How small can you make a cell?

- **E. coli**
  - 0.75 μm
  - $n_{bp} = 5 \times 10^6$
  - $n_{gene} = 4377$
  - $\phi_{DNA} = 0.005$

**robust:**
needs only mineral salts and glucose to survive

**efficient:**
cell division in 20 min
How small can you make a cell?

M. genitalium
one of the smallest organisms capable of independent growth and reproduction

\[ n_{bp} = 6 \times 10^5 \]
\[ n_{gene} = 525 \]
\[ \phi_{DNA} = 0.05 \]

limited metabolism: needs to import most small organic molecules from environment

survives as a parasite in human genital tract

slow: cell division in 10 hours

E. coli

0.5 μm

0.75 μm

\[ n_{bp} = 5 \times 10^6 \]
\[ n_{gene} = 4377 \]
\[ \phi_{DNA} = 0.005 \]

robust: needs only mineral salts and glucose to survive

efficient: cell division in 20 min
How small can you make a cell?

**Lambda phage virus**

- $n_{bp} = 5 \times 10^4$
- $n_{gene} = 50$
- $\phi_{DNA} = 0.55$

DNA tightly packaged into virus head with room for nothing else

no independent metabolism or capacity to reproduce

**E. coli**

- $n_{bp} = 5 \times 10^6$
- $n_{gene} = 4377$
- $\phi_{DNA} = 0.005$

**robust:** needs only mineral salts and glucose to survive

**efficient:** cell division in 20 min
How small can you make a cell?

**Pithovirus sibericum**

largest known virus, reported in 2014 from a 30,000 year old Siberian permafrost sample

\[ n_{bp} = 6 \times 10^5 \]
\[ n_{gene} = 467 \]
\[ \phi_{DNA} = 0.002 \]

Quite roomy inside!

A former bacterium that has jettisoned its protein machinery to replicate parasitically in amoebas?

Fresh off the presses

New article in Proc. Natl. Acad. Sci., appeared online three days ago:

In-depth study of *Mollivirus sibericum*, a new 30,000-year-old giant virus infecting *Acanthamoeba*

They found an unusual number of ribosome-related proteins in the virus volume. There is certainly plenty of space to store them.

"The fact that two different viruses retain their infectivity in prehistorical permafrost layers should be of concern in a context of global warming."
How big can you make a cell?
How big can you make a cell?

It has been rigorously proven that giraffes do not exist!
How big can you make a cell?

As big as you want, if you have fueled transport mechanisms within the cell.

Caulerpa taxifolia

seaweed

largest single-celled organism
fronds can be up to 1m long