

# One Hundred Years of Tobacco Mosaic Virus Highlights

- 1886 Adolph Mayer**—Transmits tobacco mosaic experimentally.
- 1892 Dmitri Iwanowski**—Shows that the tobacco mosaic agent can pass through filters.
- 1898 Martinus Beijerinck**—Introduces the virus concept (“contagium vivum fluidum”) with TMV and shows that the agent is a replicating entity.
- 1928 Harold H. McKinney**—Finds TMV strains and demonstrates cross protection.



**Helen Purdy Beale**—Discovers a TMV-specific antigen in infected plants.

**1929 Francis O. Holmes**—Develops local lesion assays for measuring TMV concentration.

**W. N. Takahashi & T. E. Rawlins**—Shows that TMV is composed of elongated particles.

**1935 Wendell Stanley**—Purifies TMV crystals and shows that the virus is proteinaceous.

**1936 F. C. Bawden & N. W. Pirie**—Demonstrate that TMV contains RNA.

**1937 J. D. Bernal & I. Fankuchen**—Show that TMV consists of subunits of similar shape and size.

**1939 V. G. A. Kausche, E. Pfankuch, & H. Ruska**—Use electron microscopy to visualize TMV rods.

**1955 H. Fraenkel-Conrat &**

**R. Williams**—Reassemble SDS-degraded TMV and suggest that RNA is infectious.

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S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

- 1956 **A. Gierer & G. Schramm**—Demonstrate that TMV RNA is infectious.  
**Donald Caspar**—X-ray diffraction reveals TMV has a 90Å radius with a 35–40Å central hole.  
**Rosaline Franklin**—Locates the RNA in TMV particles using X-ray diffraction.  
**Albert Seigel & Sam Wildman**—Use UV irradiation to identify several TMV infection stages.
- 1958 **A. Gierer & K.-W. Mundry**—Create TMV mutants by nitrous acid treatment of RNA.
- 1960 **H. G. Wittmann**—Conducts tryptic peptide analysis of TMV coat protein mutants.
- 1969 **I. Takebe & Y. Otsuki**—Infects tobacco protoplasts with TMV.
- 1976 **T. Hunter et al.**—Identify TMV coat protein messenger RNA.
- 1977 **G. Lebeurier et al.**—Develop model for assembly of TMV virions.  
**P. J. G. Butler et al.**—Develop model for assembly of TMV virions.
- 1982 **P. Goelet et al.**—Determine the nucleotide sequence of TMV RNA.
- 1984 **T. M. A. Wilson**—Discovers cotranslational disassembly of TMV.
- 1986 **W. O. Dawson et al.**—Develop cDNA clones for reverse genetic analysis of TMV.  
**P. Powell Abel et al.**—Discover coat protein mediated resistance in transgenic plants.

A detailed accounting of these highlights and relevant publications appears in *Tobacco Mosaic Virus: One Hundred Years of Contributions to Virology*, edited by Karen-Beth Scholthof, John G. Shaw, and Milton Zaitlin, APS PRESS (1999).

The photograph of TMV symptoms, which appears in Plate VI of *The Collected Works of Beijerinck*, was provided by Lesley A. Robertson, the curator of Professor Beijerinck's papers at Delft University of Technology.

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