1 Ancient Viruses

The human genome is mostly made of retrovirus / retrovirus-like DNA

Only 1-2% of our genomes are genes

Virus-like elements (including endogenous retroviruses) make up almost half our genomes

1.1 Retroviruses

1.1.1 Central Dogma of Biology

DNA → RNA → Protein

'Retro'viruses go against the central dogma

1.1.2 Genome Organization

Simple retrovirus has replicative enzymes:

Reverse Transcriptase (RT) (Turns RNA into DNA)

Integrase (IN) (Insert genome into genome of host cell)

→ Retroviruses become a permanent part of the cells they infect

1.2 Human Endogenous Retroviruses (HERVs)

1. Similar genomic organization to exogenous retroviruses
2. Possess a reverse transcriptase gene
3. HERVs are 'virus fossils'

   Footprint of prior infection
4. HERVs are transmitted vertically in the germline through successive generations

1.2.1 Endogenization of a Virus

1. Viruses typically infect 'somatic' cells (non-reproductive cells)
2. Occasional infection of germ line cells leads to transmission to offspring

Endogenous retroviruses (ERV) are derived from different types of exogenous retroviruses (XRV)

1.3 Koala Retrovirus (KoRV)

KoRV is a retrovirus currently endogenizing in Koala populations

Virus enters the genome of sperm and egg cells, spreading vertically

Although endogenous retroviruses are normally silent, KoRV is still active

Symptoms include immunodeficiency and cancer

1.3.1 Transmission

1. KORVs (XRV) are generally transmitted horizontally (in utero, blood, feces, urine, milk, saliva)
2. KORVs can infect the germline and be inherited (endogenization)
3. Endogenized KoRVs can reinfect and replicate in the genome

   can also infect new koalas

1.4 Endogenous Prosimian Immunodeficiency Viruses

Ancient immunodeficiency virus in primates

Lentiviruses are a type of retrovirus (including HIV)

The type of virus has existed for a long time

1.5 Endogenous Viral Elements (EVEs)

Many types of viruses have invaded genomes

Not always retroviruses, but much more rare

1.6 Co-Option of Viral Sequences

Some endogenized genes become useless (pseudogene) whereas others get co-opted by the host cell for a cellular function

1.6.1 Syncitin

A specialized layer of cells (syncytiotrophoblast layer) at maternal-fetal interface in the placenta

Key to nutrient and waste exchange

Co-opted retroviral envelope

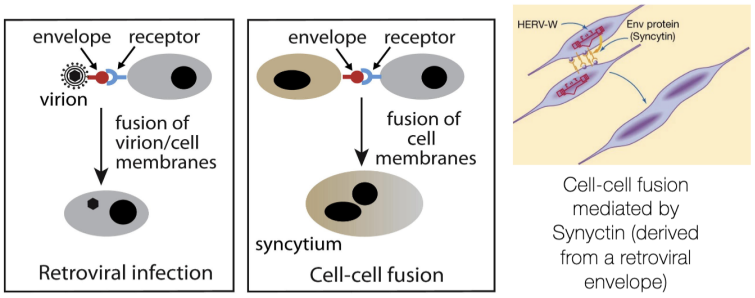

Figure 1: Syncitin Fusion