Biological application of transmission electron microscopy

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Nowadays, as that could be heard from some audience, we live after the golden era of transmission and scanning electron microscopy in medical use. But the epidemic out-brake of SARS and scientific enforced studies proved that TEM is crucial technique for understanding of mechanisms of genetic rearrangement between two different viruses, and as in the aforementioned example corona and influenza viruses. Well established applications (e.g. freeze-fracturing) used with modern biology knowledge provide abilities for better understanding and proper description of mechanisms taking part in translation of genetic changes into the proteomic level with further e.g. receptor or receptor-like mechanisms of interaction. There is now a huge pressure for use of molecular biology techniques especially genetic-studies oriented. But authors of such statement, omit in their declarations that the changes of the genetic profile or changes of expression of specific biologically-crucial molecules not always lead to functional abnormality. On the other hand there are some diseases in which for the same clinical presentation are responsible different structural abnormalities.

Transmission electron microscopy is nowadays included within group of ancillary techniques used for diagnostic and scientific purposes. It is still a powerful tool in several crucial diagnoses. It is used as standard technique for diagnosis of immotile cilia syndrome (which in some cases could be called Kartagener's syndrome). In some centres is often used in diagnosis of bullous skin diseases. Moreover in many tumours, especially poorly differentiated, TEM still could be used as one of the best method for quick and proper diagnosis. This is especially important at present when a broad panel of monoclonal antibodies are available for diagnosis and scientific studies, but which might give conflicting results. Even routine TEM studies give much deeper insight into morphological background of tumours. The ultrastructural studies revealed that almost all malignant tumours are mixture of cells with multiple differentiations. This of course leads to different respond to therapy and finally leads to revision of tumours classification, which occurs pretty often. At the end TEM is recommended in all kidney biopsies if the patient suffers form glomerulonephritis. Moreover in the rising number of organ recipients well established negative staining protocols could be used for diagnosis of viral infections. In some countries, same is true for centres of bio-terrorism.

Even now, TEM persist an excellent device used in basic biological studies. The level of details available with ultrastructural studies expands further our understanding of biological mechanism that took part in development as well as in artificial experimental environment. The biological mechanism are universal in animal world. That is why, for instance studies on genetic material transport into given embryonic structures done on the animal material could be with some limitation used for understanding of mechanism of ontogenesis. They could be also used for understanding of mechanism of inherited structural abnormalities as not all of them are genetically restricted.

This brief overview of biological application of ultrastructural studies supports the need of development of TEM tool for further medical and biological use.