

# CENTURI Workshop

## Cell biology by the Numbers



**CENTURI**  
TURING CENTRE  
FOR LIVING SYSTEMS



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### SHORT PROGRAM

#### November 04 - November 08, 2019

#### Monday, November 4

09h00-12h00	A feeling for the numbers in biology. The goal of this part of the course is to give students the challenge of understanding biology through answering the question: “What sets the scale of X?”.
12h00 -13h30	Lunch
13h30 – 14h45	CENTURI seminar
14h45 – 16h30	What sets the speed limit of cell division? Exploration of many possible hypotheses of what limits growth rate and simple estimates to test those hypotheses.

#### Tuesday, November 5

09h00-12h30	Diffusion: Biology’s null hypothesis for molecular motion. Introduction to Brownian motion, its relevance to biology and thermal energy.
12h30 -13h30	Lunch
13h30 – 16h30	Diffusion continued: Spread the butter. This part of the course focuses on random walks as coin flips and the chemical master equation as alternative ways of viewing diffusion phenomena.
16h45 – 19h	Exercises in computation in physical biology: writing simulation code to study diffusion.

#### Wednesday, November 6

09h00-12h30	Thermal energy and the dimensionless numbers of physical biology. Learning that many processes are the result of competing effects and dimensionless numbers give us a way to compare those competing effects.
12h30 -13h30	Lunch
13h30 – 16h30	The statistical mechanics protocol: applications to ion channels, ligand-receptor binding, gene expression
16h45 – 19h	Exercises in computation in physical biology: statistical mechanics on the computer.

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### Thursday, November 7

<b>09h00-12h30</b>	The great probability distributions and the rule of right thinking. Binomial distribution and protein partitioning, Poisson distribution and copying errors in the genome, exponential distribution and waiting times for molecular steps.
<b>12h30 -13h30</b>	Lunch
<b>13h30 – 16h30</b>	Active matter and the continuum theory protocol: elasticity, hydrodynamics and beyond.
<b>16h45 – 19h</b>	Exercises in computation in physical biology: explorations in probability – Poisson distribution.

### Friday, November 8

<b>09h00-12h30</b>	Case Studies in Figure 1 theory: how theory can lead experiments.
<b>12h30 -13h30</b>	Lunch
<b>13h30 – 16h30</b>	Successes and failures in physical biology.
<b>16h45 – 19h</b>	Exercises in computation in physical biology: Surprise projects.