

**FOR THE LOVE OF LEARNING
SINCE 1597**



GRESHAM

COLLEGE

The Microbial Basis of Life

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@robinmay9



UNIVERSITY OF
BIRMINGHAM



EST. 1597

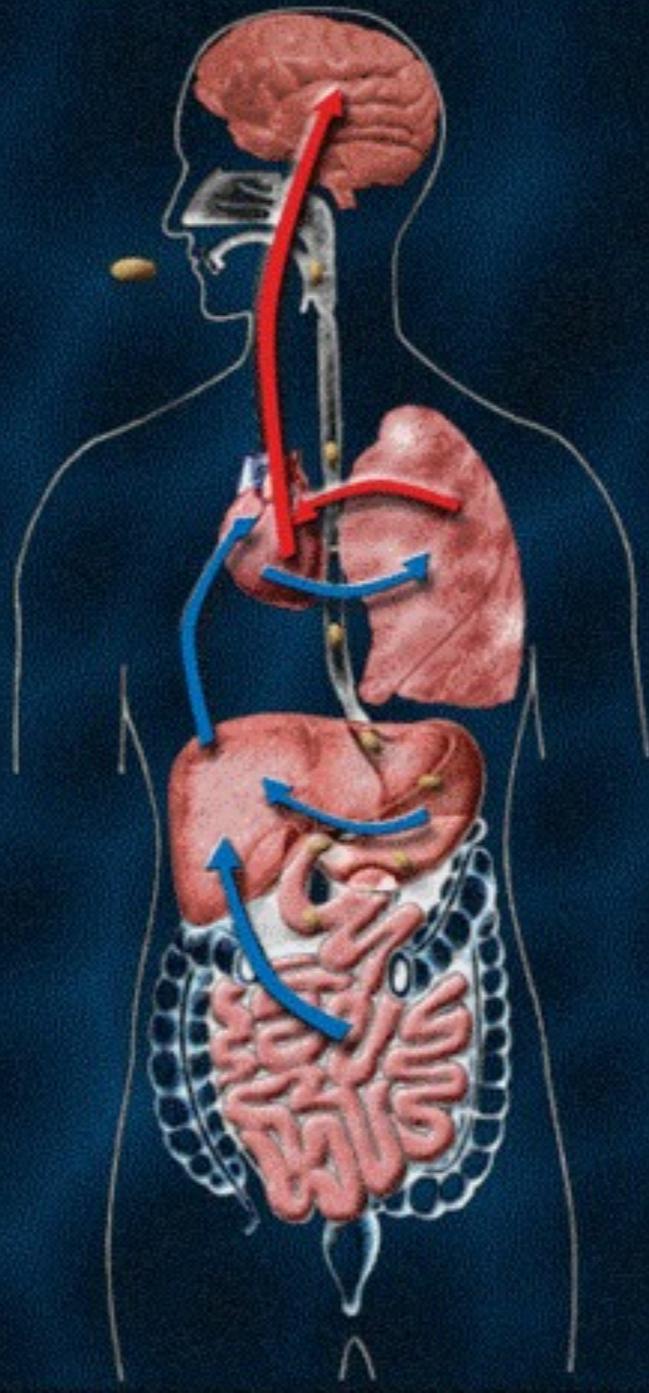
GRESHAM
COLLEGE

Microbes are everywhere and do everything...



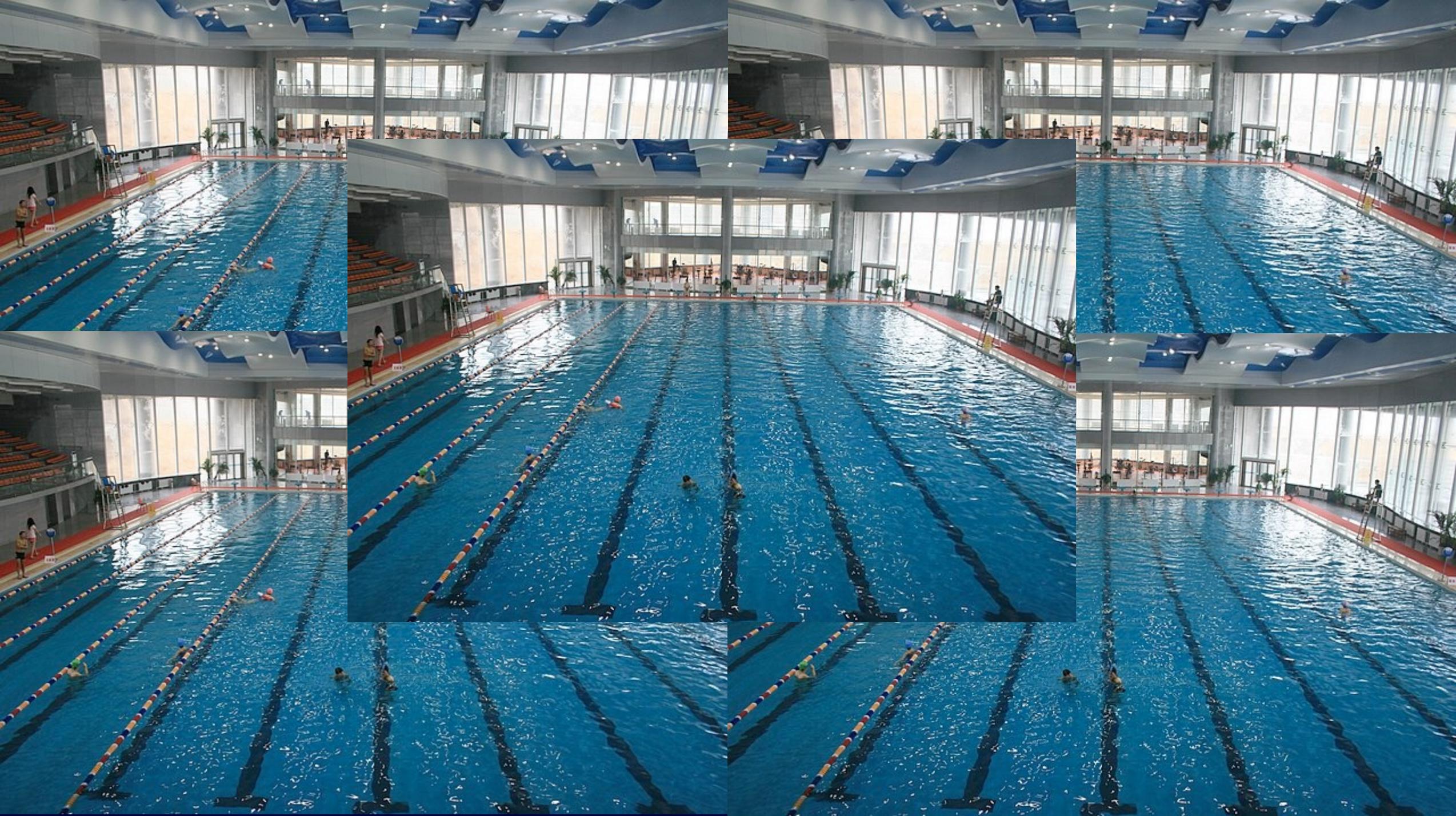
You are never very far from a microbe...





The human gut
harbours at least
39 TRILLION
bacteria

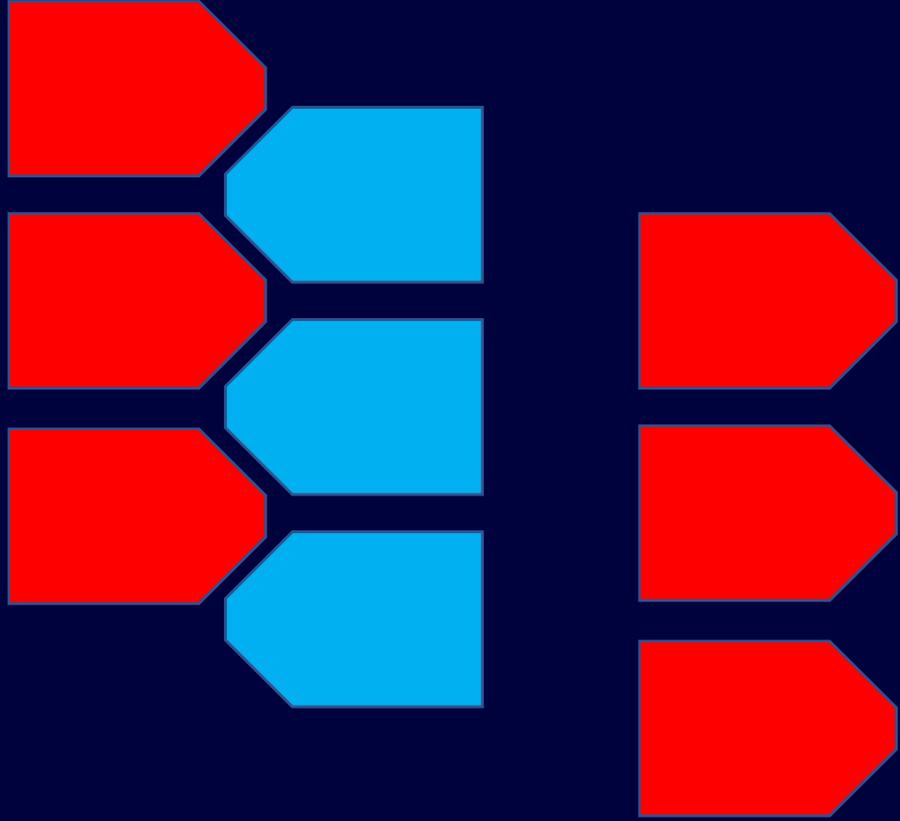




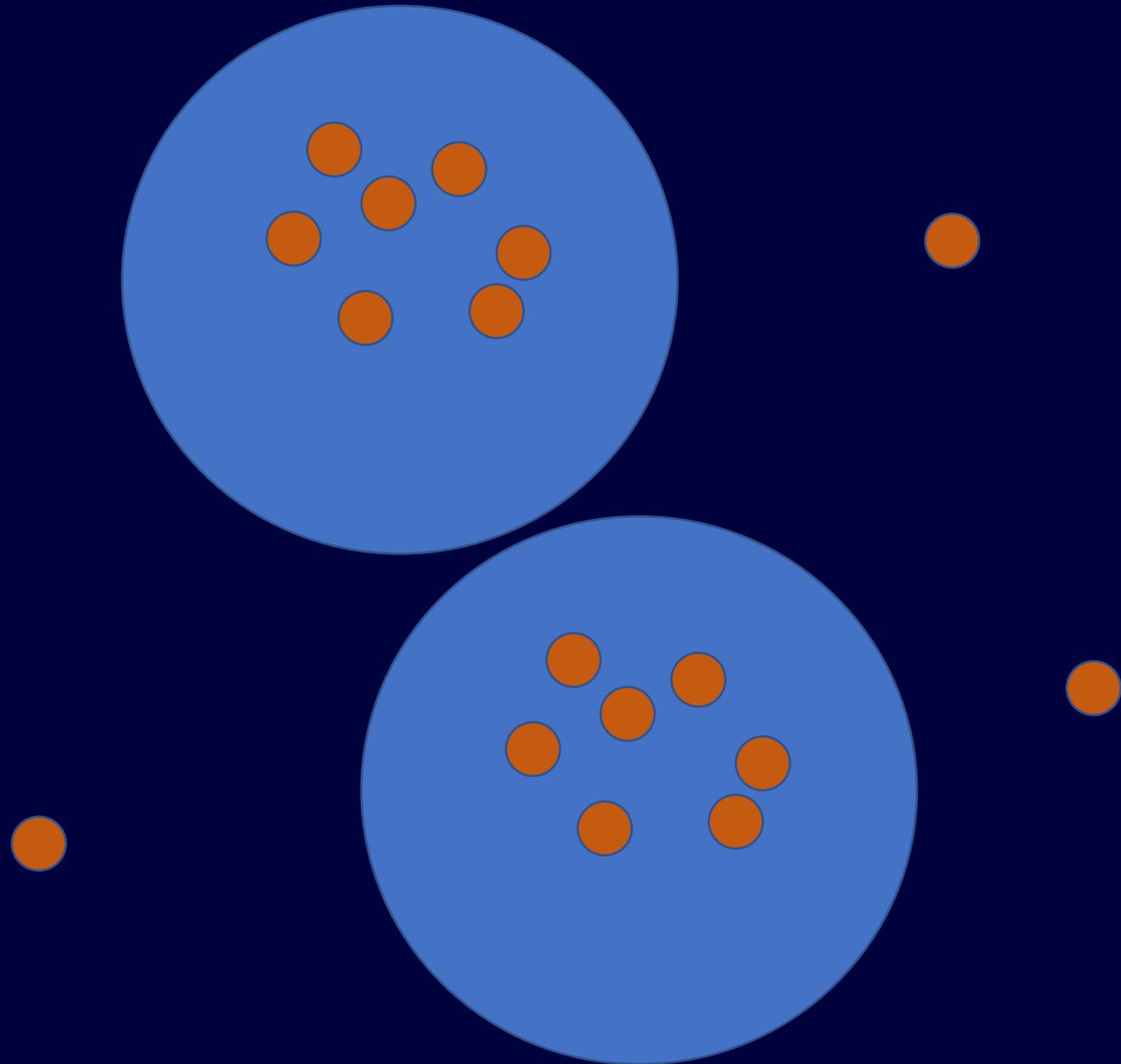
In the beginning...

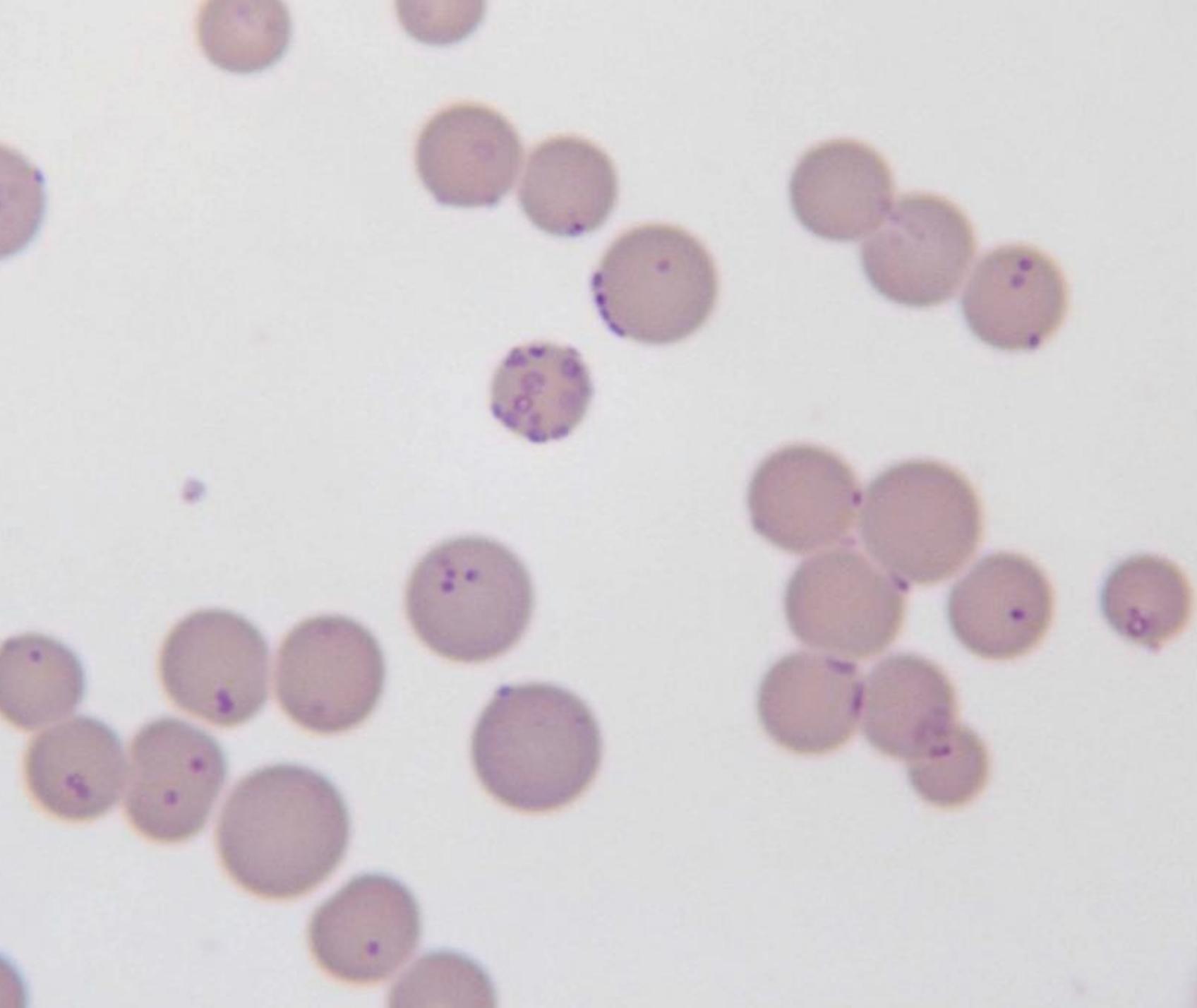






**What does it take to
make a cell?**





**The simplest life
today is still
VERY complex.**



Mycoplasma genitalium

475 genes

580 000 DNA 'letters'



A (very) brief history of life on Earth



EON	ERA	PERIOD	EPOCH	Ma		
Phanerozoic	Cenozoic	Quaternary	Holocene	0.011		
			Pleistocene	Late	0.8	
				Early	2.4	
		Tertiary	Neogene	Pliocene	Late	2.4
				Early	3.6	
				5.3		
			Miocene	Late	11.2	
				Middle	16.4	
				Early	23.0	
		Paleogene	Oligocene	Late	28.5	
				Early	34.0	
			Eocene	Late	41.3	
				Middle	49.0	
				Early	55.8	
			Paleocene	Late	61.0	
	Early	65.5				
	Mesozoic	Cretaceous	Late	99.6		
			Early	145		
		Jurassic	Late	161		
			Middle	176		
			Early	200		
		Triassic	Late	228		
			Middle	245		
			Early	251		
			260			
	Paleozoic	Permian	Late	260		
			Middle	271		
			Early	299		
		Pennsylvanian	Late	306		
			Middle	311		
			Early	318		
		Mississippian	Late	326		
			Middle	345		
			Early	359		
		Devonian	Late	385		
Middle			397			
Early			416			
Silurian		Late	419			
		Early	423			
Ordovician		Late	428			
		Middle	444			
		Early	488			
Cambrian		Late	501			
	Middle	513				
	Early	542				
Precambrian	Proterozoic	Late Neoproterozoic (Z)	1000			
		Middle Mesoproterozoic (Y)	1600			
		Early Paleoproterozoic (X)	2500			
	Archean	Late	3200			
		Early	4000			
Hayden			4000			

Humans

First cellular life

First photosynthesis

No sign of life

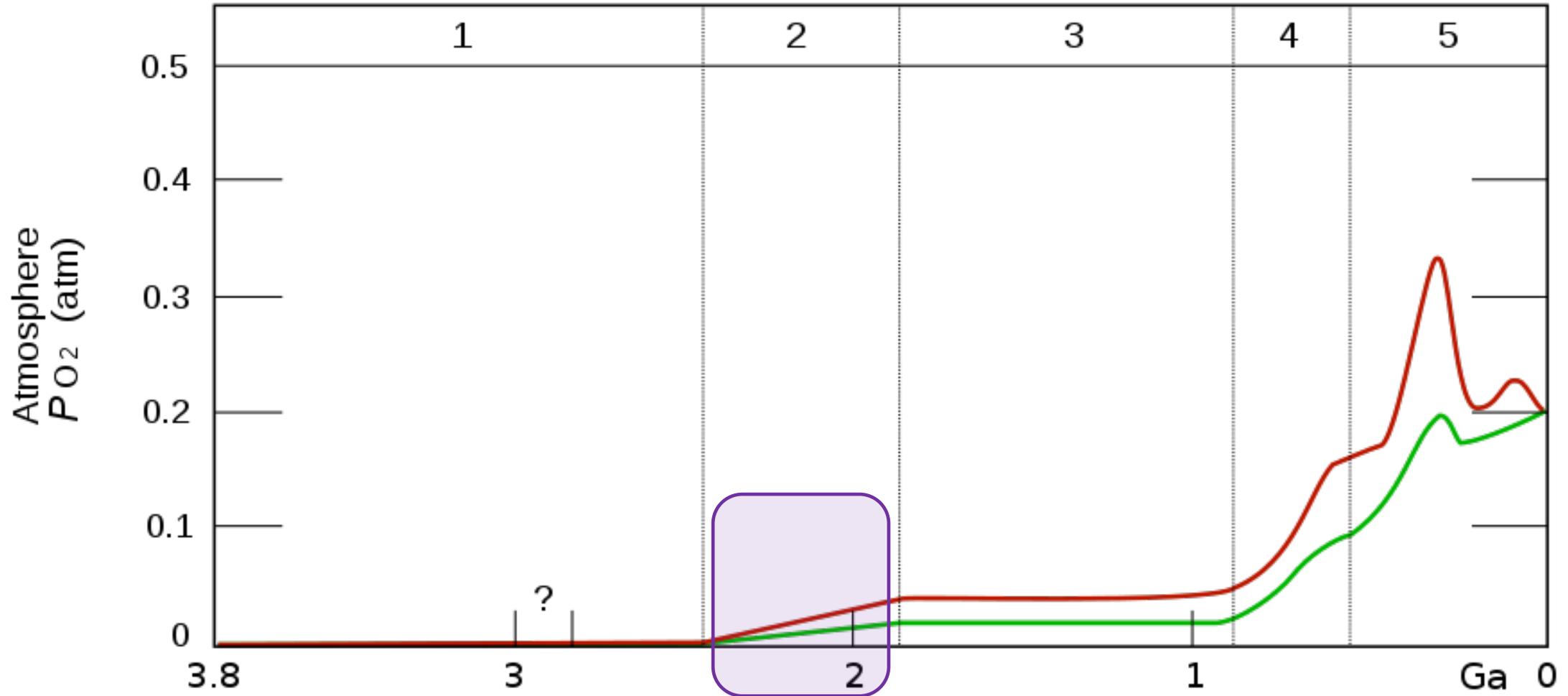




**Along came
photosynthesis...**



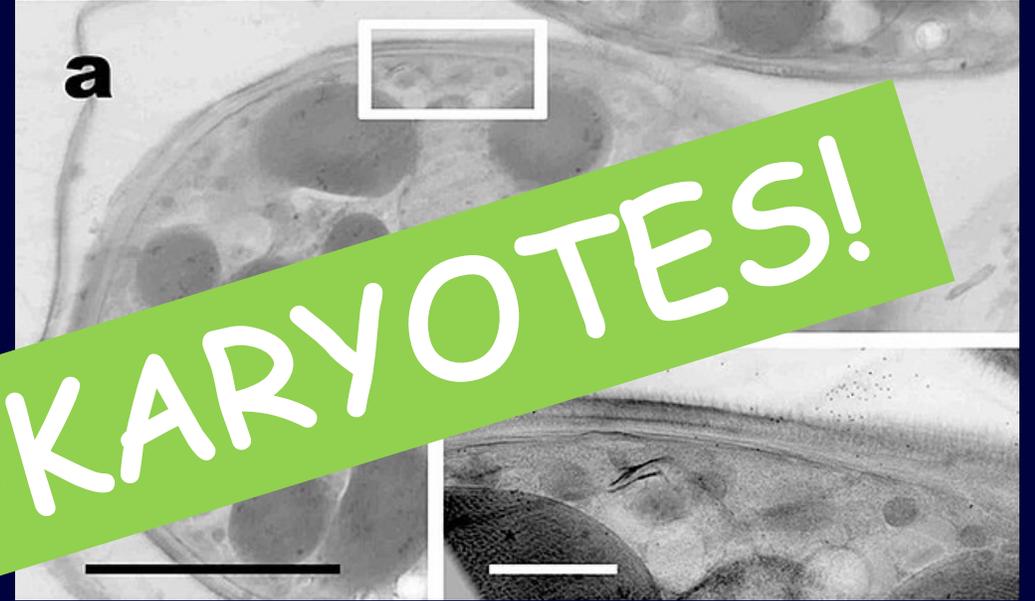
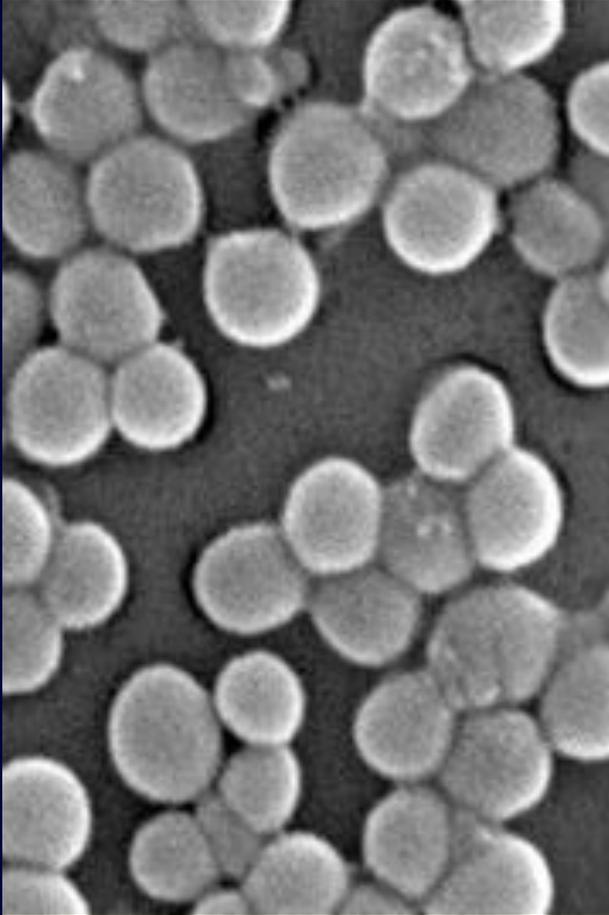
Stages

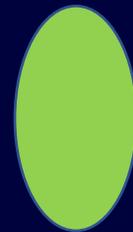
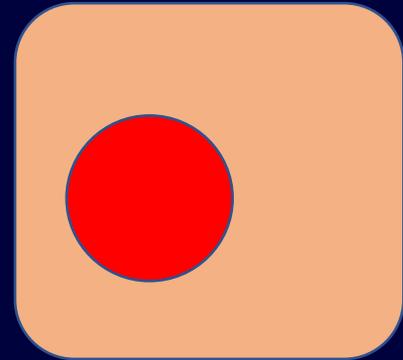
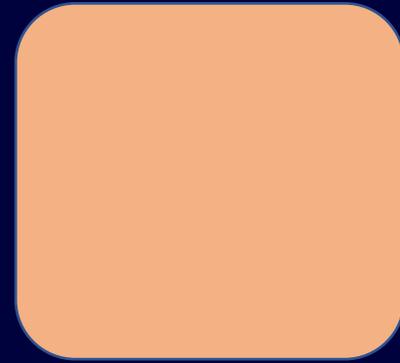
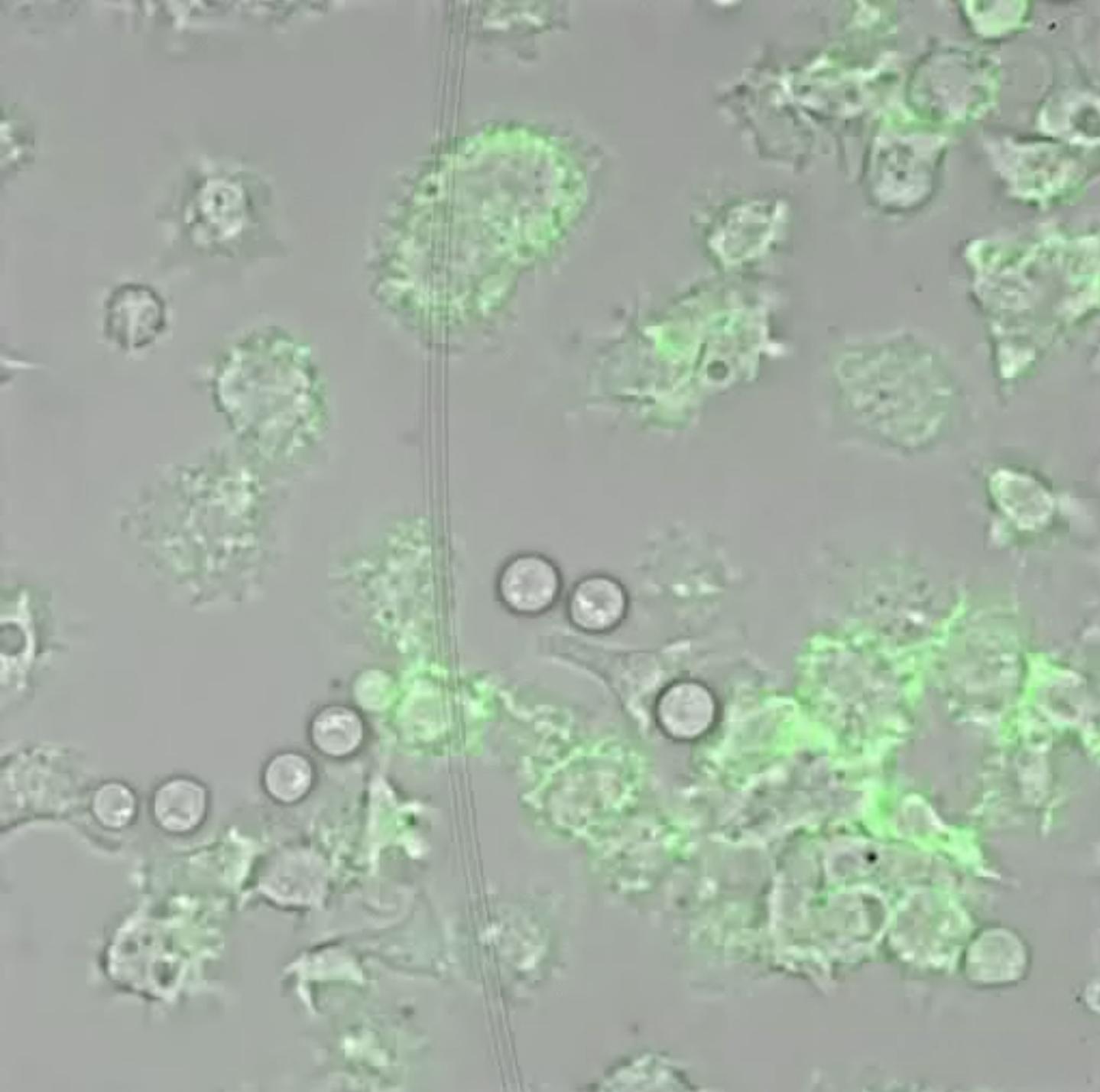


[Oxygenation-atm.svg](#): Heinrich D. Holland derivative work: [Loudubewe \(talk\)](#) - [Oxygenation-atm.svg](#)
Estimated evolution of atmospheric oxygen. The upper red and lower green lines represent the range of the estimates.



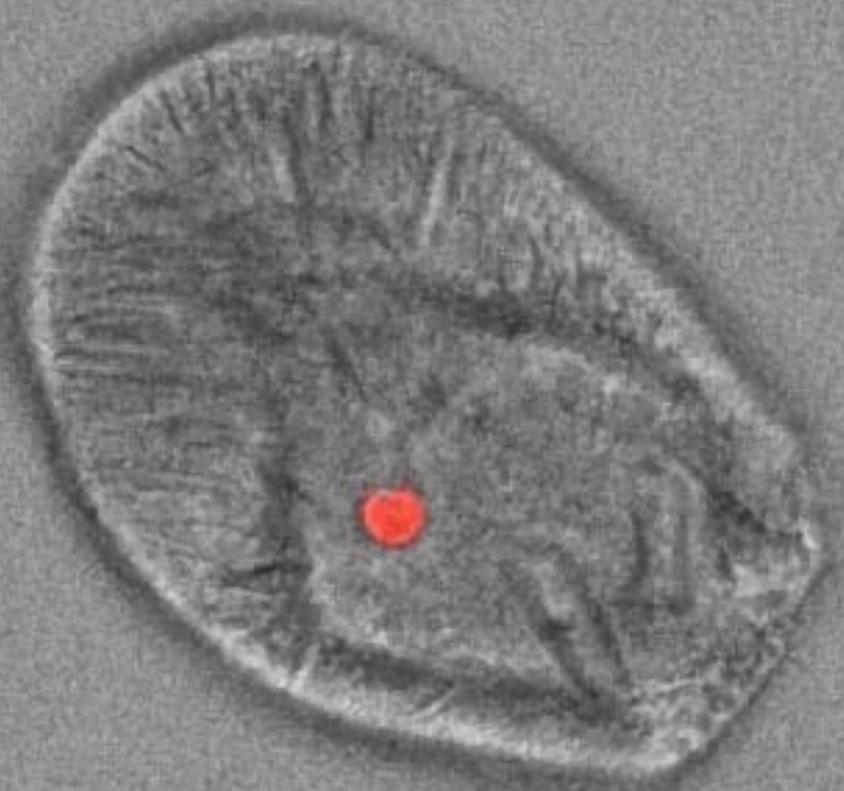
Next giant leap...cellular complexity!





00:00:00

**Much more
recent
endosymbiosis
events shape the
modern world...**

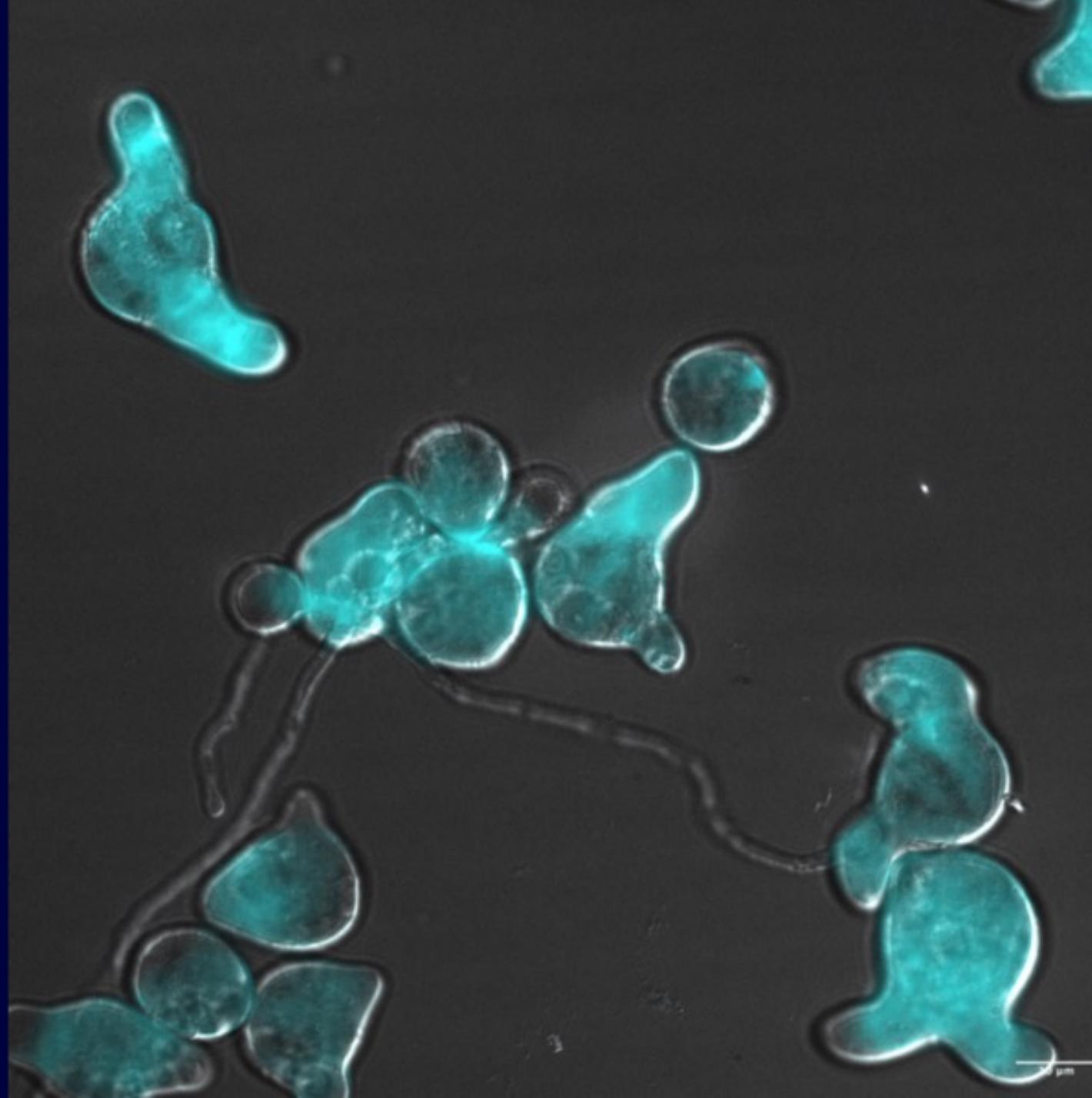


Annika Guse

30 μm

**Much more
recent
endosymbiosis
events shape the
modern world...**

*Kerstin Voelz
Liz Ballou
Dora Corzo-Leon*



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Humans

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First cellular life

First photosynthesis

First eukaryotes



What about multicellularity?



Courtesy of AlgaTerra



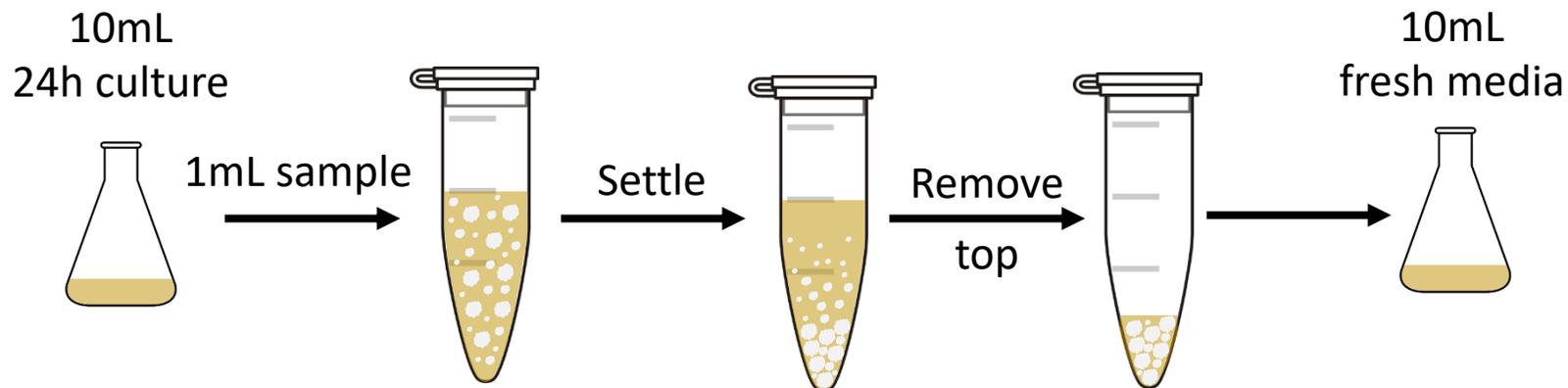
What about multicellularity?



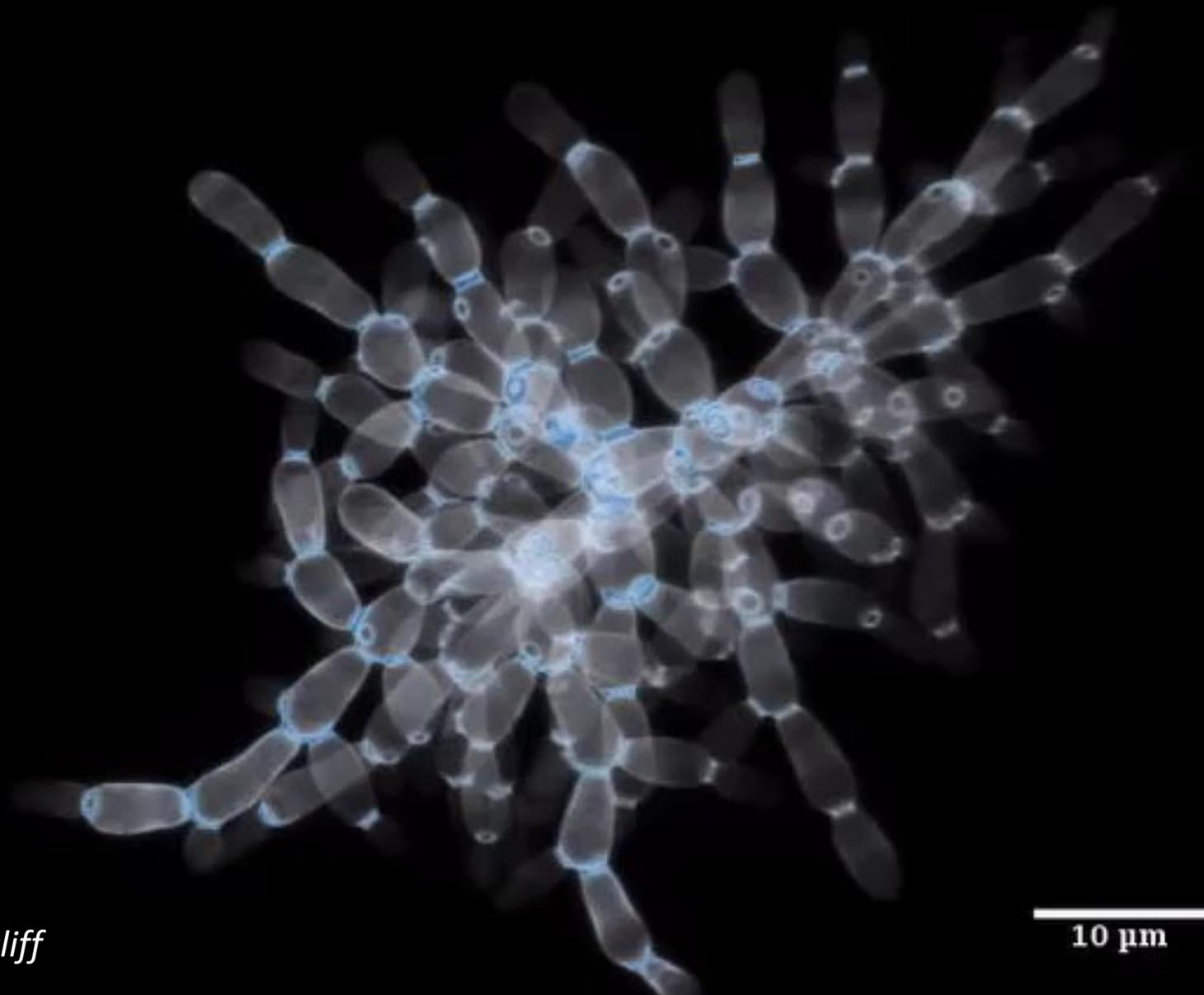
You can evolve multicellularity in the lab



Settling selection for increased multicellular size



Snowflake yeast



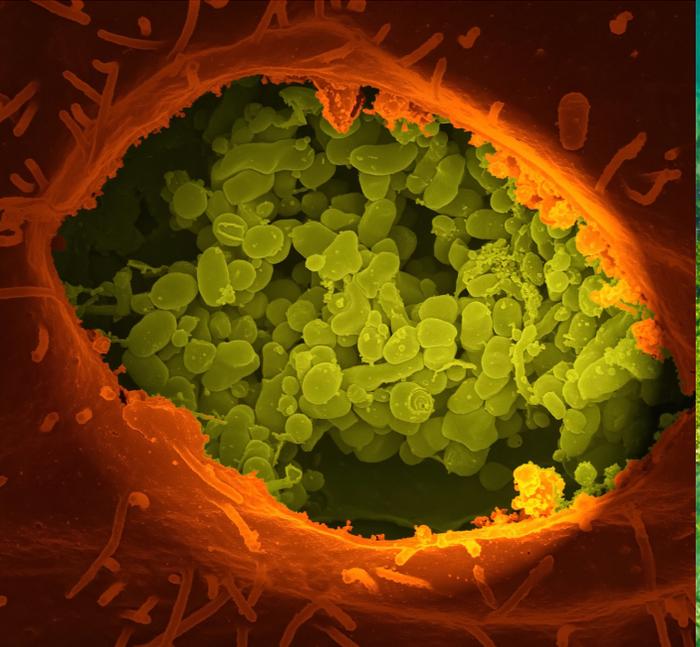
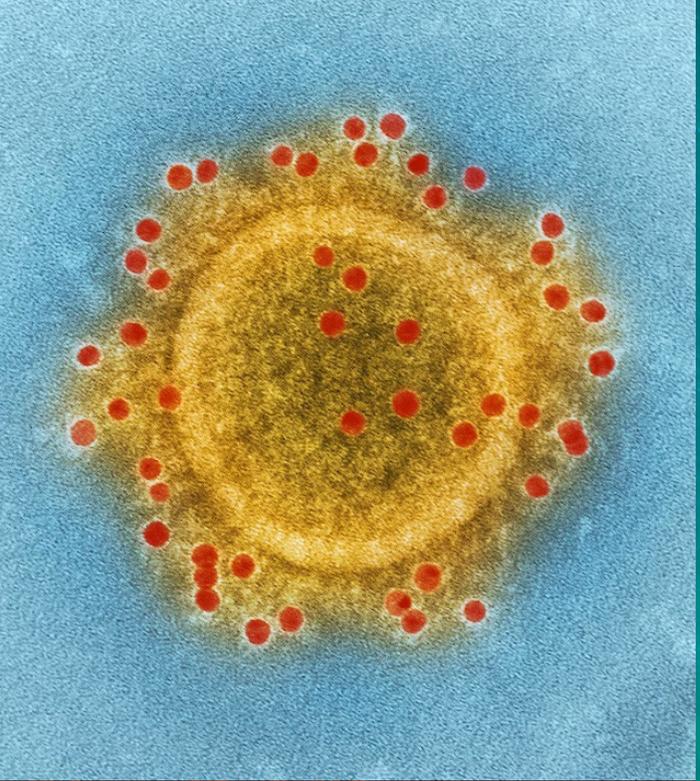
Will Ratcliff

10 μm



“...endless forms most beautiful and most wonderful have been, and are being, evolved.”





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