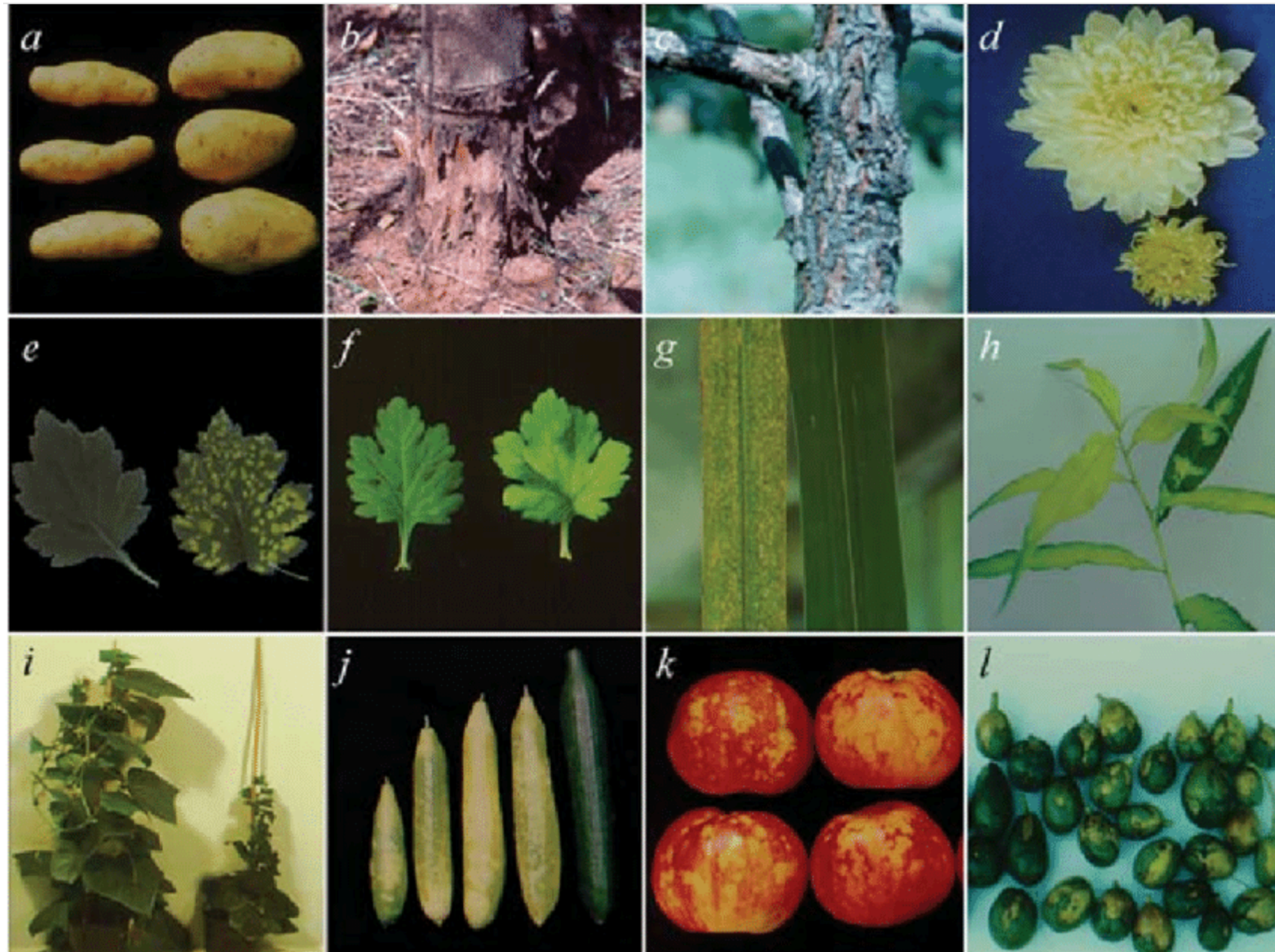
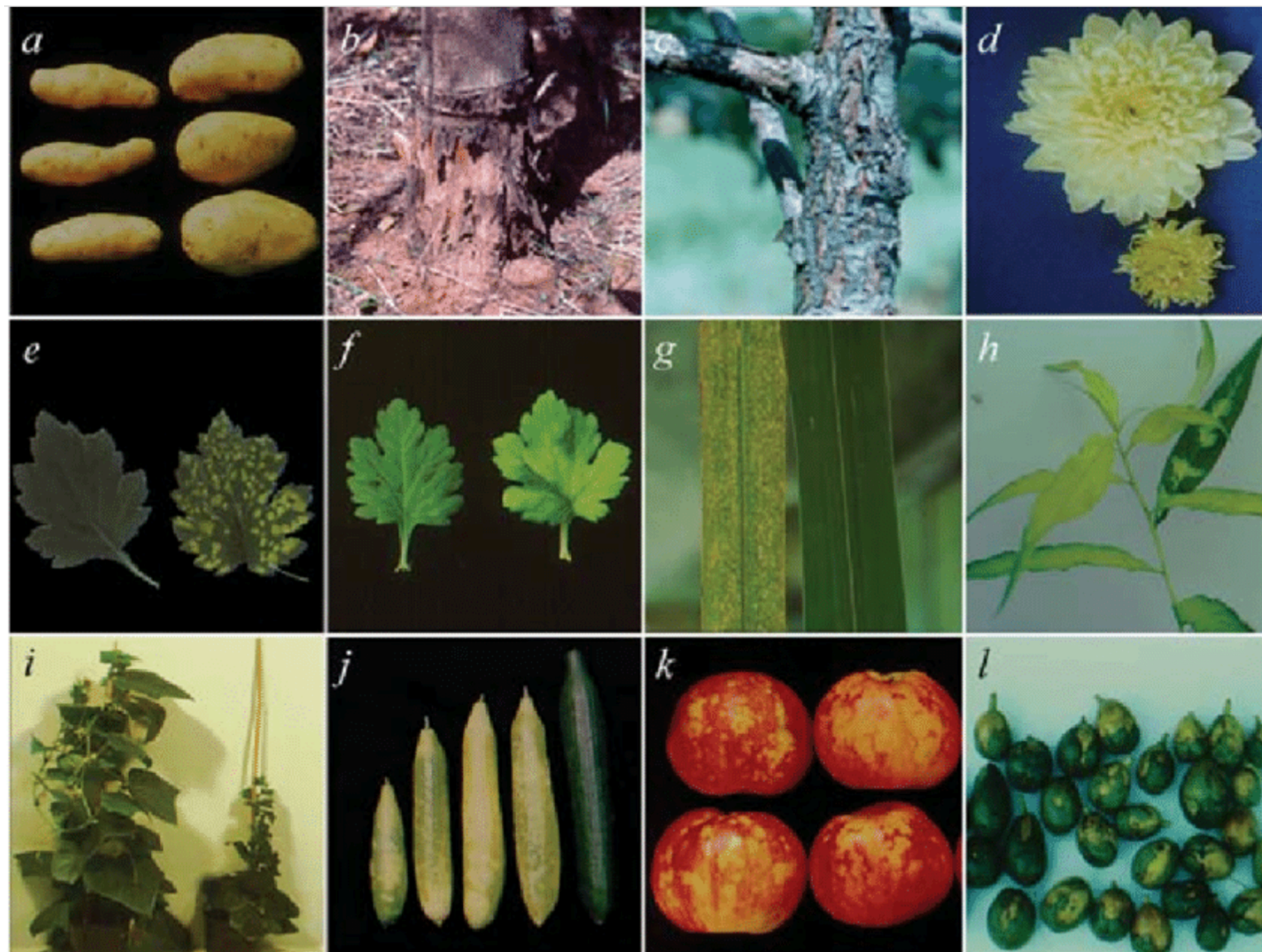


Viroids and Prions

Discovery of a new infectious disease in the sub viral domain



Diener in the 70'



(a) Symptoms of PSTVd on potato tubers (left) and healthy controls (right) (courtesy of T.O. Diener). (b) Symptoms of CEVd on a trifoliate orange rootstock (courtesy of N. Duran-Vila and P. Moreno). (c) Symptoms of PBCVd on pear A20 (courtesy of J.C. Desvignes). (d) Flower symptoms of CSVd on chrysanthemum (bottom) and a healthy control (top) (courtesy of J.M. Bové). (e) Leaf symptoms of CSVd on chrysanthemum (right) and a healthy control (left). (f) Leaf symptoms of CChMVd on chrysanthemum (right) and a healthy control (left). (g) Leaf symptoms of CCCVd on coconut (left) and a healthy control (right). (h) Extreme leaf chlorosis (peach calico) induced by PLMVd. (i) Internode shortening induced by HSVd on cucumber (right) and a healthy control (left). (j) Symptoms of HSVd on cucumber fruits (left) and a healthy control (right) (courtesy of H.L. Sängner). (k) Fruit symptoms (dapple apple) induced by ASSVd (courtesy of J.C. Desvignes). (l) Fruit symptoms of ASBVd on avocado (courtesy of P.R. Desjardins).

Viroids

Madigan et al. 2020



Diener et al., 1982

Viroid is **inactivated by ribonuclease** digestion, Zn^{2+} -catalyzed hydrolysis, and chemical modification with NH_2OH

Viroid **RNA** is a **single-stranded, covalently closed circle**, its extensive secondary structure forms a hairpinshaped double-stranded molecule with closed ends

Viroids are non-coding circular RNA molecules with rod-like or branched structures

They are often ribozymes, characterized by catalytic RNA

They can perform many basic functions of life and may have played a role in evolution since the beginning of life on Earth

They can cleave, join, replicate, and undergo Darwinian evolution

They are agent of infectious disease in plants

They “silence” plant gene expression by interfering with

Proteins can harm too!

<https://www.hopkinsmedicine.org/health/conditions-and-diseases/prion-diseases>

Prions

Prion diseases are a family of illnesses that affect people and animals (e.g., cows, deers,...)

These diseases are **rare** but always lead to death in the person or animal within months to years of symptoms beginning

Prion agent was **inactivated by proteinase K** and trypsin digestion, chemical modification with diethylpyrocarbonate, and by exposure to phenol, NaDodSO₄, KSCN, or urea

A prion is a type of protein that can trigger normal proteins in the brain to fold abnormally —> spongiform change vs. amyloid plaques in the NS

The host contains a **gene**, Prnp (Prion protein), which **encodes the native form of the prion**, known as PrP^C (Prion Protein Cellular), short arm of chromosome 20 and in mature form includes 208 amino acids

The **pathogenic prion** protein is designated PrP^{Sc} (prion protein **Scrapie**)

When the PrP^{Sc} form **enters** a host cell that is expressing PrP^C, it **promotes the conversion of PrP^C into the pathogenic form —> misfolding**

As the pathogenic prions **accumulate and aggregate —> form insoluble crystalline fibers** referred to as **amyloids** in neural cells