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INFECTIOUS MICROBE IDENTIFICATION VIA MICROSCOPY OF SPECIMENS FROM DELIBERATELY AND NON-DELIBERATELY CAUSED DISEASE

C.D. Humphrey

Infectious Disease Pathology Activity, Div. of Viral & Rickettsial Diseases, CDC, Atlanta GA 30333

An infectious disease outbreak investigation is initiated upon notification of an unusual increase of local or widespread illness within a community. The need for a laboratory investigation may result from either a typical outbreak, in which a non-deliberately introduced infectious agent is the cause (Fig. 1), or when disease is caused directly or secondarily by an individual's lifestyle (Fig. 2). Emerging diseases have been another source of disease outbreaks in recent years (Figs. 3-4), as has deliberate dispersion of infectious and noxious substances that may directly harm people as well as harm or contaminate domestic animals, wildlife (Figs. 5-7), or plants important to human health. The means for responding to such criminal activity began to receive enormous attention after the September 11, 2001 terrorism attack in New York City (NYC), and the deliberate anthrax disseminations that occurred in Florida, Washington, DC, and NYC shortly thereafter.

A list of "select agents" considered as potential bioterrorism (BT) agents has been prepared by the "Public Health Emergency Preparedness & Response" initiative [1-2]. The list includes biologic agents that are frequently and rarely encountered by public health and infectious disease specialists. In addition to enhancing our technologies for rapidly identifying select agents, we also must be prepared to identify non select agents that could cause harm to humans or to animals and plants upon which human life may depend. Since a select list has been developed and well-publicized it is possible that someone interested in causing harm to others could use a disease agent either not emphasized on the list or currently receiving public health or military focus. Dissemination of an unanticipated agent would hinder our ability to detect the putative agent by the typical highly specific identification technologies. Another consideration is that recombinant technologies in the future may permit the artificial production of harmful agents [3] or substances that many diagnostic and recognition regimes will have limited capability to quickly identify or monitor (Fig. 8).

Microscopy, in its varied forms, embraces both high precision and selectivity and permits one to see the unanticipated. The experienced electron microscopist can identify any class of agent that has been previously described and can recognize novel morphologic entities that may not have been categorized [4]. Microscopy should continue to be used for identifying routinely and uncommonly encountered disease agents, emerging disease agents, and agents resulting from BT activities.

References:

[1] Medical Management of Biological Casualties Handbook, USAMRID, CDC, FDA, Public Health Training Network, from a satellite course, September, 1999.
[2] Centers for Disease Control and Prevention. Public Health Emergency Preparedness and Response. Available at URL: http://www.bt.cdc.gov/
[3] S.M. Block, *Science* 290 (2002) 769.
[4] H.R. Gelderblom and P.R. Hazelton, *Emerging Infectious Diseases* 6 (2000) 434.

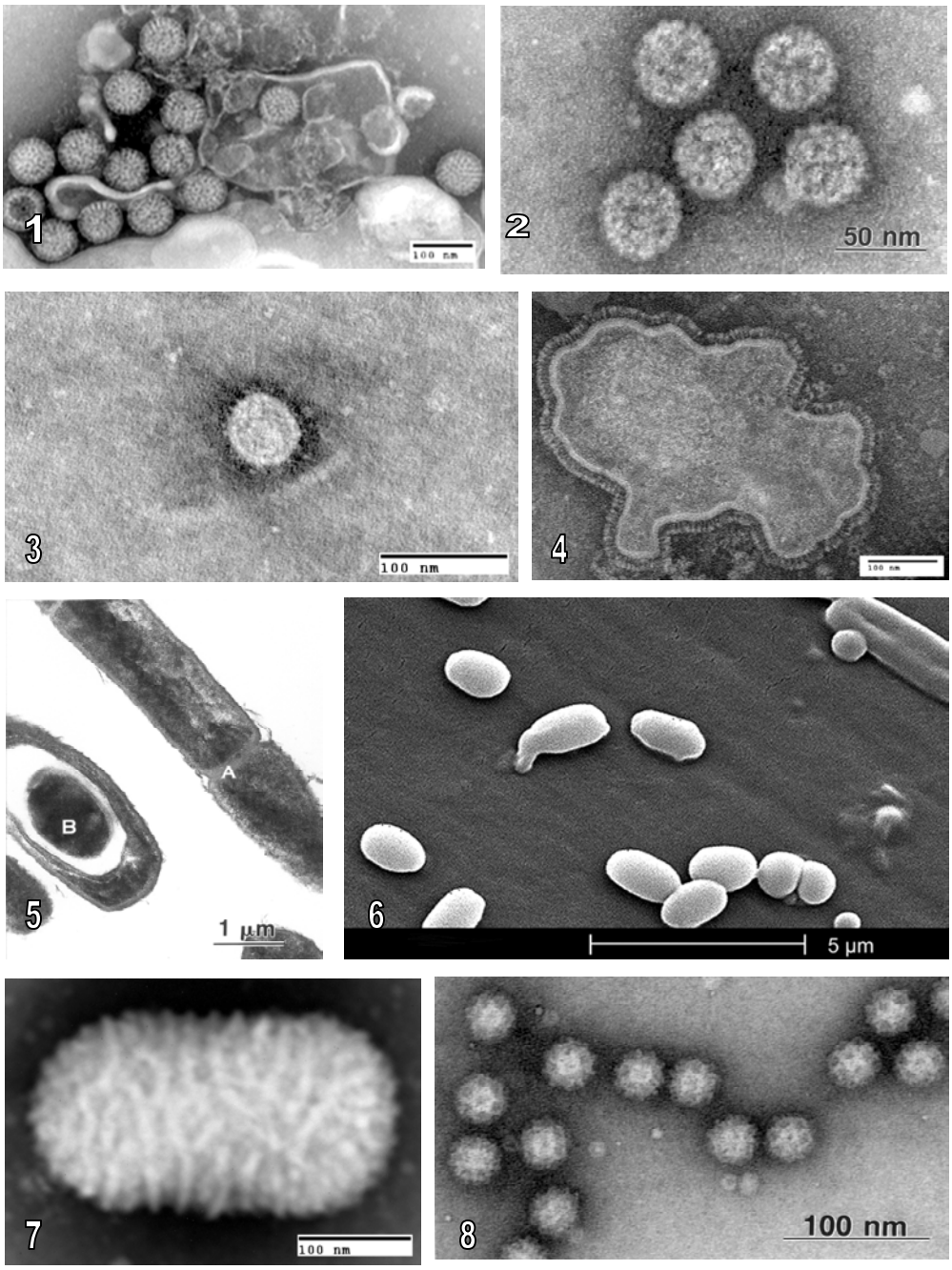

Figure legends: Figure bar markers represents 100 nm unless specified otherwise.
FIG. 1. Negative stain electron micrograph (EM) of rotavirus; 2% phosphotungstic acid (PTA).
FIG. 2 .Negative stain EM of unknown polyomavirus; PTA.
FIG. 3. Negative stain EM of West Nile virus; a flavivirus; PTA.
FIG. 4. Negative stain EM of human metapneumovirus; a new paramyxovirus; PTA.
FIG. 5. Transmission EM of anthrax bact.(A); spore (B); micrograph by Elizabeth White, CDC.
FIG. 6. Scanning EM of anthrax bacterial spores; micrograph by Janice Carr, CDC.
FIG. 7. Negative stain EM of ORF virus, a pox virus; PTA.
FIG. 8. Negative stain EM of norovirus recombinant capsids; PTA.

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