The tobamoviruses are one of the best known and most fully reviewed
groups of plant viruses (Gibbs, 1977; Shikata, 1977; Van Regenmortel,
1981); nevertheless, another review of their classification is justified by
the increasing flood of molecular sequence data which is providing new
insights into their classification and, possibly, into their evolution.

Early attempts to classify and name plant viruses by their host and
symptoms were unsatisfactory (McKinney, 1944). However, the practice,
advocated by Bawden (1941), of grouping plant viruses on characters such
as the morphology, chemical composition, and serological specificity of
their particles, and on their cross-protection behavior, soon resulted in a
stable and useful classification. The most widely used criteria were ser­
ological tests, pioneered by Chester (1937), and cross-protection tests
(McKinney, 1929; Salaman, 1933; Thung, 1931). They established the
tobamoviruses as a discrete group of which there are now more than a
dozen definitive members (Matthews, 1982). These share the following
characteristics:

Infective particles are straight tubes with a modal length, for most
members, of about $300 \times 18 \text{ nm}$ and a sedimentation coefficient of around
190 S. Each particle is constructed of ca. 2000 protein subunits of a single
protein species (relative molecular weight 1.8K) arranged as a helix (pitch
ca. 2.3 nm) enclosing the genome, which is a single molecule of single­
stranded RNA (relative molecular weight ca. 2000K, ca. 5% of the particle
weight). This RNA has a 5' methyl guanosine terminal "cap," and an
amino acid accepting ability at the 3'-terminus. It codes for at least four
proteins including the coat protein, which is translated from a subgen­
omic mRNA. Infectivity in sap survives heating to 90°C and storage for
many years. Particles occur in sap at concentrations up to 10 g/liter.
Most tobamoviruses occur naturally in one or a few angiosperm species, but may be transmitted experimentally to a very wide range of such species, and cause mottles and mosaics. They are transmitted in nature by contact between plants or from contaminated soil, and are sometimes carried on seed, but no efficient and specific vectors are known. They are readily transmitted by sap inoculation. Tobamovirus particles are found in the cytoplasm, and sometimes the chloroplasts, of cells of all tissues (except perhaps embryos) where they may form elongated (paracrystalline) or plate-shaped (crystalline) inclusions, or, together with various cell constituents, they may form amorphous inclusions.

There are other viruses that share some of these properties and these are reviewed elsewhere in this volume. Closest perhaps is the *Chara australis* virus, originally incorrectly called *Chara corallina* virus. This differs most notably from other tobamoviruses in having particles with a modal length of 532 nm and an algal host, but no known angiosperm host.

More distant are several viruses with fungal vectors and particles of two or more modal lengths, some of which are now grouped together as the furoviruses.

I. RELATIONSHIPS AMONG THE DEFINITIVE TOBAMOVIRUSES

Many different characters are available for assessing the relatedness of the definitive tobamoviruses; however, I shall concentrate primarily on the available molecular information, particularly sequences, as such data have been found to be very useful for assessing relationships of organisms. I will then attempt to correlate the relationships indicated by such data with those indicated by other criteria.

A. Coat Protein

1. Amino Acid Composition

   Early analyses of the amino acid composition of tobamovirus particles showed that they had a specific composition, which differed between isolates. The relatedness of different tobamoviruses indicated by these data correlated with that indicated by other criteria, and clearly distinguished them from other viruses (Hennig and Wittmann, 1972; Knight, 1964; Siegel and Wildman, 1954; Tremaine and Argyle, 1970; Tsugita and Fraenkel-Conrat, 1960, 1962; Van Regenmortel, 1967; Wittmann, 1960).

   Tsugita (1962) was the first to propose a classification of tobamovirus