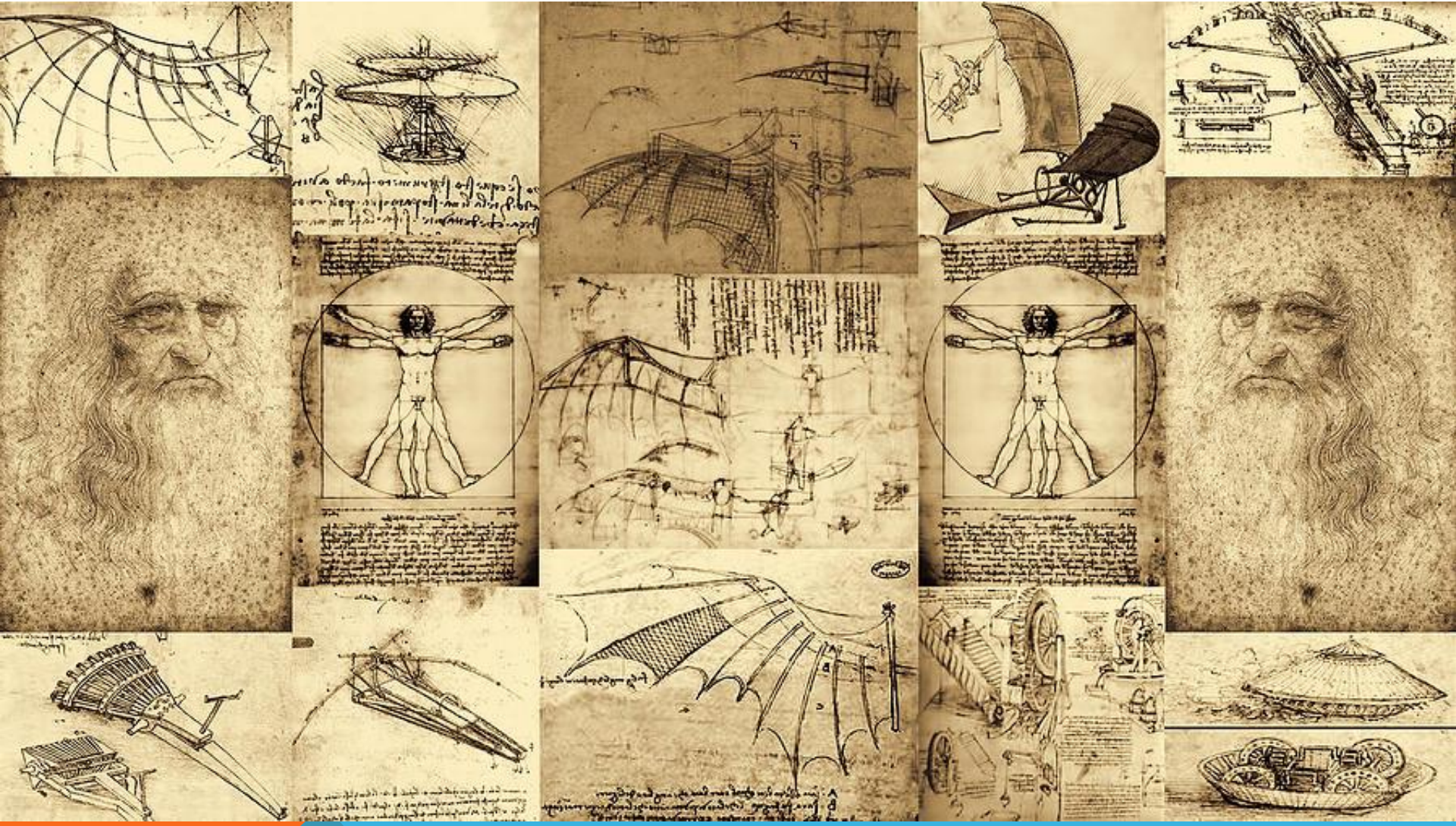

Scientific Creativity Live

4 experiments, 8 ways of knowing

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8 ways

faith

reason

intuition

imagination

language

sense perception

memory

emotion

4 experiments

1. **Searching for sun spots**

   using secondary data

2. **Engineering a water wheel**

   solving problems

3. **Colourful beetles**

   transferring knowledge

4. **Osmosis**

   experiments in silico

SEARCHING FOR SUNSPOTS USING SECONDARY DATA

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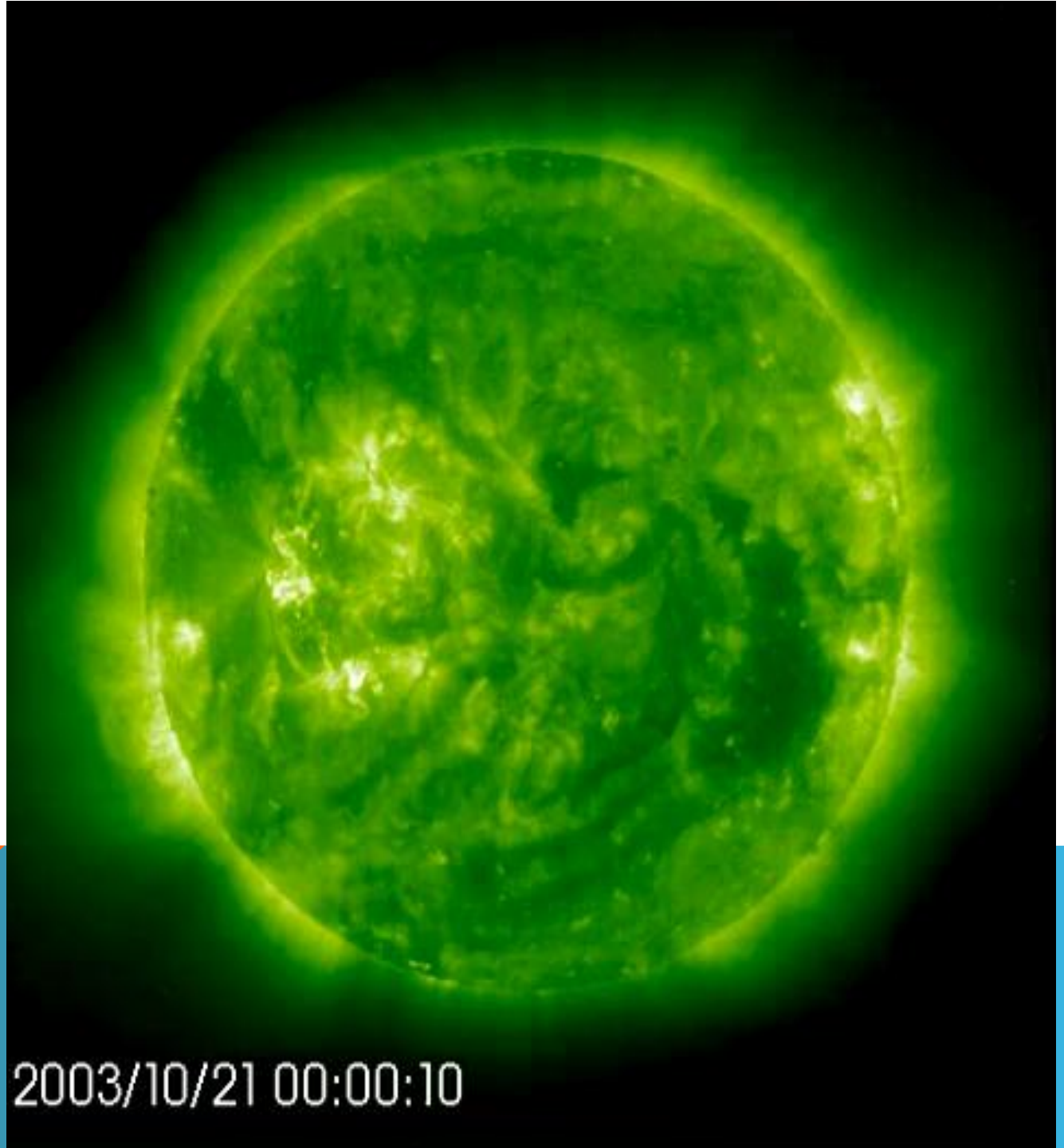
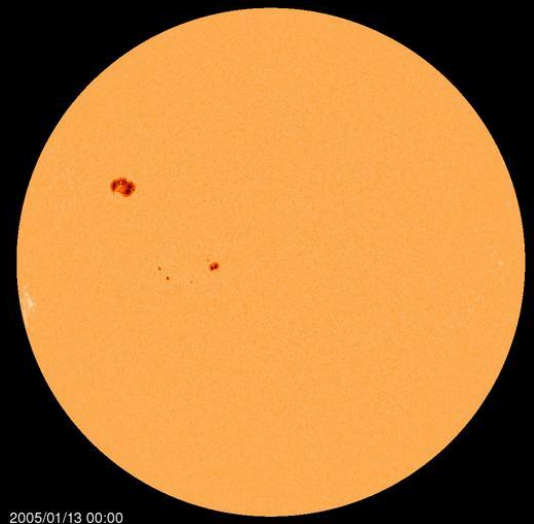
SEARCHING FOR SUNSPOTS

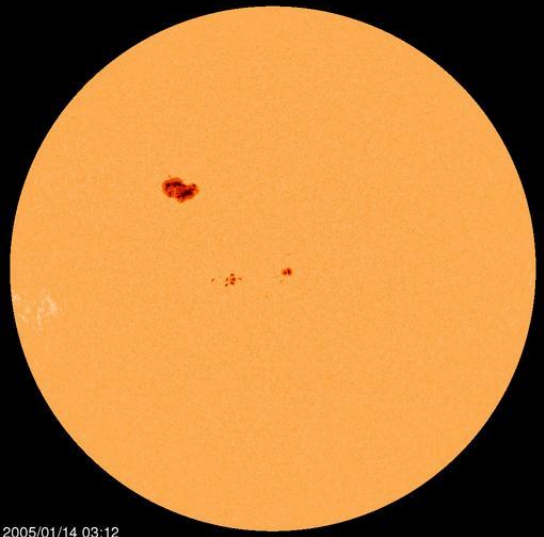
SEARCHING FOR SUNSPOTS

SEARCHING FOR SUNSPOTS

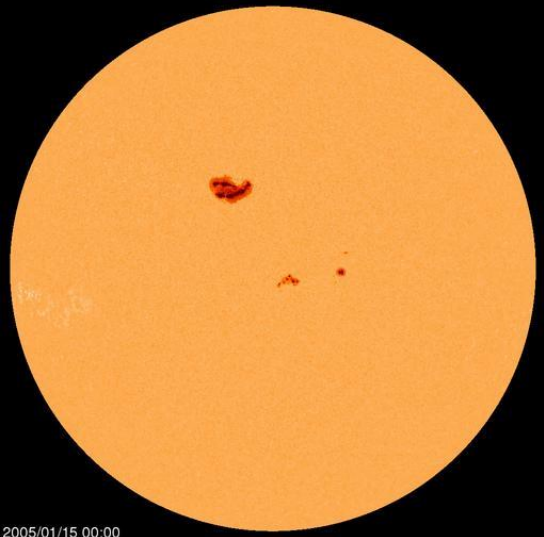




13 Jan 2005



14 Jan



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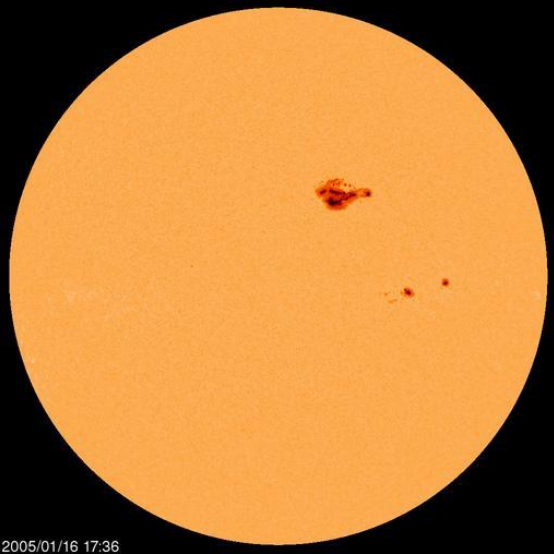
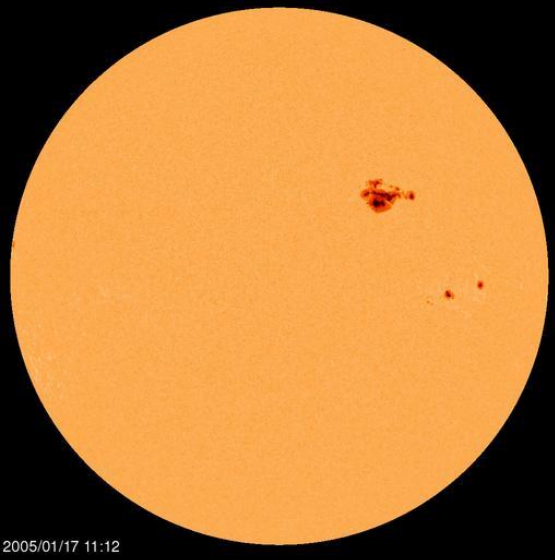


16 Jan



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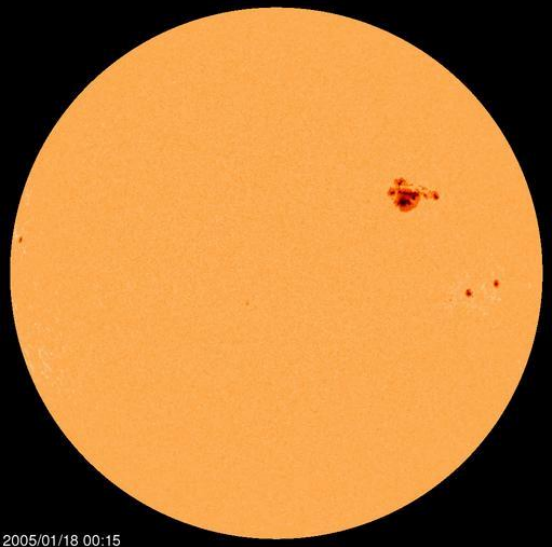

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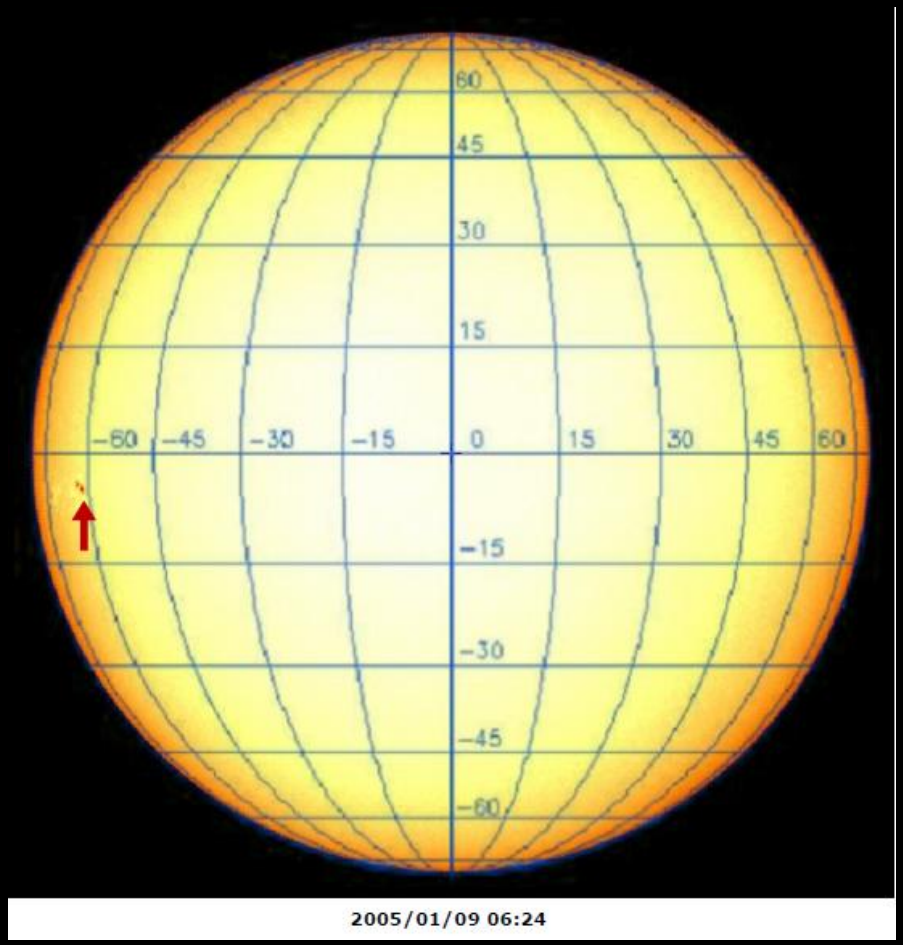

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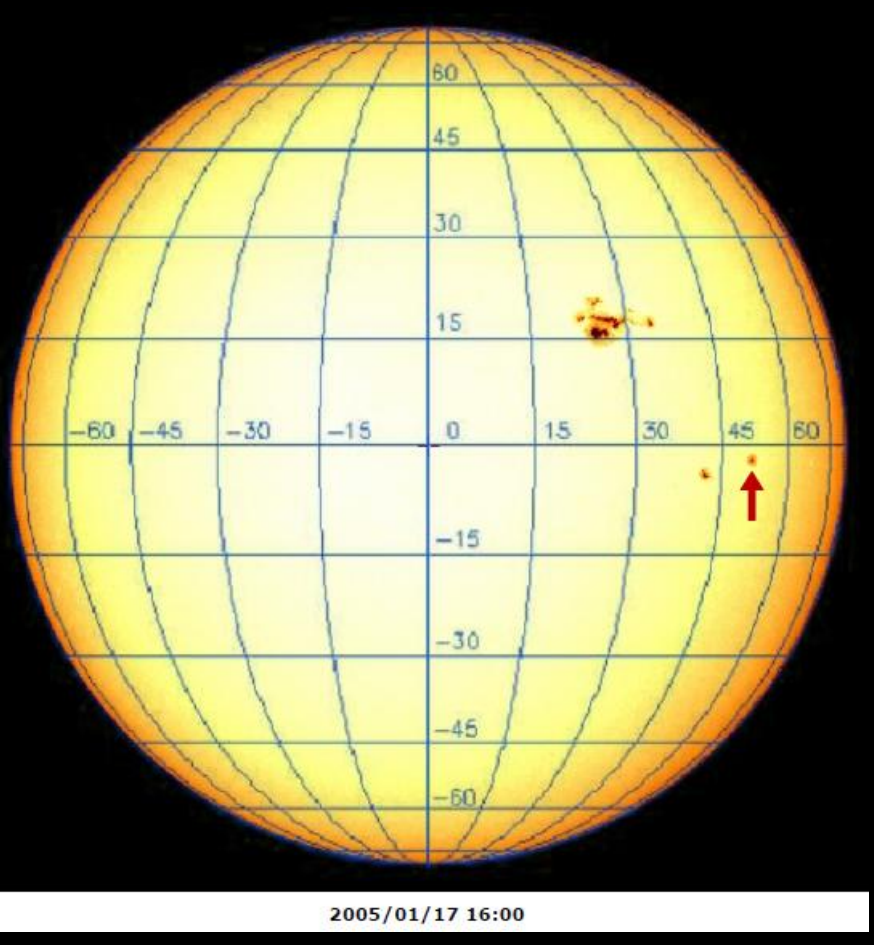

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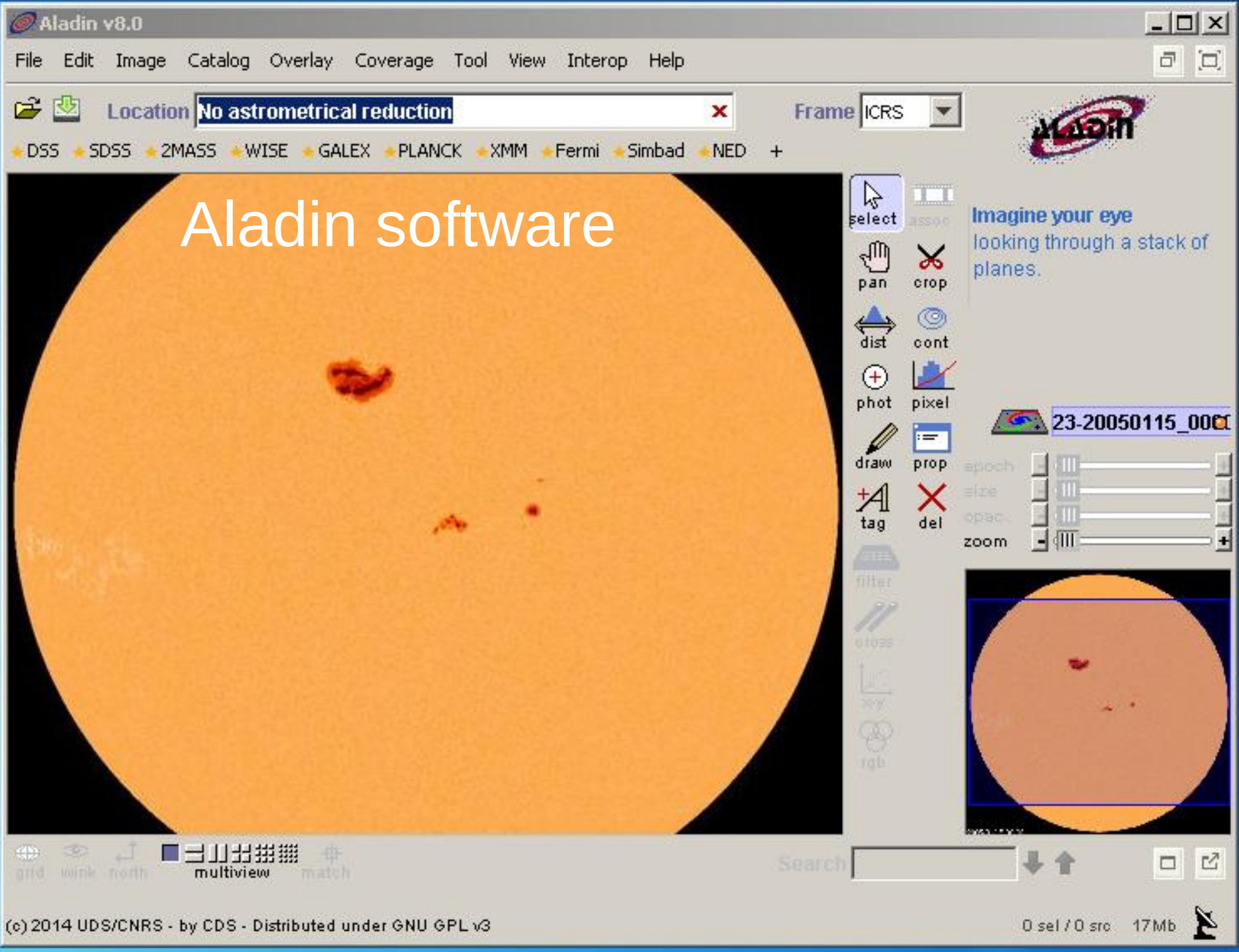
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Aladin software
select
pan
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phot
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draw
prop
tag
del
Imagine your eye
looking through a stack of planes.
23-20050115_000
zoom
multiview
Search
(c) 2014 UDS/CNRS - by CDS - Distributed under GNU GPL v3
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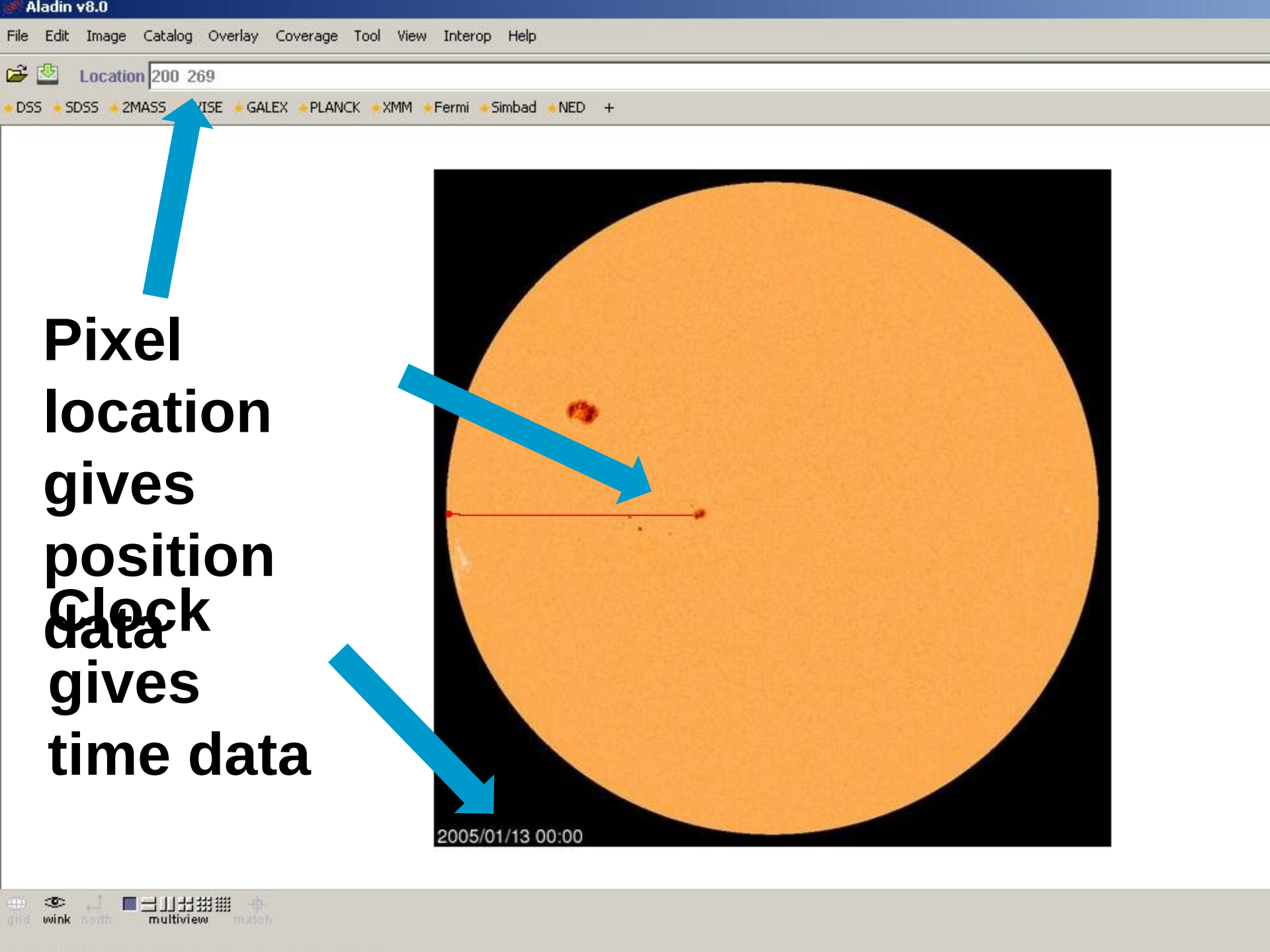
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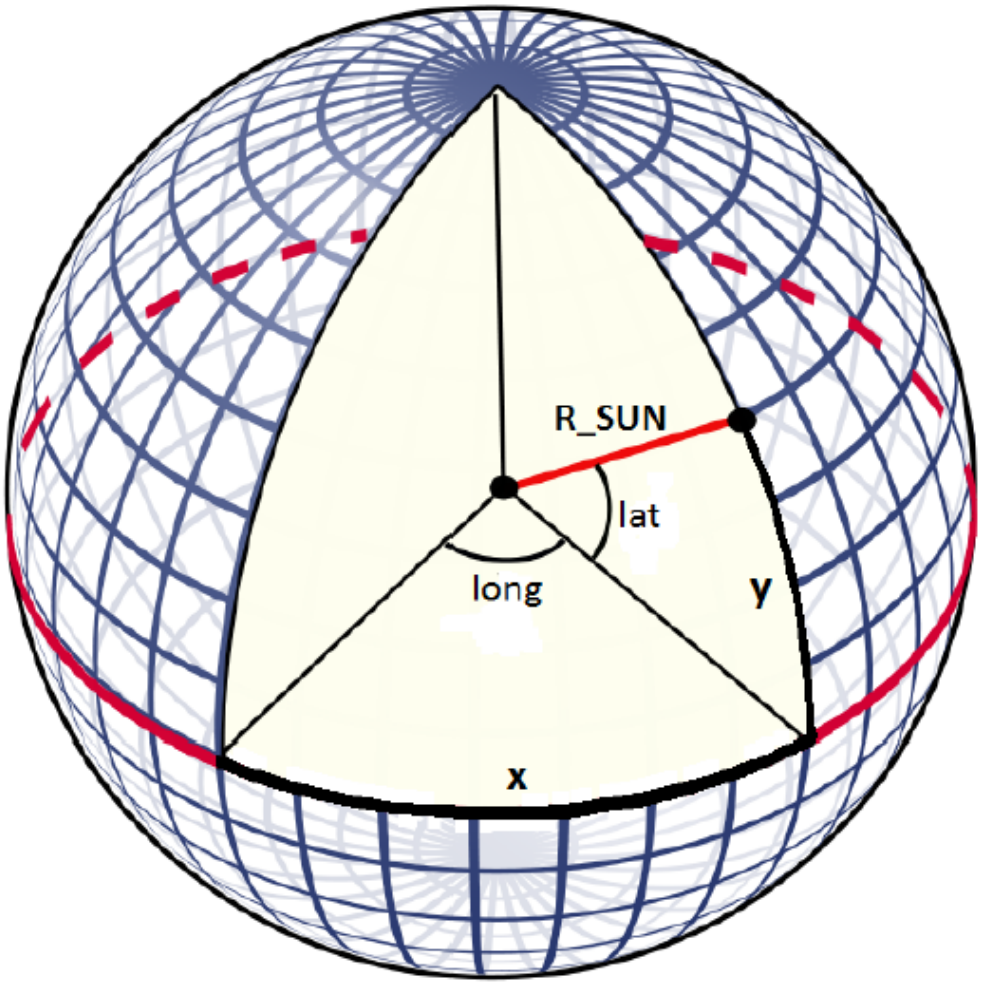
File Edit Image Catalog Overlay Coverage Tool View Interop Help
Location 200 269
DSS SDSS 2MASS GALEX PLANCK XMM Fermi Simbad NED +
Pixel location gives position
Clock data gives time data
2005/01/13 00:00
grid wink north multiview match

Tracking sunspots in 3 dimensions




language
reason
sense perception
memory
Ways of knowing
emotion
imagination
intuition
faith

ENGINEERING DESIGN

GROUP 4 PROJECT

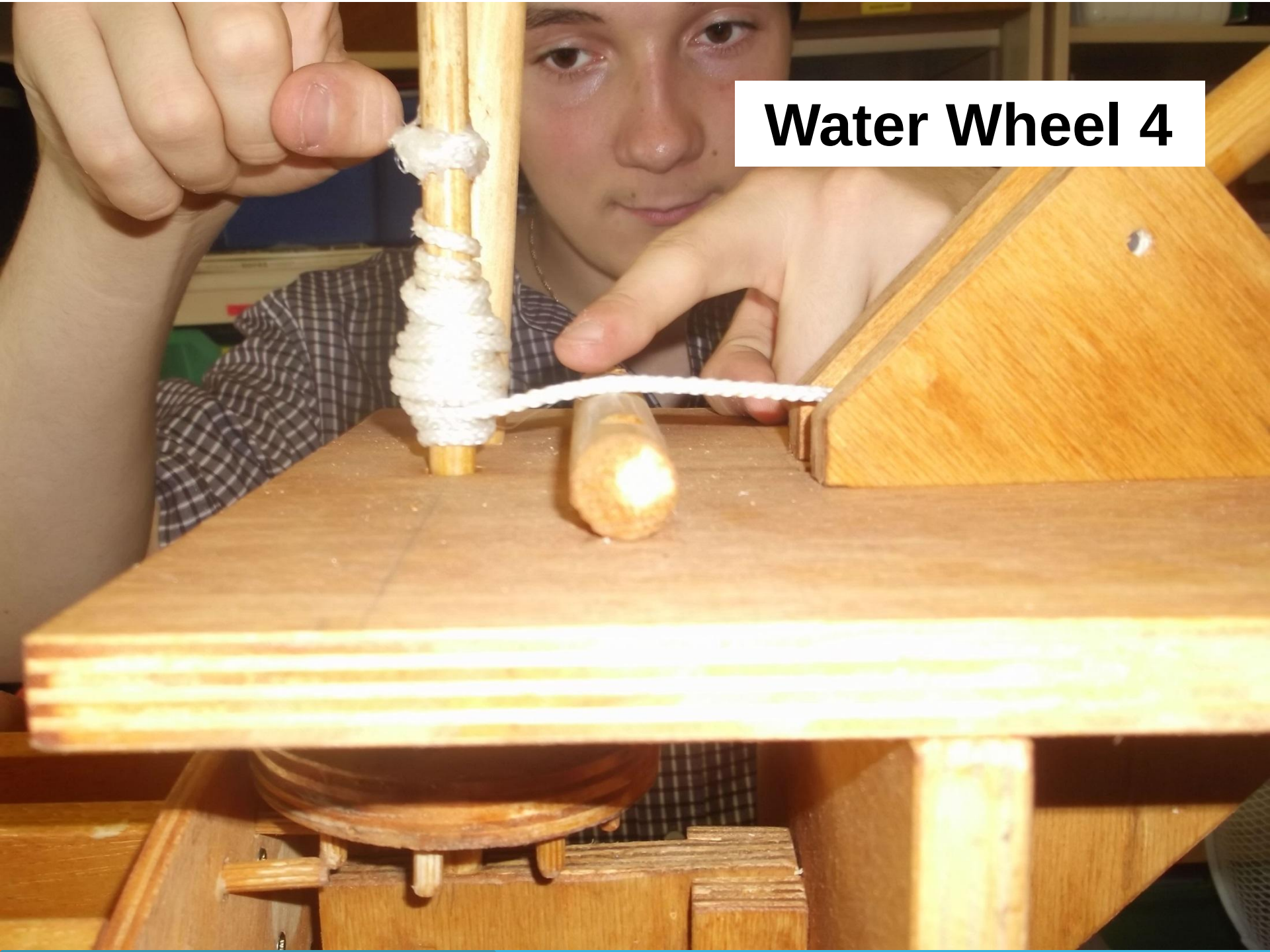
MAY 2014: WATER

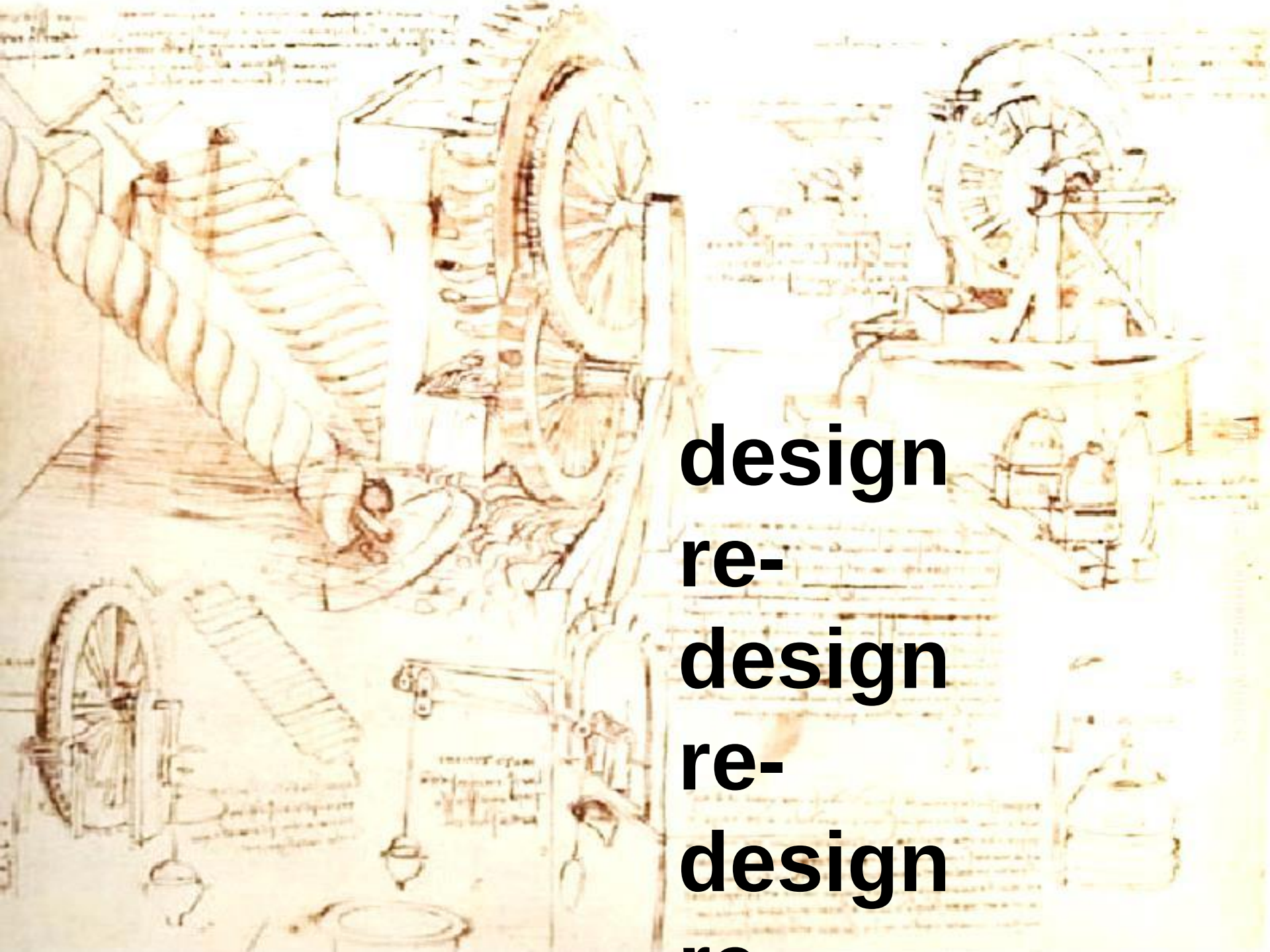
This is Water Wheel Mark 4 (WW4)


Water Wheel 1

Water Wheel 2

Water Wheel 3


Water Wheel 4


design
re-
design
re-
design

COLOURFUL BEETLES

BIOLOGY MEETS PHYSICS

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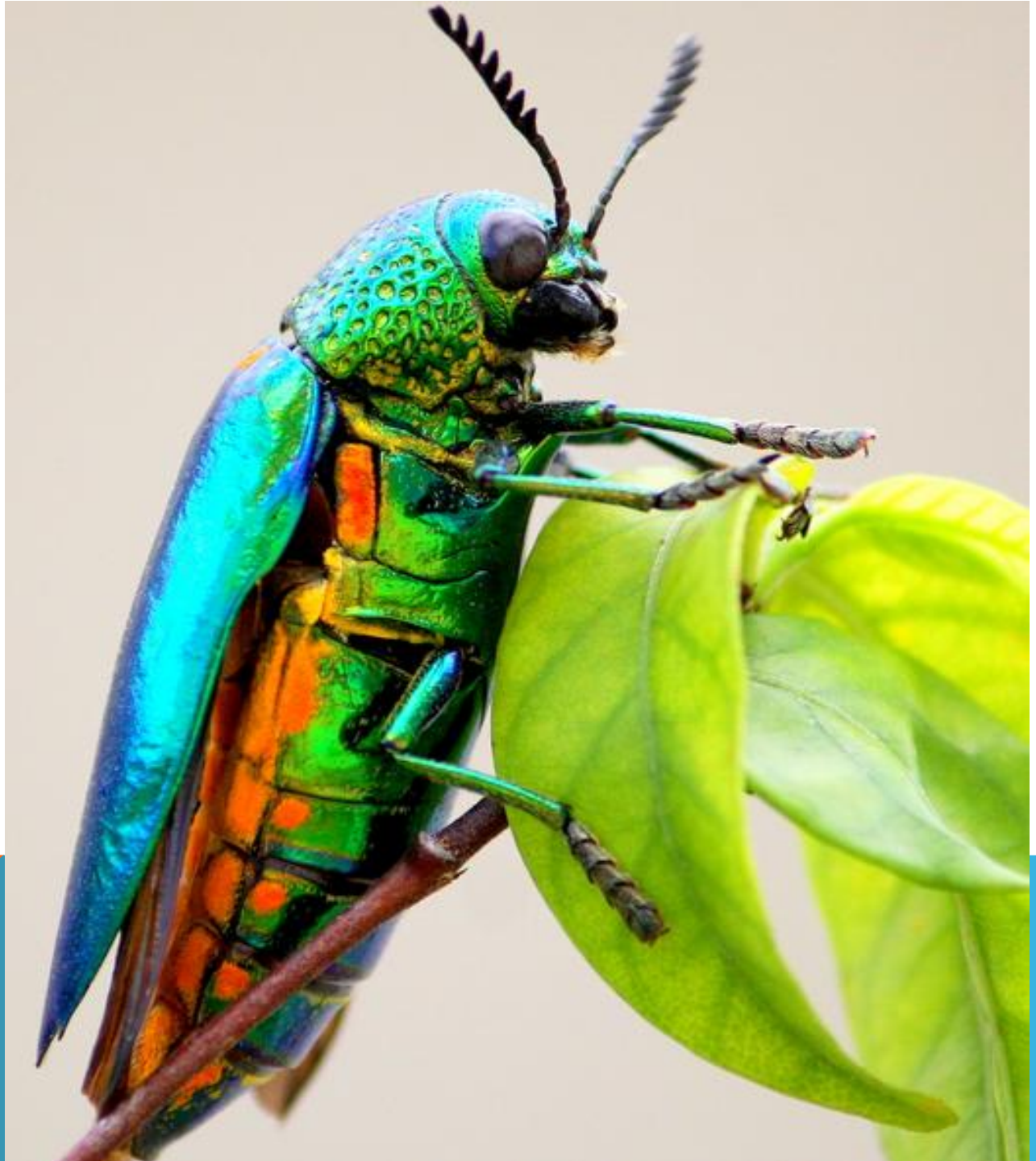
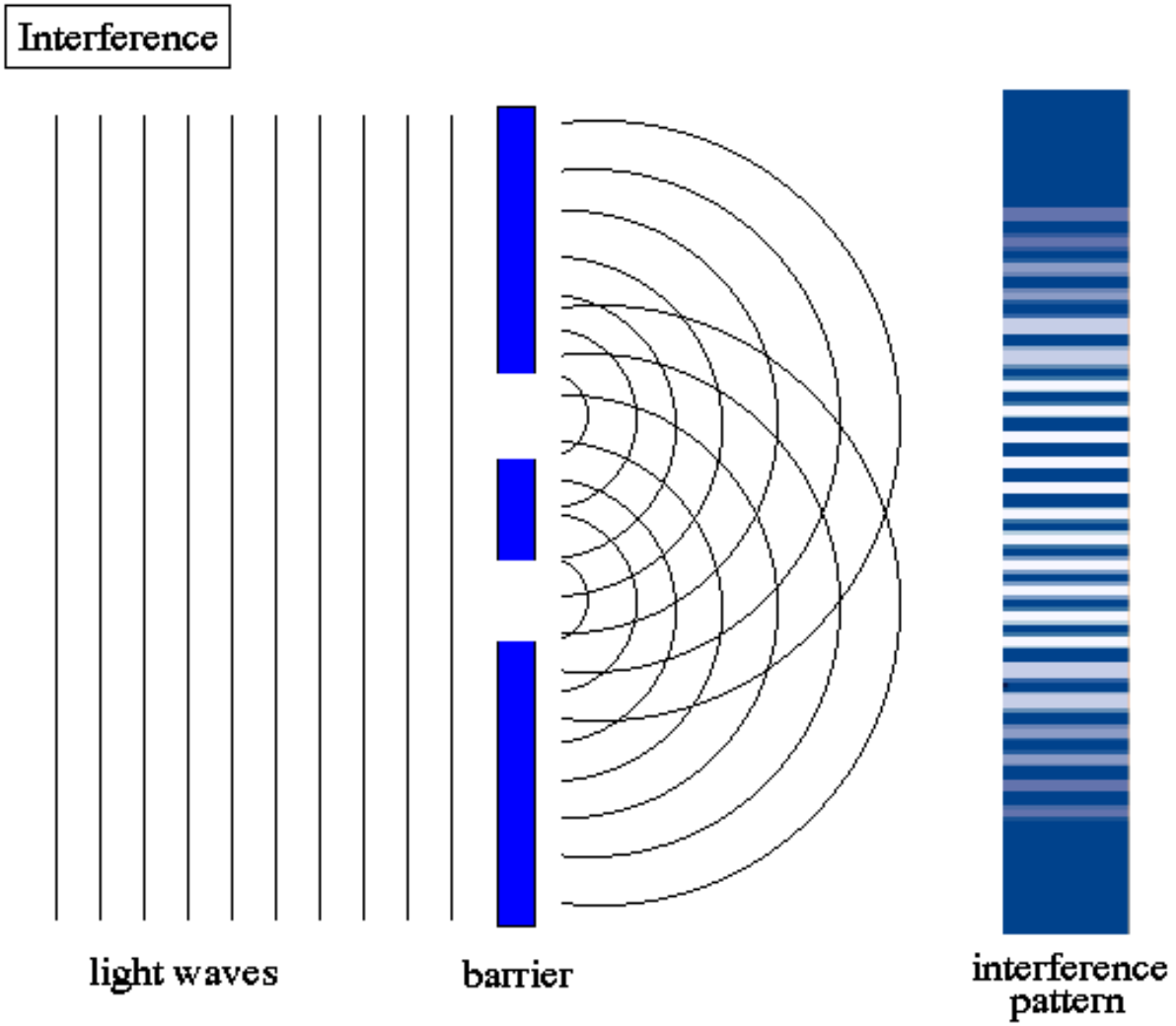
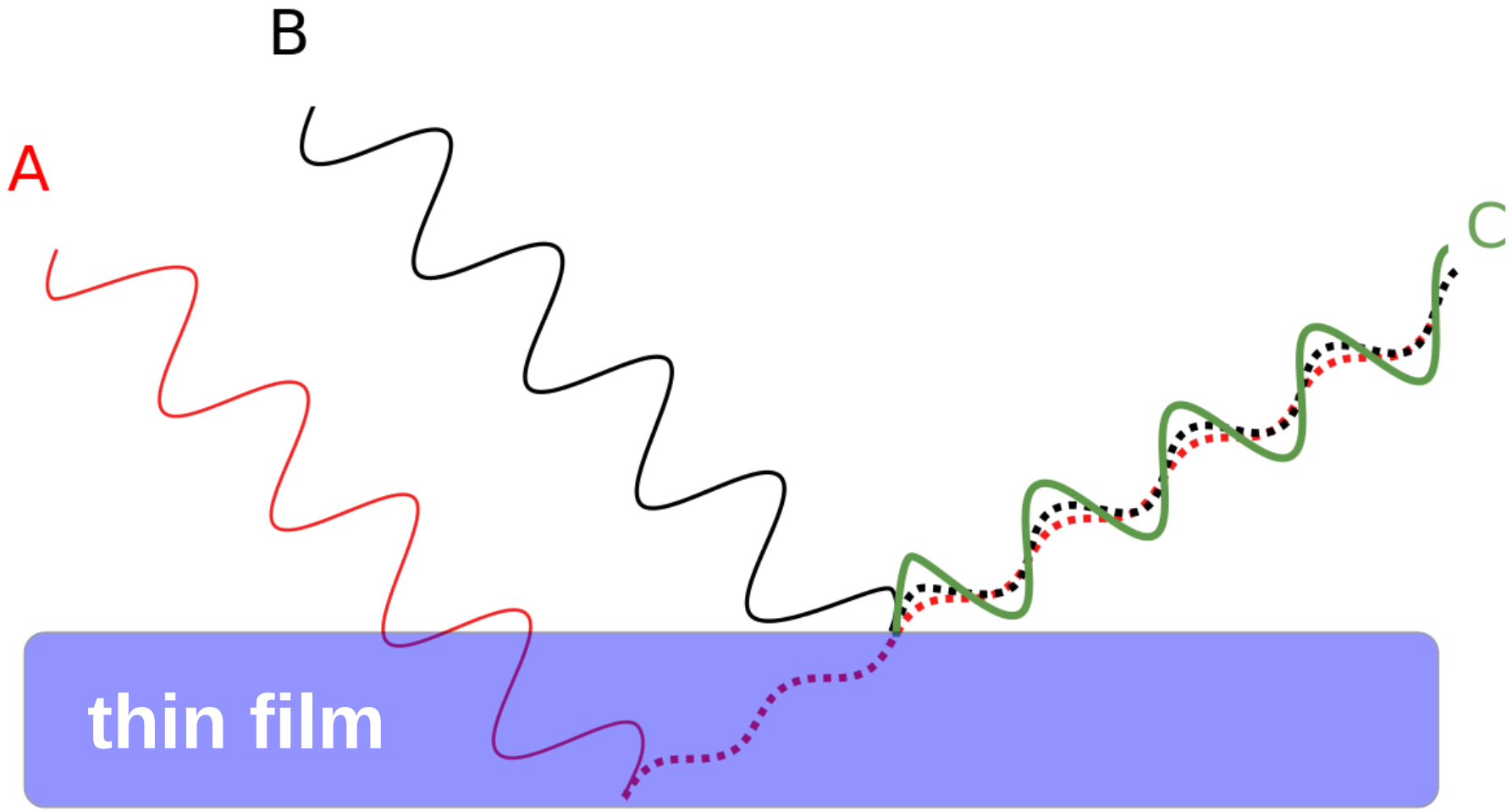
COLOURFUL BEETLES

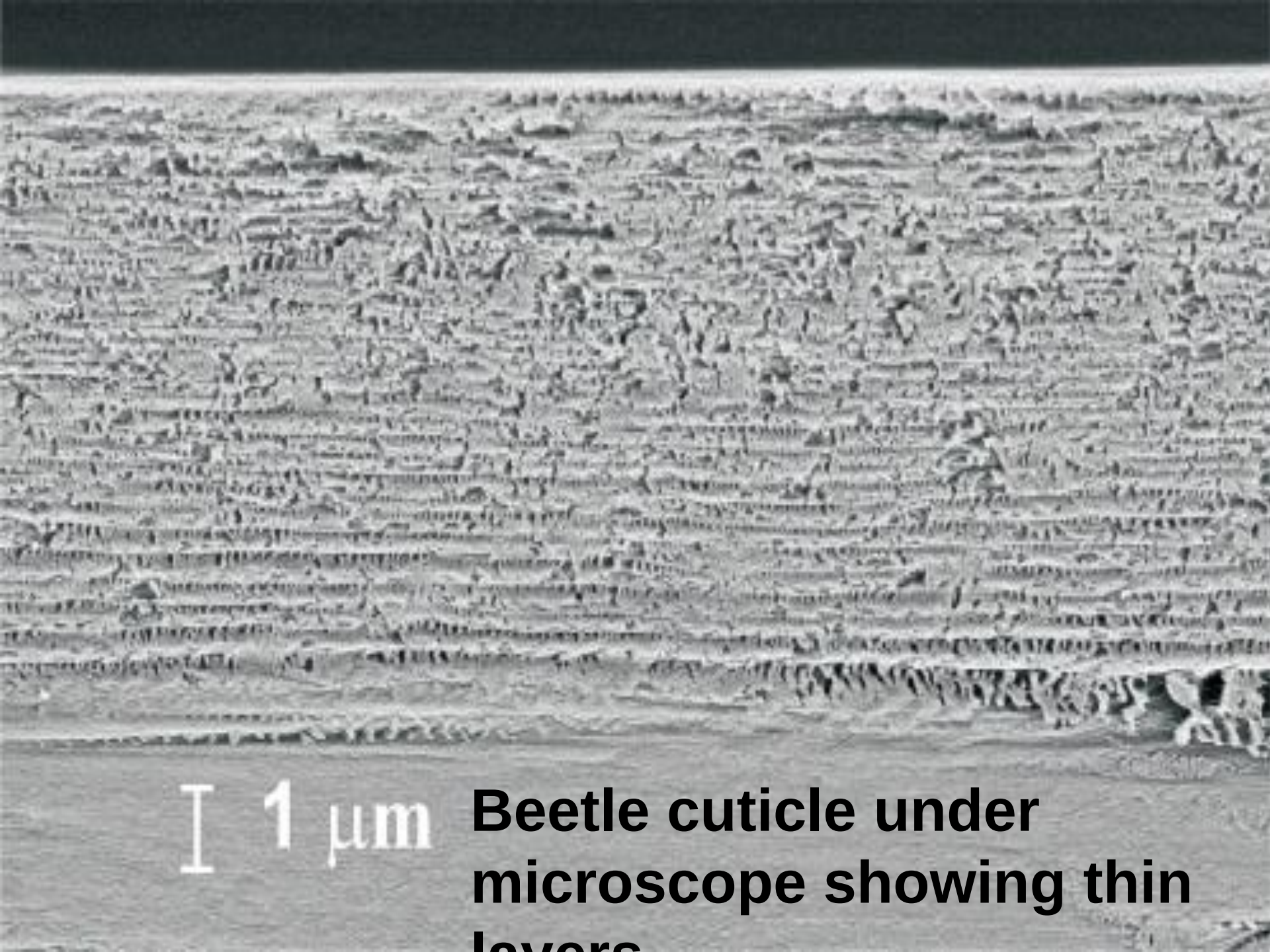



ROBERT
HOOKE
1635~1703
Physicist
& Polymath

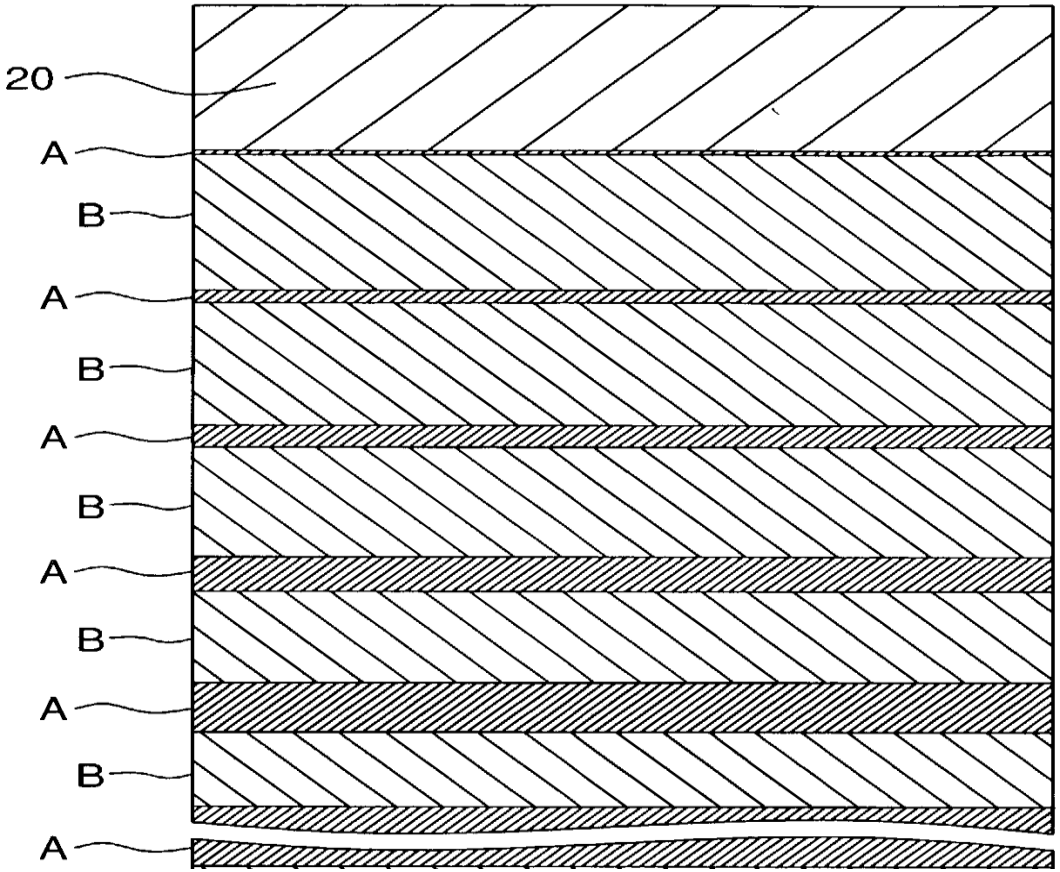
COLOURFUL BEETLES



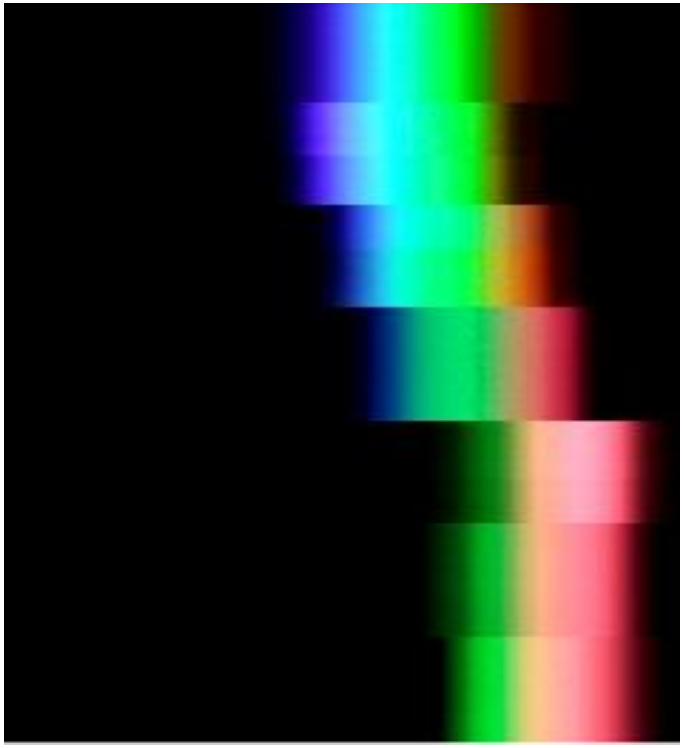

B
A
C
thin film



Beetle cuticle under microscope showing thin layers



Structure of my plastic film showing thin layers



Angle 80 deg

Angle 70 deg

Angle 60 deg

Angle 50 deg

Angle 40 deg

COLOURFUL BEETLES

OSMOSIS IN SILICO

USING SIMULATED EXPERIMENTS

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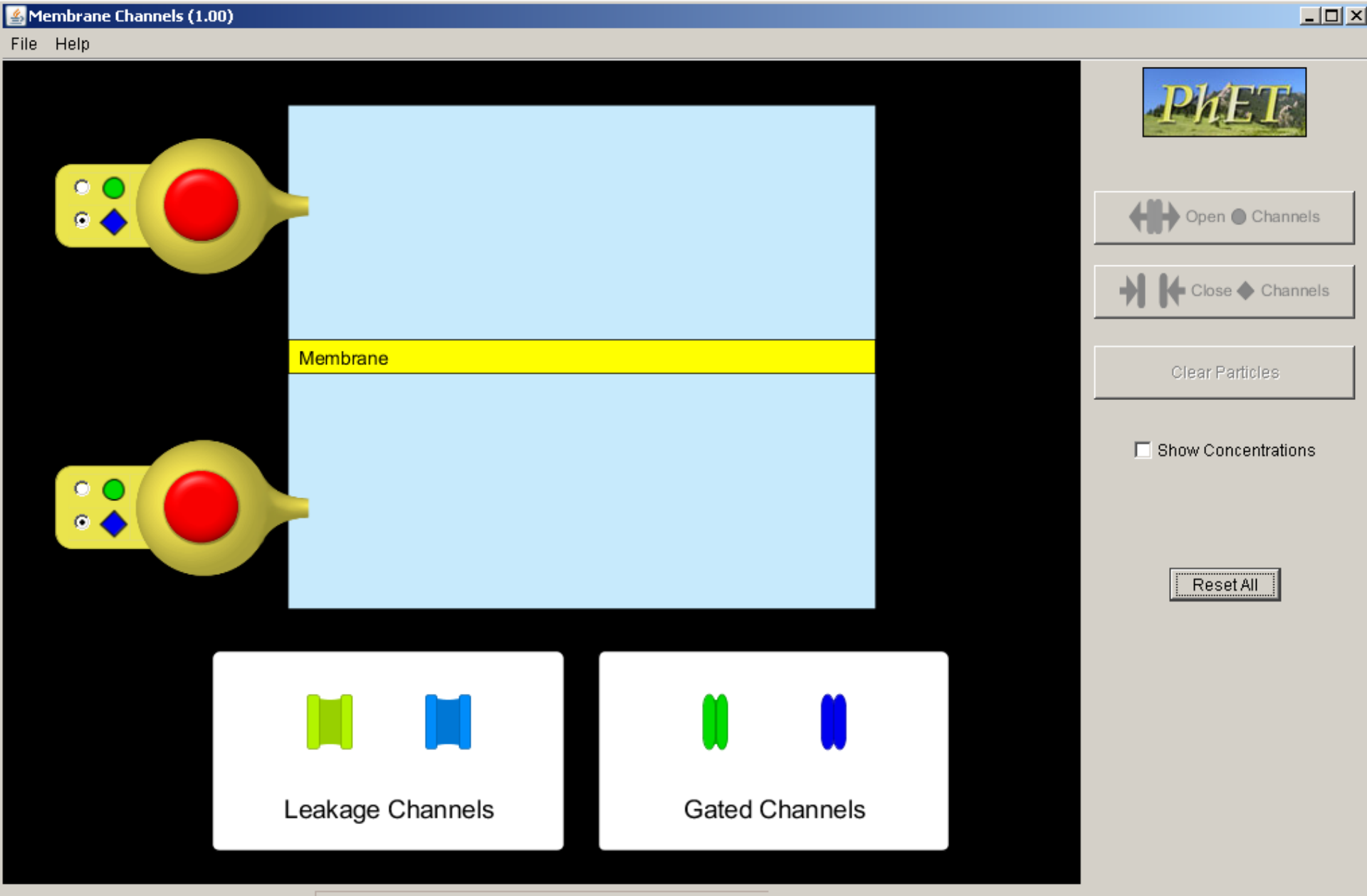
lettuce leaf
before immersion

lettuce leaf
immersed in
water for 3 hours

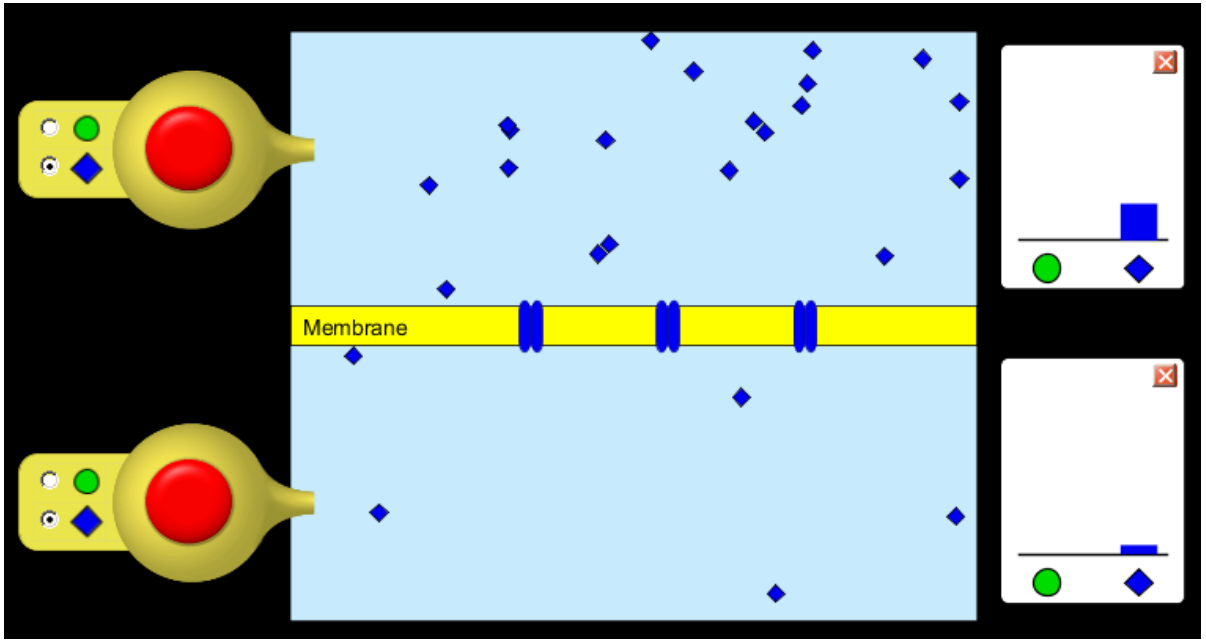
A simple simulation



DIFFUSION EXPERIMENT

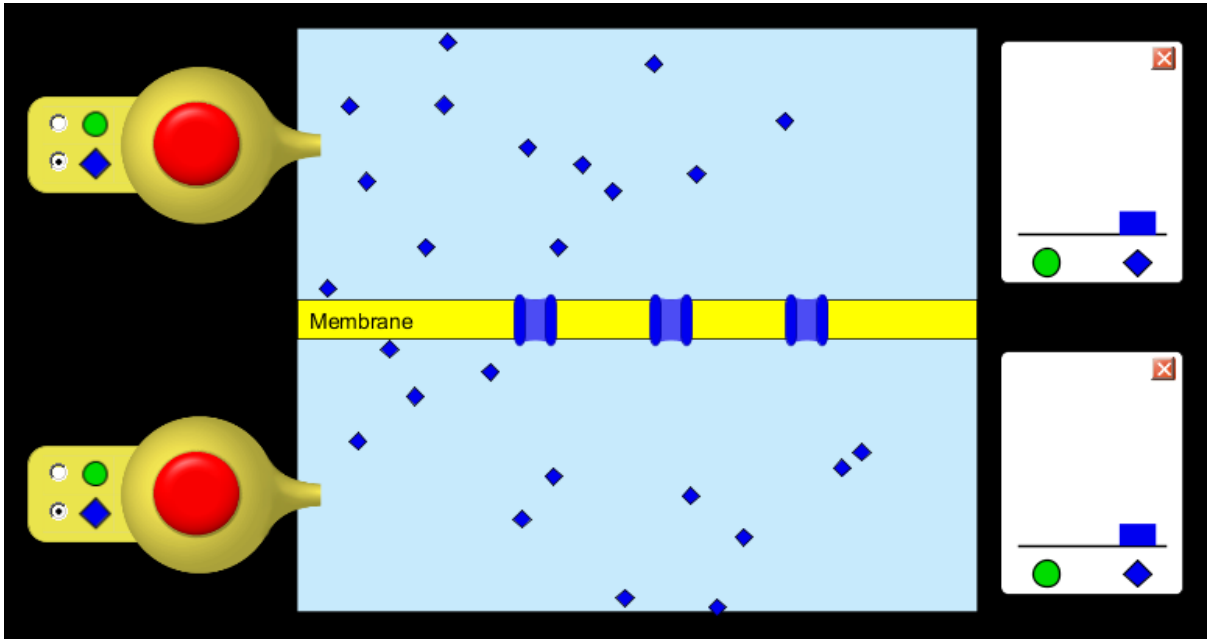
Start:
20 particles above

5 particles below



Finish:
13 particles above

12 particles below

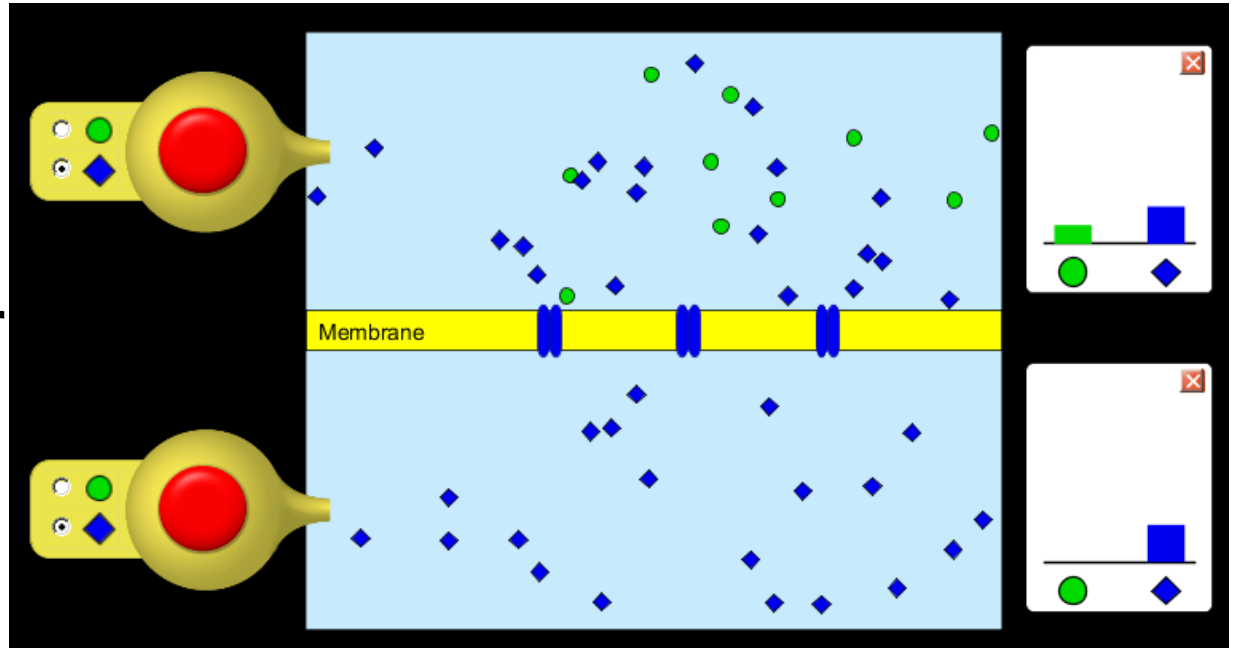


OSMOSIS EXPERIMENT

Start:

20 water, 10 sugar above

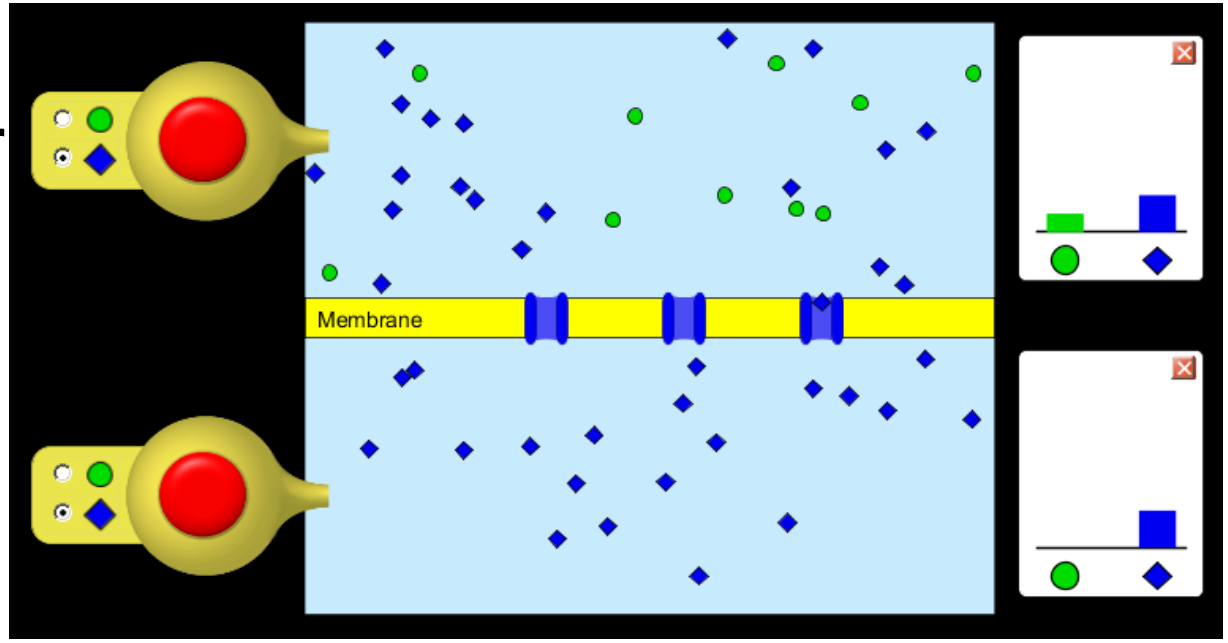
20 water below

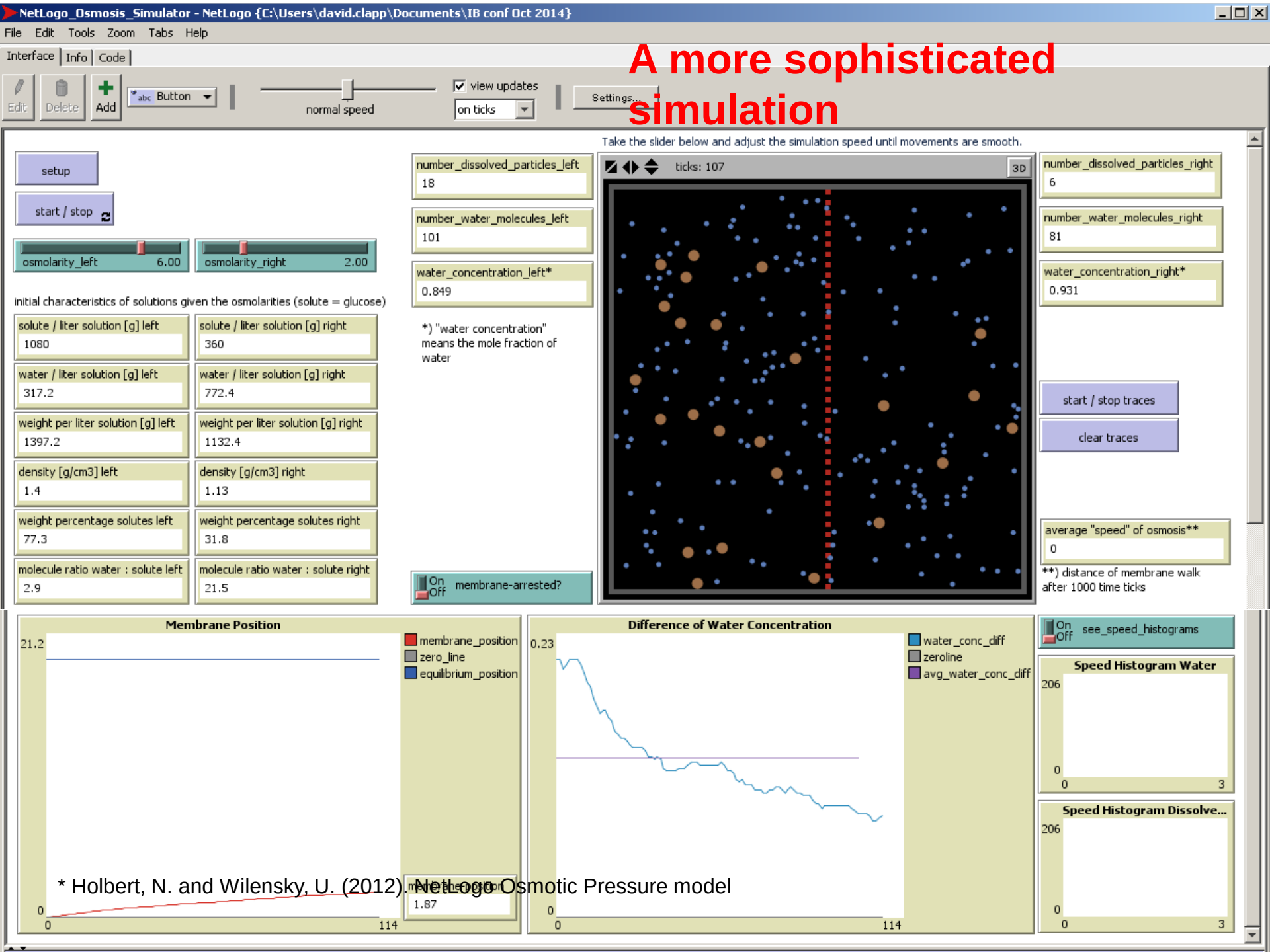


Finish:

19 water, 10 sugar above

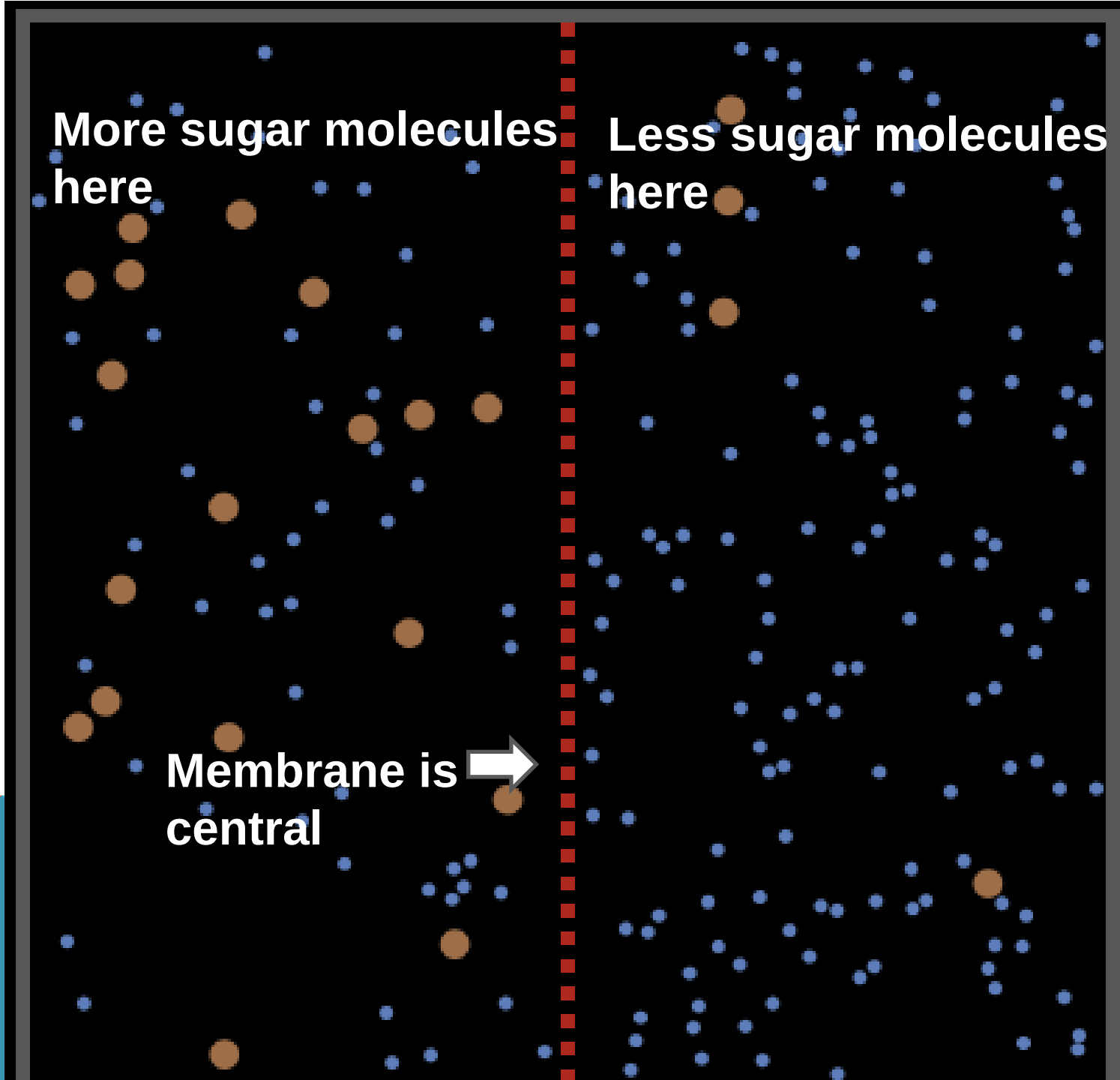
20 water below



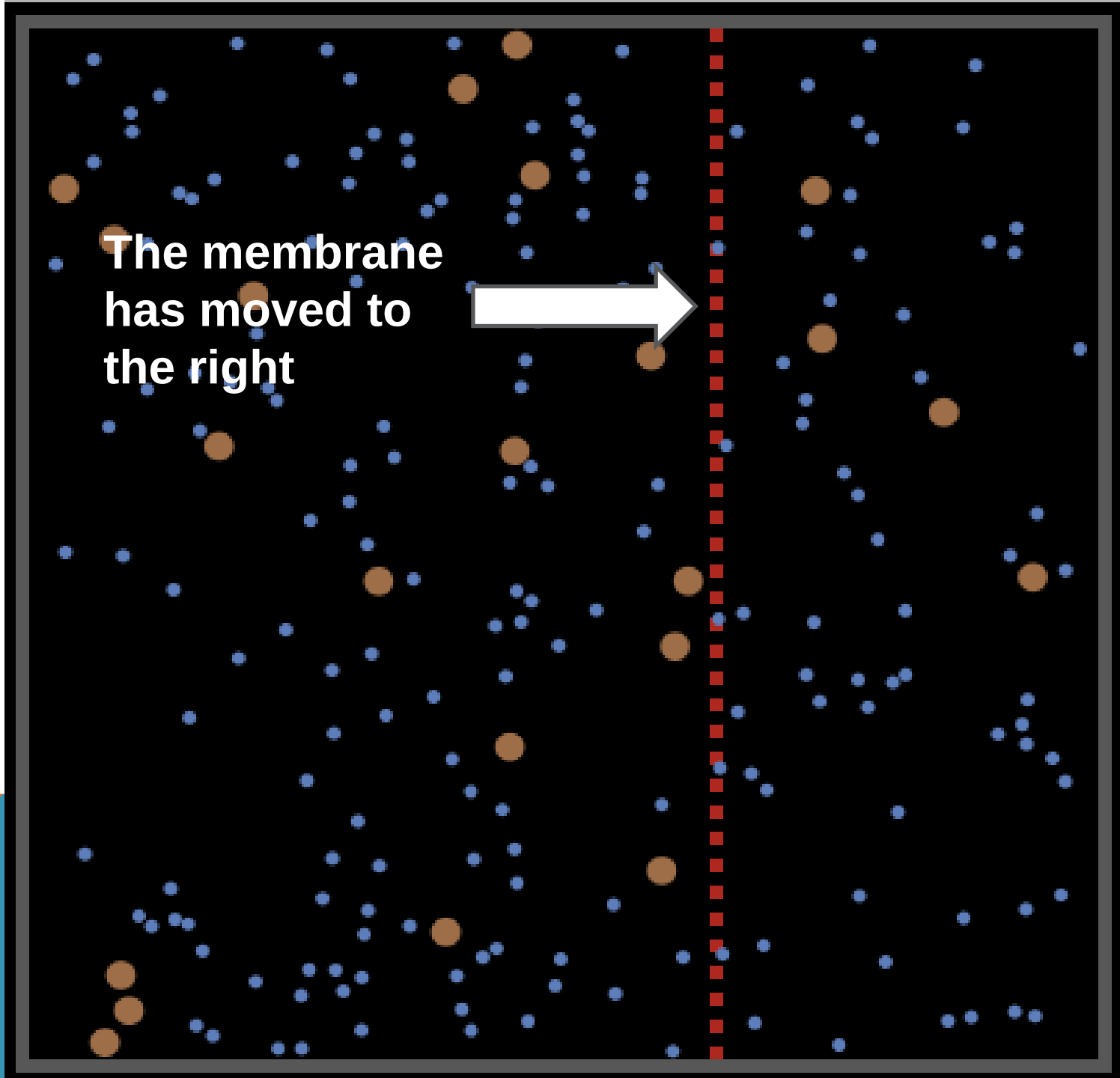


* Holbert, N. and Wilensky, U. (2012). NetLogo Osmotic Pressure model

Start


More sugar molecules here
Less sugar molecules here
Membrane is central

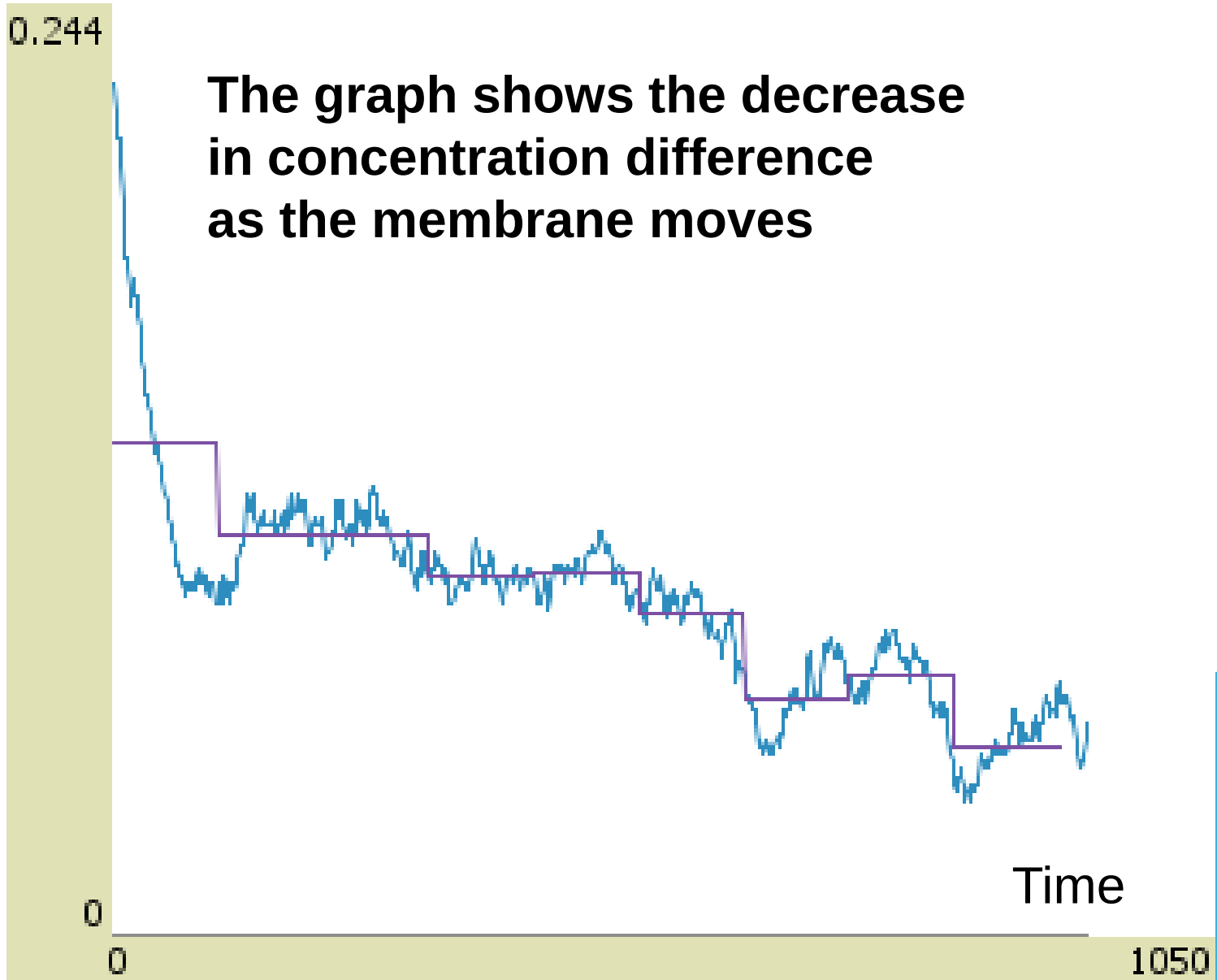
Finish



OSMOSIS IN SILICO

Data can be extracted from the simulation :

The graph shows the decrease in concentration difference as the membrane moves

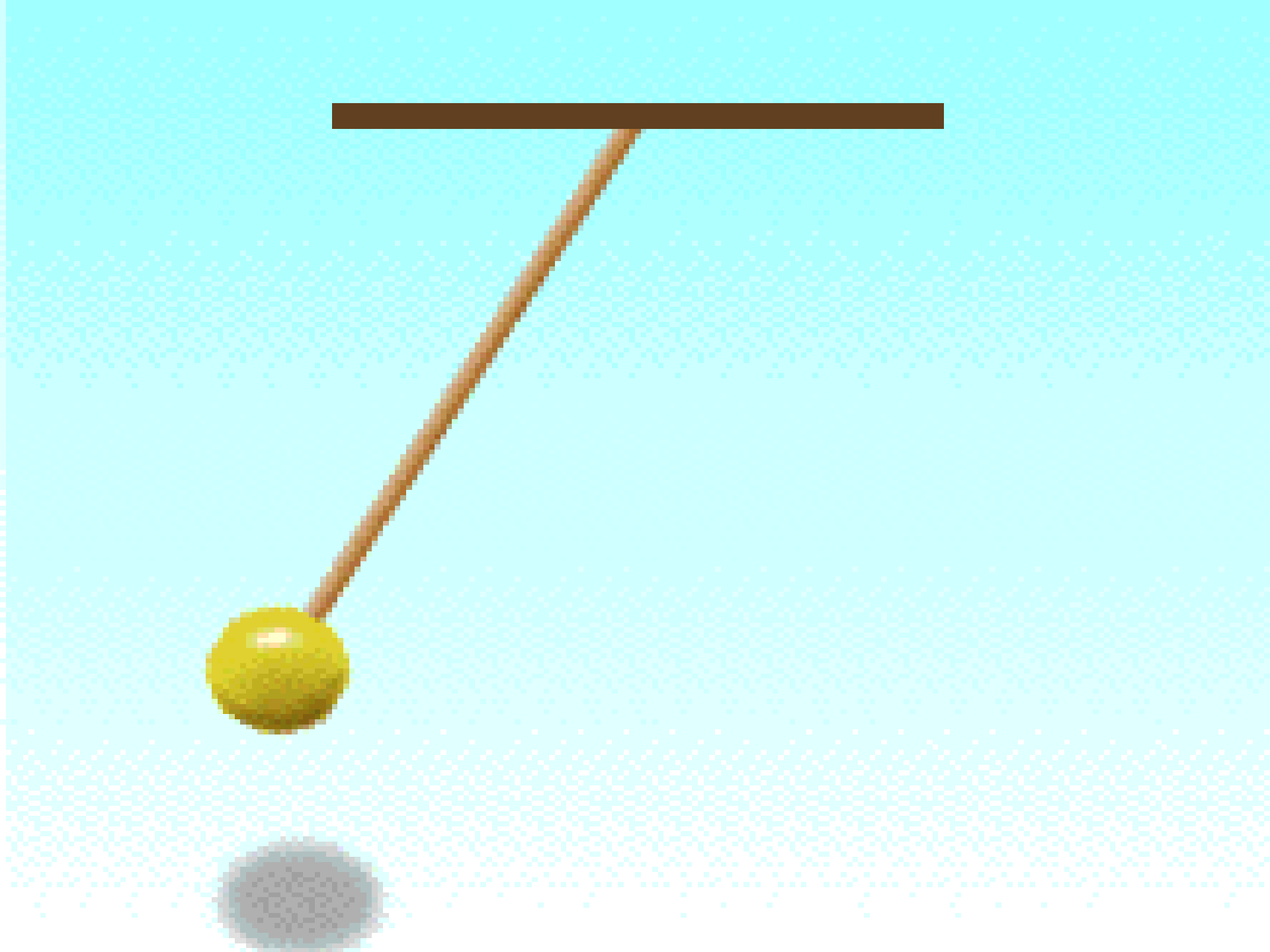


OSMOSIS IN SILICO

So we can describe osmosis.

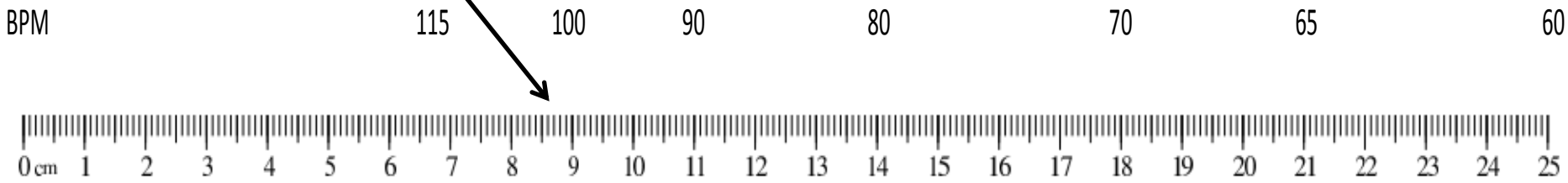
Now can we explain osmosis?

Galileo and medicine



Instructions for using your Personal Galilean Pulsometer (PGP)

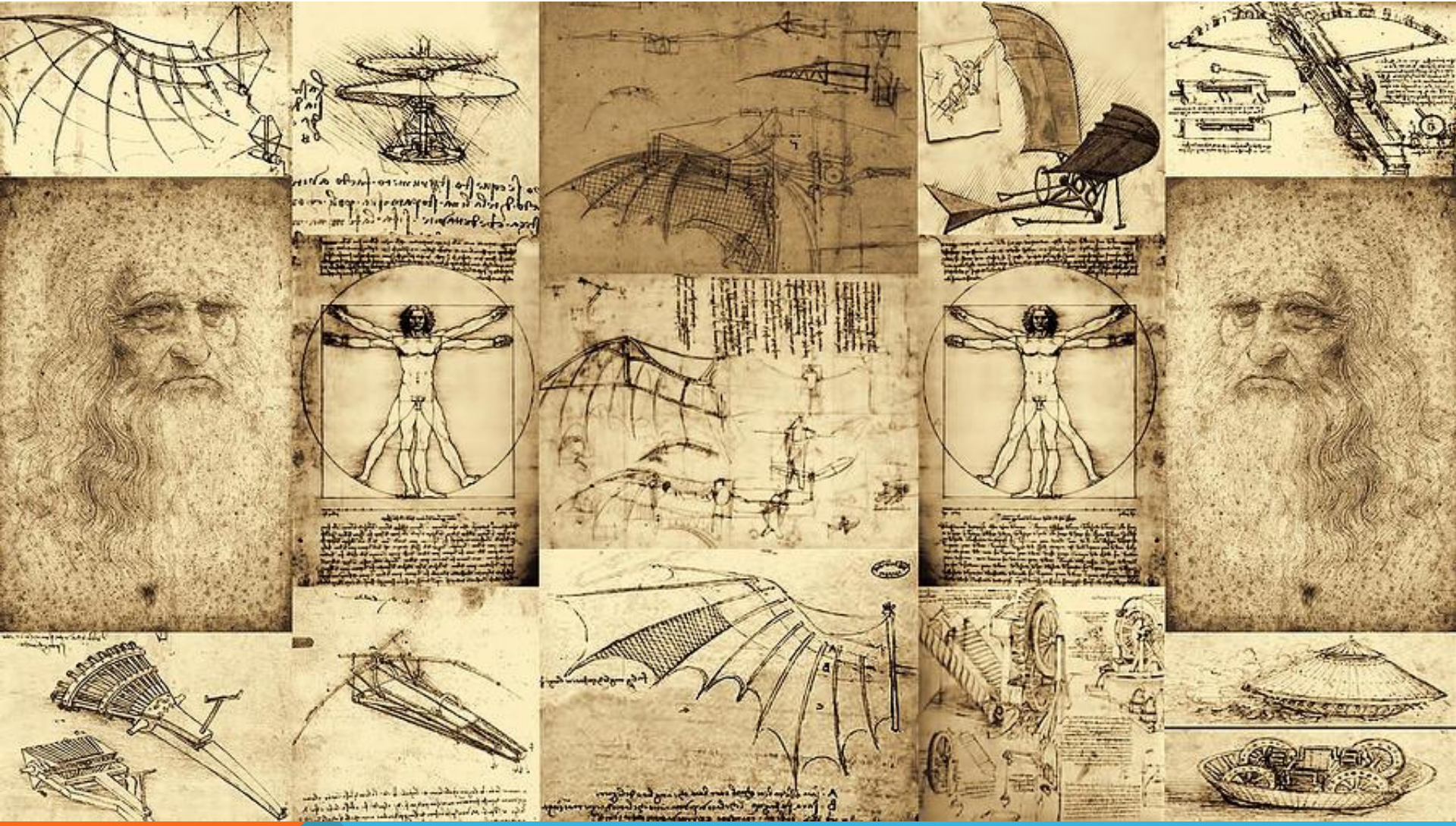
Measure length of pendulum here



length(cm)	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
BPM	150	134	122	113	106	100	95	90	86	83	80	77	75	73	70	69	67	65	64	62	61	60

Find your heart-rate here

Galileo and medicine



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