

# Telepathology: national network and regional experiences in Italy

Antonino Carbone\*, Placido Bramanti\*\*, Andrea Stoppini\*\*\*,  
Marco Pagani\*\*\*, ,

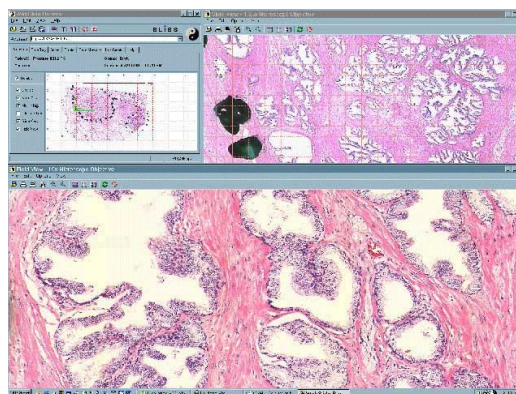
*\*IRCCS Centro di Riferimento Oncologico  
Via Franco Gallini, 2 - 33081 Aviano (PN)  
e-mail: acarbone@cro.it*

*\*\*IRCCS Centro Neurolesi "Bonino Pulejo"  
Via Provinciale Palermo, contrada Casazza, 98124 Messina (ME)  
e-mail: bramanti@irccsneurolesiboninopulejo.it*

*\*\*\*Consorzio di Bioingegneria e Informatica Medica - CBIM  
Piazzale Volontari del Sangue 2, 27100 Pavia (PV)  
e-mail: m.pagani@cbim.it  
e-mail: [a.stoppini@cbim.it](mailto:a.stoppini@cbim.it)*

*Telepathology technology allows to share histological images between different remote sites using either a monitor or a microscope.*

*With the latest technique of telepathology which is Whole Slide Imaging (WSI), images teleconsultation can be used for diagnostic aims (consensus meeting and cooperative distributed case handling) as well as for educational and training (distance medical education). The next image shows an example of histological image.*



## **1.Introduction**

Telepathology is a form of communication that includes the transmission of pathology images and associated clinical information for the purpose of various clinical applications including but not limited to primary diagnoses, rapid cytology, intraoperative and second opinion consultations and quality activities. Telepathology may be successfully used to expand access to specialized services (e.g. immunohistochemistry, fluorescence in situ hybridization,etc.) not otherwise available on a cost-effective basis in a given location.

## **2. The Teseo Network**

**Alleanza Contro il Cancro** association, that encompasses the high specialised Italian Cancer Excellence Centers, promoted since 2002 TESEO project to disseminate, at National Level, telepathology services, providing network interconnection between different Departments of Pathological Anatomy in Italy.

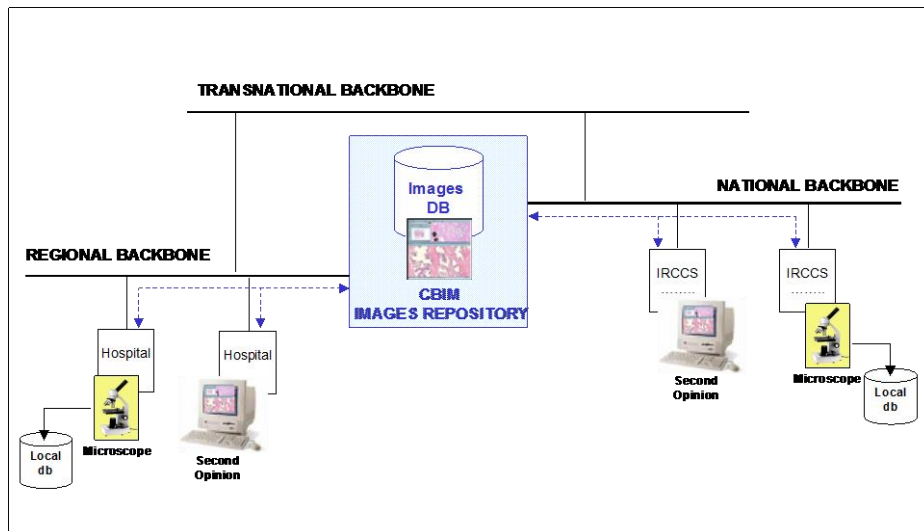
TESEO project is based on the whole slide imaging (virtual Microscopy) Technology. Virtual Microscopy is the technique of digitizing a glass microscope slide with any commonly used objective magnification producing a digital virtual microscope slide with diagnostic image quality. Once the microscope slide is digitized, it can be archived, replicated, transferred over networks and displayed from remote sites.

All the ICT activities have been carried out by the **Consorzio di Bioingegneria e Informatica Medica** - CBIM, technological partner of Alleanza Contro il Cancro. CBIM was founded in 1992 by the University of Pavia and some Italian Excellence Centers (IRCCS) to promote and facilitate the emerging ICT technologies diffusion in healthcare area.

### ***Teseo architecture***

From a functional point of view each microscope imaging workstation in Cancer Excellence Center allows to digitize slides and store digital images on the local server. Using a geographic network these images may be uploaded to a central server located in CBIM and stored in a Central Repository, available for consultation by any authorized client.

The upload may be carried out in an asynchronous way, with consequent low bandwidth need.



*Network architecture of Teseo project*

### *Teseo services*

The histological central images database makes available two different kinds of services:

- Clinical activity support
  - Second Opinion services
  - Guideline dissemination
- Teaching & medical training
  - Professional training for Continuous Medical Education (CME);
  - Interactive discussion of clinical cases, in particular for the low-frequency cancers (distributed case handling, cooperative consensus meeting).

The above mentioned services can be used in asynchronous way.

Are also available synchronous communication systems like Chat, Instant messaging, Videoconference.

The project activities were carried out by ACC (Alleanza Contro il Cancro), as scientific coordinator, and CBIM as technological partner

The Scientific Services provided and coordinated by Alleanza Contro il Cancro were:

- Second Opinion expertise
- Authoring of educational contents
- Guidelines dissemination

The technical Services provided and coordinated by CBIM were:

- Histological Images database hosting
- Application Software management
- Images repository
- Second Opinion Web application
- Chat, instant messaging, videoconference
- Learning Management Platform.

### **3. Regional Experiences**

On the basis of Teseo project's activities and goals, many regional experiences of telepathology networks have been carried out.

Some regional governments have promoted the implementation of projects of telepathology in oncology (Regione Sardegna, Regione Calabria, Regione Siciliana), adopting the technology based on virtual microscopy, and contributing to the creation of the National Network of telepathology

In this scenario, the TESEO project of Alleanza Contro il Cancro is the Backbone that ensures national connectivity in oncology network to the Telepathology projects with the regional Backbone.

The regional Telepathology networks primarily allow to manage the following processes:

- *Second Opinion*: sharing cases (Virtual slide) from any location to any other network or the entire network for obtaining diagnostic opinion
- *Consensus agreement*: sharing of cases by more pathologists in order to establish the "grading" of tumors and neoplastic processes.
- *Educational activities*: use of the system for the discussion of tumors of all kinds, and particularly those of low frequency for which the individual experience is low

In the regional pathology networks, the application solution of CBIM, ensures the full interoperability between the software functionalities and different virtual microscope slide scanner systems.

#### ***Regione Sardegna***

The Region of Sardinia, at the end of 2005, has started the project "Progetto Telemedicina Specializzata – Rete di Telepatologia Oncologica (RTP)" by which the Regional government has provided the Microscope Imaging Workstation to the 5 reference Oncology centers - in the towns of Cagliari, Nuoro, Oristano and Sassari. The project was carried out by CBIM (providing the application solution Distributed Cooperative System - DCS) in cooperation with IBM (providing the elaboration infrastructure) and Olympus (providing virtual microscope workstations)

#### ***Regione Calabria***

During 2006, the Calabria Region assigned to CBIM the Project "*ReSTO - Rete di servizi di Telepatologia Oncologica*".

Within this project the CBIM has implemented a web-based system for advanced and innovative communication and image sharing between pathologists at regional and national level.

The "Project was created by CBIM in collaboration with Olympus, Almayiva and Noemalife and is organized in three components:

- Telepatology network
- Onconet system
- Information system for the pathology departments

### ***Regione Siciliana***

As part of regional fundings 2000/2006, in Sicilia Region is starting a regional project for the creation of a regional telepathology network.

The scientific coordination of the project was assigned to the IRCCS "Centro Neurolesi Bonino Pulejo" that is a Excellence Center located in the town of Messina. With the technological partnership of CBIM, the project will link ten reference centers in Sicily where are located the virtual microscope workstations provided by Nikon.

## **4. Conclusions**

The main outcome of telepathology projects is that they have built a national network starting from the existing infrastructure, ensuring the harmonization and integration of national resources with the regional infrastructure. This national research infrastructure, while respecting the principle of subsidiarity with the Regions, may provide to the pathologists and the oncologists an Italian model to export to the European level.

Telepathology induced clinical advantages (access to pathology experts, improved patient care); and operational gains (easier to move images, encouraged consultation); and also promoted collaboration (multi-site research, repositories & education).

Guidelines will help with quality, validation & training, address regulatory, legal & privacy issues. They also will encourage widespread telepathology, standardize telepathology practice and promote safer telepathology practice.

## **5. References**

Romero Lauro G, Cable W, Lesniak A, Tseytlin E, McHugh J, Parwani A, Pantanowitz L. Digital pathology consultations-a new era in digital imaging, challenges and practical applications. J Digit Imaging. 2013 Aug;26(4):668-77.