

Learning Authentically through HIPON Platform

Olga Riccioni¹, Maria Solomou², Goce Armenski³, Charalambos Vrasidas⁴, Luka Brcic⁵, Ljupcho Antovski⁶, Annemieke Smeets⁷, Sven Seiwert⁸, J. Han J.M. van Krieken⁹, Andreas C. Lazaris¹⁰.

^{1,10}1st Department of Pathology, School of Medicine, The National and Kapodistrian University of Athens (Greece),

¹School of Medicine, Sapienza University of Rome (Italy),

^{2,4}Centre for the Advancement of Research and Development in Educational Technology LTD (Cyprus)

^{3,6}Faculty of Computer Science and Engineering, "Ss. Cyril and Methodius" University (Macedonia)

^{5,8}Institute of Pathology, School of Medicine, University of Zagreb (Croatia)

^{7,9}Department of Pathology, Radboud University Nijmegen Medical Center (Netherlands)⁶.

¹olga.riccioni@outlook.com, ²maria.solomou@cardet.org, ³goce.armenski@gmail.com,
⁴pambos@cardet.org, ⁵lbrbic@mef.hr, ⁶ljupcho.antovski@finki.ukim.mk, ⁷A.Smeets@pathol.umcn.nl,
⁸seiwert@mef.hr, ⁹J.vanKrieken@pathol.umcn.nl, ¹⁰alazaris@med.uoa.gr

Abstract

Today's global educational environment is rapidly changing. Our perspective with regard to the future of medical education is experiential learning. Learning authentically implies that learners, simulating their present or future professional practice, gain medical experience in the process of diagnosing human diseases. This challenge is linked with a main educational task undertaken, i.e., structuring an inter-active e-learning platform in the context of a novel teaching strategy. The relevant project entitled "ICT emodules on HistoPathology: a valuable online tool for students, researchers and professionals - HIPON", and co-financed by the Lifelong Learning Program of the Education, Audiovisual and Culture Executive Agency, The Commission of the European Union, has been launched at the beginning of 2013.

The project has resulted in an autonomous well-structured and user friendly, multi-language e-learning platform, specifically focused on histopathology, which provides a valuable teaching tool for students, researchers and professionals.

The modern technologies' fast progress in recent years brings about the development of new teaching tools. The implementation of e-learning programs has progressively increased in medical education. Our up-to-date platform combines a virtual portfolio, a list of resources and links and, most importantly, characteristic case studies, presented on such a basis that way of thinking and experience is conveyed and acquired, instead of mere information. The basic concept underlying HIPON's methodology is to follow mixed learning pathways based on case studies, always taking advantage of modern visual technology. The latter includes enlargeable, high resolution images, virtual slides and educational videos. The step by step analysis of the diagnostic thought is the crux of the matter.

Through the educational aspects provided by HIPON platform, users will familiarize with the diagnostic process and become highly knowledgeable about using all their acquired knowledge in order to achieve the correct diagnosis; in other words, users will learn authentically how to think as experienced pathologists.

1. Introduction

Pathology is a major medical field, primarily concerning the diagnosis of diseases through the examination of biological samples. Current education focuses mostly on theoretical knowledge, especially at its beginning. Medical students are requested to retain an extensive amount of knowledge. Then, in everyday working life, pathologists must be able to interpret a biopsy in order to make a final diagnosis, the accuracy of which is of vital importance for patients. It takes a considerable amount of time and real devotion to acquire professional experience in the field. Our perspective with regard to the future of medical education is experiential learning. Learning authentically implies that learners, simulating their present or future professional practice, gain medical experience in the process of diagnosing human diseases. This challenge is linked with a main educational task undertaken, i.e., structuring an inter-active e-learning platform in the context of a novel teaching strategy. The relevant project entitled "ICT emodules on HistoPathology: a valuable online tool for students, researchers and professionals - HIPON", and co-financed by the Lifelong Learning Program

of the Education, Audiovisual and Culture Executive Agency, The Commission of the European Union, has been launched at the beginning of 2013.

2. HIPON project

The project has resulted in the development of a valuable open resource, available for free at the website "www.hiponproject.eu". It has resulted in an autonomous, well-structured and user friendly e-learning platform, specifically focused on histopathology, which combines high quality of learning with ease of access and use, typical of the emerging technology tools. Today's global educational environment is rapidly changing [1, 2]; the modern technologies' fast progress in recent years brings about the development of new teaching tools [2]. The implementation of e-learning programs has progressively increased in medical education [3]. Despite the plurality of sources of information at a theoretical level, there is a lack in reliable references to everyday applications. Our up-to-date platform combines a virtual portfolio, a list of resources and links and, most importantly, characteristic case studies, presented on such a basis that way of thinking and experience is conveyed and acquired, instead of mere information. The basic concept underlying HIPON's methodology is to follow mixed learning pathways based on case studies, always taking advantage of modern visual technology. The latter includes enlargeable, high resolution images (Figure 1), virtual slides and educative videos. The step by step analysis of the diagnostic thought is the crux of the matter.

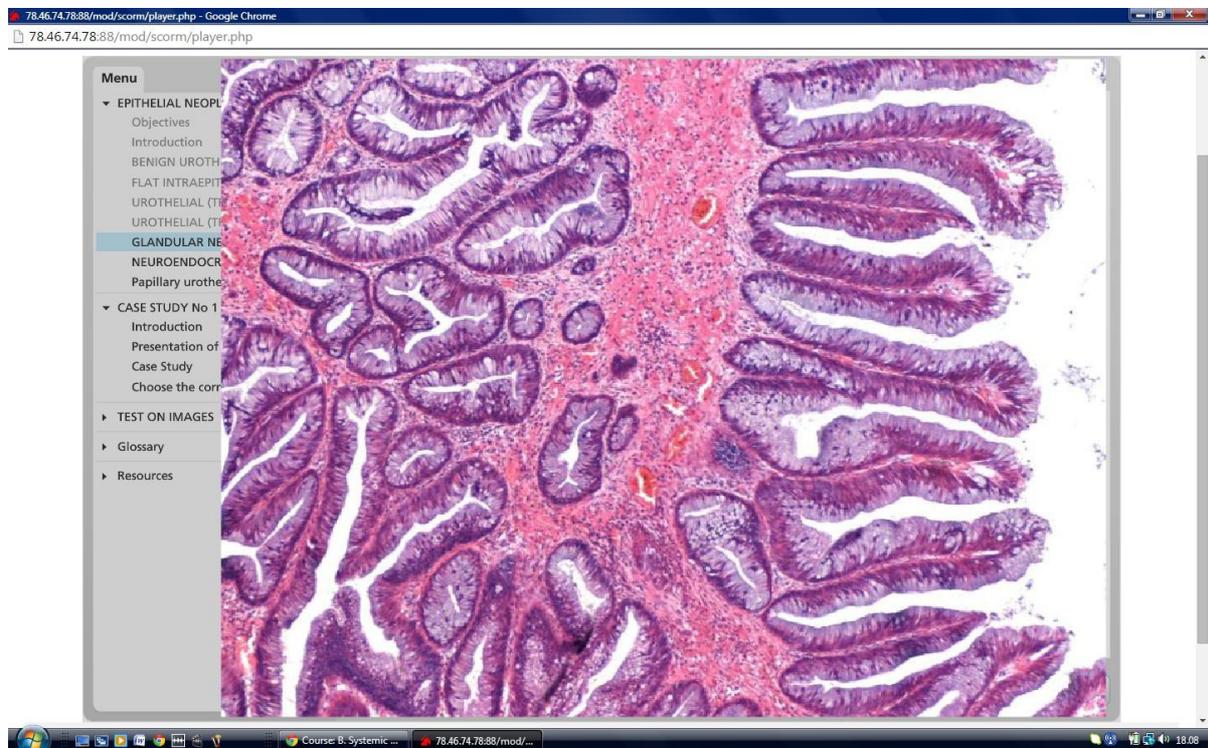


Figure 1. A HIPON enlarged high resolution image showing a villous adenoma of the urinary bladder. Note the size of the image that, when enlarged, almost fills the entire screen.

HIPON architecture, and its component sections i.e. General Pathology and Systemic Pathology, were developed completely in accordance with the project aims. In the General Pathology Section, tissue basic pathological alterations combined with both infectious and non infectious diseases, are presented. The Systemic Pathology section consists in several units and chapters, every one of which deals with a different organ-system of the human body. Every chapter responds to HIPON goals earlier identified, providing an initial overview, several case studies and a concluding image-based test. The overview section, presenting the pathological patterns of the organ analyzed in the relevant chapter, provides information which proves to be helpful while going on within the chapter. Theory is soon transferred to real life practice, thanks to the case study section, which is the most innovative one of the project. Simulating the same diagnostic procedure that expert pathologists are used to follow, the provision of case studies supplies users with the opportunity to apply what they have already learned and therefore deepen their understanding and ameliorate their skills. Then, in the image-based test section, the users' acquired diagnostic experience can be estimated by answering

single-answer or multiple-choice, image-based questions (Figure 2) as well as by matching the microscopic features shown in images with the relevant morphological terms.

The screenshot shows the HIPON e-Learning Platform interface. The top navigation bar includes the logo and the text "HIPON e-Learning Platform www.hiponproject.eu". The user is logged in as Prabal Deb. The main content area is titled "UNIT H URINARY TRACT Chapter 3 - URINARY BLADDER". A question is displayed: "Which of the following statements concerning the above tumor is correct?". To the right of the question is a microscopic image of a tumor. Below the question are four radio button options:

- An inverted pattern of urothelial carcinoma is observed.
- This is an inverted papilloma.
- This is an inverted urothelial carcinoma of low grade.
- This is a papillary urothelial carcinoma of high grade.

 A left-hand menu lists various topics, with "Question 3" selected.

Figure 2. An example of an image-based question on HIPON “Urinary Bladder Pathology” chapter .

The case study section, as the whole platform, is constructed in such a way so as to make users gain medical experience in the analytical diagnostic process, in order to reach the final diagnosis. This educational concept, which explicitly responds to the program’s purpose, can be better understood through the presentation of a HIPON chapter, for example the third one of the “Urinary Tract” HIPON Unit, i.e. “Epithelial neoplasms of the Urinary Bladder”.

The screenshot shows the HIPON e-Learning Platform interface for the "Urinary Bladder" chapter. The main content area displays three microscopic images with corresponding text descriptions:

- The first image shows a low-grade urothelial carcinoma with a predominant inverted pattern. The text notes the regular contour of the neoplastic nests (green arrows) and states that since no invasion is noticed in the lamina propria, the tumor should be staged as pTa. (H-E, X100)
- The second image shows pT1, high grade urothelial carcinoma. The text describes cellular discohesion and foci of invasion (irregularly shaped groups of cells, red arrows) within the lamina propria. (H-E, X 200)
- The third image shows invasion of the muscularis mucosae, indicated by a pink asterisk.

 A left-hand menu lists various topics, with "UROTHELIAL (TRANSITIONAL C..." selected. Navigation buttons for "PREV" and "NEXT" are visible at the bottom.

Figure 3. Part of the microscope image collection in HIPON “Urinary Bladder” chapter overview.

In the overview section, after the objectives of the chapter are pointed out, principles in bladder tumor pathology are provided. An initial introduction briefly describes the normal bladder wall, in order to better understand the pathological pattern description which comes next. Various tumor types of the urinary bladder are presented, taking advantage of modern image technologies. The tissue architecture is always analyzed in appropriate brief texts accompanying extended microscope image collections (Figure 3). The latter are composed of multiple, high resolution images, which are always enlargeable (Figure 4), so as to appreciate the shown architectural pattern better and allow an in-depth analysis. Furthermore, a virtual slide showing a papillary urothelial carcinoma of the bladder is provided. In this way, learners familiarize with the microscopic examination of a real tissue specimen, which is a cornerstone in pathology. Glossary and resources are provided; for each chapter-specific medical term, a definition is provided in the glossary page. Resources, through links to the reference page and web links, are available for further study.

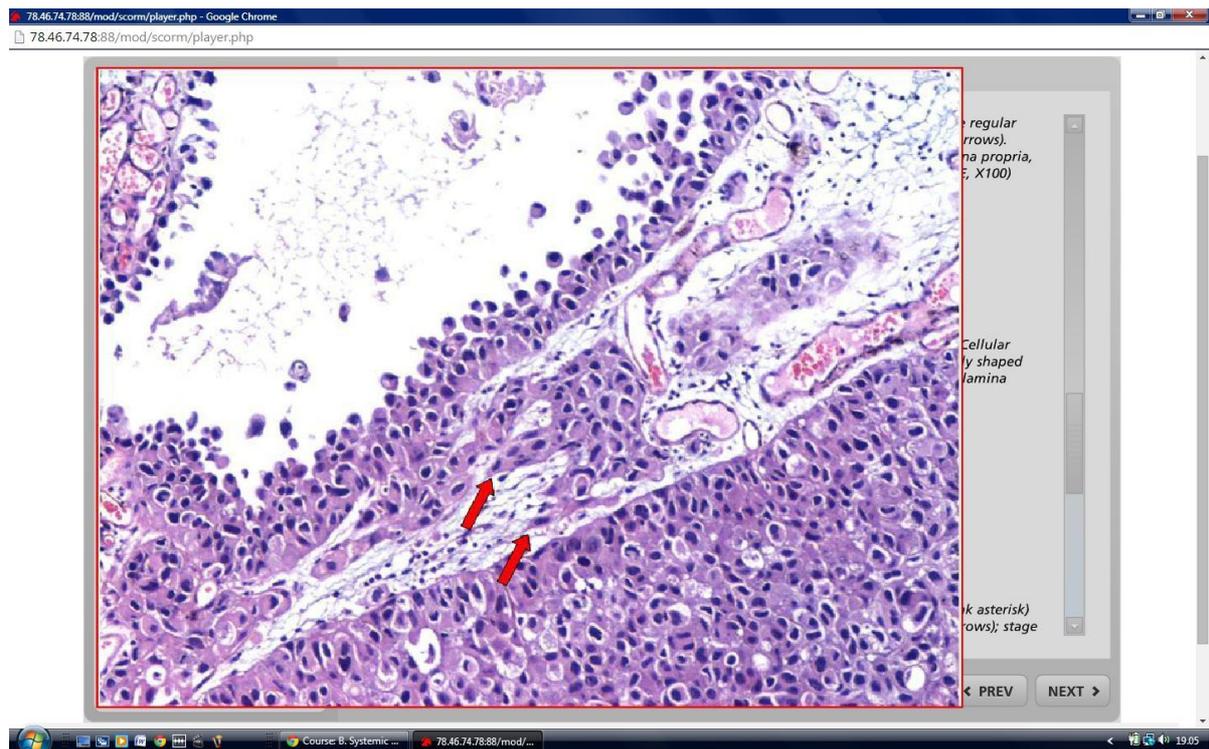


Figure 4. The enlarged version of one of the HIPON urinary bladder images shown in the previous figure. Note the markings (i.e. red arrows) which help users focus on significant morphologic features.

The case study section which follows, asks users to act as expert pathologists, reproducing step by step the diagnostic process, from the case initial presentation up to the final diagnosis. A real case is presented. Several images taken from a real biopsy of a mass located on the bladder posterior wall are provided; the high resolution images, which are always enlargeable, are supported by expert pathologists' relevant comments, bearing the proper analysis. The aim is to underline patterns which users should focus on in order to form their diagnosis. In real life, the diagnostic process is a complex procedure, that often requires additional information in support of the specimen's microscopic examination, so as to achieve the correct diagnosis. Through the platform, users improve their skills of correlating pathological data with other clinical-laboratory information. The additional information can be optionally chosen among five fields i.e., immunohistochemistry, histochemistry, further laboratory data, more detailed patient history and imaging. Some of them may not be necessary to reach the final diagnosis, as happens in this chapter with regard to the "more detailed patient history" field. Users should select the data that they consider to be of essential diagnostic value. For example, by clicking "immunohistochemistry" the staining of the marker Cytokeratin 20, which is indeed needed to confirm the diagnosis of dysplasia in the tumor-adjacent urothelium, becomes available (Figure 5). After that, users are supposed to have formed their diagnosis, so they are asked to select among four alternatives. Thereafter, in case of either right or wrong diagnosis, an educative explanation follows. In this way learners may confirm their own right diagnostic thought or understand why they were wrong. In the explanation section, the meaning of every previously presented image and data, as well as their

correlation to the final diagnosis, are clarified. Soon after, basic guidelines on differential diagnosis point out why the other diagnostic alternatives are excluded. Furthermore, some practical tips on the correct diagnostic procedure of urothelial neoplasms are provided. As in the overview section, relevant resources and web links are available so that the acquired knowledge is consolidated.

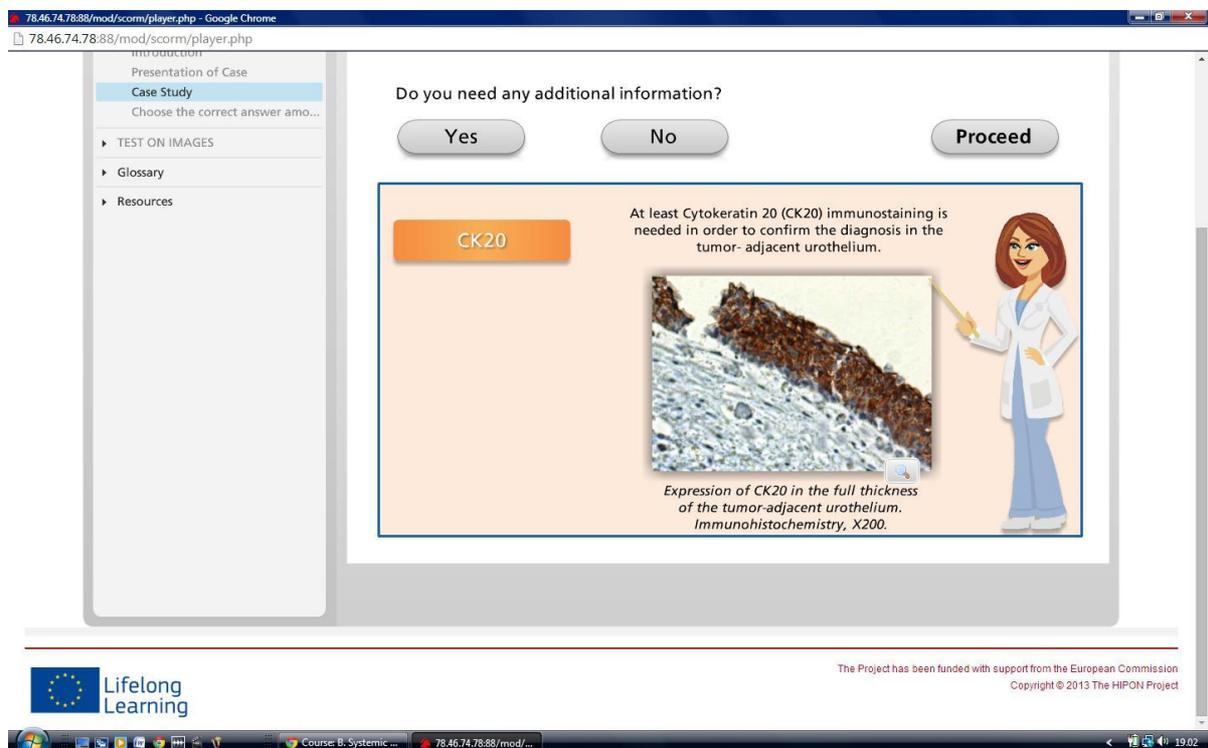


Figure 5. The “immunohistochemistry” additional information field in the case study of the “Urinary Bladder” HIPON chapter.

In the concluding image-based test section, the degree of consolidation of the users’ diagnostic experience can be estimated. Further, high resolution enlargeable images are provided accompanied by relevant questions. Users should recognize any specific pattern of injury shown in each image on their own and evaluate its significance, so as to answer the relevant question. The correct answer to the questions is revealed in the test review which becomes available after the whole test has been taken.

Conclusion

By doing all this, HIPON provides an innovative platform which imprints medical experience in diagnostic practical issues of histopathology in order to assist learners gain practical insight of the theoretical background they are traditionally thought. Through the educational aspects provided by HIPON platform, users familiarize with the diagnostic process and become highly knowledgeable about using all their acquired knowledge in order to achieve the correct diagnosis; in other words, users will learn authentically how to think as experienced pathologists.

References

- [1] Gigante G. Social Media Technologies in Distance Learning: New Capabilities for Future Higher Education. In Conference Proceedings. New perspectives in science education. Italy, libreriauniversitaria.it, 2014
- [2] Girish C. Future Education: Changing Paradigms. In Conference Proceedings. The Future of Education. Italy, libreriauniversitaria.it, 2014
- [3] Kim S et al. Smart learning services based on smart cloud computing. Sensors 2011; 11(8):7835-50