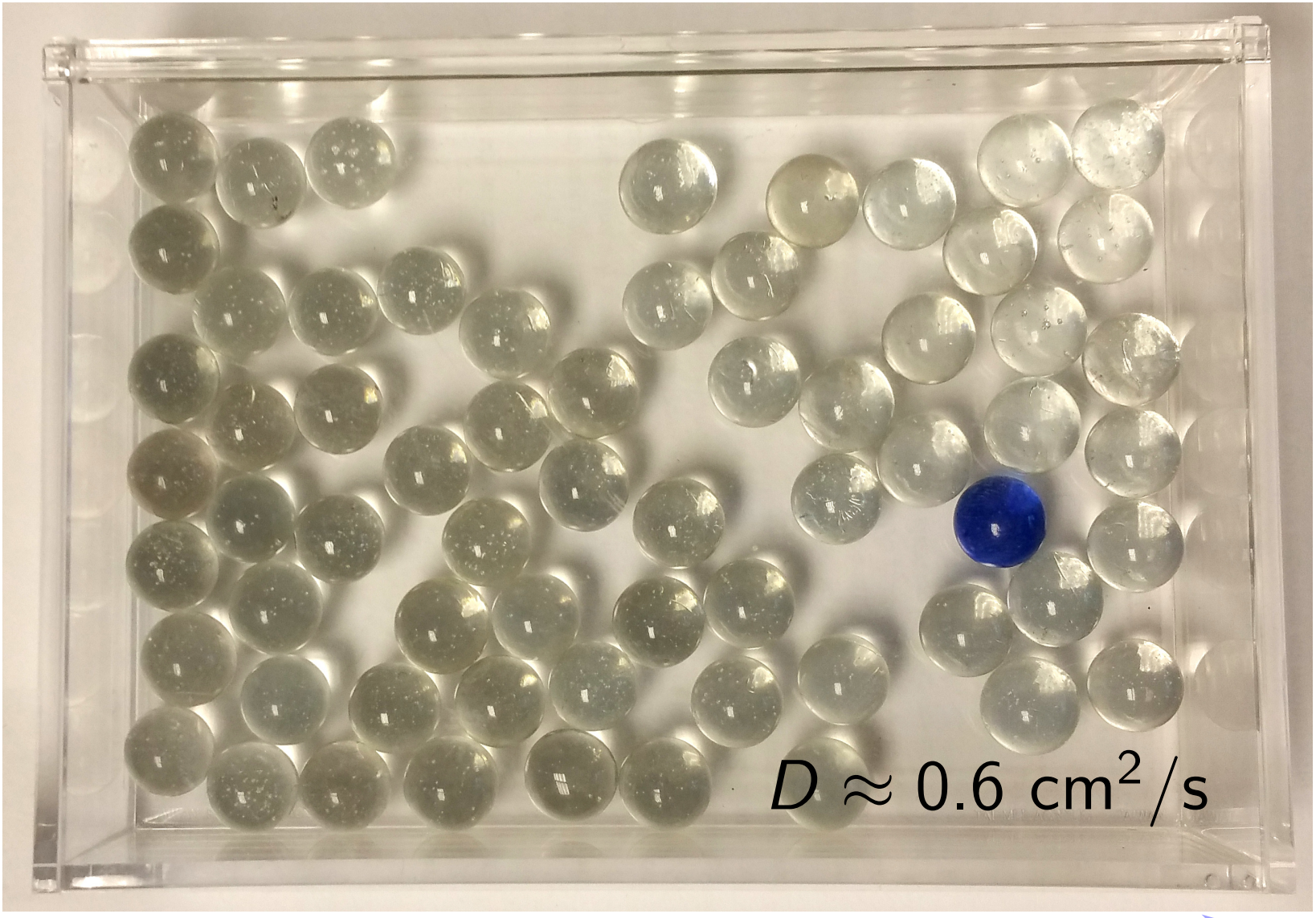
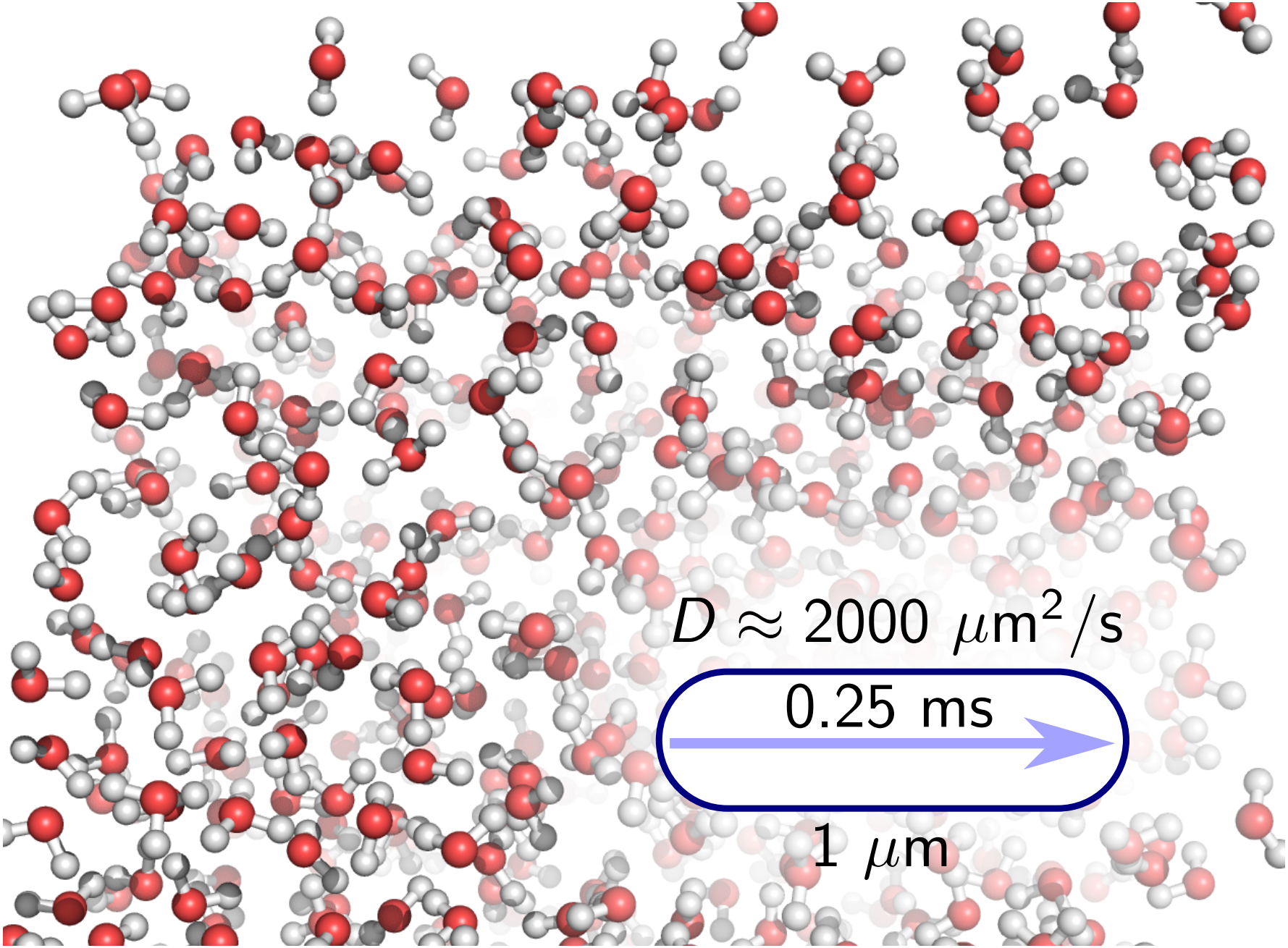
Marble in a shaking box

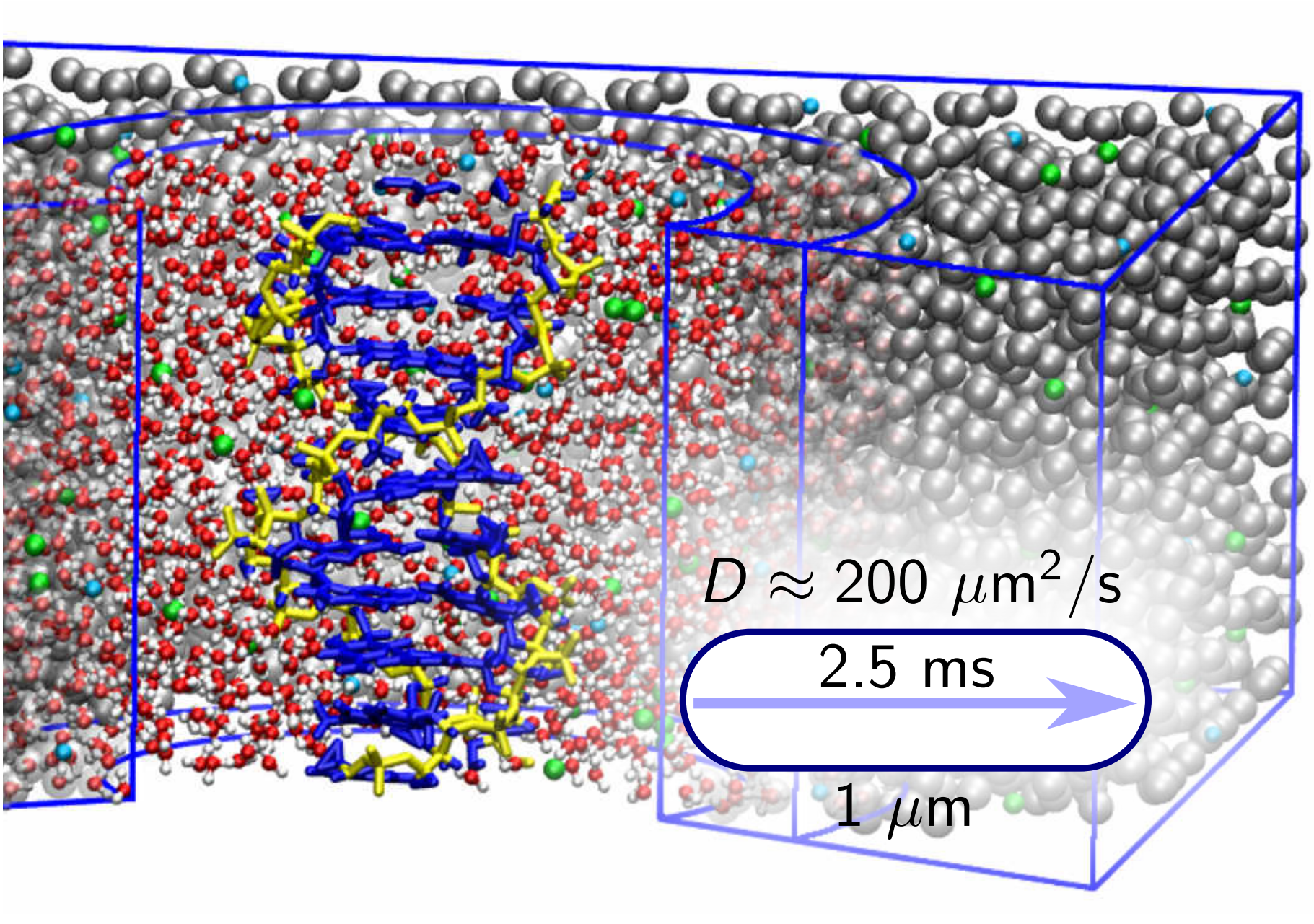


takes roughly $t = L^2/(2D) = 213$ s to diffuse $L = 16$ cm along x-axis

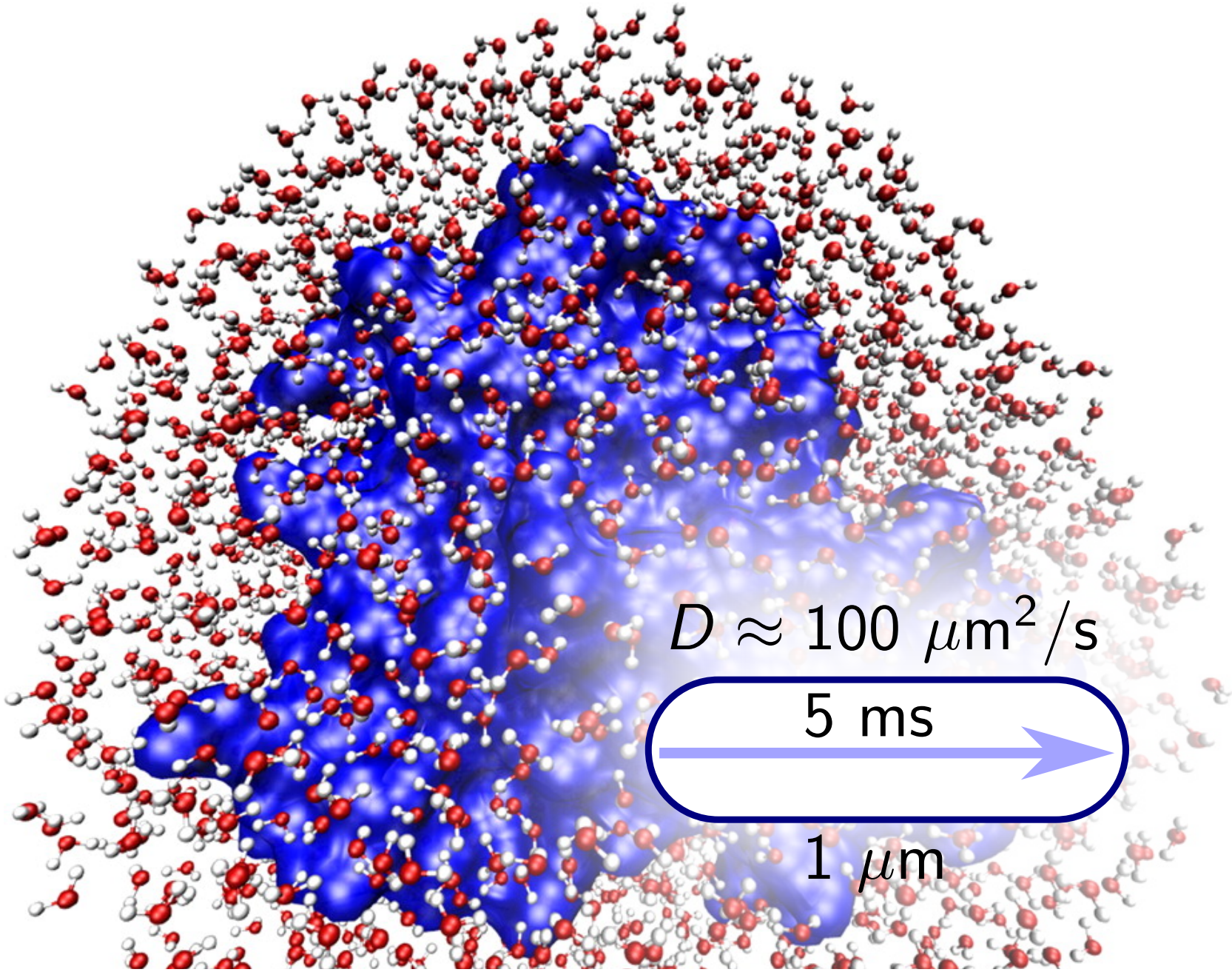
Water molecule [0.3 nm diameter] surrounded by water



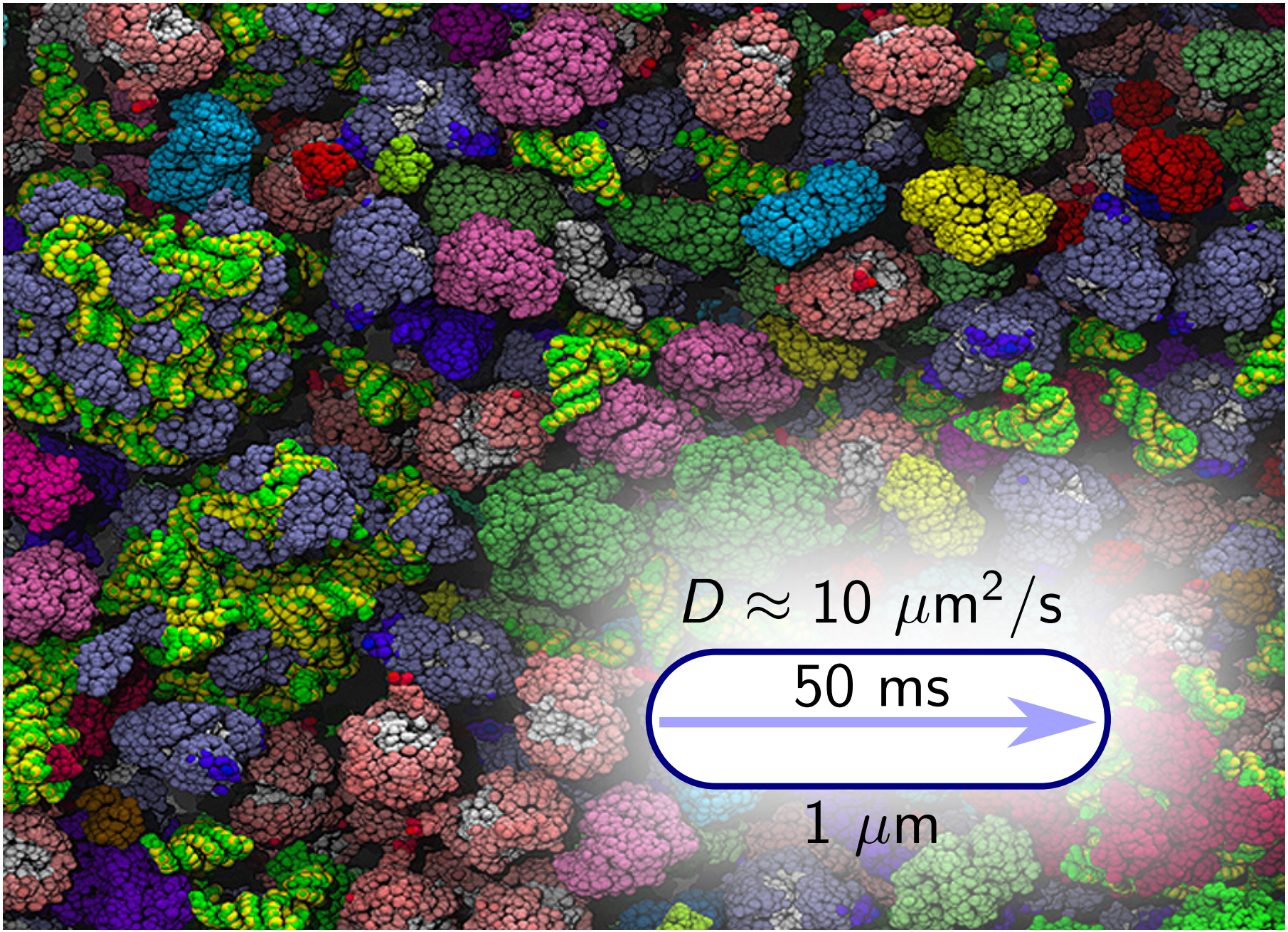
Water molecule inside cell nucleus



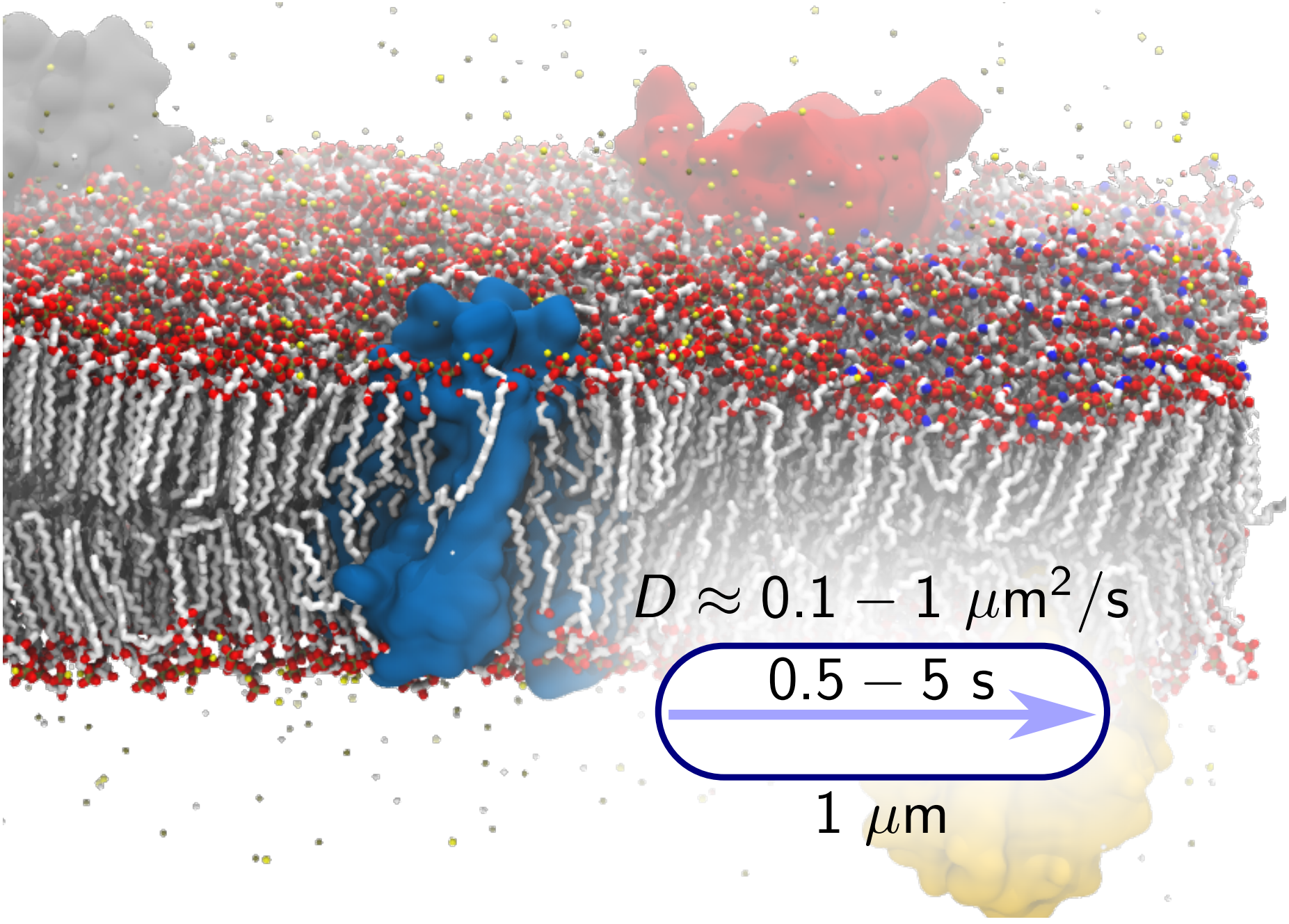
Protein [2 nm diameter] surrounded by water



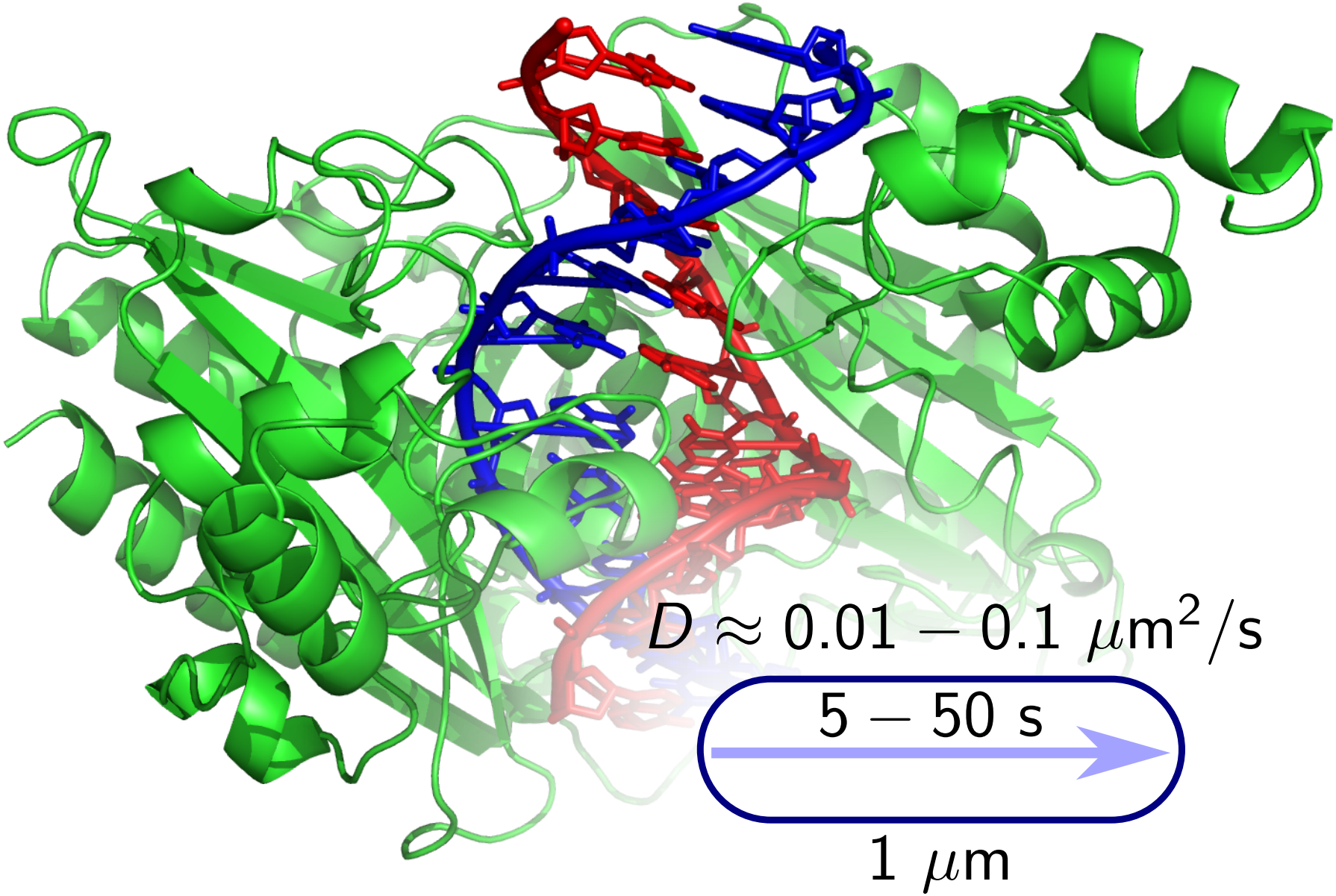
Protein inside cell



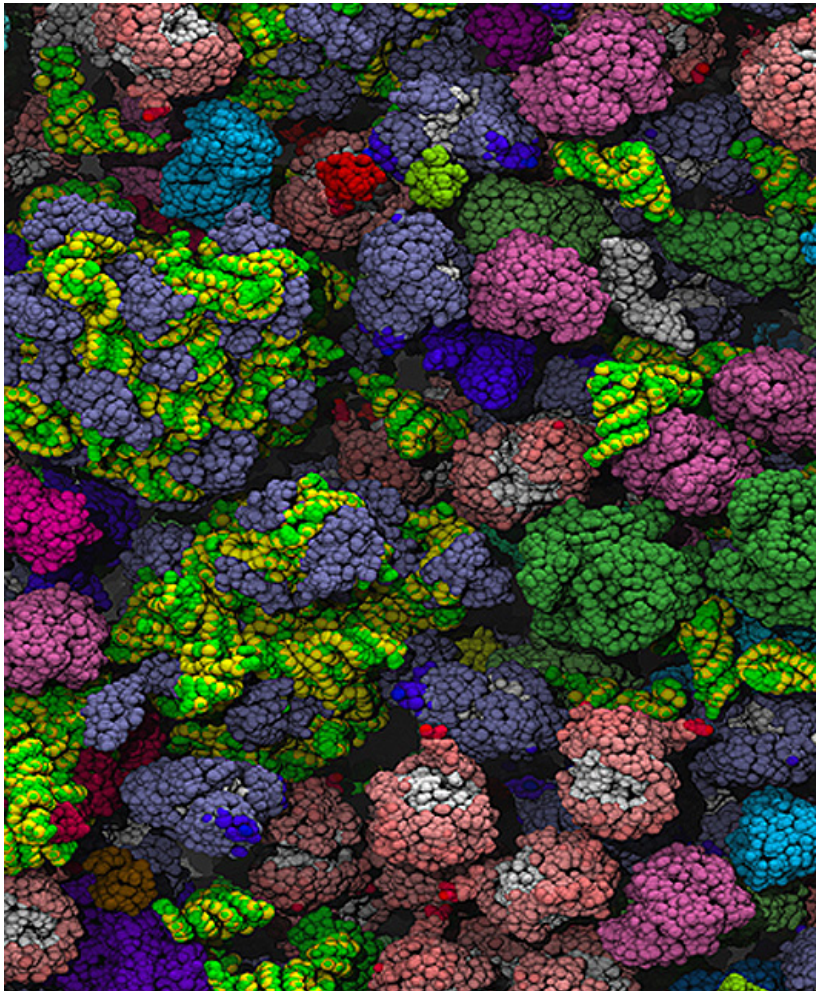
Protein bound to membrane



Protein sliding along DNA



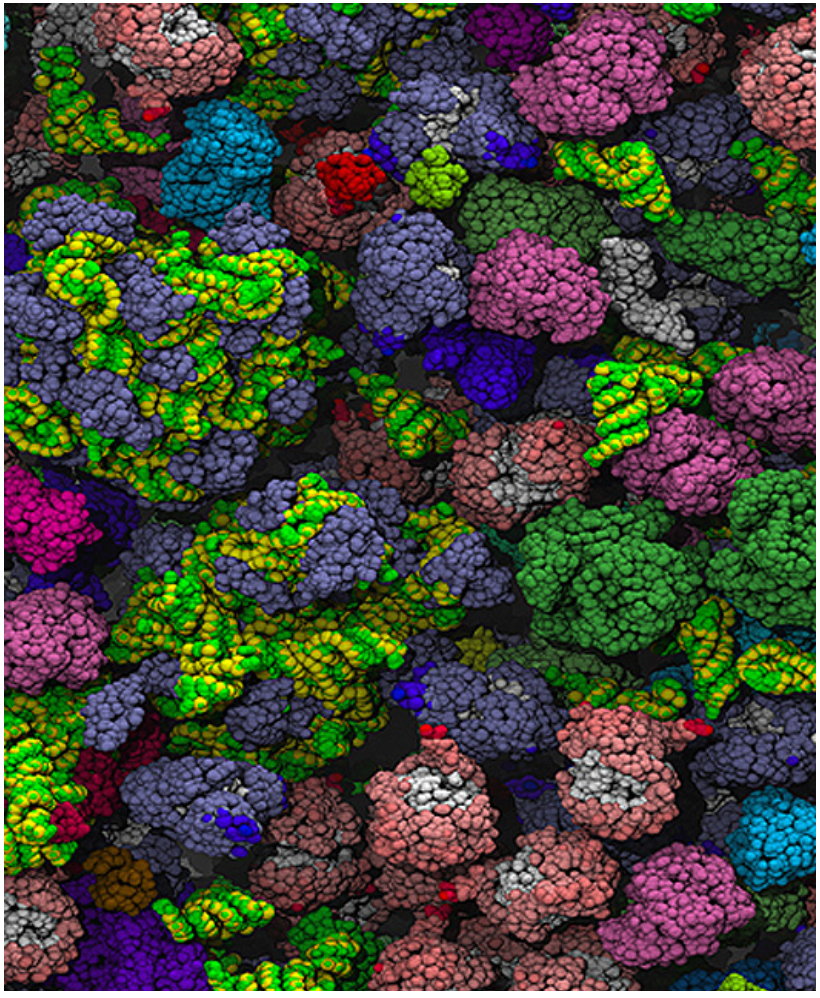
Protein inside cell: different cell sizes



Typical time to diffuse across:

1 μm bacterium: 0.05 s

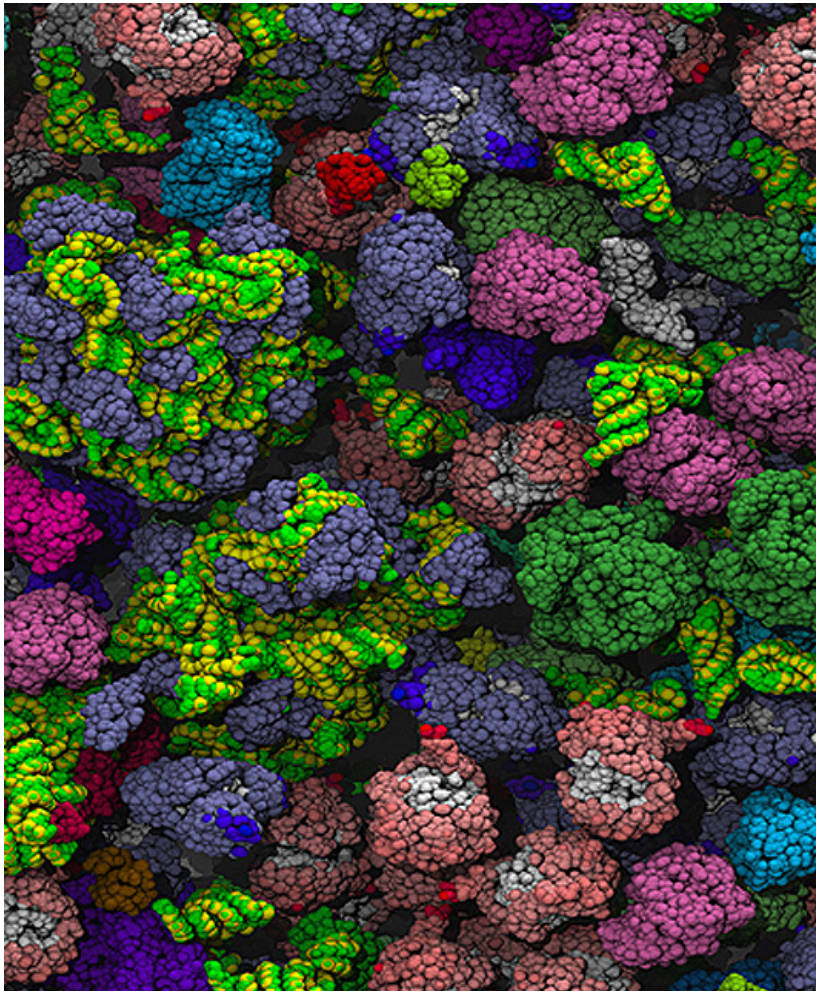
Protein inside cell: different cell sizes



Typical time to diffuse across:

1 μm bacterium:	0.05 s
10 μm human cell:	5 s

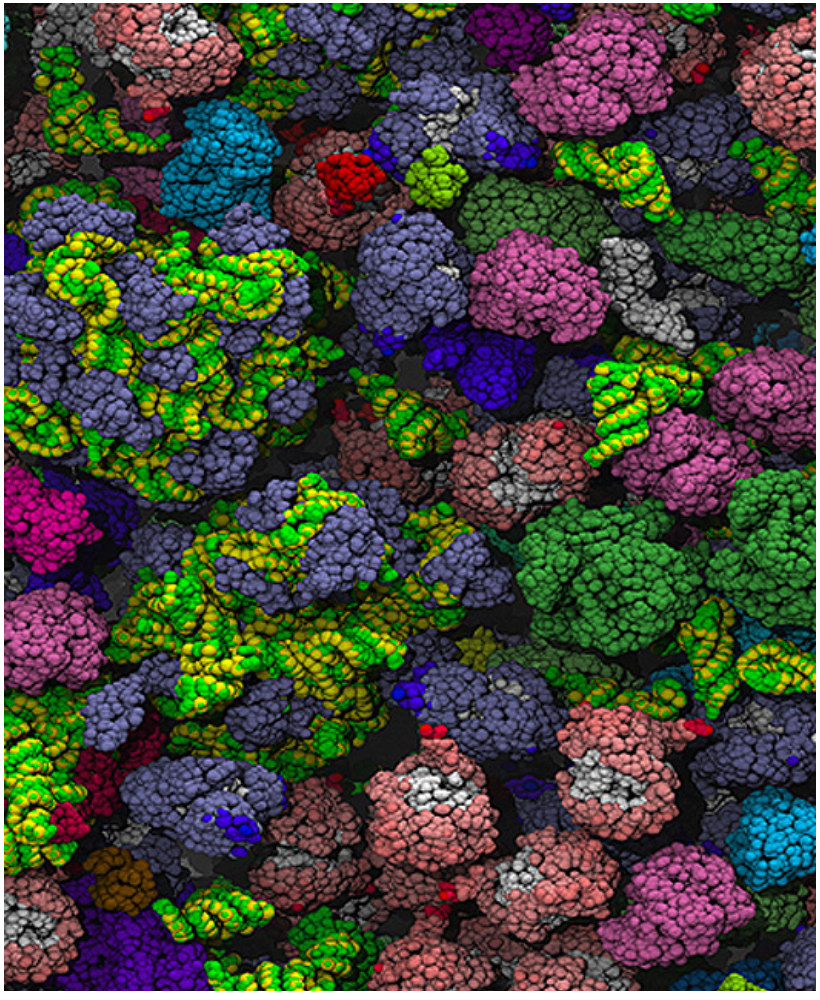
Protein inside cell: different cell sizes



Typical time to diffuse across:

1 μm bacterium:	0.05 s
10 μm human cell:	5 s
3 m giraffe neck neuron:	**14,000 yrs !!**

Protein inside cell: different cell sizes



Typical time to diffuse across:

1 μm bacterium:	0.05 s
10 μm human cell:	5 s
3 m giraffe neck neuron:	**14,000 yrs !!**

Giraffes do not exist.