Review Article

BASJVETRES

BASRAH JOURNAL OF VETERINARY RESEARCH, 2021, 0(02):79-82
Journal homepage: www.basjvet.org

The Medical Applications of Transmission Electron Microscope: Subject Review

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Received: Nov. 20, 2021; Accepted: Dec. 19, 2021; __ Available Online: Dec. 2021

Abstract

Transmission electron microscope TEM is a tool used to visualization intracellular components of certain samples ranging from very little dimension one micrometer up to one nanometer, Therefore, TEM can reveal a tiny detail that can't investigate through the light microscope. The application of TEM in the medical field may help the researchers to analyze the morphological structure of samples obtained from small organisms like bacteria and viruses, as well as study the samples of cellular inclusions on basis of three-dimensional images.

Keywords: Application, Medicine, Transmission electron microscope.

Introduction

Transmission electron microscope also abbreviated as TEM, is regarded as a tool or instrument used to analyze and visualization the samples presented in ranges of dimensions from $1x10^6$ equal to 1 micrometer and up to $1x10^9$ equal to 1 nanometer. TEM can reveal a very complex range of detail that are inaccessible via light microscope (1). In order to know how to TEM properly works, it

can be done an observation of the bacterium cell morphology and the other viruses. the mean diameter of a simple bacteria may range 100 and 200 nm as a smaller bacterium, and nearly up to 7µm for the larger bacterium; it can be investigated vis a light microscope, but regarding the details of the intracellular bacterial structures that necessary to use a TEM because that has the largest dimension may lesser than 0.2µm, therefore a better investigation is done by replacing the light beam with the electron beam, to reach to the wavelength of near to 0.005nm (2). The atoms of TEM appear to be black contrast on the white background, moreover, it shows the white contrast on the black background (3).

The sample preparation of the TEM specimens obligated less than 100 nm in its thickness because the electrons of the beam of TEM should react to the sample effectively therefore the effect may increase strongly related to the squared atomic number, to the high quality of the sample which had a proper thickness that was comparable to the mean electrons pathing in which it travels via the samples, indeed it may be several tens of nm in diameter (5).

The samples of the TEM technique for the biological origin may need to stain of high atomic number for contrast enhancements so that this stain absorbs the elections of the electrons beam that projected towards the imaging system, therefore the heavy metals compound origin like lead, osmium, and uranium as well to the gold wherever used pre to TEM investigation to deposit the electrons heavy atoms in the sample of the cellular and protein region (7).

TEM is optimistic for a range of diverse fields like nanotechnology, life science, medicine, biology, material research, forensics, and other industrials and educational practices. Moreover, TEM provides some solutions to morphological, graphical, crystalline composition and information, therefore, the images assist all the researchers to manage the samples on basis of molecular level, these are making it acceptable to analyze all the patterns regarding the structures and textures, besides

it gives great information to study the crystals as well as the metals, behinds, other parts of industrial uses; so that the TEM always applicate in semiconductor investigation and the propagation of the manufacture of computer and silicon chips that may help used in medical education (8).

The cardinal features of the TEM technique can be summarized according to (9) into:

1. Analysis of the morphological structure of samples obtained from small organisms like bacteria and viruses.
2. Study the samples of cellular inclusions on basis of three-dimensional images.
3. Samples manipulation during observation.
4. X-rays generation to microanalysis.
5. Composition analysis of a particular sample or its atoms state.

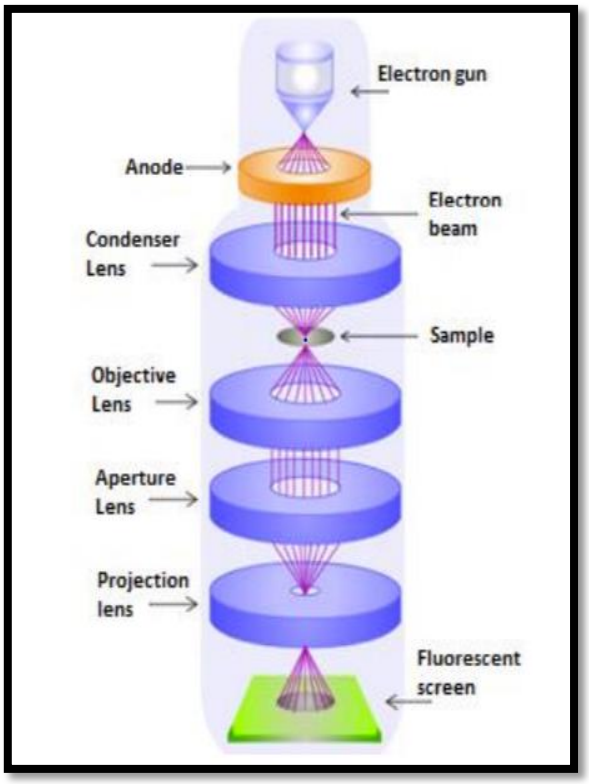

Figure (1): TEM illustration (4).

Conclusions

The TEM regarded an optimistic technique that obtained details to give the researchers and the students a helpful description of the intracellular components that may give them a full solution of the ultrastructural changes related to histopathological analysis and for other related sciences.

References

1. Zehong, W., Wei, W; Zhikang, J. and Dan, Y. (2017). A novel and simple method of printing flexible conductive circuits on PET fabric. *Applied Surface Science*. 396. 208–213 p. 210.

2. Vale, F., Correia, A.; Matos, B.; Moura, J.; Nunes, Y. and Alves, A. (2010). Applications of transmission electron microscopy to virus detection and identification. Center for Environmental and Marine Studies, University of Aveiro, Campus Universitário de Santiago, 3810-193. p 129.

3. Marisol, F. and Consuelo, G. (2002). Técnicas de análisis y caracterización de materiales. Consejo Superior de Investigaciones Científicas. pp. 458-489.

4. Rubén O. (2019). A Simple illustration of transmission electron microscopy. *Research in Nanotechnology, Nanobiochemistry، and Materials Physics*. S.F. pp.2.

5. Fultz, B. and Howe, J. (2007). Transmission Electron Microscopy and Diffractometric of Materials. pp. 540.

6. Phillips. (1961). Diamond knife ultra microtomy of metals and the structure of microtomed sections. *British Journal of Applied Physics*. 12 (10): 554.

7. Alberts, B. (2008). Molecular biology of the cell. Garland Science. (5th ed.). New York.

8. Priyanka, P. and Choudhary, O. (2018). Uses of Transmission Electron Microscope in Microscopy and its Advantages and Disadvantages. *Int.J.Curr.Microbiol.App.Sci.* 7(5): 743-747.

9. Vale, F.; Correia, C.; Matos, B.; Moura, N.; Jose, F. and Matos, A. (2010). Applications of transmission electron microscopy to virus detection and identification. Microscopy: Science, Technology, Applications، and Education. pp. 1-10.

التطبيقات الطبية للمجهر الالكتروني الناقل : مراجعة موضوع

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الخلاصة

المجهر الالكتروني الناقل هو جهاز يستخدم لمشاهدة التراكيب الخلوية الداخلية لعينات علمية محددة وذات احجام متناهية الصغر تتراوح من مايكروليتر واحد الى حدود النانوميتر الواحد، لهذا يعد هذا الجهاز لة القابلية على كشف التفاصيل الخلوية التي لا يمكن ان تكتشف بواسطة المجهر الضوئي. اما التطبيقات الطبية للمجهر الالكتروني الناقل فانة يساعد الباحثين في تحليل التراكيب الشكلية للعينات الماخوذة من الكائنات الحية المتناهية الصغر كالجراثيم والفيروسات، فضلا عن دراسة الجسيمات الداخلية للعينات على مستوى صور ثلاثية الابعاد.

الكلمات المفتاحية: التطبيقات، الطبية، المجهر الالكتروني الناقل.