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THE STRUCTURE OF REOVIRUS

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A thesis submitted for the  
degree of Doctor of Philosophy  
at the University of Auckland.

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## ABSTRACT

The arrangement of the capsomers comprising the outer shell or capsid of reovirus has been determined by the computer modelling of images of reovirus replicas prepared by freeze-etching techniques. An optical low-pass spatial filter was used to improve the visibility of the virus images and two types of capsid subunit could then be seen which were termed ring and pentamer-crater capsomers. Sufficient of them could be identified on reovirus particles to make the computer modelling of the particle possible. The capsid was shown by these methods to have  $T=13,1$  triangulated icosahedral symmetry. It is comprised of 60 ring capsomers and 12 pentamer craters surrounded by another 60 incomplete ring capsomers.

The same  $T=13,1$  symmetry was found for the single-shelled particles of the two rotaviruses, SA-11 and NCDV, which have 132 uniform capsomers. However, fragments of reovirus capsids, such as are sometimes seen in negatively stained reovirus preparations, were found which had non- $T=13,1$  symmetry, presumably as a result of capsomer rearrangement. The dimensions of a large number of the triangular subunits of these capsid fragments were measured and it was shown that triangles originating from different parts of the reovirus capsid had non-identical lengths. The lengths found were consistent with the  $T=13,1$  model proposed for the virus.

Conditions favouring the formation of crystalline aggregates of reovirus core particles have been found. The unit cell geometry of the two classes of crystals obtained was determined.

## ABBREVIATIONS

• Å	Angstrom $10^{-10}$ m, 0.1 nanometre
CPV	Cytoplasmic polyhedrosis virus
dsRNA	Double stranded ribonucleic acid
ds-rotavirus	Double shelled rotavirus
EHT	Electron microscope accelerating voltage
HP	Hewlett Packard
kV	Kilovolt
K	One thousand Daltons
mRNA	Messenger ribonucleic acid
N-terminal	Amino terminal
NCDV	Nebraska calf diarrhoea virus
PAGE	Polyacrylamide gel electrophoresis
poly-A	Poly riboadenylic acid
RNA	Ribonucleic acid
SA-11	Simian rotavirus 11
SDS-PAGE	Sodium dodecyl sulphate polyacrylamide gel Electrophoresis
SSC	Standard saline citrate buffer (0.15M NaCl, 0.015M sodium citrate pH7)
ssRNA	Single stranded ribonucleic acid
ss-rotavirus	Single shell rotavirus
SVP	Reovirus sub-viral particle
T	Triangulation number
TBSV	Tomato bushy stunt virus
TMV	Tobacco mosaic virus
TYMV	Turnip yellow mosaic virus