulations, funding, resources and support
 - GPhC accreditation – Peer reviewed by 3 Pharmacy Profs

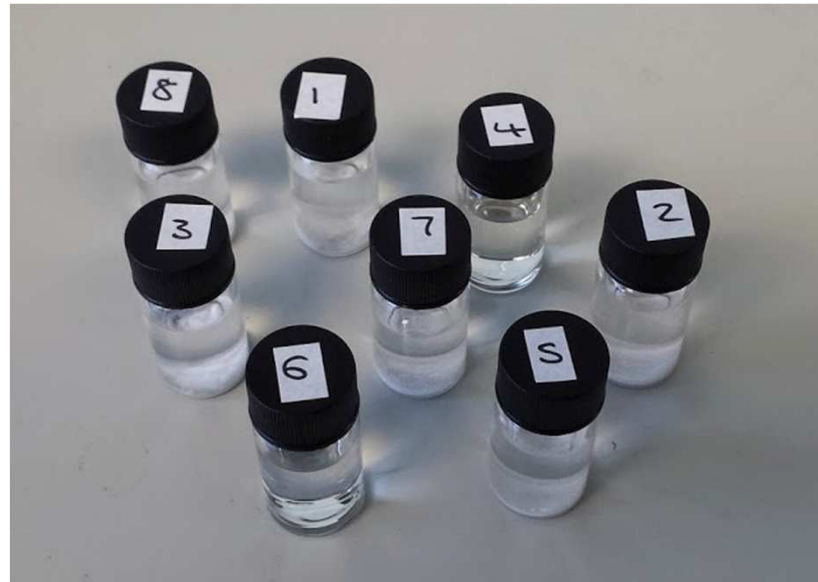
How we started... what have others done?

- Bristol Online Labs
- (OU) OpenScience
- Stock experiments e.g ChemCollective
- Numerous 'virtual' chemistry textbooks and single experimental widgets



Concept...

Unfortunately you chose to label the lids on your sample vials and you realise that you have accidentally switched some of them around while inspecting the samples.



In order to work out which sample is which you must return to the analytical lab and test the supernatant (liquid phase) of each sample to work out which sample is which...

Final object...



Concept...

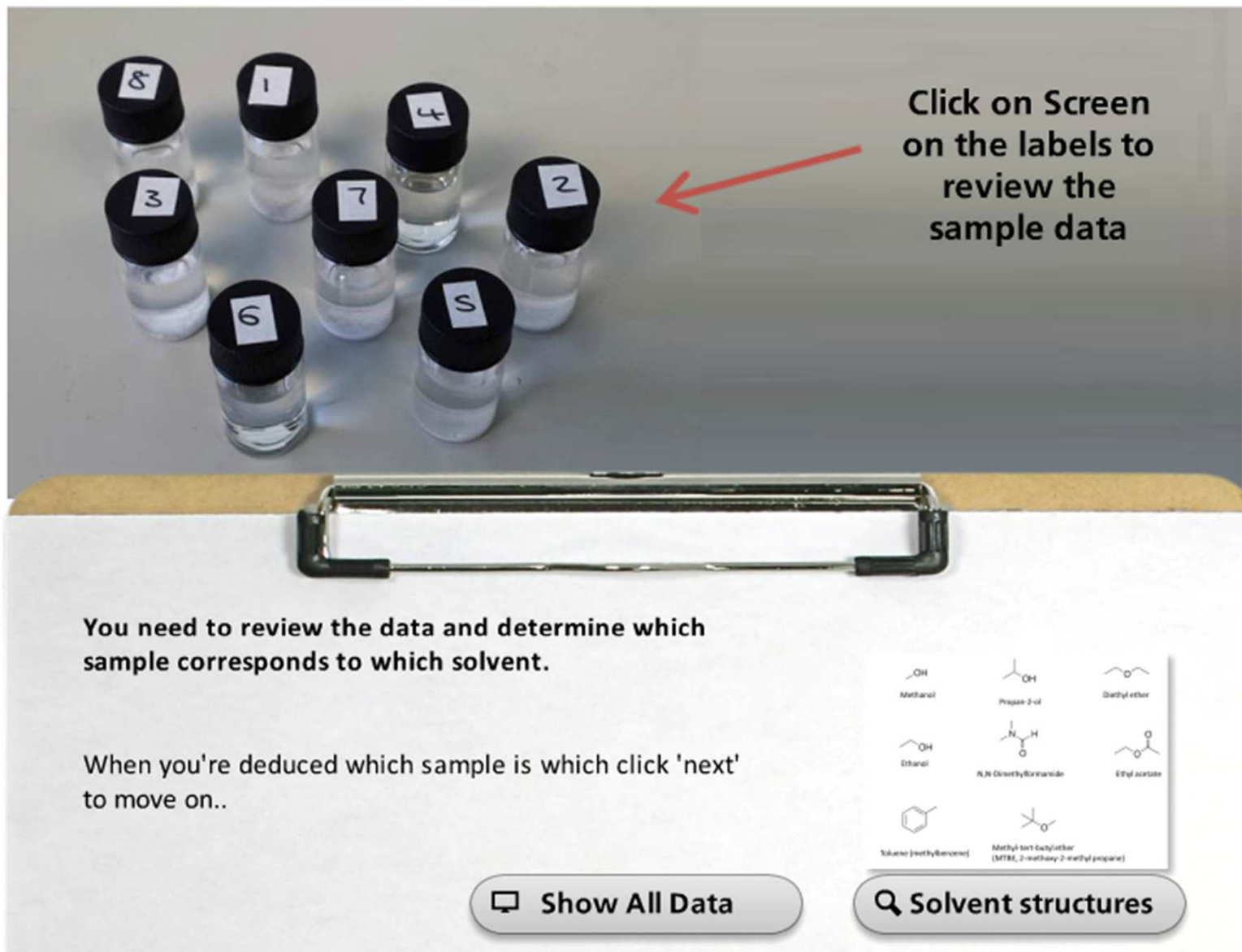
Review the data and determine which sample corresponds to which solvent:

We should discuss the format for this but I have attached all the relevant data below. I think they should be made to go through them all making notes and then make a selection at the end, otherwise it will be too easy just to click on answers and guess!

Have correct answers from slide 20 available as a pop-up for reference, and also ^1H NMR, ^{13}C NMR and IR guides

I'm wondering about making them do this based just on ^1H NMR first, then letting them have the rest of the data once they have had a go... otherwise MS is a bit of a giveaway?

Final object...



Click on Screen on the labels to review the sample data

You need to review the data and determine which sample corresponds to which solvent.

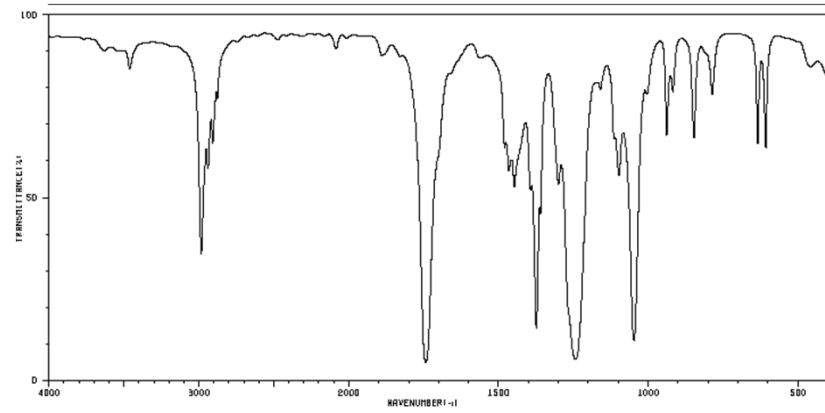
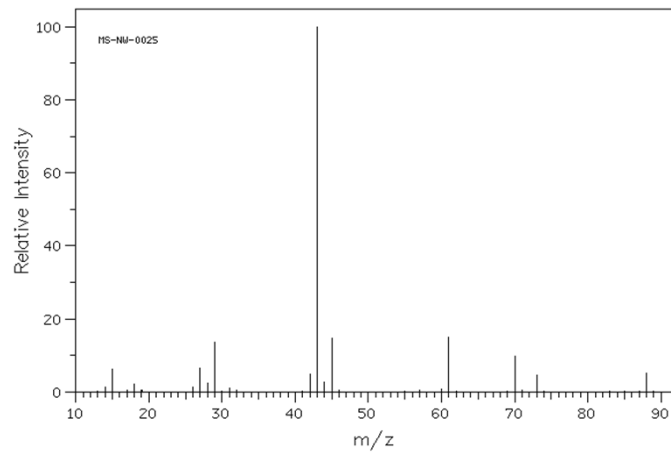
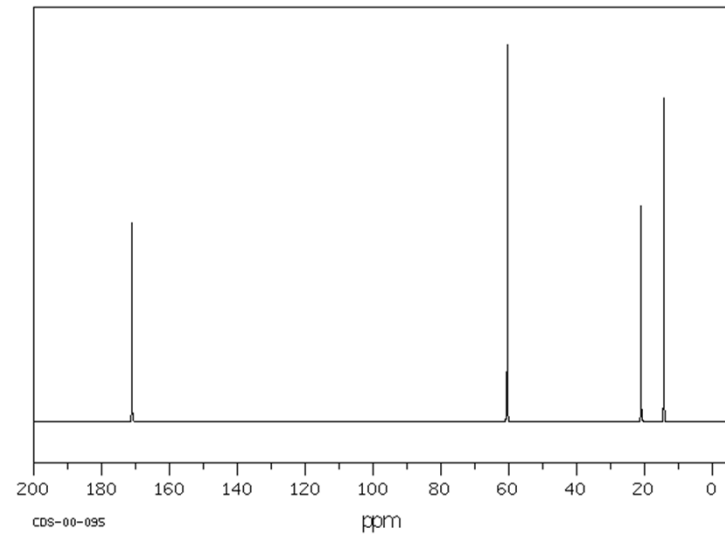
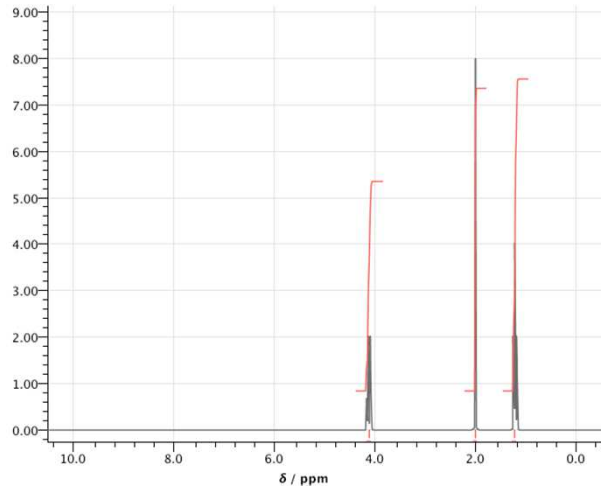
When you're deduced which sample is which click 'next' to move on..

☞ Show All Data

🔍 Solvent structures

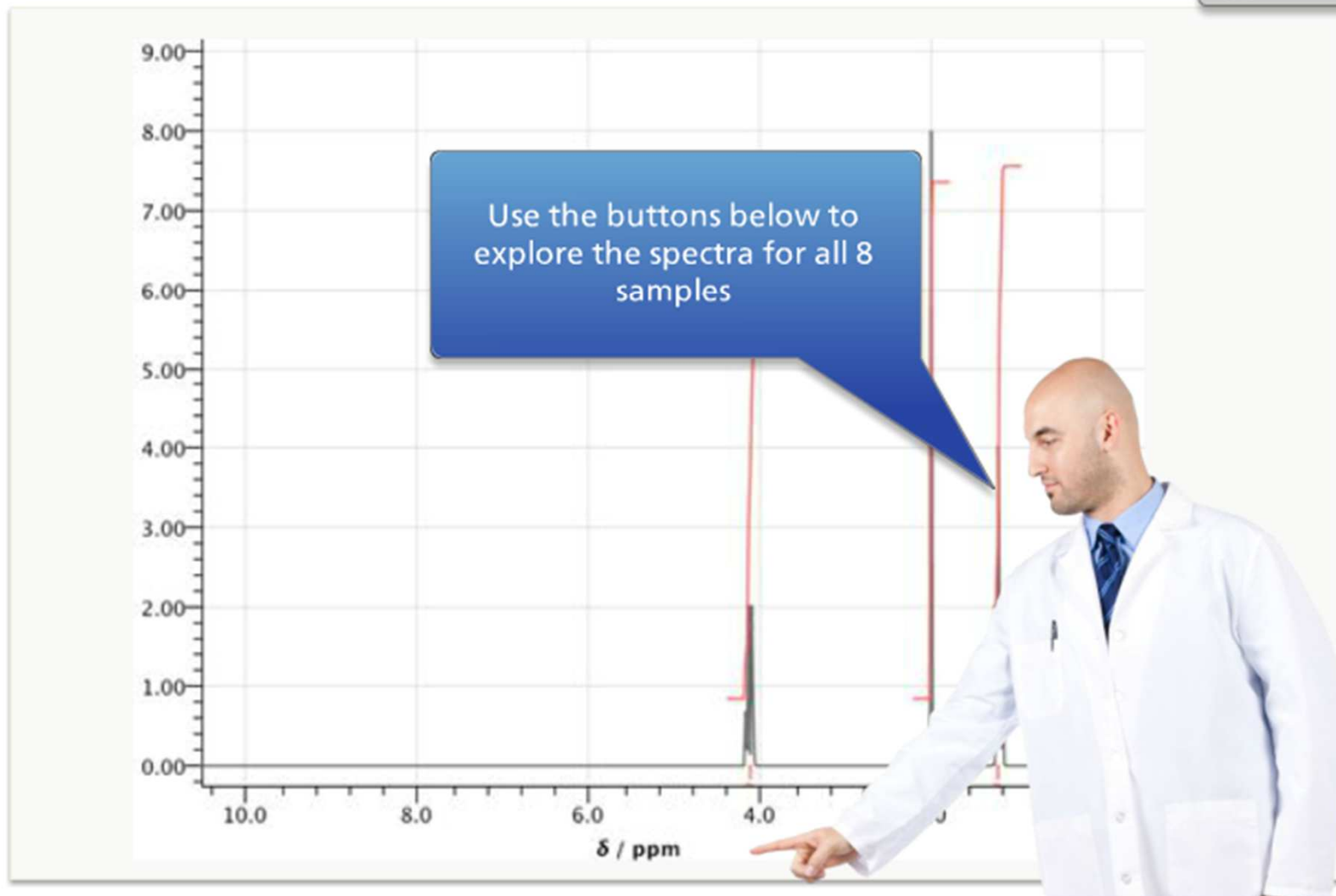
<chem>CO</chem> Methanol	<chem>CC(C)O</chem> Propan-2-ol	<chem>CCOCC</chem> Diethyl ether
<chem>CCO</chem> Ethanol	<chem>CN(C)C=O</chem> N,N-Dimethylformamide	<chem>CCOC(=O)C</chem> Ethyl acetate
<chem>c1ccccc1</chem> Toluene (methylbenzene)	<chem>CC(C)(C)OC(C)C</chem> Methyl-tert-butyl ether (MTBE, 2-methoxy-2-methylpropane)	

Concept...



Final object...

✕ Exit



¹H NMR ¹³C NMR Mass Spec IR **1** 2 3 4 5 6 7 8

Sample no.

Evaluation Data from Practical

- 88% thought the practical or experiment was interesting (SA or A)
- 90% thought the session was a valuable experience (SA or A)
- 83% thought the mode of presentation was interesting (SA or A)
- 88% thought the material covered was useful (SA or A)
- 83% thought the problems were relevant to the module (SA or A)
- 82% thought the theory behind the experience was clearly presented (SA or A)
- 94% perceived the session was integrated with at least one other MPharm module (besides Chemistry) the remainder were neutral.

(SA = strongly agree ; A = agree)

CP1 Module Learning Objectives:

Describe medicinal entities in terms of their **chemical structures and bonding properties** using **nomenclature appropriate to both laboratory and clinical environments**.

Explain the properties of medicinal products in the clinical treatment of disease using basic **thermodynamic and chemical kinetic principles** appropriately.

Explain the **reactivity** of medicinal compounds through reference to the properties of **common chemical functional groups**.

Relate **physicochemical properties of drug molecules** to their actions and uses in therapeutics and/or diagnosis.

Explain the role of computational molecular modelling in the prediction of **structure-activity relationships** using examples of medicinal compounds commonly used in therapeutics.

Relate the importance of identification of discrete drug targets to specific medicinal compound structures.

Explain the **common synthetic pathways** used in the development of drug molecules..

Impact on student performance

81%

of students passed
module at first
sitting

25%

of students achieved
>70% in exams

Only **3/79**

students failed to pass module

The reward?



e-learning
awards 2014
10 years of rewarding excellence