

Interferons in Antiviral Defence

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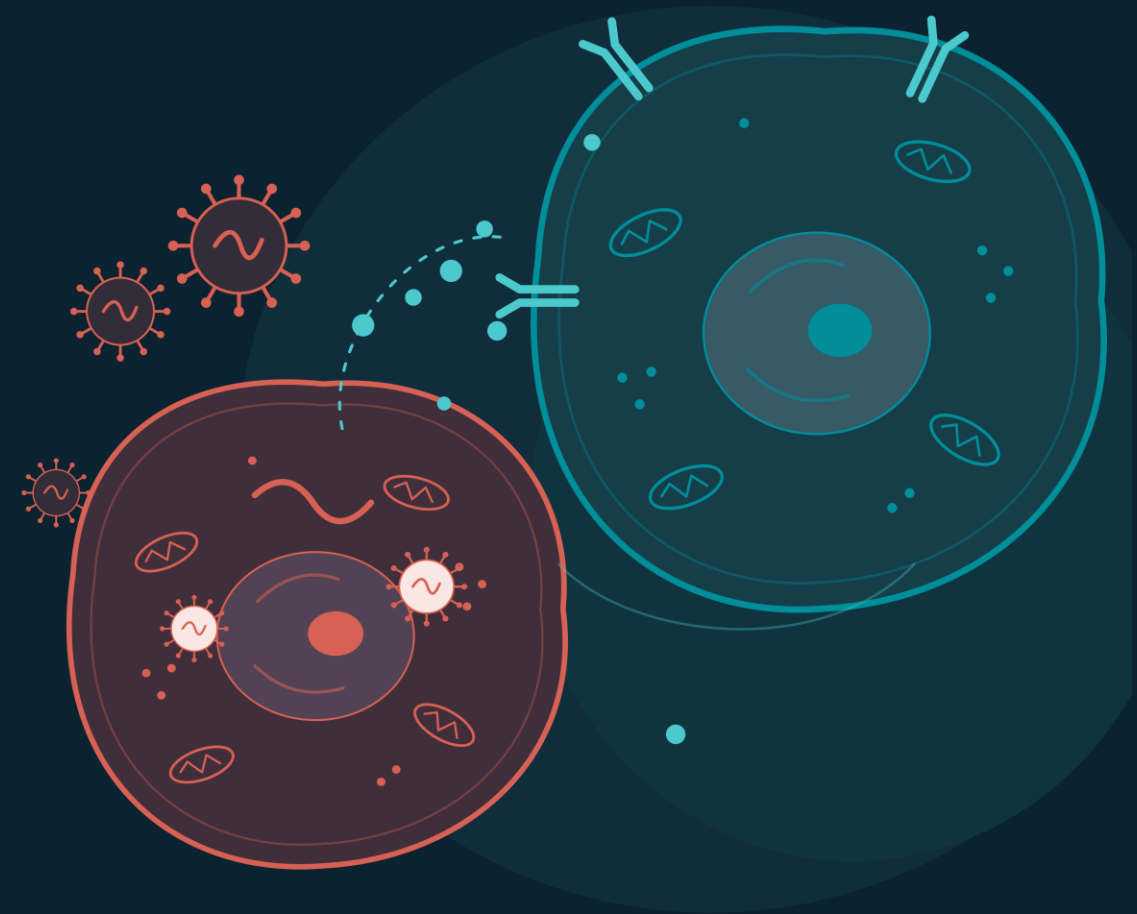
Interferons: an early warning

A virus enters a cell.

The cell sends a warning.

Nearby cells prepare.

Interferons = signalling proteins



| An early defence that buys time for adaptive immunity.

Analogy

Houses = cells

Type I interferon = alarm



Virus = burglar

Uses host ribosomes to make proteins

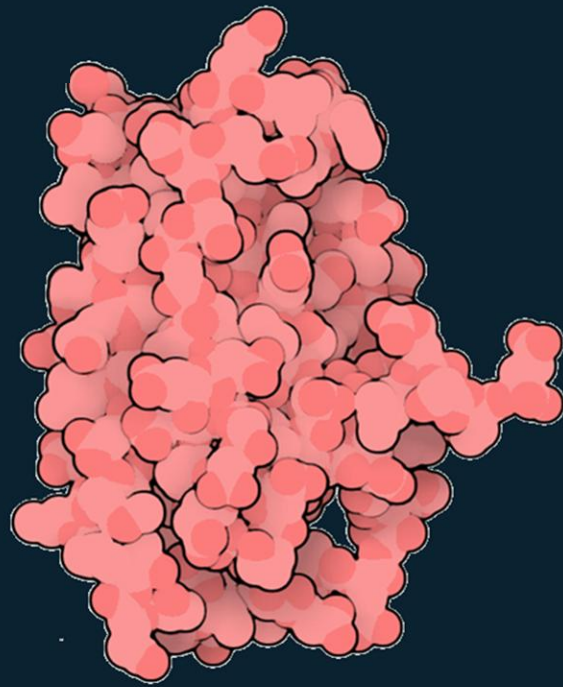
Neighbours prepare

Restrict viral replication

NK cells = patrol

Check targets before killing

What interferons look like



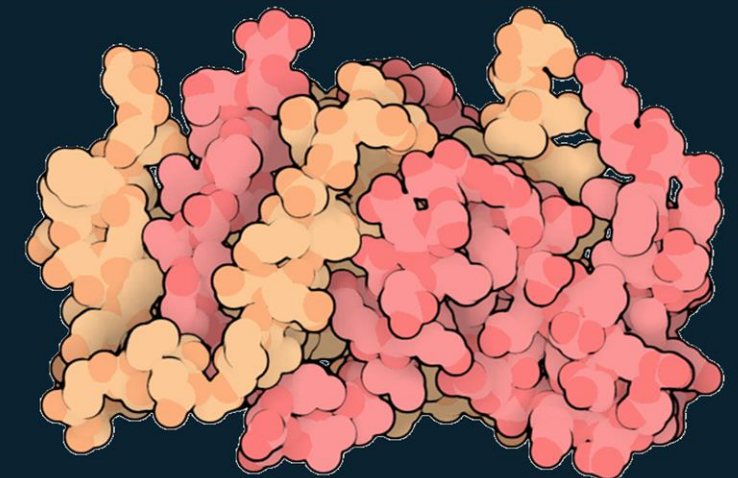
IFN-alpha

Type I / one chain



IFN-beta

Type I / one chain



IFN-gamma

Type II / two chains

Source: David S. Goodsell / RCSB PDB-101 | Structure-based illustrations

Three types, different main roles

Type I



Mainly alpha + beta

Many cell types; pDCs
are strong alpha producers

Broad antiviral
protection

Type II



Gamma

Produced by NK cells
and activated T cells

Cellular immunity;
macrophage activation

Type III



Lambda 1-4

Acts mainly on
epithelial barriers

Barrier-focused
antiviral protection

21 distinct human interferons: 16 type I + 1 type II + 4 type III.

Detect the viral material



Inside endosomes

Toll-like receptors
recognise viral RNA or DNA

Signals converge

IRF3 / IRF7

Switch on interferon genes

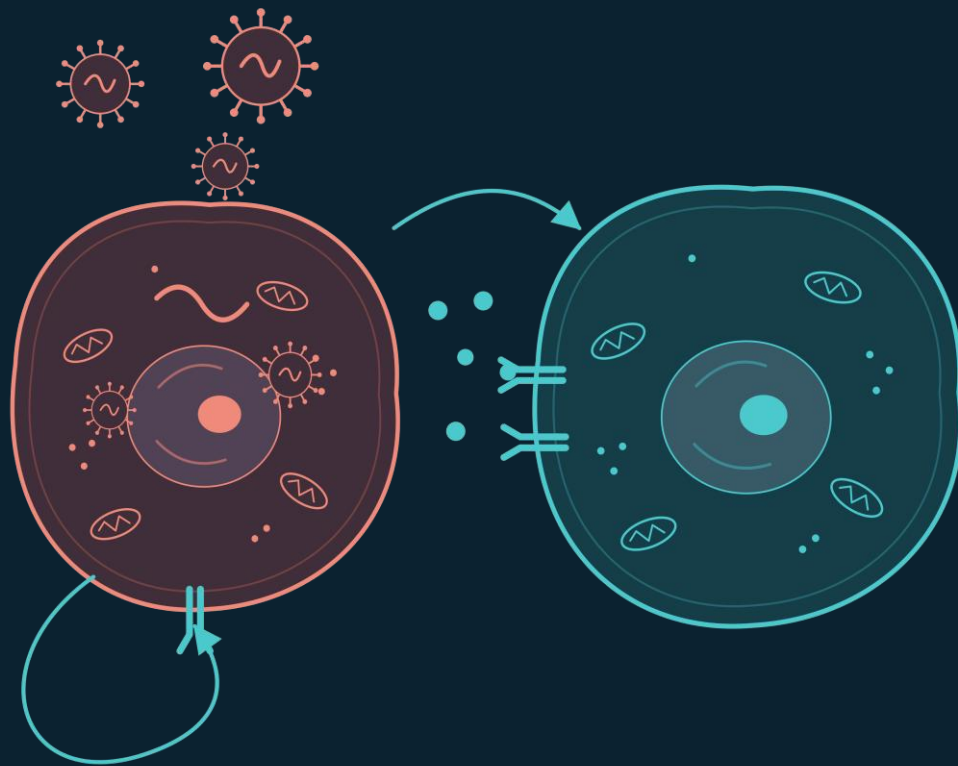
Interferon release

In the cytoplasm

Viral RNA → RIG-I / MDA5 → **MAVS**

Recognition leads to interferon production and release.

Turn the warning into a response



Interferon receptor

Receives the warning

JAK-STAT

Carries the signal to the nucleus

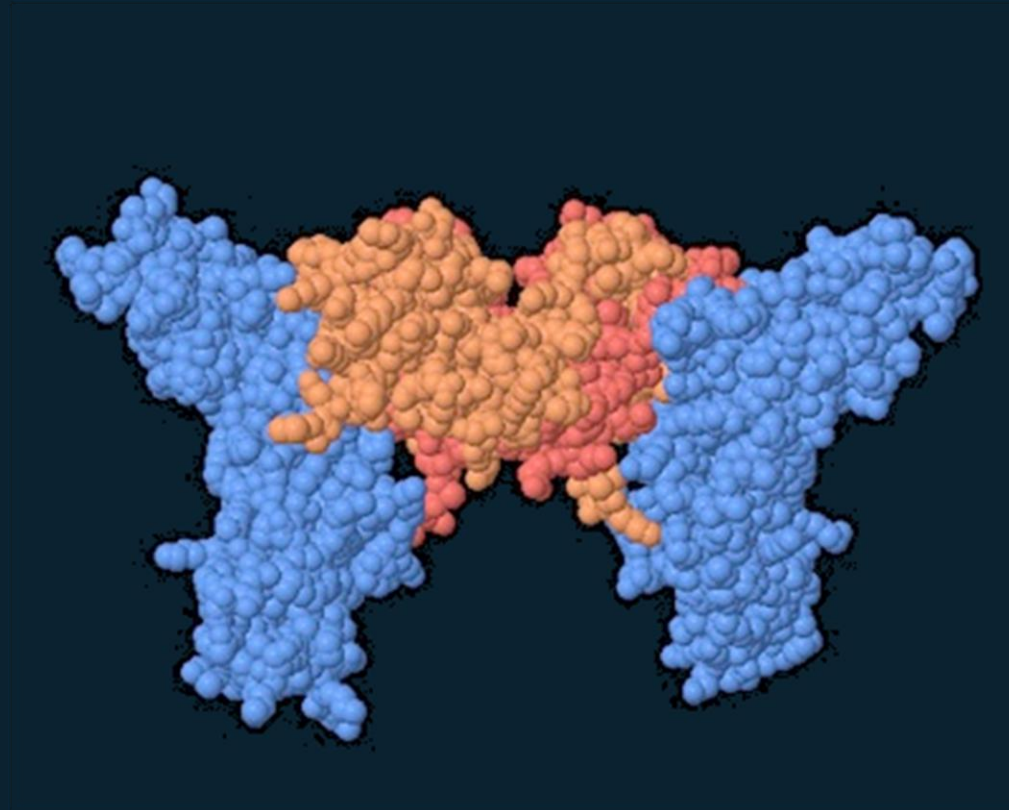
Antiviral genes

Produce protective proteins

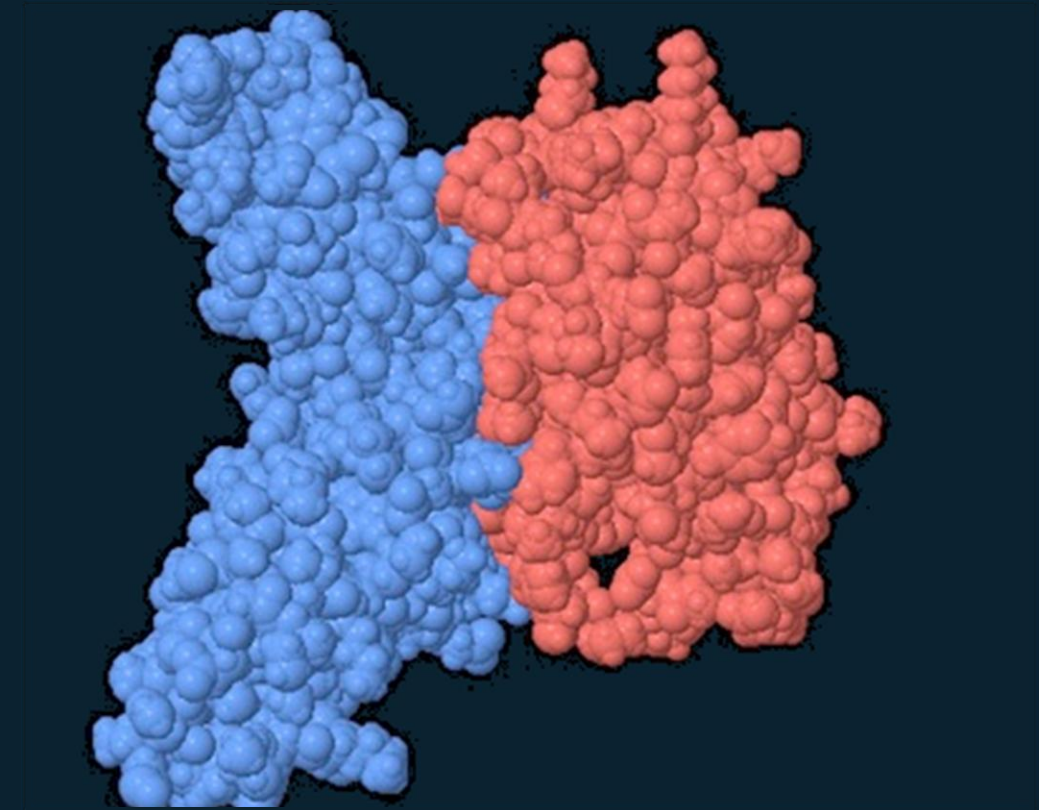
Autocrine / same cell

Paracrine / nearby cells

A signal needs a matching receptor



Gamma + receptor-binding chains



Alpha + one receptor chain

Source: RCSB PDB-101 | Structures 1FG9 and 2KZ1

Make replication more difficult

PKR

Less protein synthesis

Viral double-stranded RNA activates PKR

PKR phosphorylates eIF2-alpha

Translation initiation slows

OAS + RNase L

RNA breakdown

Viral double-stranded RNA activates OAS

OAS makes 2-5A

RNase L is activated and cleaves RNA

| An antiviral state restricts replication, but can also affect the host cell.

Protection also needs immune cells

Type I: alpha + beta

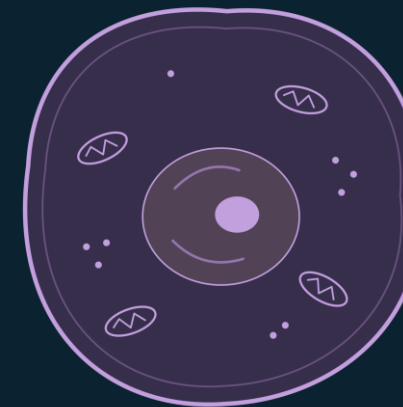
Support NK cells

Early killing of infected cells

Increase MHC class I

Help CD8 T cells recognise infection

Type II: gamma



Activates macrophages

Antiviral protection inside cells + coordinated immune-cell activity.

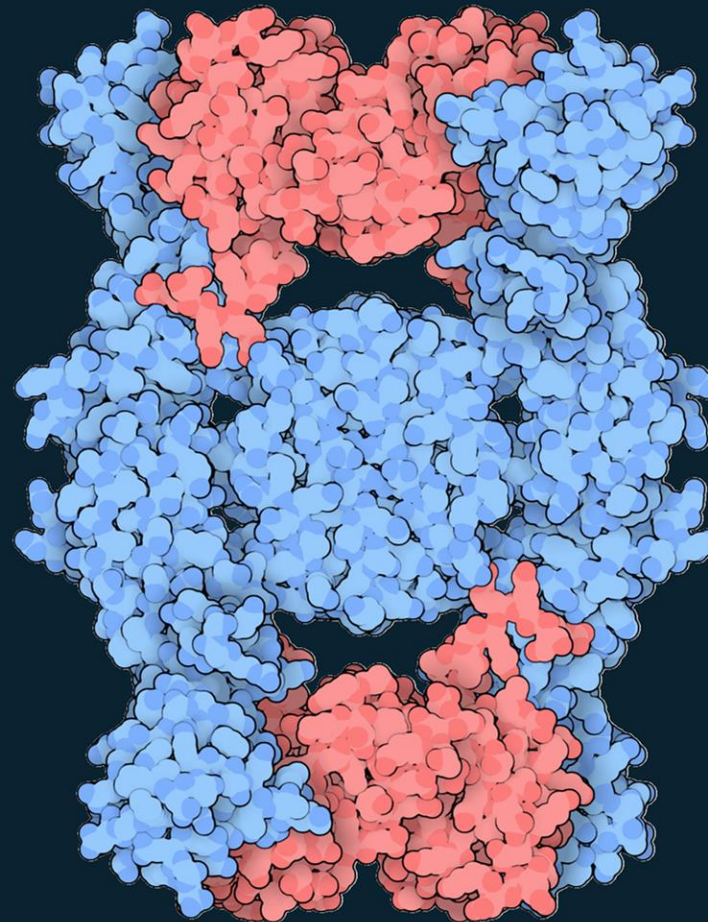
A virus can intercept the warning

- **Viral C4R**

An interferon trap

- **IFN-gamma**

The captured signal



Ectromelia virus / blocks normal receptor binding

Summary

Early + controlled

Limits viral spread

Persistent + excessive

Can injure tissue and delay repair

**Cells detect
infection**



**Interferons
signal**



**Cells inhibit
viral replication**

Buy time for adaptive immunity.

Thank you

