F

F factor. *See* F PLASMID.

F plasmids. Conjugative plasmids (mw. 63 x 10^6) which determine F+ and F– mating type in *Escherichia coli* and other enterobacteria (e.g. *Shigella, Proteus, Salmonella*) and mediate transfer of chromosomal genes between these bacteria. Code for sex pili (F pili); hollow tubes which protrude up to 20 μm from the cell. Cells containing the plasmid are denoted F+ (male). Members of the LEVIVIRUS group (e.g. MS2 PHAGE) and some INOVIRUSES (e.g. fd PHAGE) are specific for enterobacteria as they adsorb exclusively to the F PILUS.
Hardy, K. (1986) Bacterial Plasmids. 2nd. ed. Thomas Nelson: Walton-upon- Thames.
Fiers, W. (1977) **In** Comprehensive Virology. Vol. 13. p. 69. ed. H. Fraenkel-Conrat and R.R. Wagner. Plenum Press: New York.

Fab fragment. The antigen-binding fragment of IMMUNOGLOBULIN.

Fabavirus group. (Latin 'faba' = bean, after type member, BROAD BEAN WILT VIRUS GROUP, serotype 1). Genus containing viruses which resemble COMOVIRUSES in the structure and composition of the virus particles but differ in cytopathology (crystals and tubular arrays of virus particles) and in being aphid transmitted. The particles are isometric, about 30 nm. in diameter, and sediment as three components, 113-126S (bottom (B) component), 93-100S (middle (M) component) and 56S (top (T) component which lacks nucleic acid).

The capsids comprise two polypeptide species of mw. *c.*27 and 43 x 10^3. The genome is two species of linear (+)-sense ssRNA, B component containing RNA 1 (mw. 2.1 x 10^6) and M component containing RNA 2 (mw. 1.5 x 10^6). The host ranges are wide. Viruses of this group are easily transmissible mechanically and are transmitted by aphids in the NON-PERSISTENT TRANSMISSION manner.
Lisa, V. and Boccardo, G. (in press). **In** The Plant Viruses: Viruses with Bipartite RNA Genomes and Isometric Particles. ed. B. Harrison and A. Murant. Plenum Press: New York.

Facey's Paddock virus. Family *Bunyaviridae*, genus *Bunyavirus*.

Farallon virus. Family *Bunyaviridae*, genus *Nairovirus*.

Fc fragment. The crystallisable constant fragment of IMMUNOGLOBULIN.

fd phage. Proposed type member of the *INOVIRUS* genus. Virions are flexuous rods, about 870 nm. x 6 nm. Particles contain a few copies of a minor protein (mw. 56 x 10^3) present at one tip of the particle, which are involved in adsorption of the virus to the F-pilus of the host. The major protein has a mw. of about 5.2 x 10^3. The genome is circular ssDNA (mw. 1.9 x 10^6; 6389 nucleotides) with at least eight genes. During infection, replicative form (RF) DNA is produced and transcribed by host enzymes. Single-stranded progeny DNA is produced by displacement from RF DNA. The virus is specific for bacteria containing the F PLASMID. Virus infection does not lyse the host. Close relatives include f1 and M13 phages.
Ray, D.S. (1977) **In** Comprehensive Virology. Vol. 7. p. 105. ed. H. Fraenkel-Conrat and R.R. Wagner. Plenum Press: New York.

felid herpesvirus 1. Family *Herpesviridae*, subfamily *Alphaherpesvirinae*, genus not allotted. Causes nasal discharge, lacrimation and fever in kittens. Virus replicates in the mucous membranes of the nose, larynx and trachea and in the conjunctiva and genital tract. Causes lesions in cell cultures prepared from cat kidney, lung and testes.

feline calicivirus. Synonym: FELINE RHINOTRACHEITIS VIRUS. Family *Caliciviridae*, genus *Calicivirus*. Causes rhinitis, conjunctivitis, ulceration and pneumonia. Can be fatal. Replicates in feline kidney cells. Occurs as several serotypes.

feline coronavirus. Synonym: FELINE INFECTIOUS PERITONITIS VIRUS. Family *Coronaviridae*, genus *Coronavirus*. Causes loss of appetite, wasting and abdominal distension due to peritonitis, pleurisy and necrotic inflammatory lesions. The disease is fatal.

feline infectious peritonitis virus. *See* FELINE CORONAVIRUS.

feline leukaemia oncovirus. Family *Retroviridae*, subfamily *Oncovirinae*, genus *Type C oncovirus*, sub-genus *Mammalian type C oncovirus*. A common infection of cats causing leukaemia and/or sarcomas. Depresses immune system leading to a variety of infections. Virus replicates in cells of feline, human, canine and pig origin. Vaccination prevents infection.

feline panleucopenia virus. Synonyms: ATAXIA OF CATS VIRUS, FELINE PARVOVIRUS. Family *Parvoviridae*, genus *Parvovirus*. Infects all *Felidae*. Causes a severe febrile illness with vomiting and diarrhoea. Infected animals may excrete virus for prolonged periods. After an initial leucocytosis, there is a progressive fall in circulating lymphocytes and polymorphs, leading to lethargy and anorexia. Virus can be grown in kitten kidney cells, particularly if they are rapidly dividing.

feline rhino-tracheitis virus. *See* FELINE CALICIVIRUS.

feline syncytial virus. A species in the family *Retroviridae*, subfamily *Spumavirinae*. Isolated from normal cats. Not known to cause disease. Grows in feline embryo cell cultures.

fern virus. A possible *Potyvirus*.
Francki, R.I.B. *et al.* (1985) **In** Atlas of Plant Viruses. Vol. 2. p. 183. CRC Press: Boca Raton, Florida.

Festuca leaf streak virus. A plant *Rhabdovirus*, subgroup 1.
Francki, R.I.B. *et al.* (1985) **In** Atlas of Plant Viruses. Vol. 1. p. 73. CRC Press: Boca Raton, Florida.

Festuca mottle virus. Synonym: COCKSFOOT MILD MOSAIC VIRUS.
Hull, R. (1988) **In** The Plant Viruses. Vol. 3. p. 113. ed. R. Koenig. Plenum Press: New York.

Festuca necrosis virus. A member of the *Closterovirus* subgroup 1.
Francki, R.I.B. *et al.* (1985) **In** Atlas of Plant Viruses. Vol. 2. p. 219. CRC Press: Boca Raton, Florida.

Feulgen stain. A histochemical stain made up from basic fuchsin and sulphurous acid. Stains CHROMATIN containing THYMIDINE. Also known as Schiff's reagent.

few-polyhedra variant. Plaque variant of NUCLEAR POLYHEDROSIS VIRUS which produces few or no polyhedra in nuclei of infected insect cell cultures. Arises as a spontaneous mutant of MANY POLYHEDRA VARIANT ('wild-type'), apparently by a transposon-like insertion into the viral genome of host cell DNA sequences.
Fraser, M.J. *et al.* (1985) Virology **145**, 356.

fibroblast. The stellate connective tissue cell type found in fibrous tissue. Important type of cell for use in cell culture, e.g. HELA CELLS.

fig virus S. A *Carlavirus*, occurs in Japan.
Doi, Y. *Personal communication.*

figwort mosaic virus. A *Caulimovirus*.
Francki, R.I.B. *et al.* (1985) **In** Atlas of Plant Viruses. Vol. 1. p. 17. CRC Press: Boca Raton, Florida.

Fiji disease virus. *See* SUGARCANE FIJI DISEASE VIRUS.

Fijivirus group. Synonym: PLANT REOVIRUS SUBGROUP 2. (SUGARCANE FIJI DISEASE VIRUS, the type member). One of the two genera of plant viruses in the family *REOVIRIDAE*. The particles are isometric, 65-71 nm. in diameter with 12 external knobs 8-16 nm. long, 11 nm. in diameter situated one on each 5° axis. This structure breaks down

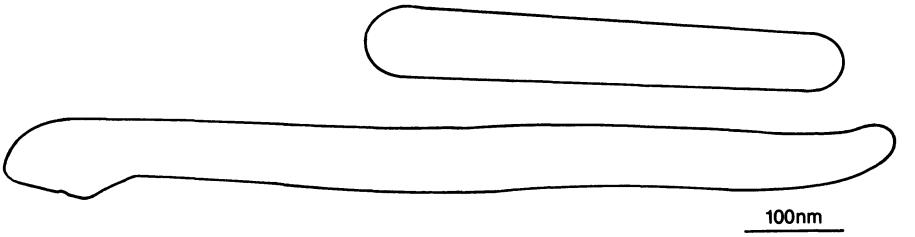
100nm

readily to release cores 54 nm. in diameter, which have 12 spikes 8 nm. long, 14-19 nm. in diameter. The particles contain ten species of dsRNA (mw. 1.0-2.9 x 10^6). Replication is in cytoplasmic VIROPLASMS consisting of a matrix containing filaments. Fijiviruses multiply both in higher plants (confined to Graminae) and in insects (plant hoppers). Particles are found in most cell types. Natural transmission is by Delphacid plant hoppers in which the relationship is in the PERSISTENT TRANSMISSION manner and propagative; the virus can be transmitted transovarially.
Matthews, R.E.F. (1982) Intervirology **17**, 85.

filamentous phages. *See* INOVIRUS.

filaree red leaf virus. A possible *Luteovirus*. Francki, R.I.B. *et al.* (1985) **In** Atlas of Plant Viruses. Vol. 1. p. 137. CRC Press: Boca Raton, Florida.

Filoviridae. (Latin 'filo' = thread, filament.) A family consisting of the two viruses Marburg and Ebola, which cause haemorrhagic fever in man. Except for their extreme length, the viruses have a morphology similar to that of members of the family *Rhabdoviridae*. The length is highly variable and can be as great as 14,000 nm. but is usually about 800-1000 nm.; the diameter is 80 nm. The particles are enveloped with spikes *c.*7 nm. in length and 10 nm. apart. The virus RNA has a mw. of *c.*4.2 x 10^6, has (–)-sense and is therefore non-infectious. There are at least five virus proteins with mw. of *c.* 190, 125, 104, 40 and 26 x 10^3. Both viruses are highly virulent for man and several species of monkey.
Kiley, M.P. *et al.* (1982) Intervirology **18**, 24.



Filaree red leaf virus. A possible *Luteovirus*. Francki, R.I.B. *et al.* (1985) **In** Atlas of Plant Viruses. Vol. 1. p. 137. CRC Press: Boca Raton, Florida.
Casper, R. (1988) **In** The Plant Viruses. Vol. 3. p. 235. ed. R. Koenig. Plenum Press: New York.

filterable. The ability of a solute in a solvent to pass through a filter. The early recognition of the small size of virus particles was due to their filterability through diatomite or glazed porcelain filters with pore sizes too small to allow the passage of bacteria. D. Ivanowski (1892) and M.W. Beijerink (1898) showed that the particles of TOBACCO MOSAIC VIRUS would pass through a Chamberland filter-candle.
Beijerink, M.W. (1898) Verhand. Kon. Akad. Weten. Amsterdam **6**, 3.
Ivanowski, D. (1892) St. Petersb. Acad. Imp. Sci. Bull. **37**, 67.

fin isolate virus. Family *Reoviridae*, genus *Orbivirus*.

finch paramyxovirus. Family *Paramyxoviridae*, genus *Paramyxovirus*.

finger millet mosaic virus. A plant *Rhabdovirus*, subgroup 2; leafhopper transmitted. Francki, R.I.B. *et al.* (1985) **In** Atlas of Plant Viruses. Vol. 1. p. 73. CRC Press: Boca Raton, Florida.

fingerprinting. A procedure for characterising DNA, RNA or proteins by electrophoretic or chromatographic analysis of specific fragments, e.g. uniformly- or terminally-labelled RNA is digested using various ribonucleases (often T1 or pancreatic) and the products separated by electrophoresis in two dimensions. The oligoribonucleotides are then detected by autoradiography.

flacherie. A term applied to a disease condition of the silkworm, *Bombyx mori*, caused by a complex of pathogens and physiological deficiencies.

The most common viral pathogens involved are CYTOPLASMIC POLYHEDROSIS VIRUS, INFECTIOUS FLACHERIE VIRUS and INA-FLACHERIE VIRUS.

flacherie 1 virus. Synonym: INFECTIOUS FLACHERIE VIRUS.

Flanders virus. Family *Rhabdoviridae*, not allotted to genus. Isolated from mosquitoes and from an ovenbird in USA. Kills new-born mice when inoculated i.c.

Flaviviridae. (Latin 'flavus' = yellow.) Formerly a genus in the family *Togaviridae*. A family of enveloped RNA viruses with spherical particles 40-50 nm. in diameter, sedimenting at *c.*200S and with surface projections. There are

100nm

three proteins, the glycosylated surface projection (mw. 53-63 x 10^3), the nucleocapsid protein (mw. 13.5 x 10^3) and a small protein (mw. *c.*8 x 10^3). The RNA is ss (+)-sense (mw. 4.0-4.6 x 10^6). Replication is in the cytoplasm. Most members multiply in arthropods as well as in vertebrates. Westaway, E.G. *et al.* (1985) Intervirology. **24**, 183.

Flavivirus. (Latin 'flavus' = 'yellow'.) The only genus of the family *Flaviviridae*. Contains many members, the most important being those causing dengue haemorrhagic fever, Japanese encephalitis, louping ill, Murray Valley encephalitis, St. Louis encephalitis, tick-borne encephalitis and yellow fever.

flexal virus Be An 293022. Family *Arenaviridae*, genus *Arenavirus*.

flock house virus. A possible NODAVIRUS (NODAVIRIDAE) isolated from the grass grub, *Costelytra zealandica* (Coleoptera) in New Zealand. Scotti, P.D. *et al.* (1983) Arch. Virol. **75**, 181.

fluorescein isothiocyanate (FITC). ($C_{12}H_{11}NO_5S$) (mw. 389.4). A fluorescent compound used for labelling proteins or nucleic acids. It is excited by light of wavelength in the range 450-490 nm. and emits in the range 520-560 nm.

fluorescence microscope. A compound light microscope which is arranged to admit radiation of specific wavelengths (e.g. UV) to the specimen which then fluoresces.

fluorescent antibody. An antibody which is labelled with a fluorescent dye, e.g. FLUORESCEIN ISOTHIOCYANATE. It can then be used in conjunction with a fluorescence microscope to detect viral antigen in cells. *See* ENZYME CONJUGATE.

5-fluorodeoxyuridine (Fudr). A pyrimidine analogue which is a reversible inhibitor of DNA synthesis. Phosphorylation by THYMIDINE KINASE converts it to an analogue of thymidylic acid. Used in the treatment of CYTOMEGALOVIRUS.

fluorography. Photography of an image produced on a fluorescent screen. Now more widely used to describe a technique in which ^{3}H-labelled molecules can be detected in chromatograms and polyacrylamide gels. The scintillator PPO is introduced into the chromatogram or gel which is then exposed to photographic film.
Laskey, R.A. and Mills, A.D. (1975) Eur. J. Biochem. **56**, 335.

5-fluorouracil. *See* BASE ANALOGUE.

FMDV. *See* FOOT-AND-MOUTH DISEASE VIRUS.

focus-forming assay. An assay for non-cytolytic transforming viruses, e.g. ROUS SARCOMA VIRUS based on the transformation changing the morphology of the cells in tissue culture. The sites of growth of these modified cells show up as foci. A similar test can be used for the assay of DEFECTIVE INTERFERING PARTICLES of a cytolytic virus (e.g. LYMPHOCYTIC CHORIOMENINGITIS VIRUS) in which the DI particles prevent the virus destruction of the cells by the helper virus.

focus-forming units (f.f.u.) Units of quantification for the FOCUS-FORMING ASSAY.

foetal calf serum. A frequent constituent of culture media used for growing animal cells or tissue cultures. *See* SERUM-FREE MEDIUM.

foot-and-mouth disease virus. Synonyms: APHTHOVIRUS, FMDV, VIRUS AFTOSA, LE VIRUS DE LA FIEVRE APHTEUSE, MAUL- UND KLAUENSEUCHEVIRUS. Family *Picornaviridae*, genus *Aphthovirus*. Only species of genus. First virus shown to cause disease of animals (1897). Produces blisters on tongue and feet of cattle, pigs, sheep and goats. Highly contagious and debilitating disease. Very

important economically because of productivity losses and restrictions it causes on trading. This has led to extensive vaccination programmes where disease is endemic. Control in areas with sporadic outbreaks is by slaughter. Occurs worldwide except in Australasia, Britain, Japan and North America. Antigenic variation is an important consideration in vaccination (seven serotypes, O, A, C, SAT1, SAT2, SAT3 and Asia 1).

Formvar. Trade name for polyvinyl formal used for making films for grids for electron microscopy.

formycin. 7-amino-3-(β-D-ribofuranosyl)-pyrazolo[4,3-d]pyrimidine. An analogue of adenosine which acts as a nucleoside antibiotic.

formycin B. 3-(β-D-ribofuranosyl)pyrazolo[4,3-d]-6(H)-7-pyrimidine. An analogue of inosine isolated from *Streptomyces lavendulae* and *Nocardia interforma*. Acts as a nucleoside antibiotic.

Fort Morgan virus. Family *Togaviridae*, genus *Alphavirus*.

fowl adenovirus. Family *Adenoviridae*, genus *Aviadenovirus*.

fowl diphtheria virus. *See* FOWLPOX VIRUS.

fowlpox virus. Synonym: FOWL DIPHTHERIA VIRUS. Family *Poxviridae*, subfamily *Chordopoxvirinae*, genus *Avipoxvirus*. Causes lesions which are followed by scabbing. Sometimes there are eye lesions. Transmitted by contact or by mosquitoes.

foxtail mosaic virus. A *Potexvirus*.
Short, M.N. (1983) CMI/AAB Descriptions of Plant Viruses No. 264.
Francki, R.I.B. *et al.* (1985) **In** Atlas of Plant Viruses. Vol. 2. p. 159. CRC Press: Boca Raton, Florida.

FP variant. Abbreviation for FEW POLYHEDRA VARIANT.

frame shift. 1. A mutation caused by insertion or deletion of one or more nucleotides whose effect is to change the reading frame of a codon giving a changed amino acid sequence starting at the mutated codon. 2. The change from the reading frame of one cistron to that of an overlapping cistron, e.g. the retroviruses. *GAG-POL* GENES of some retroviruses

frangipani mosaic virus. A *Tobamovirus*.
Varma, A. and Gibbs, A.J. (1978) CMI/AAB Descriptions of Plant Viruses No. 196.
Brunt, A.A. (1986) **In** The Plant Viruses. Vol. 2. p. 283. eds. M.H.V. van Regenmortel and H. Fraenkel-Conrat. Plenum Press: New York.

Fraser Point virus. Family *Bunyaviridae*, genus *Nairovirus*.

Freesia mosaic virus. A possible *Potyvirus*.
Francki, R.I.B. *et al.* (1985) **In** Atlas of Plant Viruses. Vol. 2. p. 183. CRC Press: Boca Raton, Florida.

Freesia streak virus. A possible *Potyvirus*.
Francki, R.I.B. *et al.* (1985) **In** Atlas of Plant Viruses. Vol. 2. p. 183. CRC Press: Boca Raton, Florida.

freeze-drying. *See* LYOPHILISATION.

freeze fracture. A method for preparing samples for electron microscopy. They are frozen rapidly at very low temperature and then the brittle material is fractured. The exposed surfaces may be etched to reveal further details.

Freund's adjuvant. A mixture of mineral oil and emulsifier (and, in the complete adjuvant, killed mycobacteria) with which an antigen is emulsified before intramuscular or subcutaneous injection. The antigen is released slowly into the blood stream, often leading to the production of a higher antibody titre.

Friend leukaemia virus. Family *Retroviridae*, subfamily *Oncovirinae*, genus *Type C oncovirus*. Originally obtained from spleen of Swiss mouse which had been injected at birth with cell-free extract of Ehrlich ascites tumour cells. Adult mice die a few weeks after injection.

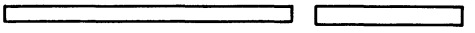
Frijoles virus. Family *Bunyaviridae*, genus *Phlebovirus*. Isolated from insects in Panama.

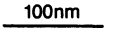
frog virus 4. *See* RANID HERPESVIRUS 2.

Fuchsia latent virus. A possible *Carlavirus*.
Francki, R.I.B. *et al.* (1985) **In** Atlas of Plant

Viruses. Vol. 2. p. 173. CRC Press: Boca Raton, Florida.

Furovirus group. (Sigla from fungus transmitted rod-shaped). (Type member SOIL-BORNE WHEAT MOSAIC VIRUS). Genus of MULTICOMPONENT plant viruses with rod-shaped particles. The type member has two nucleoprotein components of length 110-160 nm. and 300 nm., width 20 nm.





The particles are composed of a single species of coat protein (mw. 19.7 x 10^3) encapsidating two genomic linear (+)-sense ssRNA species (mw. 0.86-1.23 and 2.28 x 10^6). Host ranges are narrow. Furoviruses are mechanically transmissible. They are naturally transmitted by fungi (Plasmodiophorales). Many viruses in this group were originally classified as tobamoviruses but are distinguished from them by their multicomponent nature, coat protein mw. and fungal transmission.

Shirako, Y. and Brakke, M.K. (1984) J. gen. Virol. **65**, 119.

Brunt, A.A. (1986) **In** The Plant Viruses. Vol. 2. p. 305. ed. M.H.V. van Regenmortel and H. Fraenkel-Conrat. Plenum Press: New York.

fusion (of cells). Phenomenon caused by some enveloped viruses (e.g. SENDAI VIRUS). The ability of inactivated Sendai virus to fuse cells has been used in the production of hybrid cells.