



The Leica TPS 1 telepathology system

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The TPS concept

The Leica TPS 1 telepathology system is designed to cover the two key areas of telepathology, i.e.

1. obtaining a second opinion and
2. providing hospitals without pathology facilities with frozen section diagnosis.

1. Due to the high degree of specialisation in the field of pathology it is becoming more and more important to obtain a second opinion from a colleague who has particular expertise in a special field. For small and medium-sized institutions with only one or few in-house pathologists, this is a major problem which can be solved by the introduction of telepathology. Even in larger establishments, pathologists of-

ten confirm their own diagnosis by asking the advice of an expert, e.g. in a tumour register.

Before now, getting a second opinion has involved sending the specimen to a colleague on specimen slides or as a paraffin block. Quite apart from the extra work caused by packaging and the cost of transport, the time taken to mail the specimen often delayed the diagnosis by several days – valuable therapy time.

2. For hospitals performing cancer operations with no pathology department of their own, the technique of telepathology offers the possibility of high-quality intraoperative rapid section diagnosis. A particular advantage is the direct dialogue between surgeon and pathologist.



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With its TPS 1 Telepathology System, designed in collaboration with the Pathological Institute and the Dept. of Prenatal Diagnosis and Therapy of the Charité hospital, Berlin, Leica offers a professional solution for both requirements. It provides the optimal telepathological platform for connecting two pathologists with the aim of obtaining a second opinion. It is a time-saving method involving the transmission of electronic images supplemented by the clinical patient data customary in pathology.

For frozen section diagnosis, the Leica TPS 1 has a microscope/macroscope remote control facility which allows the diagnosing pathologist to

- macroscopically cut the sample to size in coordination with the operating surgeon (direct static and dynamic transmission of macroscope image)
- create histological overviews (e.g. an overall view of the specimen for orientation purposes)

- select any image area directly
- to adjust the movement of the specimen stage, select the magnification and the focus by remote control in a similar way to familiar conventional microscopy.

To enable the TPS 1 to be used on a routine basis, the following facilities have been implemented:

- The TPS 1 allows the transmission of patient-related case data (previous diagnosis, results of preliminary examinations, clinical data),
- The setup of a patient-related case database in which all images and diagnoses relevant to the particular case as well as the sequence of the telepathology session(s) are stored provides documentation of the course and contents of the telediagnostic process.



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- An integrated video and audio conference between the two partners encourages effective communication.

Workflow TPS 1

The workflows in consultation mode (second opinion) and in frozen section diagnosis mode are intrinsically different.

Second opinion

First, the pathologist requiring a second opinion sets up a new TP case (TP telepathology) on his TPS 1 screen by keying in the name of the patient, date of birth and registration number. The TP numbers are given clearly parallel to the usual registration numbers. The information is completed by the input of clinical data, the specific question and the differential diagnosis.

Then the pathologist builds up a connection to the colleague he wants to consult

and transmits the entire case electronically to his colleague's computer, using the telepathological enquiry facility, in which the level of consultation and the question are specified (Fig. 1).

The colleague can then view the histological microscope images and assess them to make his diagnosis.

The two pathologists can communicate acoustically (video conference) and draw each other's attention to specific details by moving a special cursor. Both can operate the microscope.

The diagnosis, differential diagnosis and further comments are then communicated to the enquiring pathologist, either in direct dialogue or time-shifted.

Online frozen section

In this case it is a surgeon who asks for information by sending an enquiry and the



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Fig. 1: Leica TPS 1 with remote controllable Leica DM RXA microscope, 3CCD camera, autofocus; server PC with specific hard- and software for image and data communication



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necessary case data to a pathologist. The telepathology session can then begin.

The removed tissue is trimmed by the surgeon in cooperative dialogue with the pathologist, i.e. the pathologist watches the section being cut via a macro camera and discusses details, e.g. cutting the edges, etc. with the surgeon. Cryosectioning and staining are then performed by an MT and the histological section is placed on the microscope stage.

The TPS 1 has been designed to make the telemicroscopy procedure almost identical to conventional microscopy. For example, the pathologist has the possibility of obtaining a first overall view of the specimen, choosing from the following options:

- General view of the specimen slide
- Overviews of specific areas and
- Detailed view in various magnifications

The overviews aid visual orientation within the entire specimen (see Fig. 2) and are an innovative, user-friendly telepathology tool. There is no restriction of the field of view which can be quite disturbing in conventional microscopy – electronically the whole specimen slide can be displayed in one image consisting of $n * m$ single images. From the overviews, the size and position (x/y coordinates) of the image area can be selected by mouse. Then the pathologist uses the conventional controls (selection of objective magnification, direction arrows for stage movement, autofocus, image intensity, etc). The diagnosis can either be given orally during the telepathology session or communicated in written form.

More elements of the Leica TPS

Other ergonomic features of the TPS 1 include:

- Integrated videoconferencing facility for direct discussion of the case



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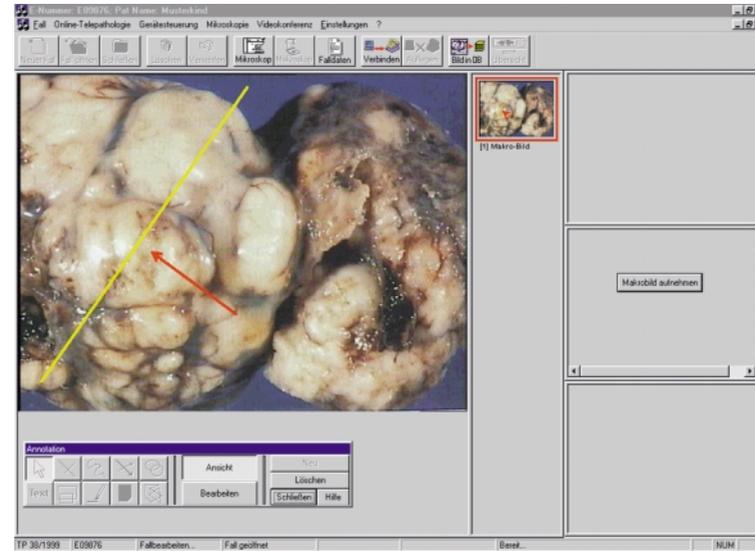


Fig. 2: Micro and macro images can be annotated with graphics to facilitate communication

- Use of discussion mode (cursor pointer)
 - Use of the case and image database as a reference case archive
 - Marking of important specimen details (annotation mode)
 - Display of microscope and macro images in separate picture galleries
- Each recorded image can be annotated if necessary and filed in the image archive. All stored images can be displayed in a picture gallery and are automatically labelled with the corresponding objective magnification.



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During discussion of the image contents, the cursor can be used alternately by both partners to mark important details. The cursor can only be moved by one partner at a time – when one partner releases it, it can be used by the other. The cursor changes colour to indicate the mode which is in.

The macroscope and microscope images are displayed in separate galleries. Comments can be made and details pointed out at any time. The microscope images are displayed together with the objective magnifications used.

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