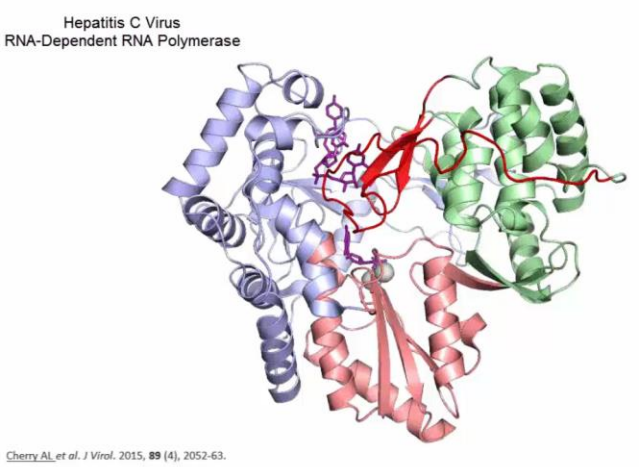
Proteins
Nature's Molecular Machines

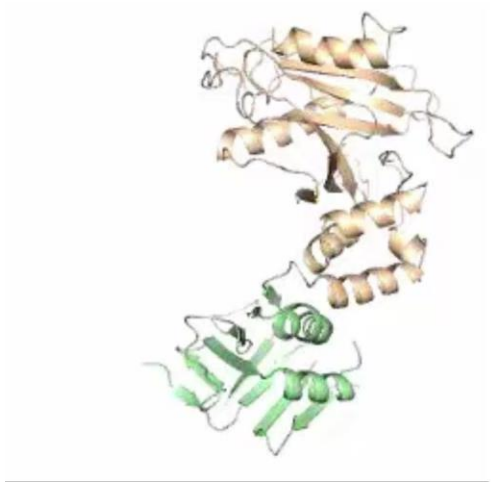
Dr Amy Cherry
University of Worcester

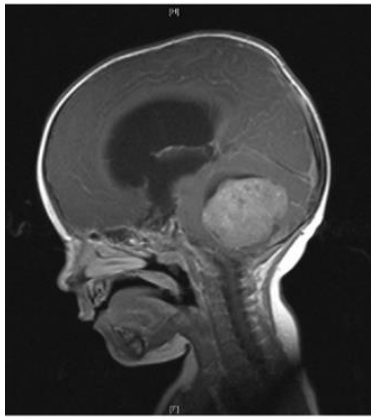
My Research on Proteins

How can we stop cancer?

How can we stop Hepatitis C Virus replicating?







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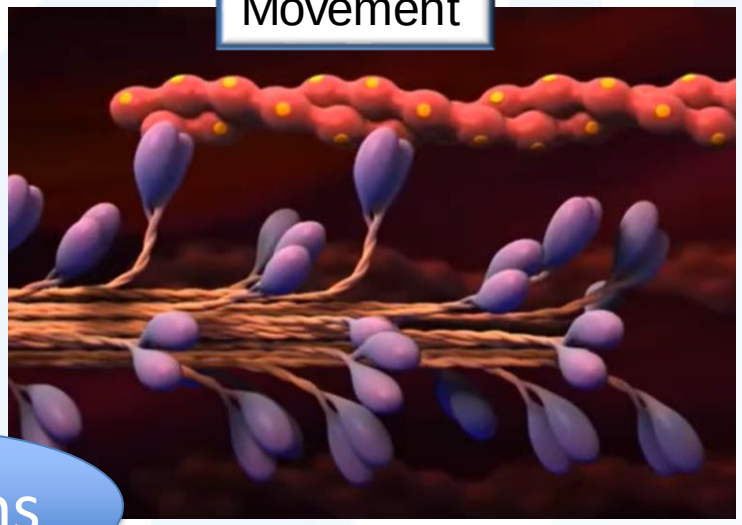
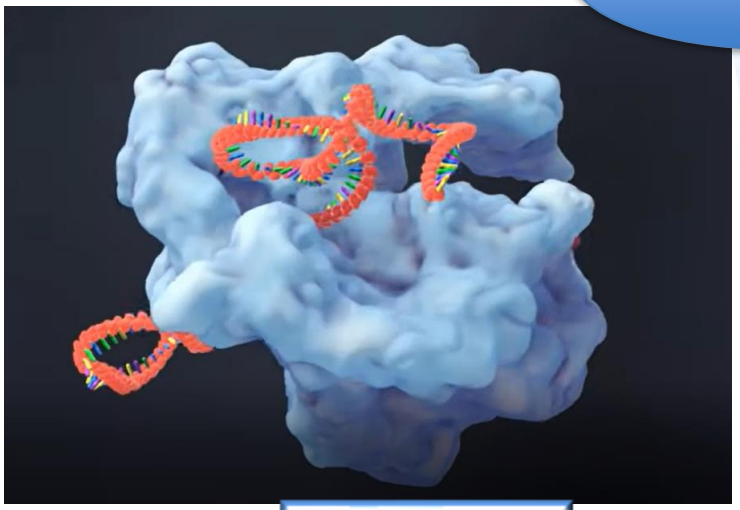
Recognition

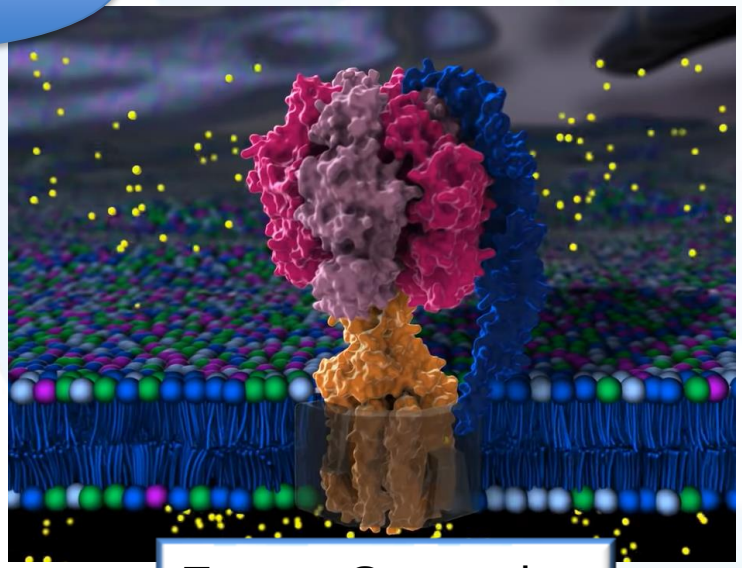
Movement



Proteins



Catalysis



Energy Generation

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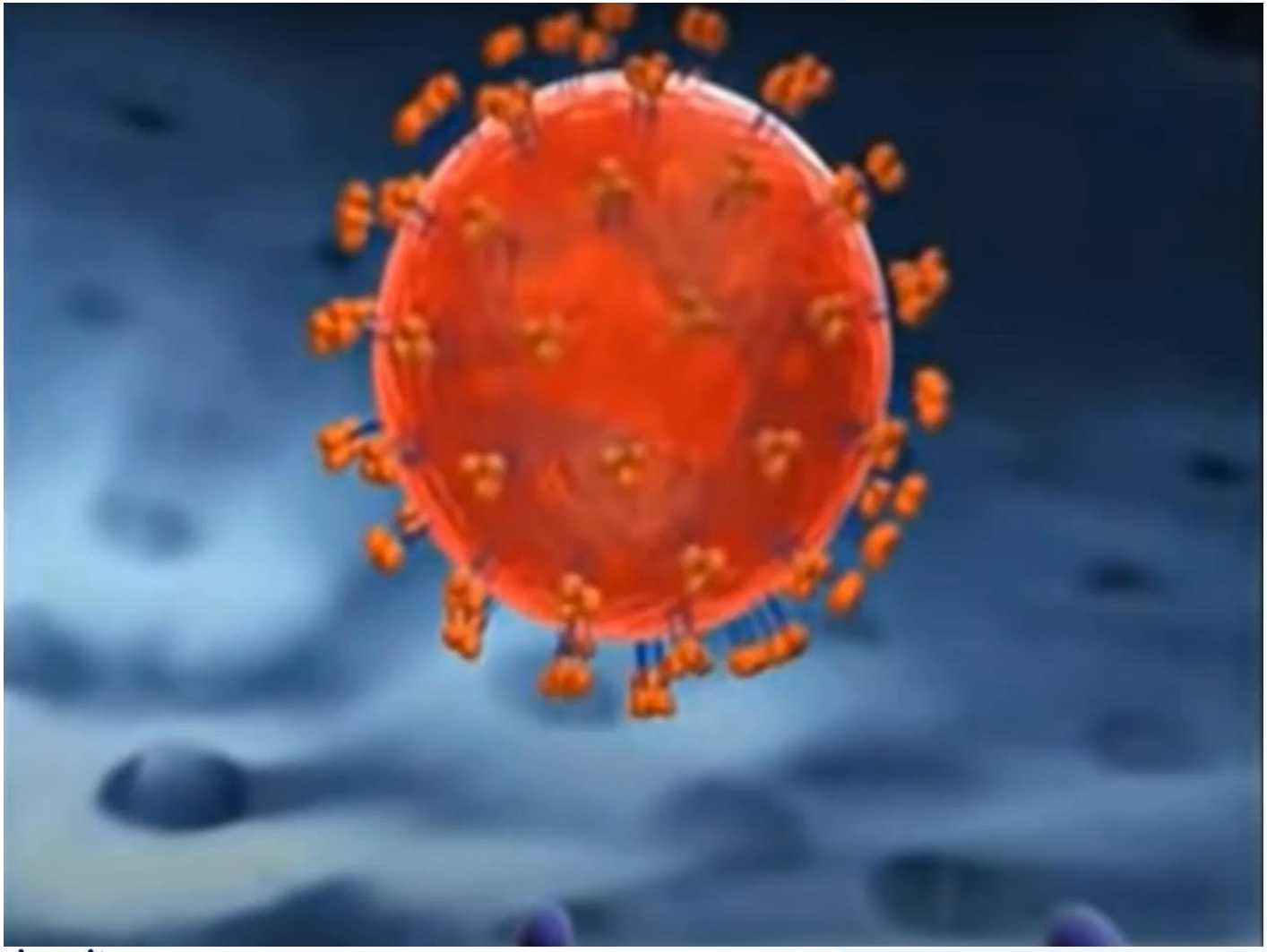
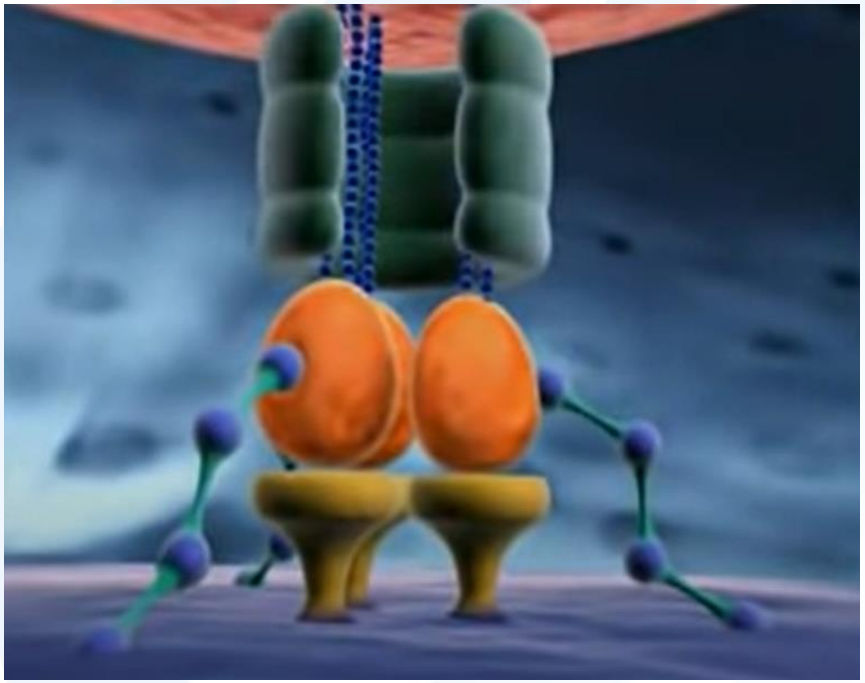
Recognition – HIV Glycoproteins



Recognition – HIV Glycoproteins

Fusion inhibitors

Stop the viral glycoprotein from folding

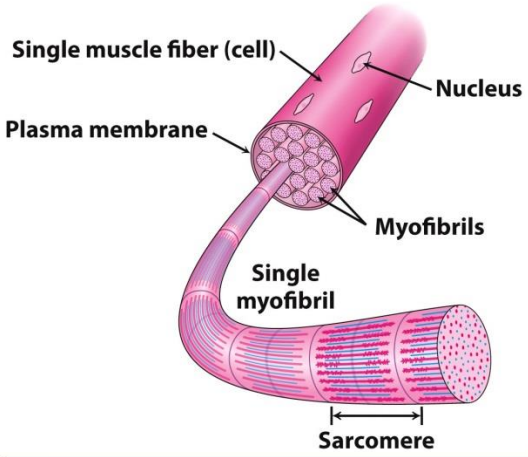


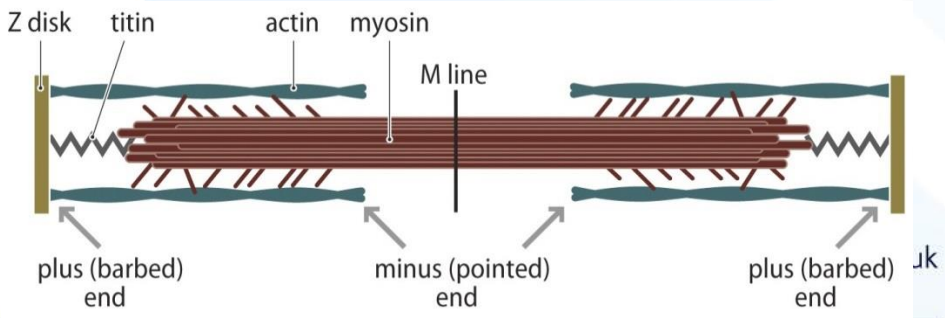
Enfuvirtide

NH_2-F-W-N-W-L-S-A-W-K-D-L-E-L-L-E-Q-E-N-K-E-Q-Q-N-Q-S-E-E-I-L-S-H-I-L-S-T-Y-Ac

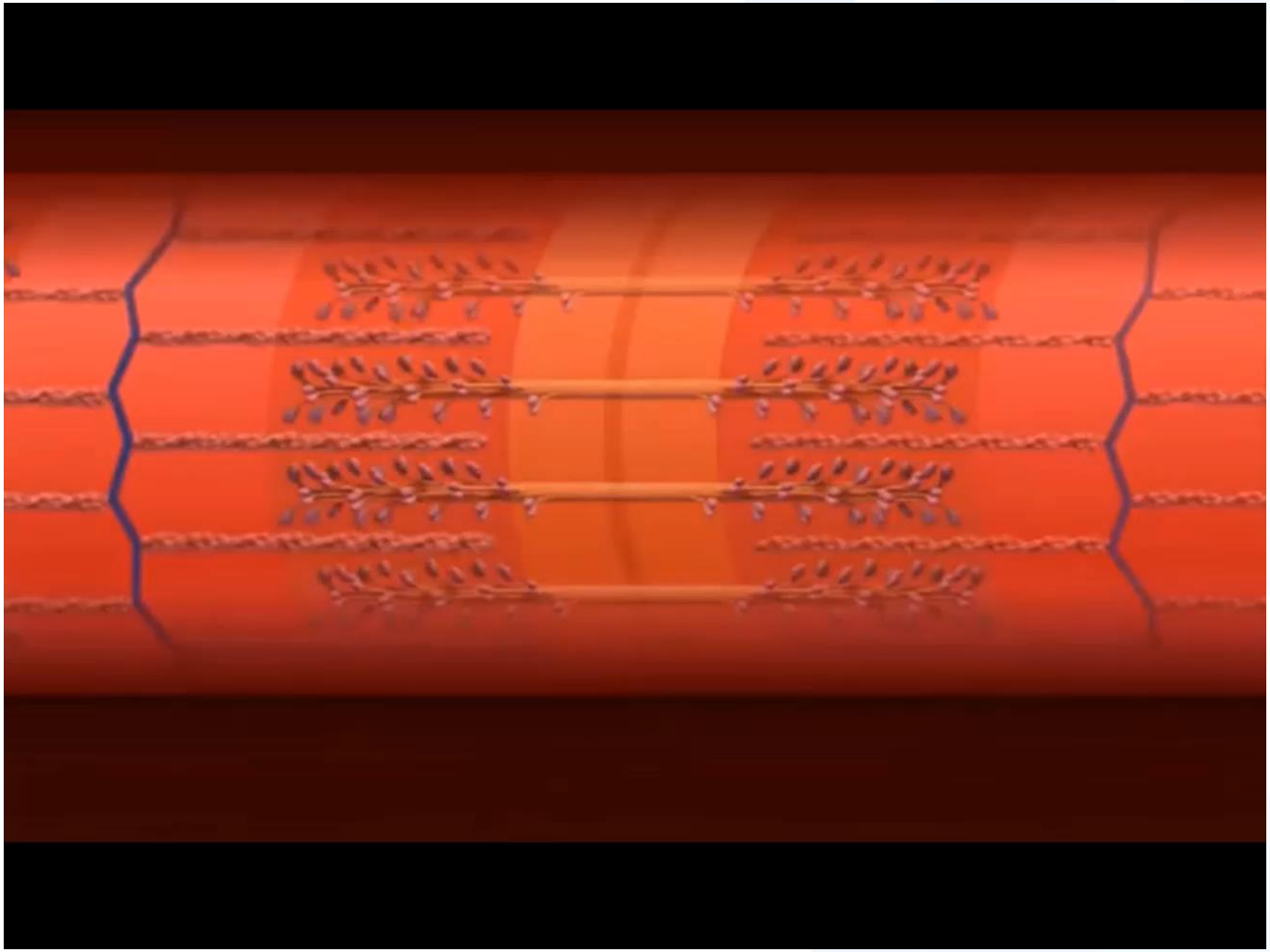
Movement – Actin and Myosin

- Muscle cells contain myofibrils – bundles of interwoven actin and myosin filaments.
- Actin filaments are attached to the z disc via the +end
- Myosin filaments contain multiple myosin II molecules.
- Myosins “walk” towards the +end of actin.
- Multiple sequential interactions slide filaments across each other.



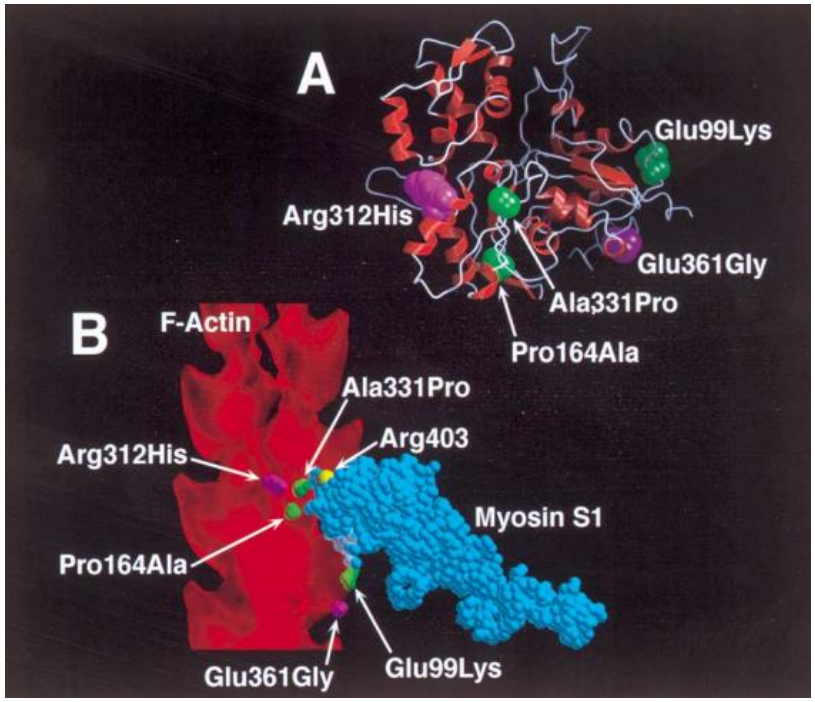


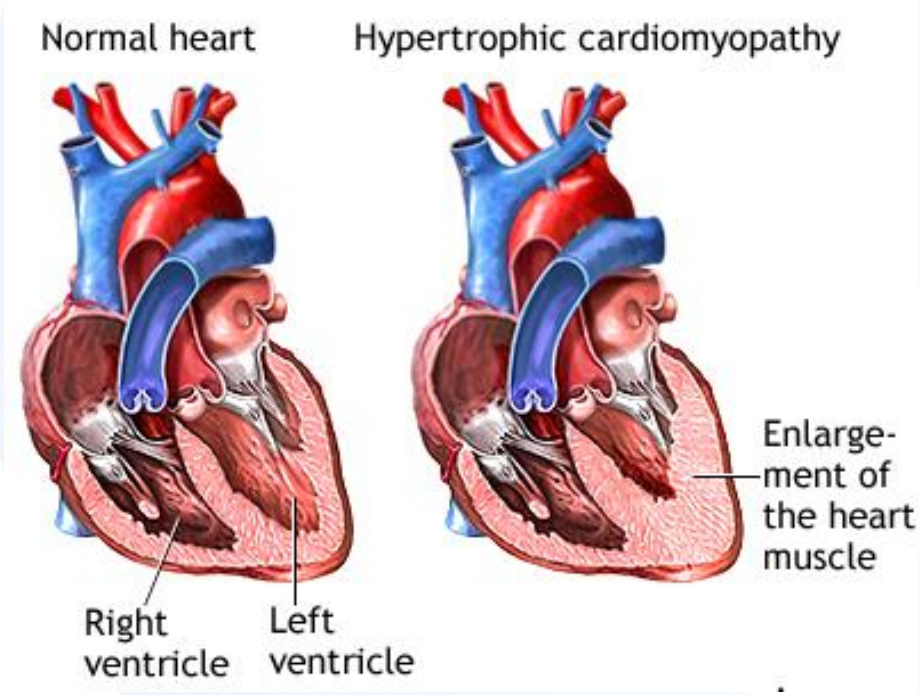
Movement – Actin and Myosin



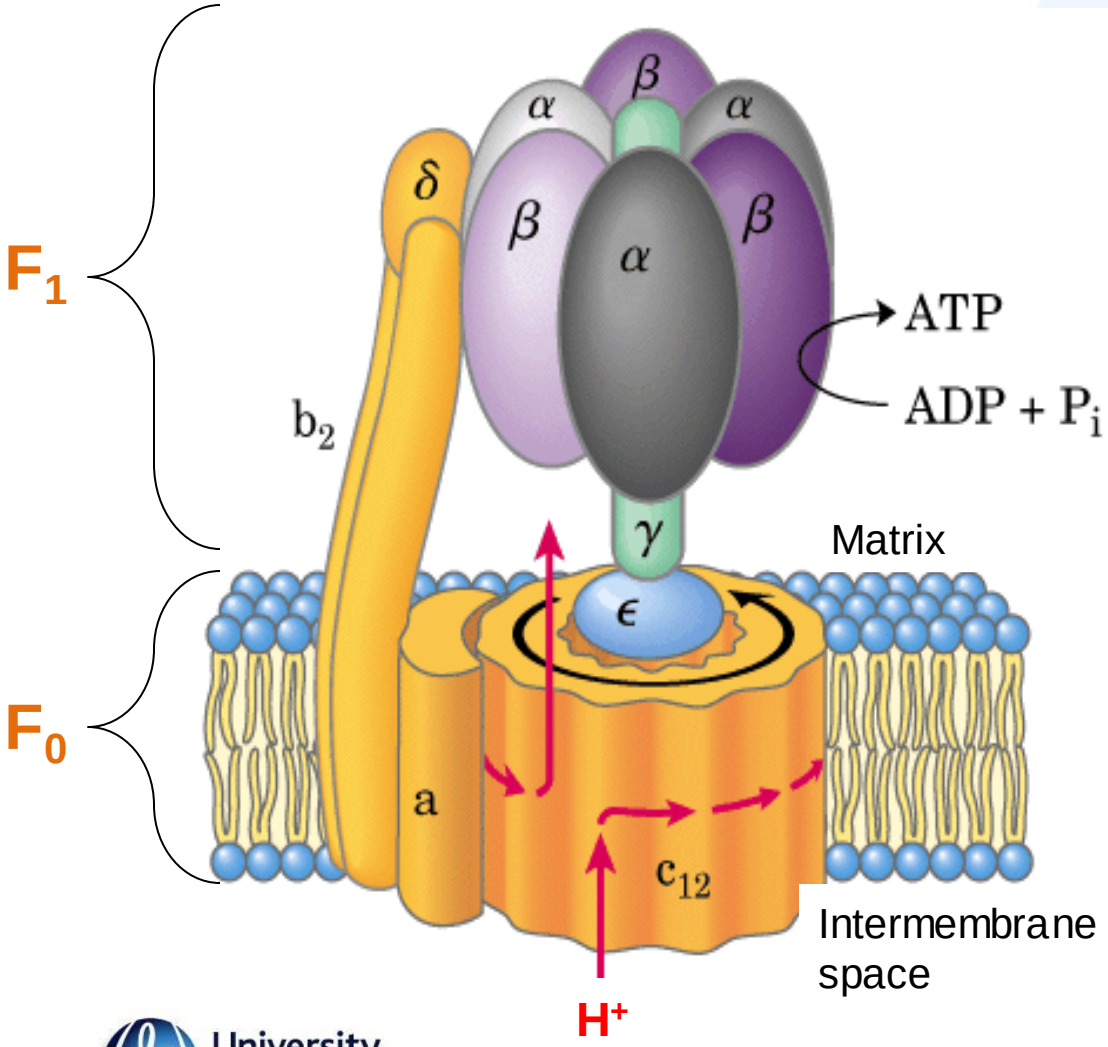
Movement – Actin and Myosin

Mutations in actin which affect myosin binding can cause hypertrophic cardiomyopathy





Energy Generation – ATP Synthase

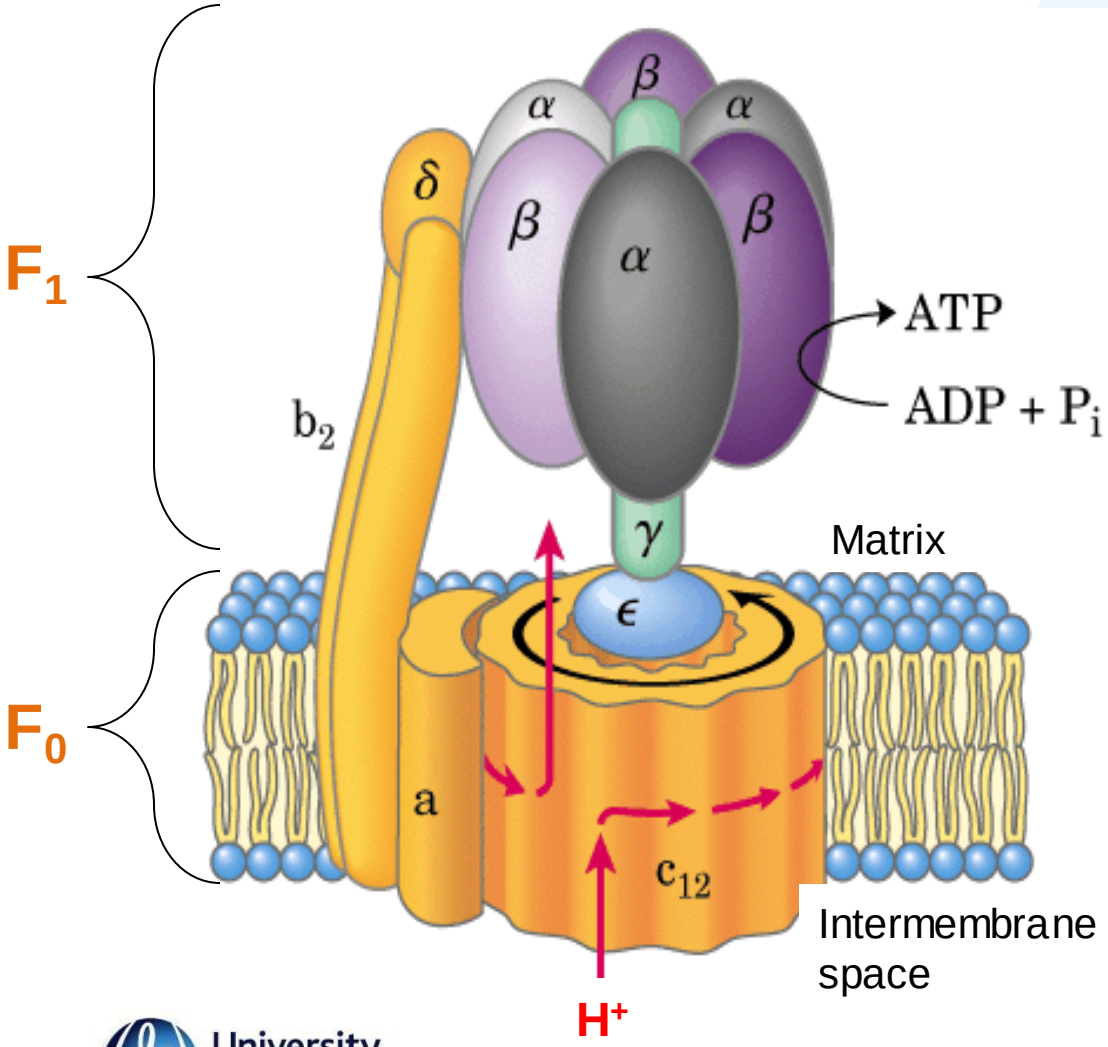


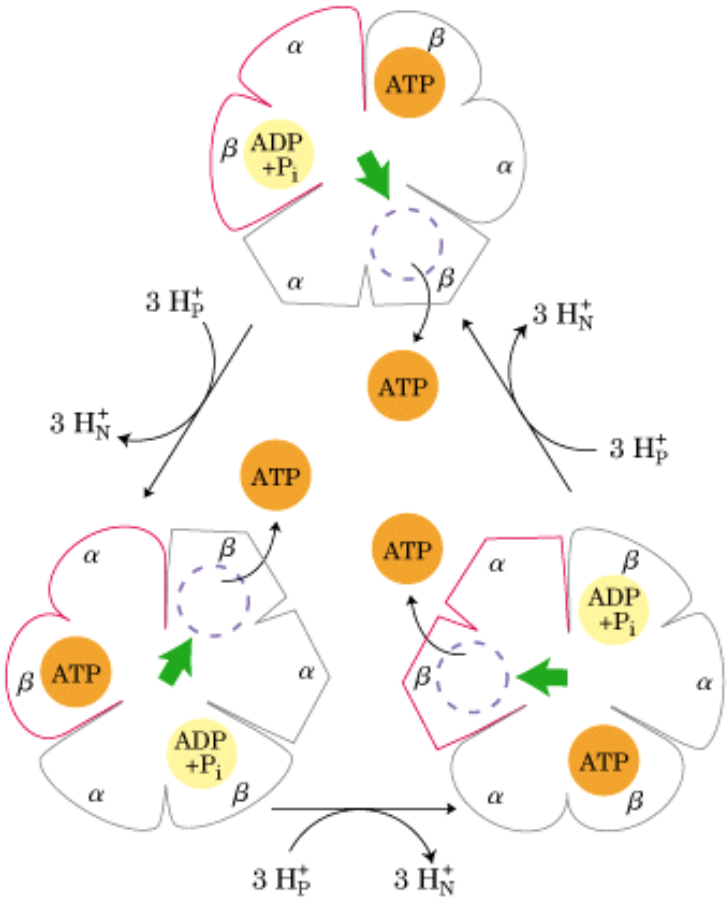
b_2 from F_o associates with a α/β subunit in F_1 holding them fixed relative to the membrane

the F_o cylinder of **c** subunits is attached to the F_1 **shaft (γ and ε)**

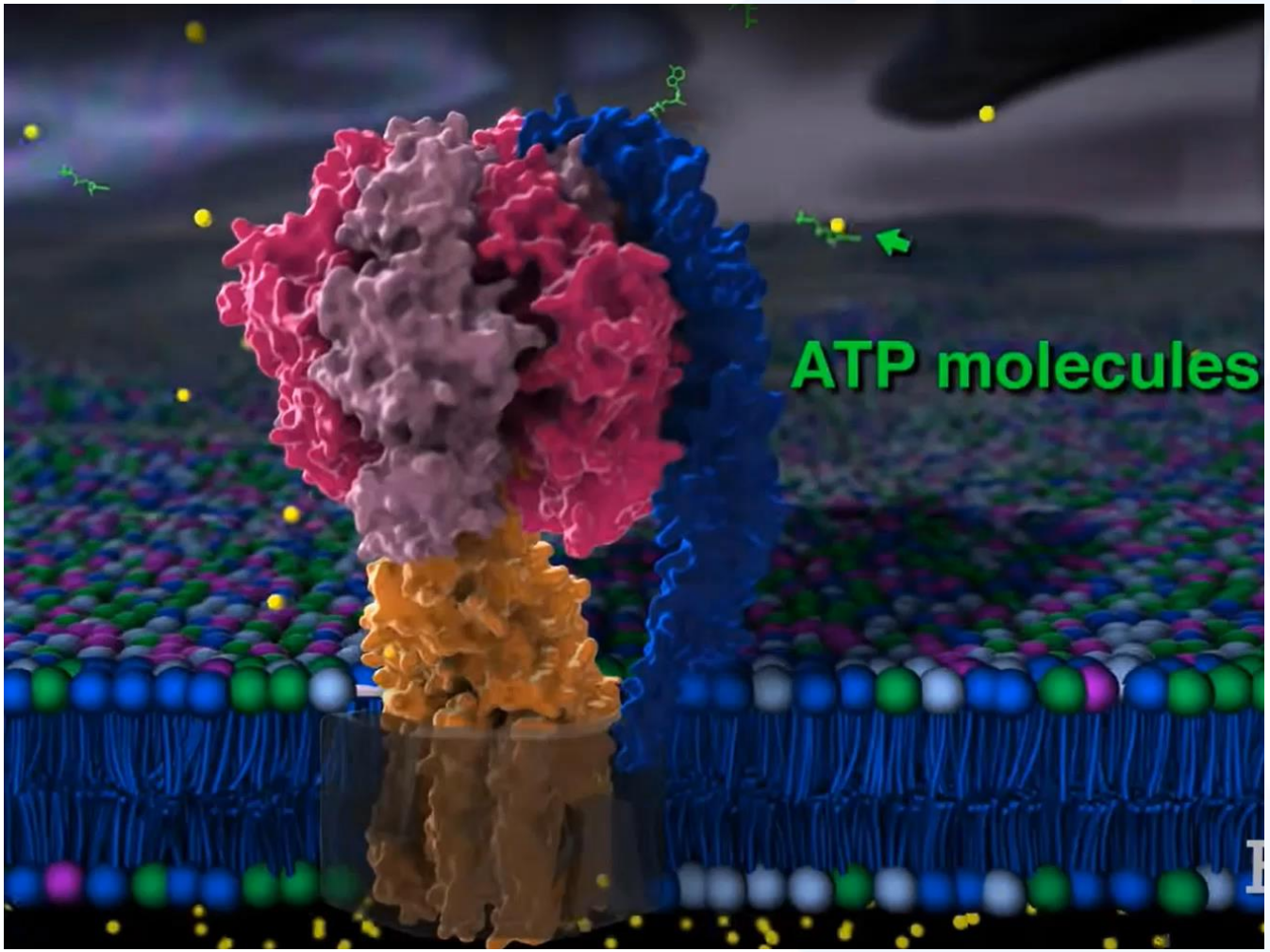
as H^+ flow through the membrane, the cylinder and shaft rotate and the β subunits of F_1 change conformation as the **γ subunit** associates with each in turn

Energy Generation – ATP Synthase

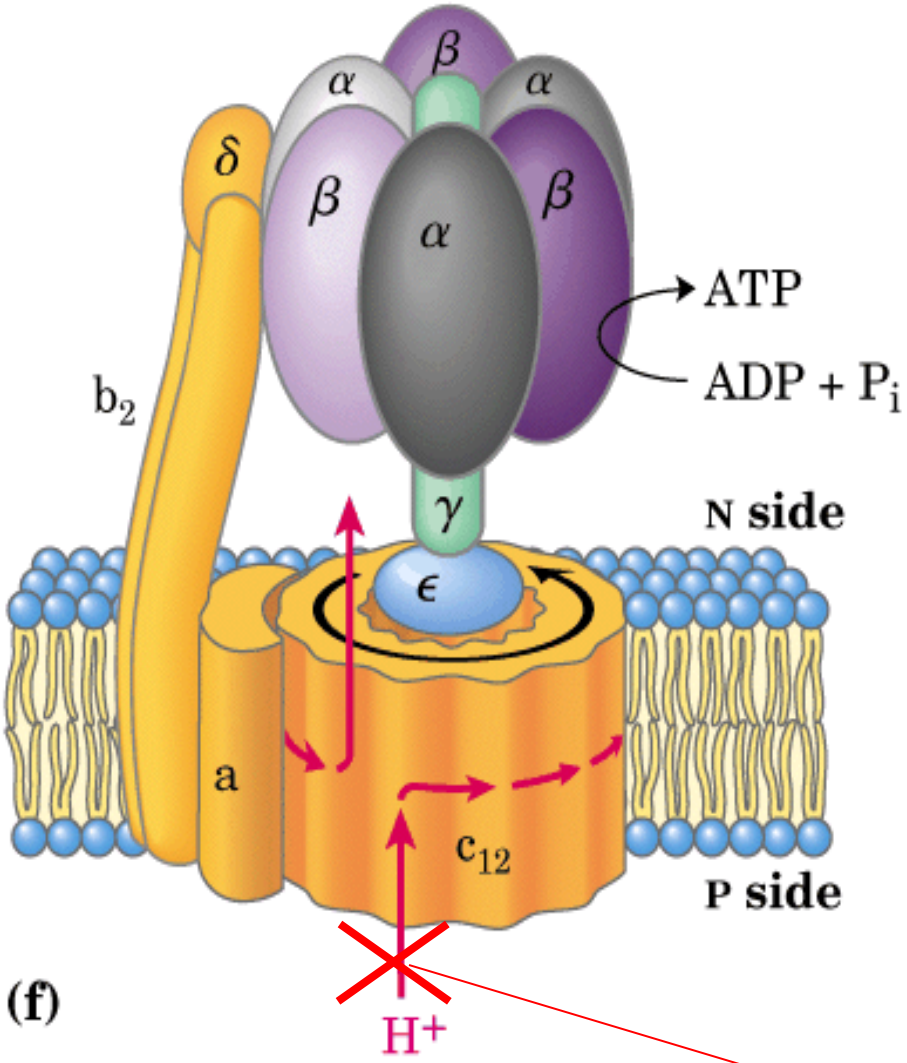


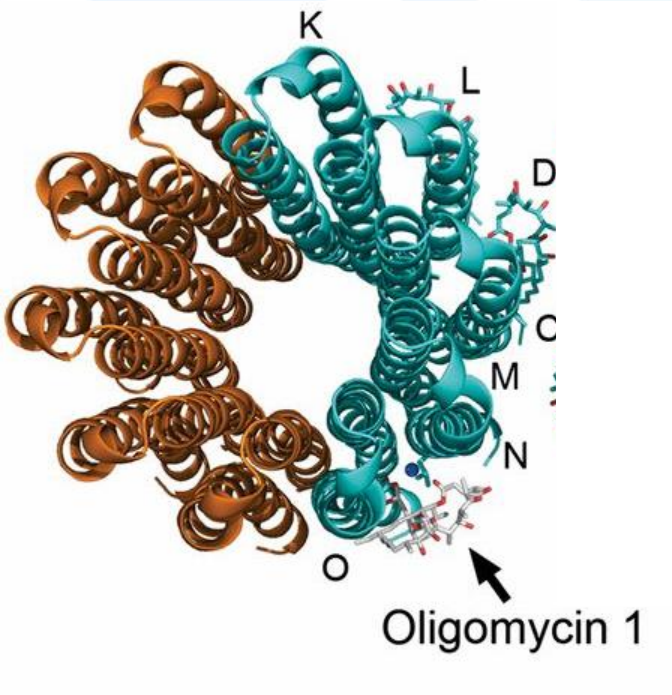


Energy Generation – ATP Synthase



Energy Generation – ATP Synthase





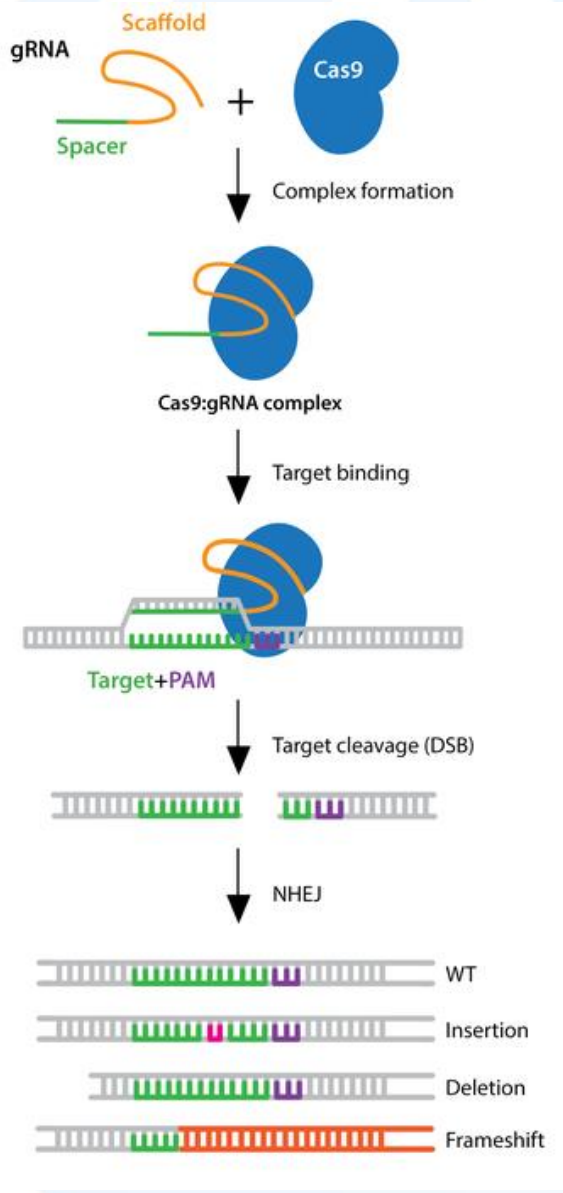
Oligomycin (blocks H^+ flow)

Catalysis – Cas9 Endonuclease

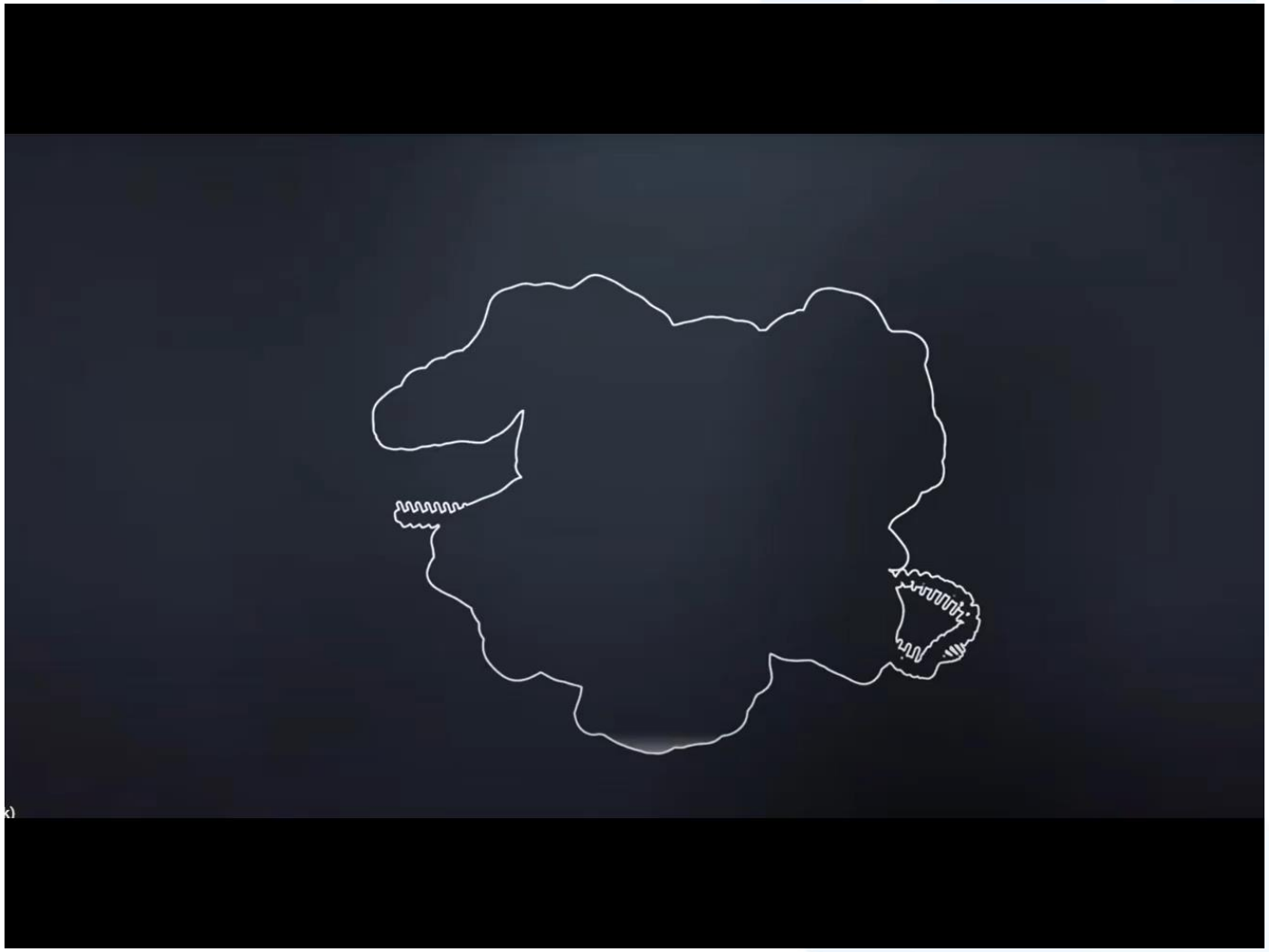
Cas9 is a bacterial defence enzyme which breaks viral DNA.

It uses guide RNA (gRNA) to recognise Clustered Regularly Interspaced Short Palindromic Repeats in viral DNA.

Scientists use the CRISPR-Cas9 system to genetic modify DNA by breaking specific genes. When the genes are repaired, insertions of nucleotides change the gene and create a “knock-out”.



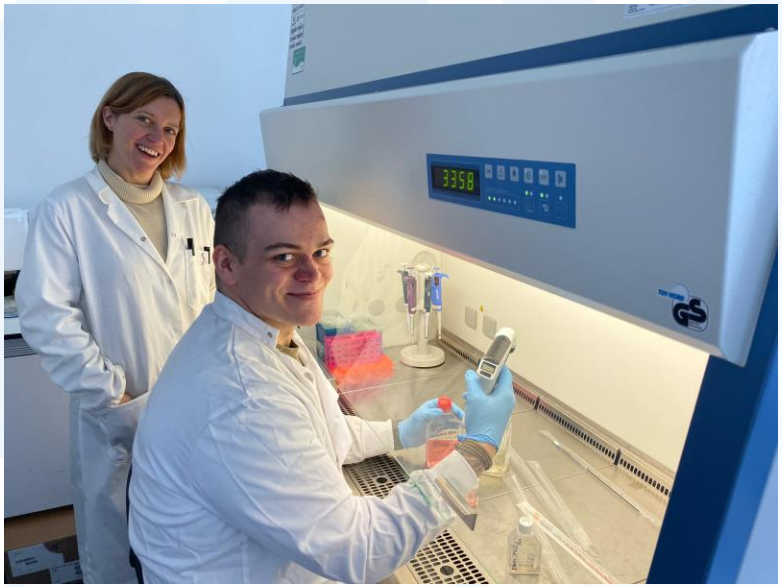
Catalysis – Cas9 Endonuclease



Catalysis – Cas9 Endonuclease

Student research projects can involve CRISPR.

Testing the effect of Sufu knockout on blood cell development.



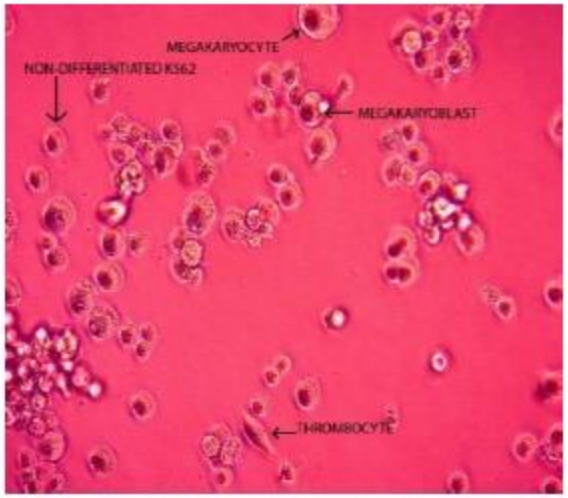


Figure 7 - K562 Cells Treated with PMA at a concentration of 10nM, with Cell Types Identified

Any Questions?

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