Food Security - Instruct infrastructures – examples of potential impact.

David Stuart

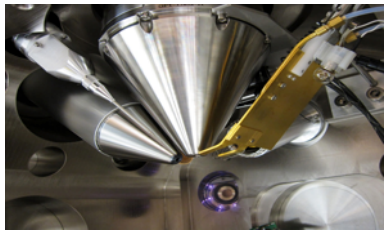
Instruct: Aims to establish a pan-European distributed RI providing state-of-the-art technologies for structural cell biology.

To accelerate the structural biology that underpins translational research.

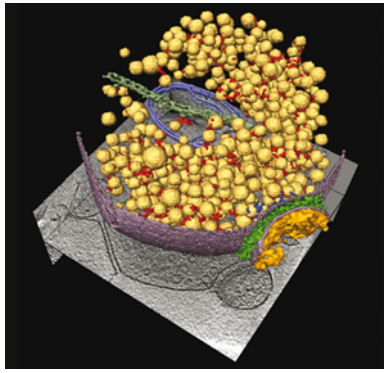
Structural Biology Is already fully embedded in the pipeline for drug discovery.

In contrast structure-based research on plants and domesticated animals remains the poor relation of biomedical research.

The challenge is to integrate novel methods, and industrial and academic research to effectively re-engineer protein based products, specifically to address food security.







Instruct: **providing free access to structural biology infrastructure for Europe – better technologies and expertise = better research.**

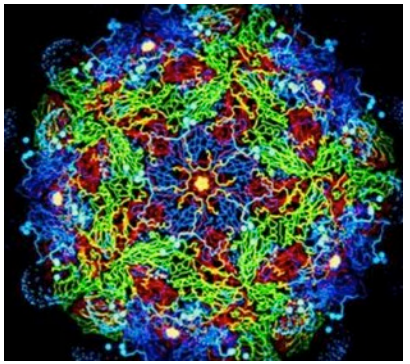
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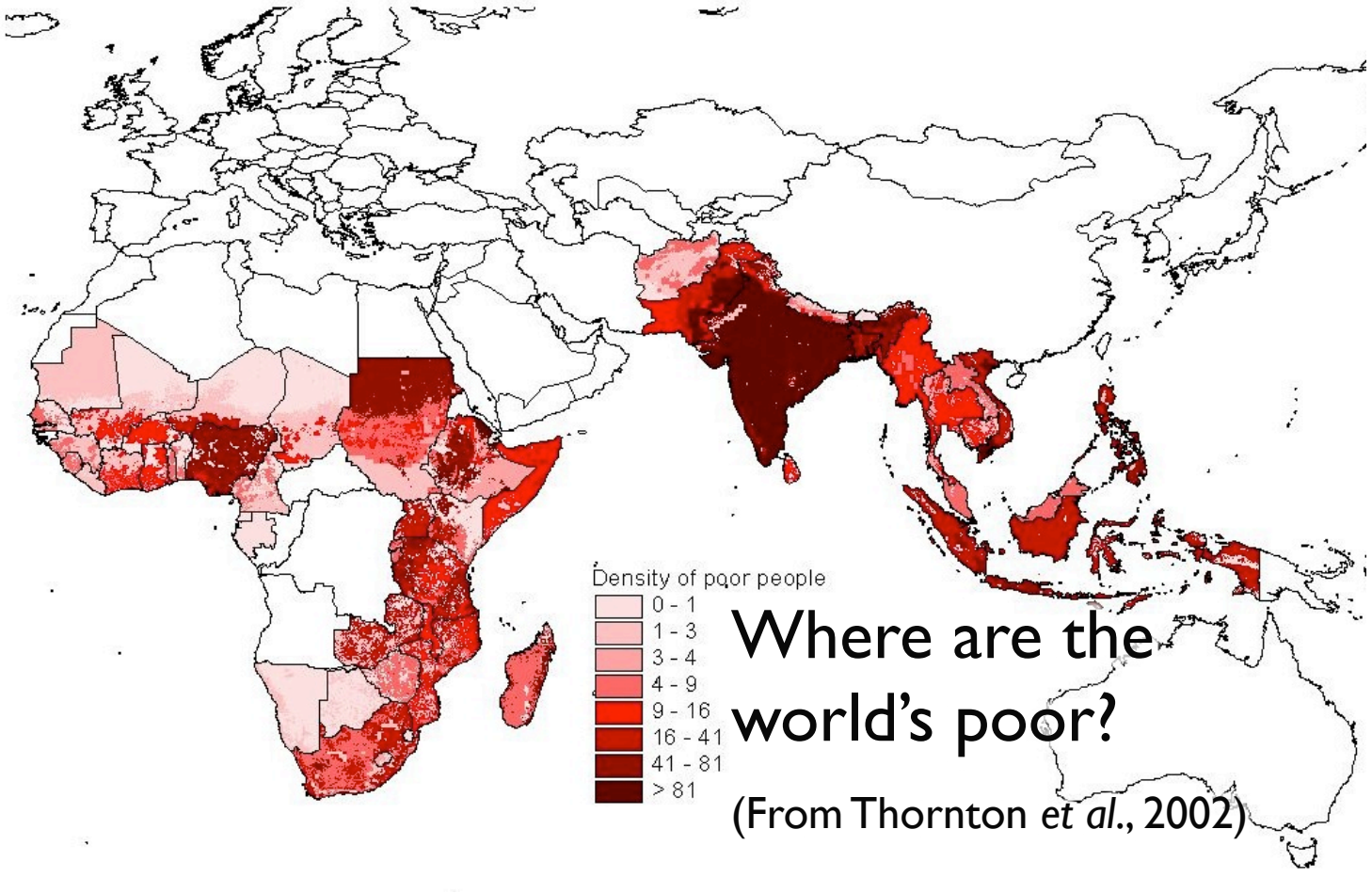
Food Security – Instruct – examples of potential impact (i)

Foot-and-mouth disease. A global food security issue and a priority impediment to wellbeing









Where are the world's poor?

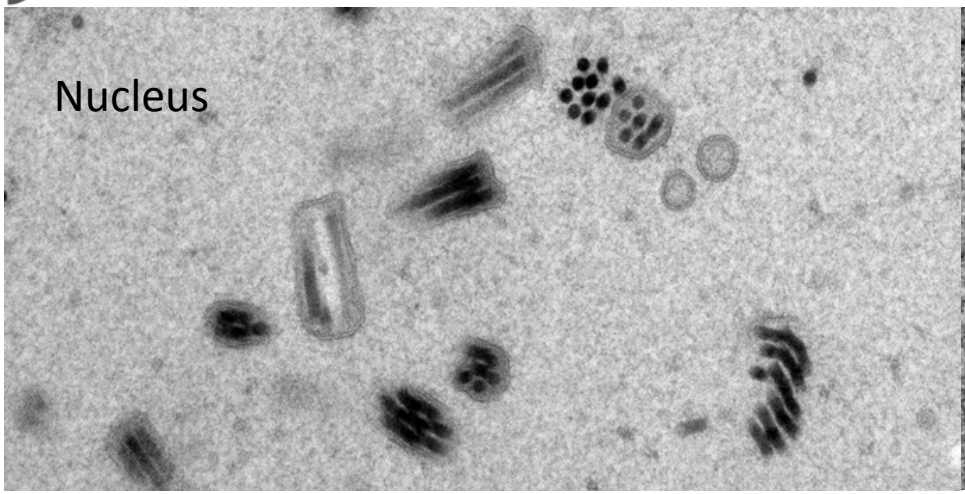
(From Thornton *et al.*, 2002)

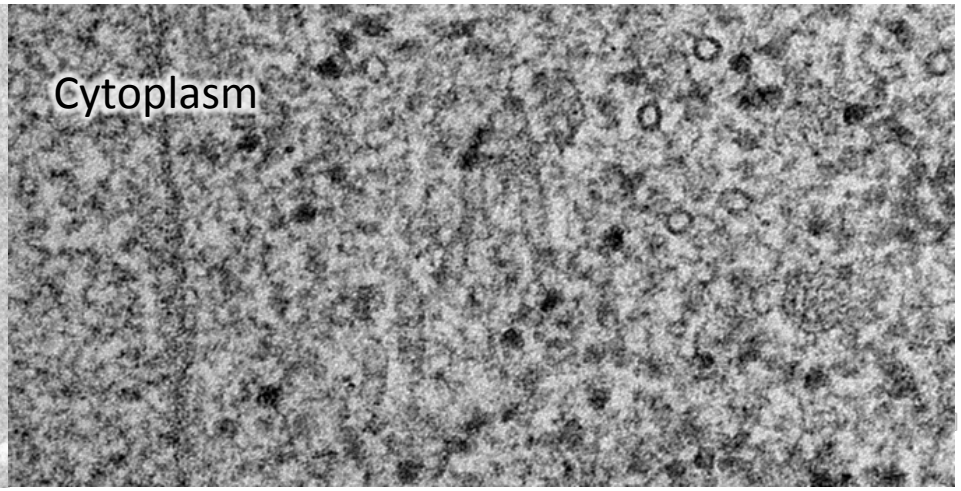
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- Much of the global FMD burden of production losses falls on the world's poorest communities, and those which are most dependent upon the health of their livestock.
- In addition, the presence of FMD in these countries has an impact on the overall herd fertility, modifying the herd structure and affecting the selection of breeds.
- Overall the direct losses **limit livestock productivity** creating a **food security** issue and contributing to **malnutrition**

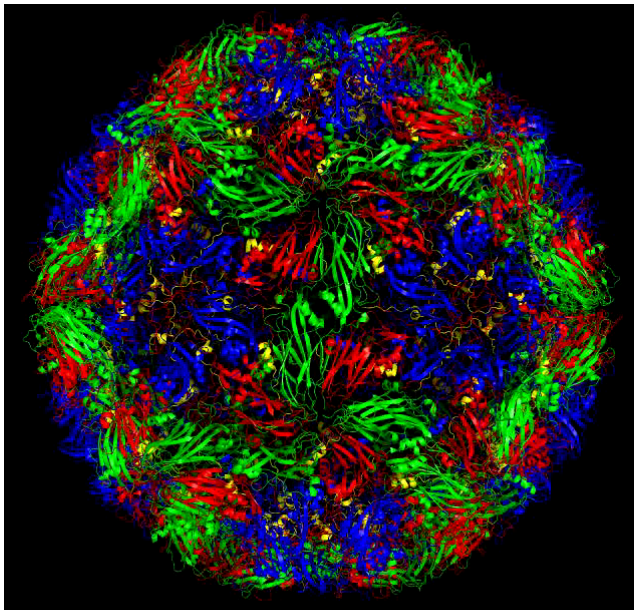
- **Current vaccines** are inactivated live virus formulated with adjuvant for parental inoculation
- Globally there is a **shortage of vaccine** – billions of doses needed. **Cost benefit ratio of 11.5** (Barasa et al., (2008))
- **This is 50 year-old technology**
- We are trying to bring this up-to-date: safe, cheap, effective (for some types of FMDV there is NO effective vaccine)
- (i) **How to make a synthetic, safe product?**
- (ii) **How to make an effective product?**

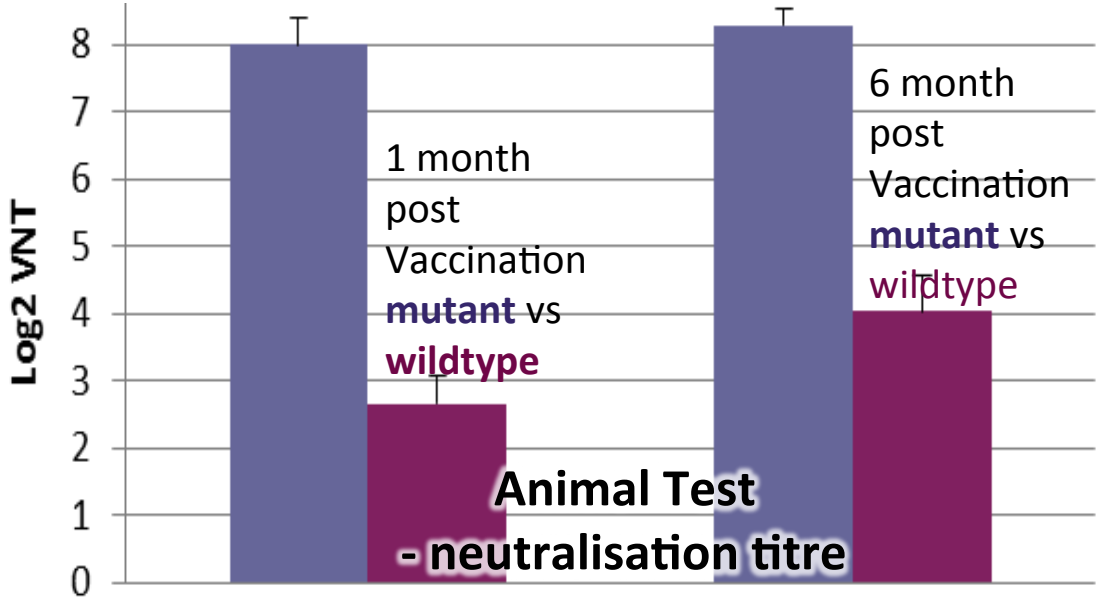
- Make vaccine as synthetic particles, *eg* in Insect cells, yeast or plants. This requires detailed work and basic understanding.



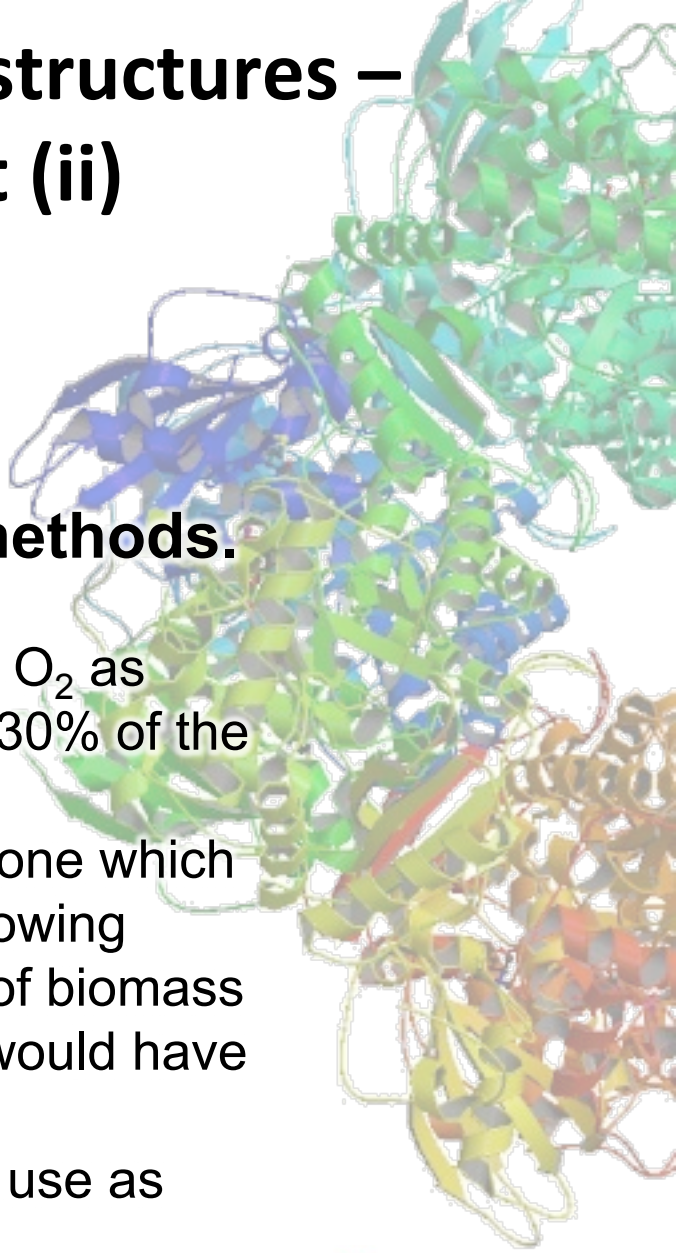


- Make more effective by using structure-based capsid engineering using cycle of design and validation (*cf* drug discovery)





Food Security - Instruct infrastructures – examples of potential impact (ii)



Potential for improving the efficiency of "Rubisco" (Ribulose-1,5-bisphosphate carboxylase), the CO_2 fixing enzyme of photosynthesis using structure based methods.

Rubisco is sluggish and inaccurate, because it uses O_2 as substrate instead of CO_2, leading to a loss of about 30% of the light energy absorbed.
The structure based design of a better enzyme, i.e. one which discriminates better between CO_2 and O_2 without slowing down the reaction rate, would increase the amount of biomass produced both for food and biofuels, and therefore would have an enormous impact on food and energy security.
There are a number of Rubisco structures known to use as design substrates.....

Hartmut Michel, Nobel Prize Chemistry, 1988

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