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Computer-Aided Learning in the Pharmaceutical Sciences at the University of Vienna

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The Pharmaceutical curriculum in Austria:

- currently as “diploma” study,
academic degree: “Mag. pharm.” (*Magister pharmaciae*)
- transition to Bologna architecture (Bachelor/Master) is still
in discussion; will require legal changes
- duration (minimum): 9 semesters, 225 semester-hours
- 3 sections:
 - propaedeutic courses (2 semesters)
 - pharmaceutical core disciplines (5 semesters)
 - specialisation, diploma thesis (2 semesters)
- 3 locations: universities of Vienna, Graz, Innsbruck

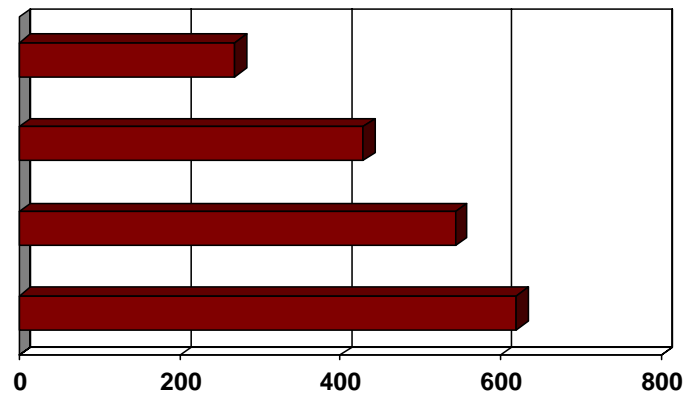
Enrollment figures for Pharmacy students, University of Vienna:

WS 2005: 269

WS 2006: 429

WS 2007: 544

WS 2008: >600



- effective capacity (laboratory space, etc.):
approx. **120 students/year**
- no *numerus clausus* in Austria,
no pre-enrollment selection system (entrance exam etc.)

Problems at the students' side:

- very heterogeneous level of basic knowledge in natural sciences
- diffuse/wrong expectations of academic studies and of job as a pharmacy professional
- inadequate learning techniques:
 - learning “by heart” instead of profound understanding
 - predominant use of short-time memory
 - training of known sets of exam questions+answers
 - underrating of “common sense”

Problems at the lecturers' side: eLearning?

- teaching workload is already at the upper limit
- lack of time to become familiar with eLearning techniques
- usefulness of eLearning in a curriculum with emphasis on experimental skills is not immediately obvious
- lack of individual support; no attractive incentives
- “intellectual property” (course materials)

Project background:

- rector's call for proposals, 2005
- focus on “study entrance phase”, blended learning
- evaluation by international jury of experts
- all 6 pharmaceutical departments joined forces for 1 project
- positive evaluation, funding of € 105.000,- for 2006-2007,

Central features of the project:

- 1 “e-tutor” headcount per department, qualification level: graduate student or final-year undergraduate

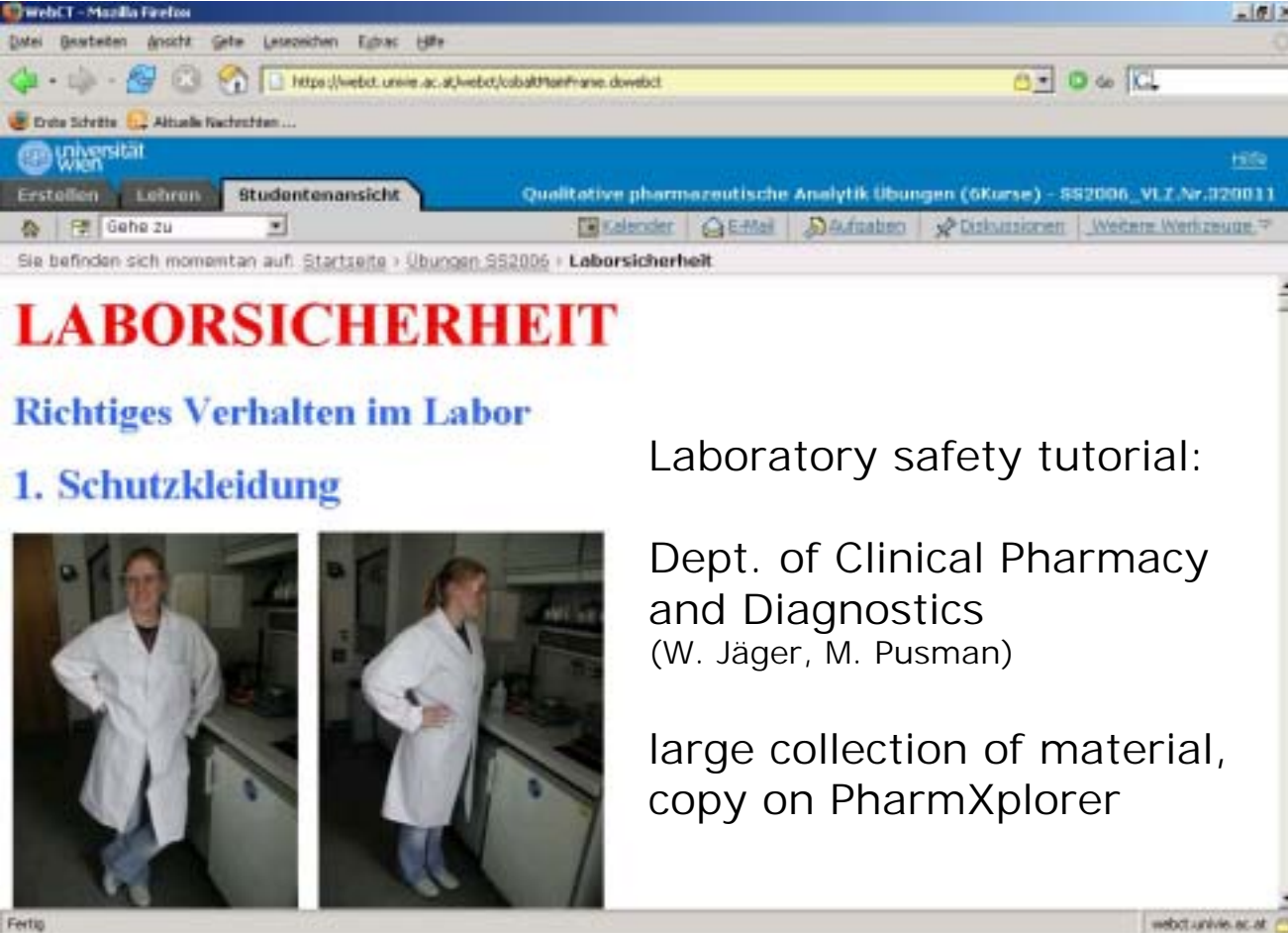
- e-tutors give support to
 - students (on-line & off-line)
 - lecturers (course material production; organisation)

- special feature:
integration of heterogeneous eLearning environment,
including the pharmaceutical eLearning portal,
PharmXplorer (www.pharmxplorer.at)

Didactic concept:

- promotion of a real, profound **understanding** of complex scientific facts, processes, interdependencies by means of scientific **visualisation** (graphics, animations, video clips,...)
- organisation of course material as
 - learning elements (LE): hypertext documents,...
 - training elements (TE): **interactive tools** with immediate feedback
- promotion of a transdisciplinary approach, cross-linked thinking rather than course-centered (exam-centered)


Content examples: static documents



LABORSICHERHEIT

Richtiges Verhalten im Labor

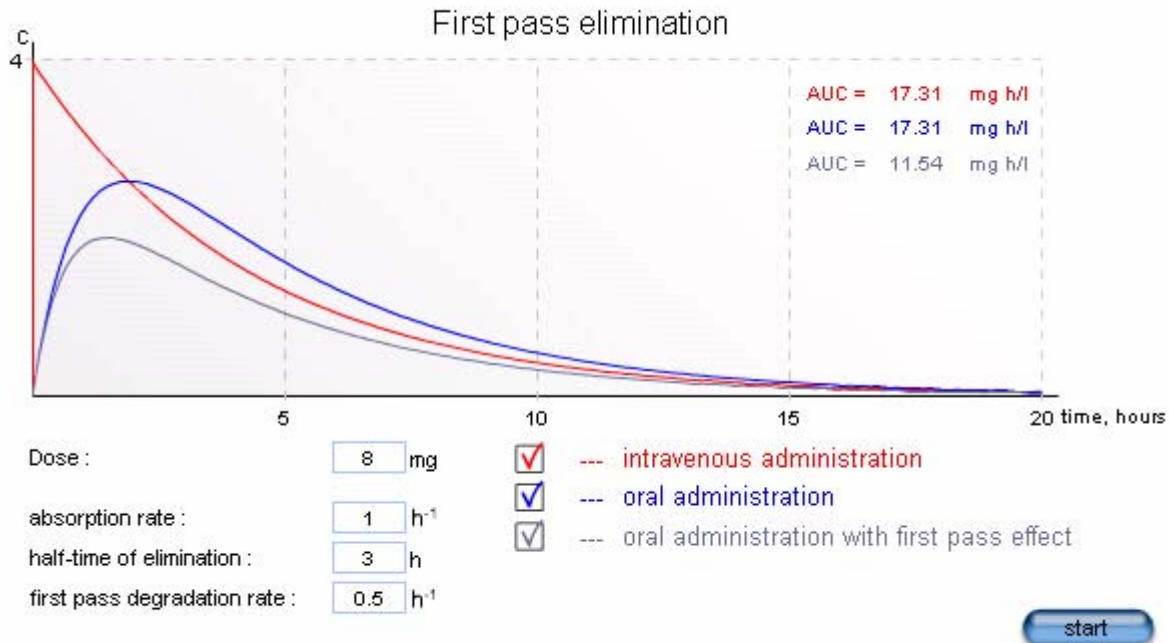
1. Schutzkleidung



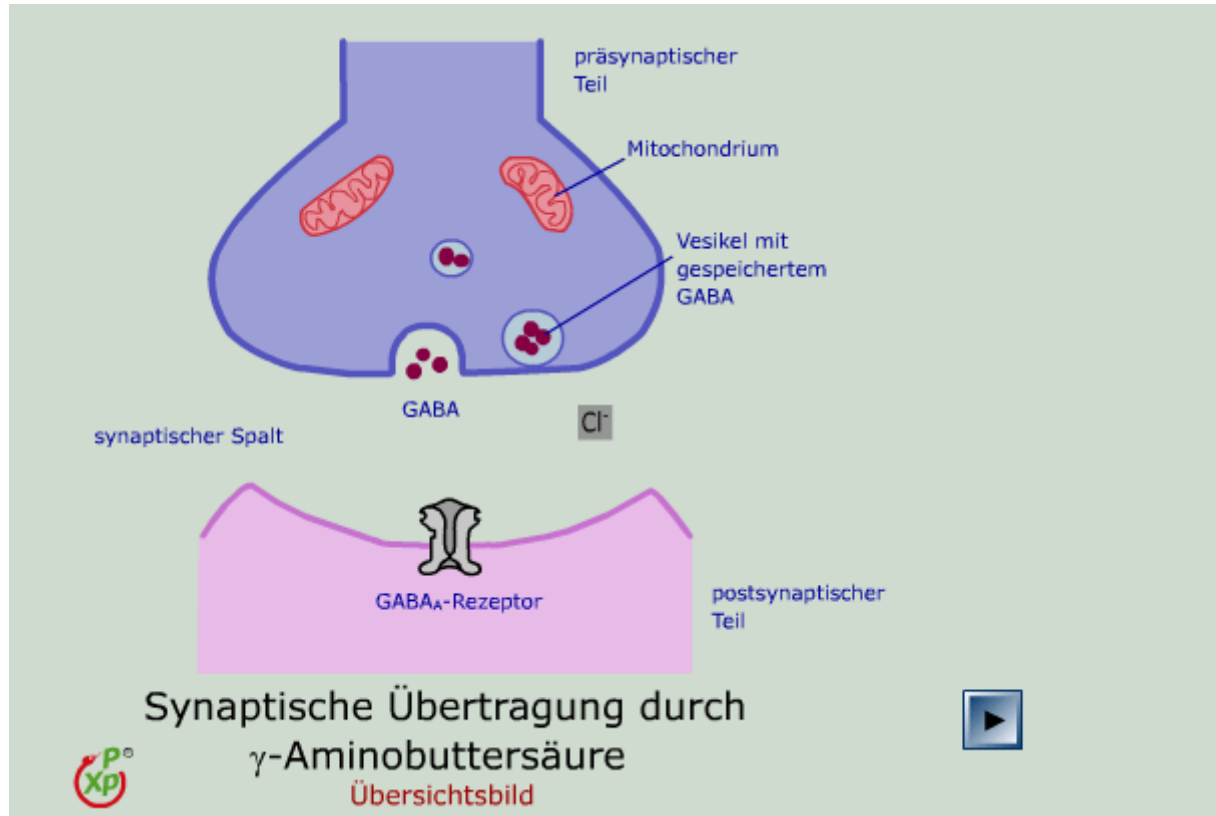
Laboratory safety tutorial:
Dept. of Clinical Pharmacy
and Diagnostics
(W. Jäger, M. Pusman)

large collection of material,
copy on PharmXplorer

Content examples: Flash applications



Content examples: Flash applications

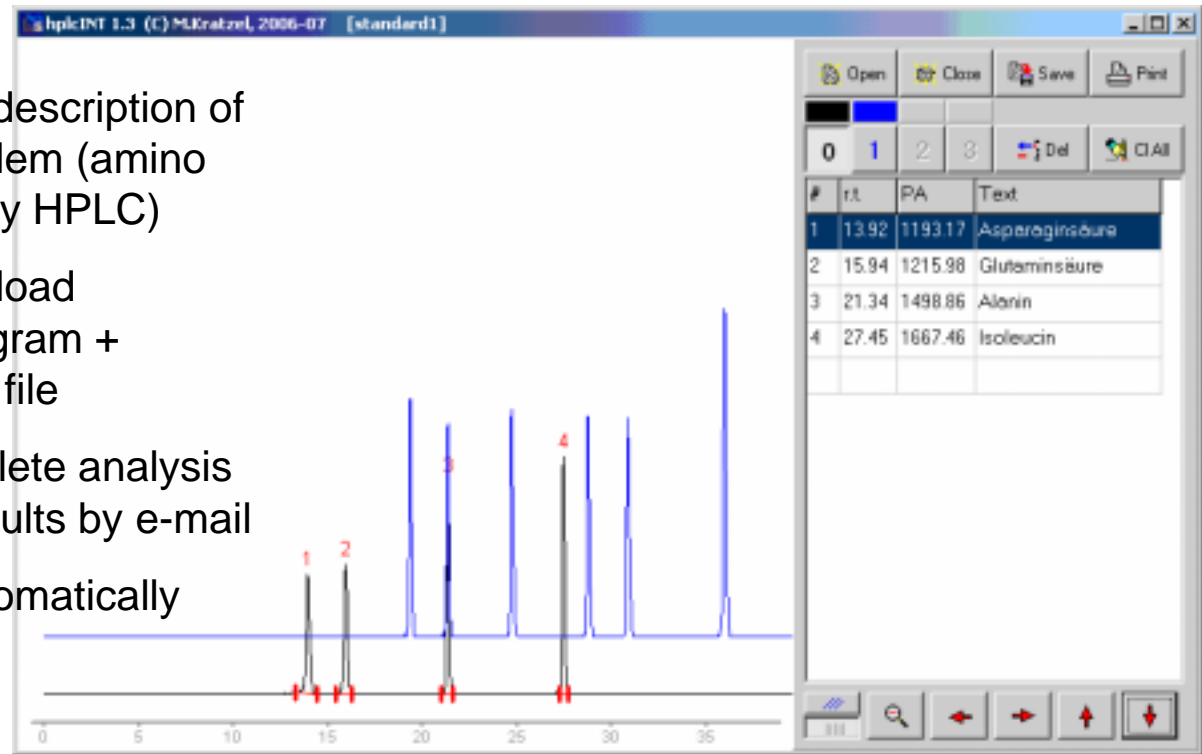


Neurotransmitter mode of action:
PharmXplorer

Content examples: web + stand-alone application

workflow:

- 1) students read description of analytical problem (amino acid analysis by HPLC)
- 2) students download simulation program + individual data file
- 3) students complete analysis and submit results by e-mail
- 4) results are automatically evaluated



Content examples: calculation trainer



5. Das Problem der Volumprozent

Zur schnellen Erinnerung — Massenprozent waren definiert zu: die in 100 Massenteilen Lösung (nicht Lösungsmittel) enthaltene Masse des gelösten Stoffes.

Die Definition von Volumprozent ist analog, nur auf das Volumen bezogen: das in 100 Volumteilen Lösung (nicht Lösungsmittel) enthaltene Volumen des gelösten Stoffes.

Wo legt nun das Problem? Ist nicht $(m/m)\% = (V/V)\%$??? Wenn wir zwei Flüssigkeiten (A und B) mischen, so entspricht die Gesamtmasse der Summe von Masse A und Masse B. Das Gesamtvolumen muss aber nicht (!) der Summe von Volumen A und Volumen B entsprechen. Warum? Flüssigkeit A und B können verschiedene Dichtewerte aufweisen, und die Dichte ändert sich nicht linear mit dem Mischungsverhältnis.



5 mL Wasser und



5 mL Ethanol (96% vol.)



geben weniger als 10 mL Gesamtvolumen


- tutorial: basics of pharmaceutical calculations
- interactive training elements:
 - calculations
 - estimations
- random generation of numeric input data
- “random” selection of question wording from collection

Content examples: e-testing in Pharm. Biology

https://webct.univie.ac.at - Frage in Vorschau anzeigen: Benstet - Mozilla Firefox

Note für: **Pflanzengruppenzuordnung 9**

Nur die links und rechts befindlichen Körbchenblütler



Studentantwort	Wert	Rück
Wahr	100%	Wa
Ergebnis:	100.0%	

Allgemeines: Aster alpinus / Knaulia arvensis /
Feedback:

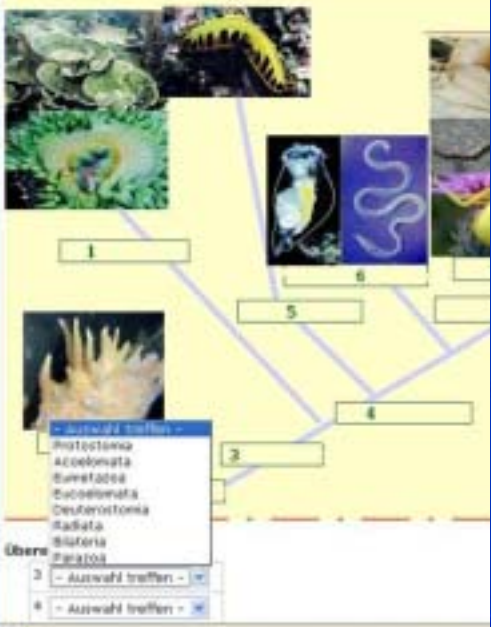
Zurück Schließen

Fertig

https://webct.univie.ac.at - Frage in Vorschau anzeigen: Mozilla Firefox

Biologie Grundwissen 043

Ordnen Sie den Elementen [3], [4], [7] und Stammbaums die korrekten Gruppenbezeich



1
2
3
4
5
6

- Auswahl treffen -
Protostoma
Acetabulata
Eumetazoa
Eucelenterata
Deuterostoma
Radiata
Bilateria
Parazoa

Übersicht
3 - Auswahl treffen -
4 - Auswahl treffen -


Fertig

https://webct.univie.ac.at - Frage in Vorschau anzeigen: Mozilla Firefox

Spross – Mais / 1

Bitte ordnen Sie nach dem Betrachten des Bildes den Zahlen die entsprechenden Begriffe aus der Dropdownliste zu. Achtung, es können auch einzelne Begriffe mehrere male bei der Zuordnung zu einer Zahl verwendet werden!

Spross – Mais / 1



1
2
3

Übereinstimmende Paare

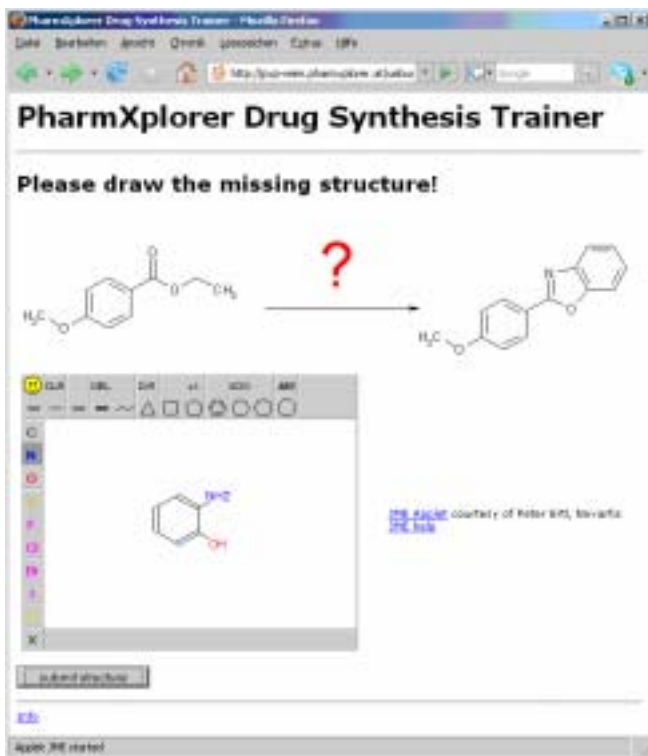
1. - Auswahl treffen -
Auswahl treffen -
2. Siebröhre
3. Parenchym
kollaterale Gefäßbündel
Abschlussgewebe mit Fasern unter Epidermis

Note Schließen

Fertig

webct.univie.ac.at

Content examples: drug synthesis trainer (1)



- task: reaction scheme with a missing structure formula
- students draw their answer in a Java applet
- data are submitted as “connectivity table” (MDL molfile format)
- server-side program checks for correctness (comparison with pre-defined correct structure)

Content examples: drug synthesis trainer (2)

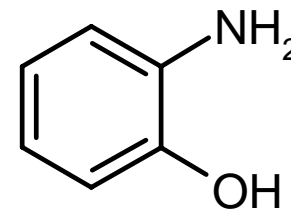
```

Nc1ccccc1O
JME 2003.05 Mon Sep 15 16:38:14 CEST 2008

  8  8  0  0  0  0  0  0  0  0  0999 v2000
  3.6373  2.8000  0.0000 N  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
  3.6373  0.0000  0.0000 O  0  0  0  0  0  0  0  0  0  0  0  0  0  0
  0.0000  2.1000  0.0000 C  0  0  0  0  0  0  0  0  0  0  0  0  0  0
  0.0000  0.7000  0.0000 C  0  0  0  0  0  0  0  0  0  0  0  0  0  0
  1.2124  2.8000  0.0000 C  0  0  0  0  0  0  0  0  0  0  0  0  0  0
  1.2124  0.0000  0.0000 C  0  0  0  0  0  0  0  0  0  0  0  0  0  0
  2.4249  2.1000  0.0000 C  0  0  0  0  0  0  0  0  0  0  0  0  0  0
  2.4249  0.7000  0.0000 C  0  0  0  0  0  0  0  0  0  0  0  0  0  0

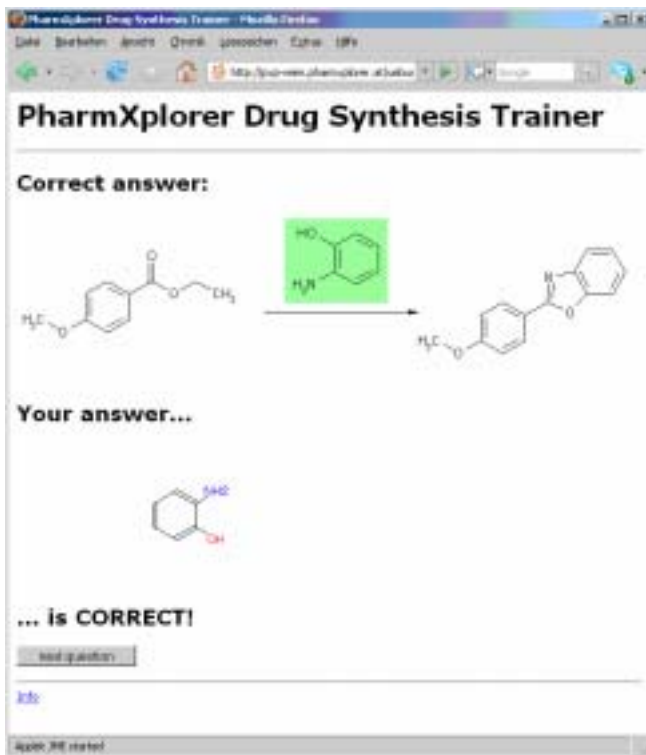
  1  7  1  0  0  0  0
  2  8  1  0  0  0  0
  3  4  2  0  0  0  0
  3  5  1  0  0  0  0
  4  6  1  0  0  0  0
  5  7  2  0  0  0  0
  6  8  2  0  0  0  0
  7  8  1  0  0  0  0

M  END
  
```



connectivity table: textual representation of chemical structure, “molecular graph”; atom-by-atom comparison with reference structure(s)

Content examples: drug synthesis trainer (3)



PharmXplorer Drug Synthesis Trainer - Phallo-Corlin

Correct answer:

Your answer...

... is CORRECT!

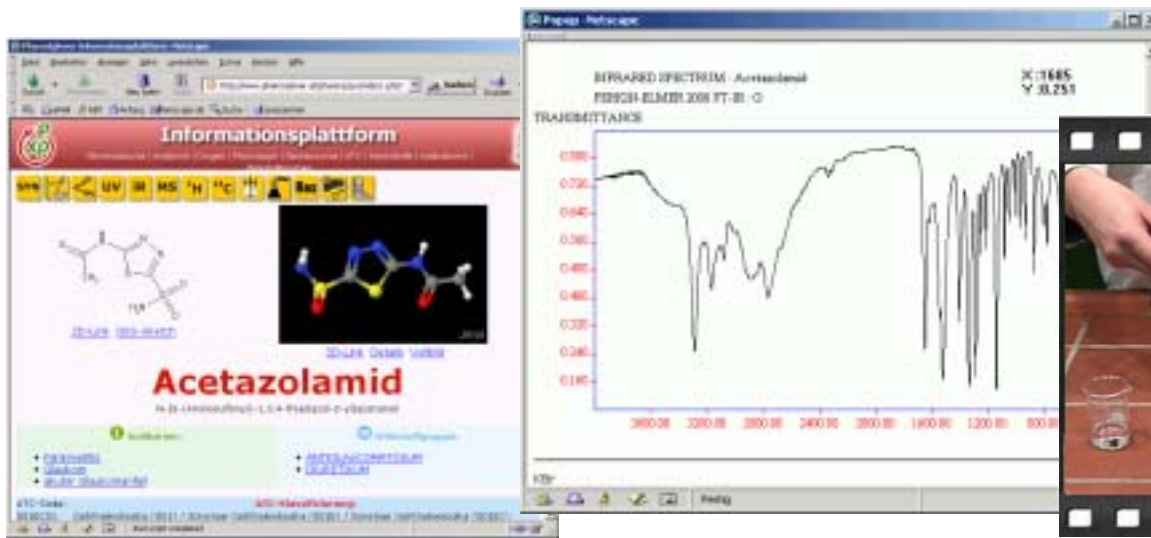
next question

help

- feedback: correct scheme + student's answer + evaluation ("right" or "wrong")
- questions are randomly chosen from a pre-defined catalogue
- students are trained in actively using the "language" of chemical structures
- back-end software: checkmol/matchmol (open-source)

Added value by integration of PharmXplorer

- drug database of approx. 2800 drug compounds
- medicinal plants database
- massively hyperlinked documents stimulate “exploring”, transdisciplinary view
- collection of animated graphics, video clips (lab techniques)



Project organisation:

- kick-off workshop with lecturers and e-tutors
- regular meetings with all e-tutors
- reports
- mailing list
- evaluation of courses by students
- documentation, project website
- international networking:
*European Workshop on Computer-Aided Learning
in the Pharmaceutical Sciences*
<http://merian.pch.univie.ac.at/eufeps/workshop2008/>

Conclusions

- large-scale deployment of eLearning is a challenge
- the “bottleneck”: lecturers rather than students
- e-tutors with media skills *and* scientific competence can strongly support transition from conventional teaching to IT-supported teaching
- top-quality media production is beyond the capabilities of e-tutors
- future “blended learning” scenarios: a further shift from classroom to on-line phases (optimum may vary)

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