Telepathology

Development of Telepathology in Europe – in commemoration of Professor Etienne Martin, MD

Klaus Kayser

Charite - Berlin, Germany

http://orcid.org/0000-0001-5076-3936

Abstract

Implementation of telepathology in Europe started in the late 1980's and was actively promoted by an international European team of well - known pathologists. They formed a group of innovative colleagues, informed each other of their research goals and organized a series of European Telepathology Scientific Conferences which lasts until today.

In their early days the main interest focussed on remote and straight forward frozen section services followed by consultation activities, and less often by image quantification and analysis. Now-a-days most members of the original group are retired, others have passed away.

Therefore, it seems appropriate to retrospectively analyse some early activities of telecommunication in pathology, to validate the results and specific conditions, and to commemorate the involved actors.

One of the main players was Professor Etienne David Martin, Paris, who passed away recently. Herein, we describe the predominant incidents, factors and actions of the pathologists who implemented and directed the present stage of telepathology, including image analysis and diagnosis assistance.

Keywords:

Telepathology; tissue – based diagnosis; digital pathology; artificial intelligence.

Introduction

Telepathology or telecommunication in surgical pathology has matured to become a worldwide specific section in tissue – based diagnosis (surgical pathology) (1) (2-4).

Today, it includes several extensions such as 'Information Technology in Pathology', 'Image Analysis', 'Laboratory Information Systems', 'Self -Organizing Diagnosis Systems in Pathology (Deep Learning)', 'Automated Diagnosis' and 'Risk Analysis' (5-7). In addition, more advanced fields are arising at the horizon. These discuss 'Ethics of computerized Diagnosis', 'Gold Standards of computerized (automated) Diagnosis', and 'Predictive Autopsy' performance (8).

This surprising and rapid development of innovative new technology in surgical pathology was forged ahead by a small number of colleagues who were either 'technology freaks' or just 'pathologists specialized in different diseases / organs' (9). They were initially viewed with disapproval by an outstanding number of 'conservative' colleagues, who worried about their position and medical reputation (10). These times are gone.

Within less than twenty years telepathology and its related systems became an important part of modern tissue – based diagnosis. The application of digital tools entered nearly all medical specialties, which started at the diagnostic level, entered the therapeutic frame, created a new

medical environment in terms of risk calculations, and, finally, individual – based prediction of life expectation and date of death (1, 8).

One of the pioneers during the childhood of telepathology was, without any doubt, Etienne Daniel Martin, a prominent French pathologist, former head of the Institute of Pathology, Kremlin-Bicetre University Hospital, Paris, France.

Herein, a brief description of his career and impact on telepathology is presented in grateful commemoration of a close friend and a great European colleague.

Brief description of Professor Etienne David Martin's career

Etienne David Martin was born in Le Cateau, France, May 19, 1927. He graduated from high school in 1946, received the medical degree in 1953, the certificate of Anatomy and Pathology in 1957 (Medaille d'Argent), and became the head of the Laboratoire d'Anatomie Pathologique at the Bichat Hospital, Paris. In October 1979 he was elected director of the Surgical Pathology Services at the Antoine Beclere Hospital in Paris. He became a lecturer in pathology at the UFR (Unité de Formation et de Recherche, Diderot University) in 1982, and was entitled 'Professeur Classe exceptionelle' in October 1992.

Professor Etienne David Martin (left) and Professor Klaus Kayser (right) in Paris, 2014.

He was a specialist in gastro-intestinal diseases, and worked on problems of disease classification and standardization, and in image quantification, electronic distribution and consultation (together with P. Dussere and M. Fabre) since 1991.

He was the organizer of the 2nd European Congress on Telepathology, Paris, 1994, co-organizer of the 12th European Congress on Digital Pathology in Paris, 2014, and honorary president of the 5th European Congress on Telepathology in Aurich, Germany, 2000.

He passed away September, 29, 2019.

The beginning of European Telepathology, 1980 – 2010

In 2011, Professor Etienne Martin wrote that 'the eye is the most frequently used organ in medical practice' since ancient times (11).

Obviously, this statement applies especially to pathologists, and related medical fields in our days. The development of microscopy with all its specialties (electron, laser, ultrasound, nuclear resonance or Raman microscopy (spectroscopy) has been substantially promoted by electronic transport of the acquired images. Thus the close interaction between image acquisition and communication technology promoted both, imaging tools and communication networking (12-15).

Acoustic and distinct electronical signals could be electronically transmitted over long distances since the times of Reid (1861) and Bell (1876), still images about 100 years later using analogue telephony with appropriate image transformation (FAX) (10). Convenient electronic image and movie transportation started with the commercial availability of charge coupled devices (CCD) cameras and the contemporary construction of 'high speed, huge memory and large board' computers and screens (16).

Implementation and expansion of the mandatory electronic networks followed. Former analogue components were digitized. The digital signals were transmitted by use of fixed 'real' wires and furthermore by wireless communication tools (9, 10, 13, 15). In contrast to the present situation, reliability of information transfer was not really sufficient, and unforeseen problems such as breaks or line delays were quite common (17).

The early telepathologists

Emergency and 'just on time' medicine strongly influenced the release of ideas and the implementation of telepathology. One of the triggers was a traffic accident which blocked the connecting tunnel between the Logan International Airport and the city of Boston (18-20) . R.O. Weinstein was one of the early telepathologists who noticed the need for innovative solutions and to bridge the interrupted road distance by electronic tools (18-20) . Ivar Nordrum and Tor Eide tested long distances frozen section services at the University of Tromsö and demonstrated the practical advances of the applied technology (telepathology) (21, 22).

Professor Etienne Martin belonged to the group of telepathologists who were interested in trials of 'quantitative' and 'remote control' telepathology including expert consultation and – at its highest level – long distance routine diagnosis. Herein, the successful iPATH project has to be mentioned. It provided the whole routine surgical pathology services of the Salomon Islands for about two years (K. Brauchli, G. Haroske, K. Kayser, KD Kunze, M. Oberholzer) (23-25).

A large group of European telepathologists focussed on the application of internet tools for telepathology and its future (N. Agnantis, JP. Baak, L. Banach, A. Batistatou, G. Brugal, C. Busch, Y. Collan, Z. Danilovic, V. Della Mea, G. Delides, A. Djubur, M. Drlizek, P. Dussere, C. Fatu, A.

Ferrer-Roca, P. Fritz, P. Gombas, L. Gonzalves, P. Hamilton, G. Haroske, P. Hufnagl, J. Klossa, KD Kunze, T. Mairinger, E. Martin, J.P. Mc Gee, G. Miaoulis, R. Montironi, M. Oberholzer, E. Protopapa, S. Seiwerth, P. Schwarzmann, G. Stauch, J. Szymas, P. Van Diest). Their research forms the basis of virtual education and training in pathology in multiple countries (16).

Only few colleagues of that time are still active at present. All of them were representatives of the European share on development of telepathology. Certainly, their efforts belong to the roots of digital pathology and therefore, to the promotors of artificial intelligence (AI) in tissue –based diagnosis.

Personal remarks:

Nature rules with its own basic unavoidable and probably eternal laws. Man has to be amenable to the laws of physics and cannot modify or change them. However, man can detect, recognize and extend, or transfer them according to his needs or wishes.

Telepathologists followed the natural laws, expanded the visible world of diseases and introduced location independent image interpretation.

At present, approximately 40 years after the dawn of telecommunication in pathology some of the pioneers remain in memory of today's colleagues, others left the scenario without notable traces.

Professor Etienne David Martin was one of the telepathology pioneers in Europe. He was an important member and promotor of the European 'faculty of telepathology', and, in addition, he contributed to set up better understanding and practice of medicine beyond the national boundaries. He shared his distinguished knowledge with his European colleagues to the benefit of patients independently of their affiliation, position or birth.

In one of his last letters he wrote to me: 'The activities and meetings we shared over the years have left me with many warm and pleasant memories.'

I am convinced that all my 'contemporary comrades of the European Telepathology era' possess the same remembrance of him. In addition, I want to encourage our 'next generation pathologists' who are engaged in digital pathology or AI in tissue – based diagnosis to take him as an icon in their profession for the benefit of both patients and international collaboration.

His merits in the maturation process of telepathology should be a motivation to the further development of AI in tissue – based diagnosis.

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