Redefining Electron Microscopy in tackling Emerging Plagues

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Keywords: diagnostic EM, emerging diseases, virus, microbial pathogens, climate change

With the reality of global climate change as a reality affecting many dimensions of ecology, the emergence of infectious diseases from previously unknown niches have made inroads into human public health priorities. As species cross habitat zones, demographic features of continents change and mass human migration in countries affected by long drawn political unrest and wars begin to disseminate, hitherto unknown agents into newer habitats- plagues of novel dimensions have emerged and will evolve as ecology alters.
The rapid identification of such novel pathogens has been founded on several disciplines of infectious diseases. This includes clinical investigations, detailed epidemiology of the novel syndromes and laboratory investigations. Electron microscopy has been the cornerstone of laboratory investigations for identifying a novel pathogen in many such situations in the last decade. The identifications of Human immunodeficiency virus, the Sin Nombre hantavirus, SARS coronavirus, Chandipura virus and Hepatitis E virus are some classic examples of primarily EM-based identification of pathogens whose etiologic association with clinical diseases were subsequently confirmed by molecular tools and the time-tested postulates of Robert Koch.
Modern transmission electron microscopy platforms are no longer restricted to a cross sectional imaging tool but with integration of modern computers and very high resolution imaging technology, the spectrum of application of TEM in infectious disease research has undergone a phenomenal paradigm shift. Electron tomography can reconstruct almost “true” 3D images of viruses in both negative stained and cryo-systems (1); the immunolabeling methods have stretched from “lock-on” areas to being more ultrastructurally accurate identification of host-virus interplay and diagnostic EM has emerged as a frontline tool in detection and primary characterization of etiologic agents of unknown epidemics (2).
The present talk will outline the strategic role played by TEM in identifying the etiologic agent of several major human epidemics in South Asia over the last three decades from hemorrhagic fevers to hepatitis, unknown encephalitis and avian influenza (3-4). It will further restructure the TEM approach with modern technology to battle the future.

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M.A. Pabst, G. Zellnig (Eds.): MC2009, Vol. 2: Life Sciences,
DOI: 10.3217/978-3-85125-062-6-369, © Verlag der TU Graz 2009

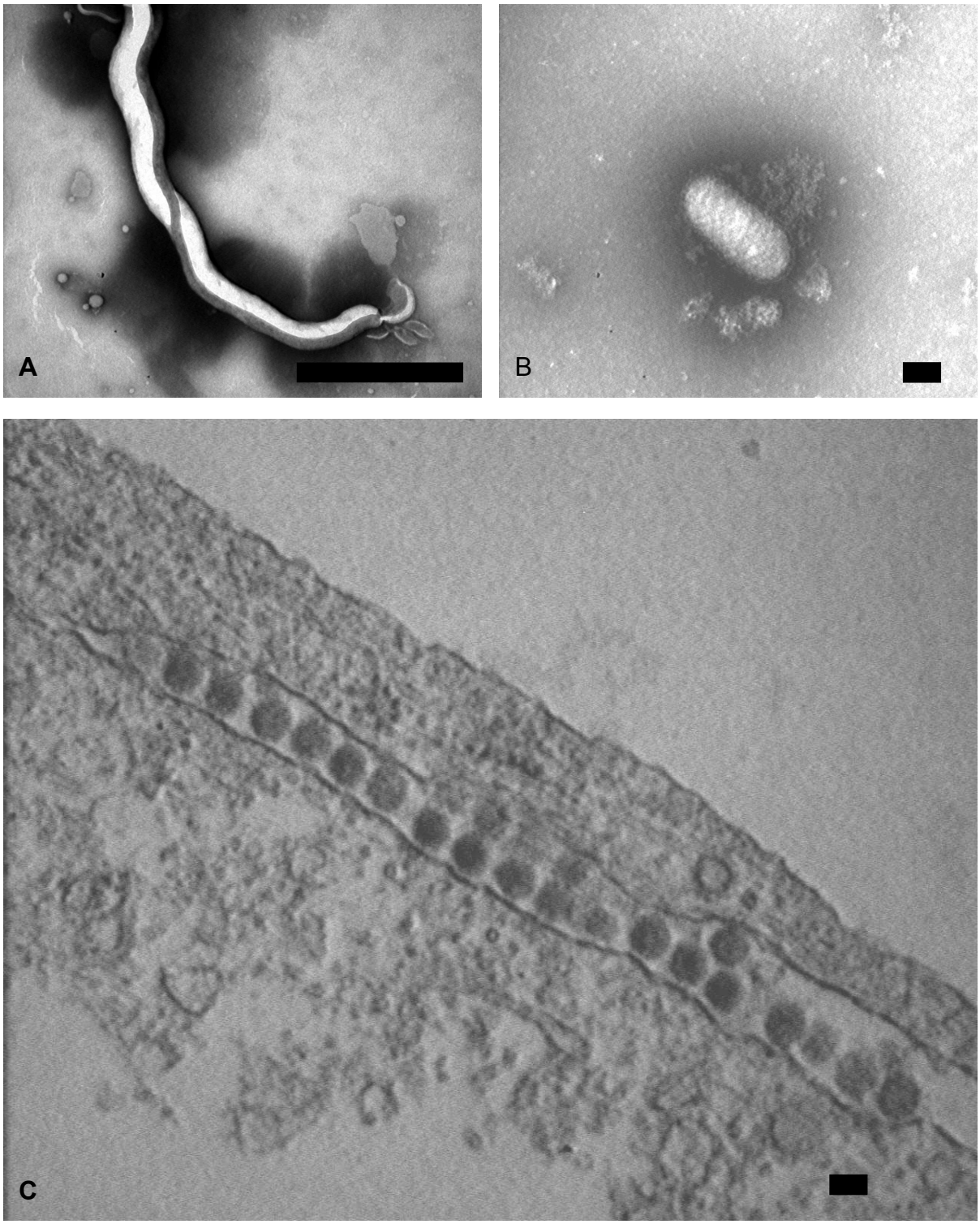

Figure (A) Negative stained rapid imaging of Leptospira in the urine of suspected hemorrhagic fever case. Bar= 0.5 um; (B) Parapoxvirus imaged from lesion of "pock" in milkers hand in a focal outbreak of pox disease. Bar= 100 nm; (C) Ultrathin section of the Chittoor virus, a novel Bunyavirus isolated from mosquitoes in India. Bar = 50 nm

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