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PRELIMINARY REPORT

ABERRANT FORMS OF VARICELLA-ZOSTER VIRUS

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In tissue culture varicella-zoster (V-Z) virus is strongly cell-associated. An extremely small amount of infectious virus is released into the culture fluid and the cytopathic effect progresses slowly by peripheral spread from cell to cell. On the other hand cell-free virus obtained from vesicular fluids of varicella or zoster patients is infectious.

Some information on the mechanism of cell association of the virus in vitro has been obtained by electron microscopic studies on infected cells by various investigators. Cook and Stevens (1968) found that extracellular viruses were pleomorphic and had incomplete coats. They suggested that the envelopes and capsids, which they called collectively the "coat", were degraded outside the nucleus and this labile coat was the principal reason for the lack of cell-free infectious virus. Synthesis of faulty coat proteins in infected cells may be the cause of such a labile coat, or the cell may contain enzymes that specifically attack V-Z virus coats. In relation to the latter possibility Gershon, Cosio and Brunell (1973) stressed the role of lysosomal enzymes and postulated that the presence of lysosomal enzymes and V-Z virus in the same cytoplasmic vacuoles may result in inactivation of V-Z virus during its egress from the nucleus to the outside of the cell. This might account for the cell-associated nature of this virus.

Cook and Stevens, however, thought that the virus obtains its envelope from the inner nuclear membrane but not from any cytoplasmic structures (Cook and Stevens, 1970). Consequently they considered that aberrant forms of the virus were produced only by the cytoplasmic and extracellular degradation of the virus. Electron microscopic observations on V-Z virus-infected VERO cells have given evidence of another more probable mechanism of appearance of aberrant forms of the virus. The present paper is on the latter findings.

In the present study, the same embedded specimens of V-Z virus-infected VERO cells were used as in earlier investigations (Nii, 1971b). Other procedures for electron microscopy were similar to those described previously (Nii and Ono, 1971). Fig. 1 shows numerous particles present extracellularly as well as in the cytoplasmic vacuoles. As reported previously (Cook and Stevens, 1968; Gershon et al., 1973), pleomorphism of V-Z virus is evident and various aberrant forms can be seen.

The process of envelopment of the virus was observed at the inner nuclear membrane and also in the cytoplasmic area (Nii, 1971a), and capsids enclosing an electron-dense core were frequently seen in the cytoplasm, although pictures of these are not illustrated here.

Occasionally peculiar sites were detected in the cytoplasm with accumulations of electron-dense masses, reduplicated membranous structures and dense bodies of variable sizes. Fig. 2 shows one of these sites in the cytoplasm. A duplicated membranous structure, indicated by an arrow seems to be in the process of formation of a so-called aberrant form of V-Z virus and the inner membrane encloses some electron-dense material which delineates two vacant areas inside of the membranous structure. No viral capsids are seen in this figure but they were occasionally seen in such sites. The dense bodies observed here resemble the particles seen in Fig. 1. Fig. 3 illustrates two duplicating membranous structures. Duplication of the left one seems to be almost complete. Presumably complete encircling of the inner membrane of the structures would result in formation of a so-called aberrant form of V-Z virus while the outer counterpart would become a vacuolar membrane enclosing the inner one.

The data presented here strongly suggest that electron-dense bodies and aberrant forms of V-Z virus are produced in the cytoplasmic area. Moreover, budding of these particles and of viral capsids in the cytoplasm seem to take place by essentially the same mechanism. This new hypothesis on the formation of aberrant forms of V-Z virus by no means contradicts the idea that the coats of V-Z virus are incomplete and fragile.

Formation of dense bodies in the cytoplasm

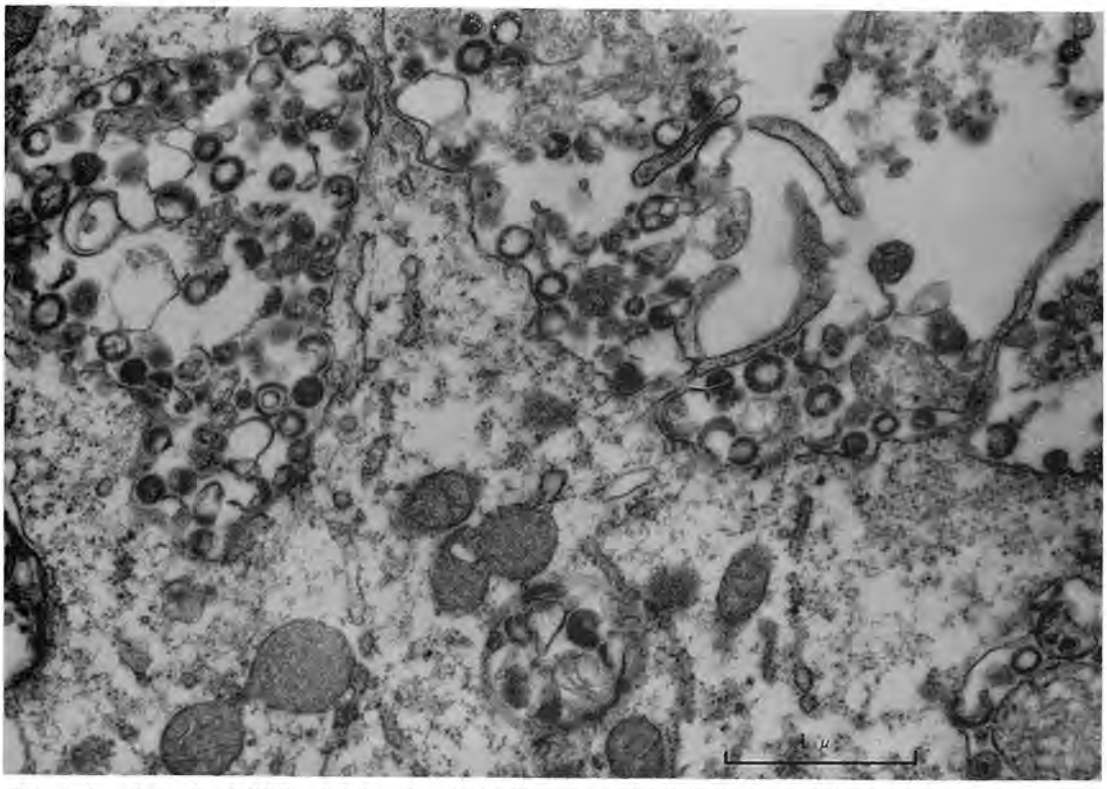


FIGURE 1. *Part of a VERO cell infected with the Marumo strain of V-Z virus. The many virus particles seen extracellularly and in cytoplasmic vacuoles exhibit considerable pleomorphism. Most particles are devoid of a capsid or core and instead the inside of these envelopes is lined with electron-dense material. Some particles show breakage of envelopes and a few have an envelope and a capsid with or without an electron-dense core.*

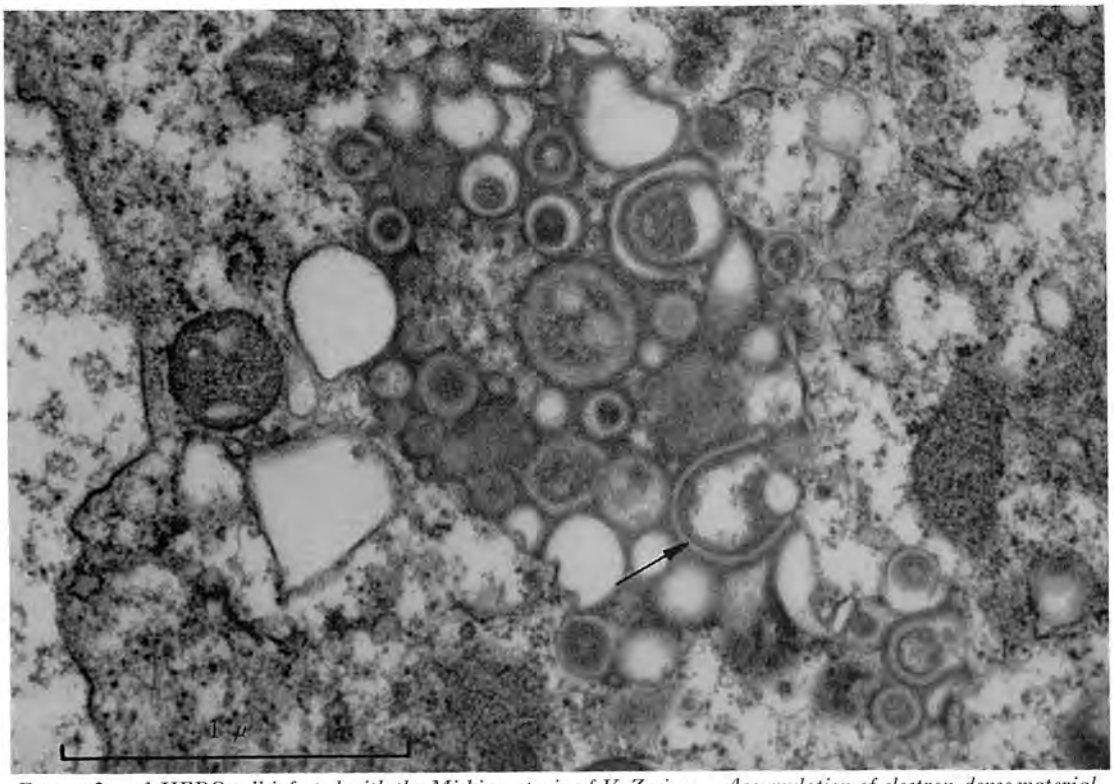


FIGURE 2. *A VERO cell infected with the Mishima strain of V-Z virus. Accumulation of electron-dense material, electron-dense bodies and duplication of membranous structures are seen in part of the cytoplasm. The arrow indicates duplication of a membranous structure which perhaps shows the process of formation of a so-called aberrant from of V-Z virus.*

of infected cells is not peculiar to V-Z virus. Recently Craighead, Kanich and Almeida (1972) investigated the morphogenesis of dense bodies produced in the cytoplasm of cells infected with cytomegalovirus and the same phenomenon was also reported by us with a herpesvirus of turkeys (Nii, Katsume and Ono, 1973). Further detailed studies on the aberrant form of V-Z virus will be published elsewhere.

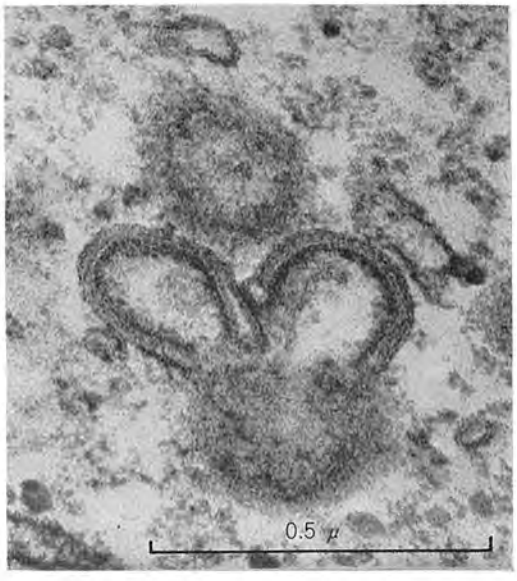


FIGURE 3. *Two duplicated membranous structures found in the cytoplasm of a VERO cell infected with the Marumo strain of V-Z virus. The structures are thought to be related to the process of formation of aberrant forms of V-Z virus.*

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