

Establishment of Innovative Multidisciplinary Centres for the Development of Virtual Laboratories in Biology and Medicine (Start date – December 1st 2013)

Main Objective

To equip e-learning units in TSU and other South Caucasian Universities with up-to-date technology (hardware and software) and training, to produce learning aids in the form of images and simulations for in-house use in Biomedicine (but also other disciplines).

A virtual laboratory in Microbiology will be set up during the project with the help of all the partners for both undergraduates and research usage.

Western Partners.

University of Westminster

University of L'Aquila (Italy)

University of Brest (France)

AMNIM, center for Scientific Visualization (Slovenia)

Southern Caucasus Partners

Azerbaijan

Baku State University

Azerbaijan State Medical University

Georgia

Tbilisi State University

Davit Agmashenebeli University

Ukraine

Odessa National University

Ivan Franko National University of Lviv

Roles of the Western partners

To train computer literate staff in the various aspects of creating a virtual laboratory. This will include:

- 1) Developing video podcasts
- 2) Use of 'decision making' software for e-learning
- 3) Use of gaming software for e-learning
- 4) Development of virtual environments

Example of what will be created as part of the project involving all partners:

A virtual environment where students can:

- a) view what equipment is in a microbiology laboratory and what it is used for.
- b) See how it is used in good laboratory practice
- c) See how specific named microorganisms (eg HIV or Tb) are investigated from sample taking to identification subsequent therapy
- d) Assess their own progress in carrying out experiments

Some advantages of a virtual laboratory over a 'real laboratory'

- Expensive laboratory reagents are not required
- Students can use the laboratory either in University computer facilities or on their own computers
- Mistakes made are not expensive or dangerous!
- Infectious agents that are not possible to study in a real laboratory can be studied eg. Tuberculosis and HIV and even Ebola virus.

Additional Objectives include:

- 1 - To develop an efficient optimal scheme for commercialisation and advertising of created virtual e-learning resources.
- 2- To re-structure the existing MSc Curriculum in Microbiology across the BSc, MSc and PhD degrees at each of the participating SCU to ensure the integration of the virtual learning resources
- 3- To disseminate the project outcomes both internally and externally.

Some division of labour in training

University of Westminster,

Training in the Health and Safety component of a virtual laboratory using decision-making software.

Training in production of podcasts for specific areas of microbiology.

The University of L'Aquila (UNIVAQ, Italy),

Professor Guido Macchiarelli, Dr Giovanni De Gasperis.

Design of a virtual electron microscope

Development of virtual simulations using Unity3D simulations and OpenSim (and up to date programmes)

University of Brest (UBO, France)

Dr Jean-Pierre, Professor Pascal Ballet, Dr Vincent Rodin, Dr Alexandra Fronville

Production of virtual simulation software for specific areas of the virtual lab and research (experimentation for biologists)

BIOANIM (Slovenia)

Dr Tomaz Amon:

Training, production of VMML using gaming software? Marketing of the virtual lab.

First Stage

The first stage will be devoted to building an effective competent team of national MICVL with the regional centre at TSU. Each Centre will be led by a Head of the Centre and 3 groups of team-members:

I. Innovative Technology/Research Group will include IT specialists, post-graduate and BSc students from Applied Mathematics and IT Departments. The aim of this group will be to create Virtual Simulations (VS) that will also contribute to PhD projects.

II. Theoretical/Educational Group will include academics with an appropriate Biomedical background. The aim of this group will be to establish the academic content for the VS developed by Group I.

We increased the number of the MSc and BSc students in Groups I and II of the ENAU teams in response to the project evaluation report from the 2012 selection.

III. The Business Development Group will include a consultant from the National Intellectual Property (IP) Centre (in a regional MICVL) and a mixed group of IT specialists and academics. The aim of the group will be IP support, marketing and advertising of the end-product. We will put more emphasis on identifying relevant national IT enterprises to set up links for further sustainability of the project.

Second Stage

- 1) Intensive training of ENAU staff with expertise in IT and Biomedicine.
 - Resident training in EU centres
 - Video conferencing
 - Visits of experts to help in organisation of specialist IT in the ENAU

- 2) MICVLs will be equipped with computers and software

Each MICVL can be represented as a triangle with the tips occupied by the three Groups. All 6 MICVLs from 3 ENAU will be integrated making a regional ENA triangular network.

Third Stage

Creation of the Virtual Medical Microbiology Laboratory (VMML), as a pilot product scheme

- Proposal from Western partners on content.
- Building of academic content Group II (Education) and Group I (Innovative Technology/Research) of each MICVL for pilot and additional local wish list .

This collaboration will be essential in determining the relevant IT technologies to use for each aspect of the virtual laboratories. The choice of resources, delivery platforms and technology will be informed by both the educational and practical requirements/restrictions to ensure that the eventual solutions are usable, practical and effective.

After the first six months a workshop at the regional centre (TSU, Georgia) will be organised to discuss content. Following its decisions, the final version of academic content of the VMML will be produced.

Final Stage

Dissemination and sustainability.

- Involvement of administrative and academic staff of non-partner regional universities
- This technology should facilitate new approaches of teaching/learning in the Southern Caucasus

Tasks suggested based on TSU document – more detail 11/1/11

1. **Equipment layout in virtual microbiology laboratory** - Lab Tour
 - a. 3D imagery of laboratory identifying equipment, areas used to make up media etc. category 3 separate room , ?click on equipment to identify it , Flow cytometer etc

2. **Health and Safety issues** – protecting the person, the work place and the work

Procedures – link with wrong practices in virtual lab (1 above) and consequences

Sterilization, disinfection, waste disposal.

Aseptic technique.

3. **Practical requirements for bacteriology** –
 - Media preparation for growing and identifying bacteria
 - Setting up microscope for looking at samples
 - (These could be linked to podcasts with video) – some already prepared at UOW but would need translation

4. **Practical requirements for virology** – ? mycology and parasitology?
 - Growing viruses in tissue culture
 - Virtual Electron Microscope
 - Immunofluorescence and nucleic-acid-based techniques for identification

5. **Sample taking and their examination** - Urinary tract infections
 - visual and micro levels, examine under microscope etc.
 - Gram stains
 - = Plating out
 - cell counts
6. **Bacterial growth and identification**
 - Use of different growth media, Colony counting - Biochemical tests etc
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7. **Antibiotic sensitivity testing**
8. **Case studies: TB–growth, tests for strains, -PCR etc**
9. **Case studies: HIV – handling, ELISA, Flow, etc**

We could do sample taking and identification of viruses as a separate task (ie(8) or condense 6 and 7 if number of tasks too many.