

Preface

In 2004, in the framework of the **Initiative for the spread of scientific culture** (law 6/2000), a project by the University of Padova was financed to provide an interactive educational tool on the eukaryotic cell, its structural elements and its relationship to the external environment.

The structure and content of this learning tool were designed for use in high schools, public libraries and to supplement course material in higher education.

The project came to fruition with the creation of the Cd-Rom entitled *Virtual Journey through the cell*. This virtual journey takes place in an imaginary Research Department, in which there are several microscopy laboratories (only some of which are currently operational) in which the user, guided by voice and text, learns how to use light microscopes to observe cells and tissues. Using the instruments of light microscopy, this version highlights particularly the organization of the skin, its appendages and of the cells which constitute them. The journey includes the observation of 17 original preparations, text commentaries, numerous diagrams and 3 animations. During observation of the preparations under the various types of microscope, the structure of the cell and its components is presented to the user with the help of simple yet comprehensive texts. Though virtual, the use of these various instruments effectively introduces the principles of microscopy and highlights the differences in performance of the various types of optical microscope.

The contents of the CD are organized to allow continuous updating of material, through the replacement of individual modules. Its method also facilitates the addition of subsequent information gained, for example, through observations using both confocal and electron microscopes.

Before being made available to everyone, the project first requires a period of didactic testing. For this reason, it is necessary to have the collaboration of high school teachers, who, using *Virtual journey through the cell* as part of their coursework, can express their opinion on the validity of the work, particularly in relation to the students' level of interest, to its value as a learning tool and to its ease of use. A copy of the CD-Rom will be sent to interested teachers with a questionnaire to complete on their experience of using the material.

How does the CD-Rom work?

General Information

A visitor to the Department of Cell Biology of the Virtual University is accompanied by text commentaries on images and by a voice guide. The spoken voice, which can be muted, is more concise than the written text and provides information essential to an understanding of the images.

Navigation is similar to that which you will have encountered on the internet. The pages of the CD-Rom can be browsed like those of a book using the instructions on the navigation bar.

By means of associated hypertext connections (in orange) to the key terms, you will be able to form connections between different topics, thereby creating an itinerary adapted to your own personal interests.

In addition, special interactive icons allow the following alternative options:

- a magnifying glass enlarges the image to full-screen size
- a film reel indicates an animation
- an object bordered in orange leads to an active link either to another page or to another virtual location.



viaggio
virtuale
nella
cellula

Virtual journey
through the cell

Your route

On entering the Department, the user is given a notepad (Fig. 1) to use during his visit. In the notepad, he will find information on:

- the significance of the icons,
- an interactive map of the various laboratories and how to navigate,
- a list of topics covered in greater depth.

The notepad is one of the novel elements of this learning tool. Indeed, using this tool, the user is able to create his own personal route, particularly by using the interactive map of laboratories and in-depth topics covered. The former allows direct access to a particular location or instrument, thus enabling the visit of different laboratories in succession without the need to retrace one's steps.

In addition, selective consultation of the in-depth topics covered allows for study tailored to the age and knowledge of the user.

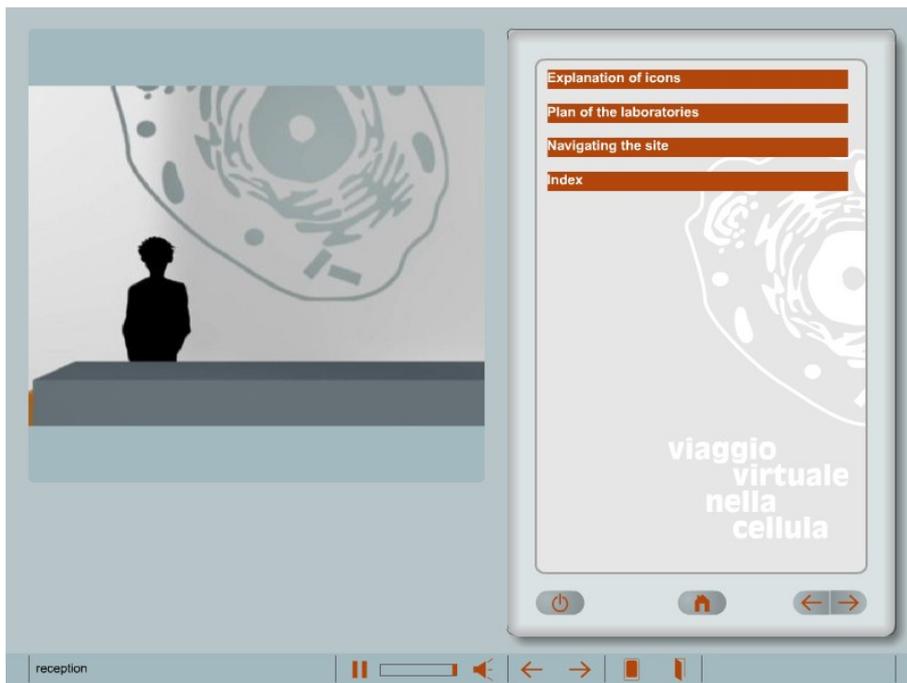


Fig. 1 - The entrance to the Virtual Department with the summary of the notepad, on the right.

After reaching the different laboratories, the user may visit them virtually using the arrows which appear on moving the mouse to the sides of the image (Fig.2).



Fig. 2 - The virtual light microscope laboratory. By positioning the mouse at the sides of the image and clicking on the white arrow, the user may move around the laboratory. By clicking on the orange square, he may enlarge the image.

This enables the user to appreciate the size of the laboratories, how they are arranged and the location of the microscopes. The text opposite contains general information on the functioning of different instruments located in these areas. Occasionally, the user must interact with virtual reality e.g. he must find the light switch in the fluorescence microscope laboratory and switch it off.

The instruments available for observation are the stereomicroscope, the composite light microscope and the fluorescence light microscope. The instruments used in the virtual representations of these microscopes are the most recent models of Leica microsystems, diagrams of which they kindly provided to the authors.

The structure and use of each instrument is shown briefly, noting its power of resolution and possible methods of preparing material for observation.

There are a total of 17 preparations for observation using different microscopes, 3 using the stereomicroscope, 8 the composite light microscope and 6 the fluorescence microscope. The sequence of preparations (shown opposite) is designed to introduce the user progressively to the organization and structural complexity of the cell. In fact, the first observations are all conducted on samples using a stereomicroscope, an instrument with a limited power of resolution. Study then proceeds with the analysis of histological preparations under the composite light microscope. Here, the possibility of increased magnification introduces the user to the diversity of cell types and distinguishes between various cell components such as the nucleus, cytoplasm, etc. Finally, use of the fluorescence microscope allows the observation of other cell components, such as the cytoskeleton, which cannot be seen using the afore-mentioned techniques. A list of the preparations is available in the notepad under the heading *Map of the laboratories*. All the topics on this page are interactive. This allows the user to complete the entire visit on separate occasions, each time resuming at the point at which he left off.

During virtual observation of the preparations, the user may:

- a) personally regulate the focus,
- b) shift the field of vision,
- c) alter the magnification moving the mouse onto cursors located under the image.

In addition, when using the x100 lens, he must use immersion oil.

The text accompanying the images contains a simple yet comprehensive description of the preparation under observation, while providing opportunities for additional in-depth study. Indeed, all the colour highlighted terms lead to more detailed information in the notepad. Clicking on these terms gives direct access to this in-depth knowledge (Fig.3), providing more detailed and complex information in an easily understood manner.

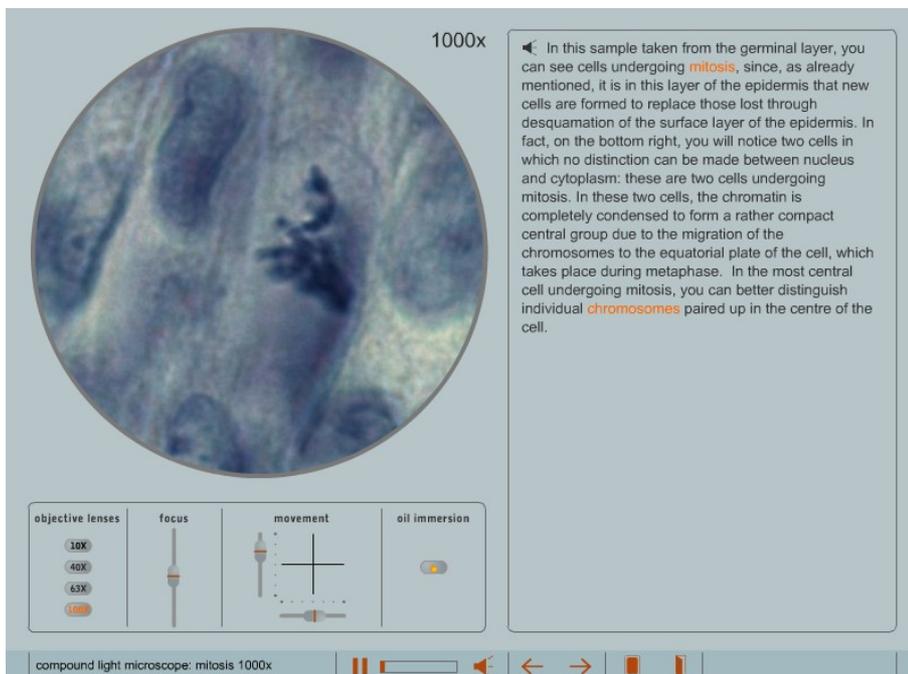
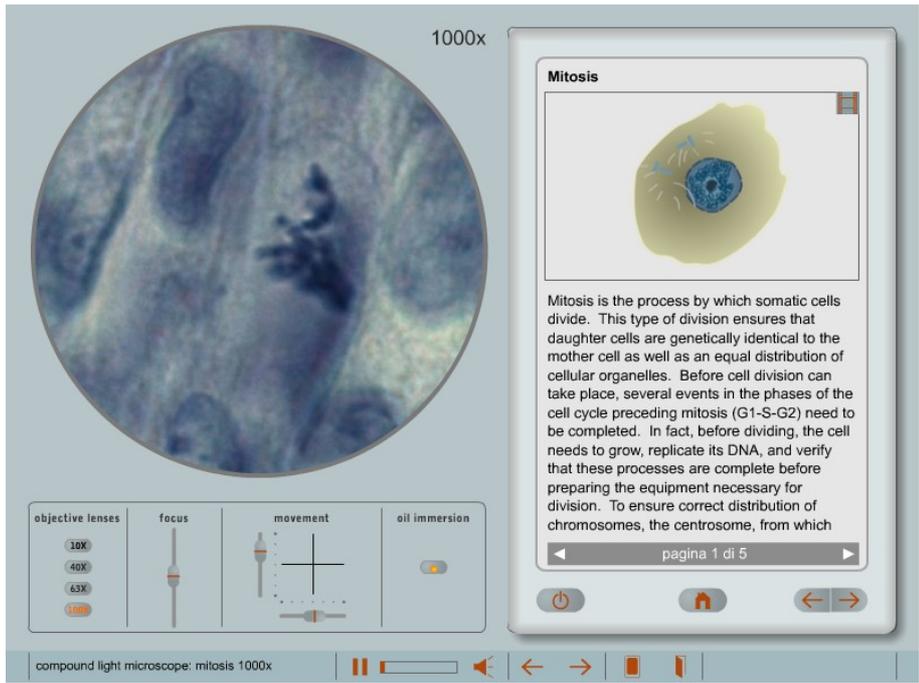


Fig. 3 - A preparation of skin showing a cell in *mitosis*, observed using a x100 lens. The word *mitosis* appears in colour in the text opposite and has a link to the relative detailed information in the notepad. The diagram shows this information appearing when clicking on the word *mitosis*. The small photo reel symbol in the top right corner indicates that the diagram has a linked animation.



Like the text, the more in-depth topics include diagrams, additional photographs and animations. The more in-depth knowledge on mitosis (Fig.3) contains an animation showing the succession of the stages of mitosis. If a small magnifying glass is present, as in Fig. 4, the diagram may be enlarged to fill the screen, after which a key appears indicating the various illustrated parts.

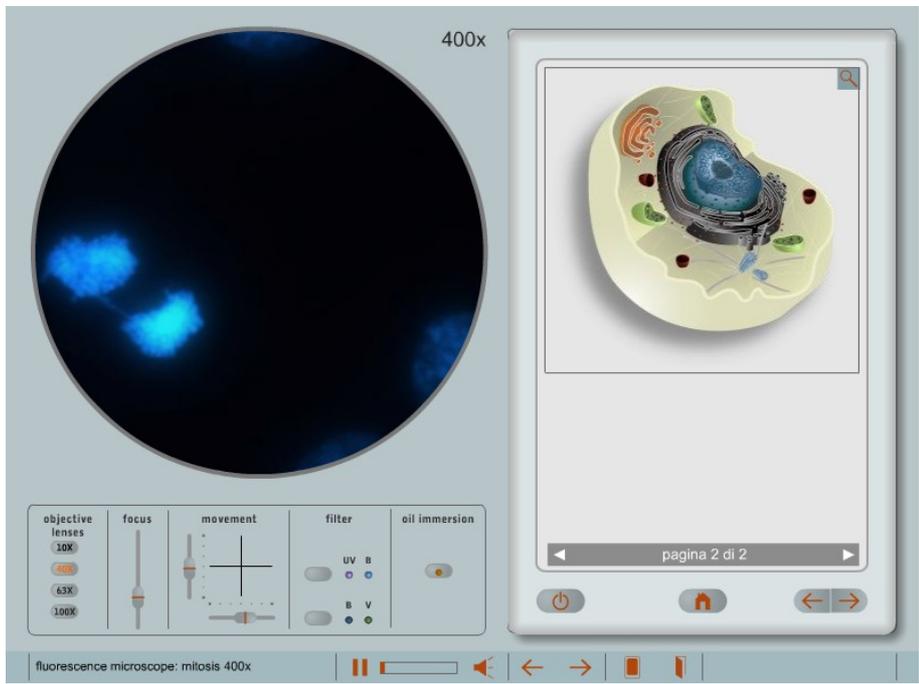


Fig. 4 a - Magnification of a preparation for observation under the fluorescence microscope. Here, in addition to the usual cursors, there are also buttons to choose the filters (see arrow). Opposite you will find a 3-D cross-section diagram of a eukaryotic cell in the in-depth topics in the notepad. Icons of a magnifying glass at top-right indicates the possibility of enlarging the diagram to fill the screen;

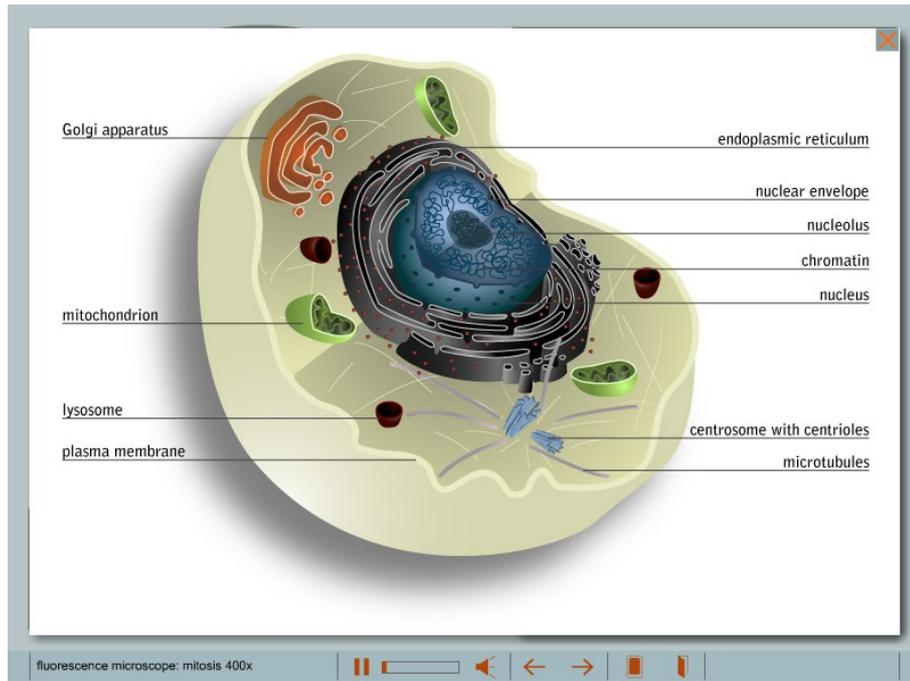


Fig. 4 b - Enlargement of a diagram of a eukaryotic cell showing the key of its various components.

The Authors

The project was conceived and designed by Profs. Lucia Celotti, Maria Berica Rasotto, Roberto Bisson and Piero Benedetti with the collaboration of Doctors Carlotta Mazzoldi and Maddalena Mognato of the Departments of Biology and of Biomedical Sciences of the University of Padova.

Graphic and hypertext design was by the Gris-Co Srl. Studio of Padova.

The electron micrographs were kindly donated by Prof. E. Lucio Benedetti and Irene Dunia of the Institut Jacques Monod (CNRS-Universit s Paris 6 - Paris 7, Paris, France).

Leica Microsystems provided diagrams of the stereomicroscope and the light microscope.

Virtual journey through the cell

For more information and for a questionnaire, please contact the Head of project:

Prof. Lucia Celotti
Dipartimento di Biologia,
Universit  degli Studi di Padova,
via U.Bassi 58/B,
35121 Padova,
Italy

Tel: (+39) 049 8276283
e-mail: lucia.celotti@unipd.it