# Welcome to Math 102 - Calculus for Life the Sciences

- Information about the course.

- Shapes of cells.

- Power functions and polynomials.

# Math 102 - info

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- I'm Prof. Cytrynbaum or Eric.

(Gratuitous baby picture)

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- Course website: http://wiki.math.ubc.ca

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- Office hours (MATX 1219)

  - Wed 11 am -12 pm,

  - Thurs 10 - 12 am.

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  - WeBWorK (online) - 15%
  - Old-School Homework (written) 5%

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- Final exam - 50% ("44% rule")

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- Piazza - online forum for help.

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- Solutions:

  - WW - immediate yes/no.

  - OSH - you'll get solns.

  - Text - answers at the back, no solns.

  - Anything else - exam training (no solns).

# Math 102 - info

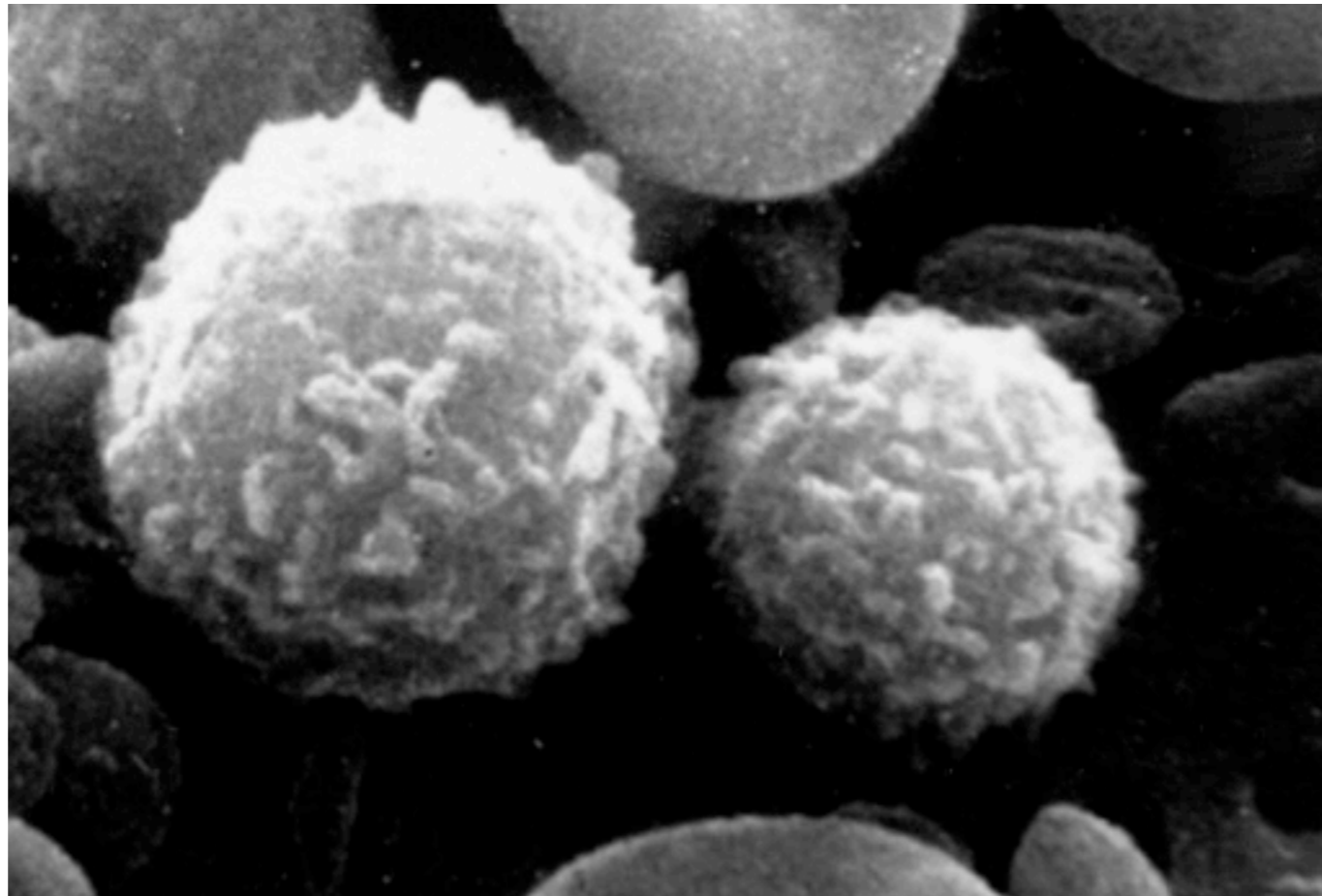- Course notes - two sets (Leah Keshet's and Paul Dawkins's)

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- A quick view of the course site, Piazza, WeBWorK...

# Shapes of cells



White blood cells (spheres)

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- For different shapes, this balance scales better or worse as size increases...

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$$S = 4\pi r^2 \qquad A = k_1 S = 4k_1\pi r^2$$

- Consumption is proportional to volume:

$$V = \frac{4}{3}\pi r^3 \qquad C = k_2 V = \frac{4}{3}k_2\pi r^3$$

where $k_1$ and $k_2$ are positive constants.

# Which of the following is true?

$$C = \frac{4}{3}k_2\pi r^3 \qquad A = 4k_1\pi r^2$$

(A) Absorption is greater than consumption for sufficiently large cells and vice versa for small cells.

(B) Consumption is greater than absorption for sufficiently large cells and vice versa for small cells.

(C) Both A and B are possible - it depends on $k_1$ and $k_2$.

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# Power functions

(A) Green: $x^3$, yellow: $x^4$, red: $x^5$, blue: $x^6$.

(B) Green: $x^5$, yellow: $x^4$, red: $x^3$, blue: $x^2$.

(C) Green: $x^6$, yellow: $x^5$, red: $x^4$, blue: $x^3$.

(D) Either (B) or (C) (not enough info).
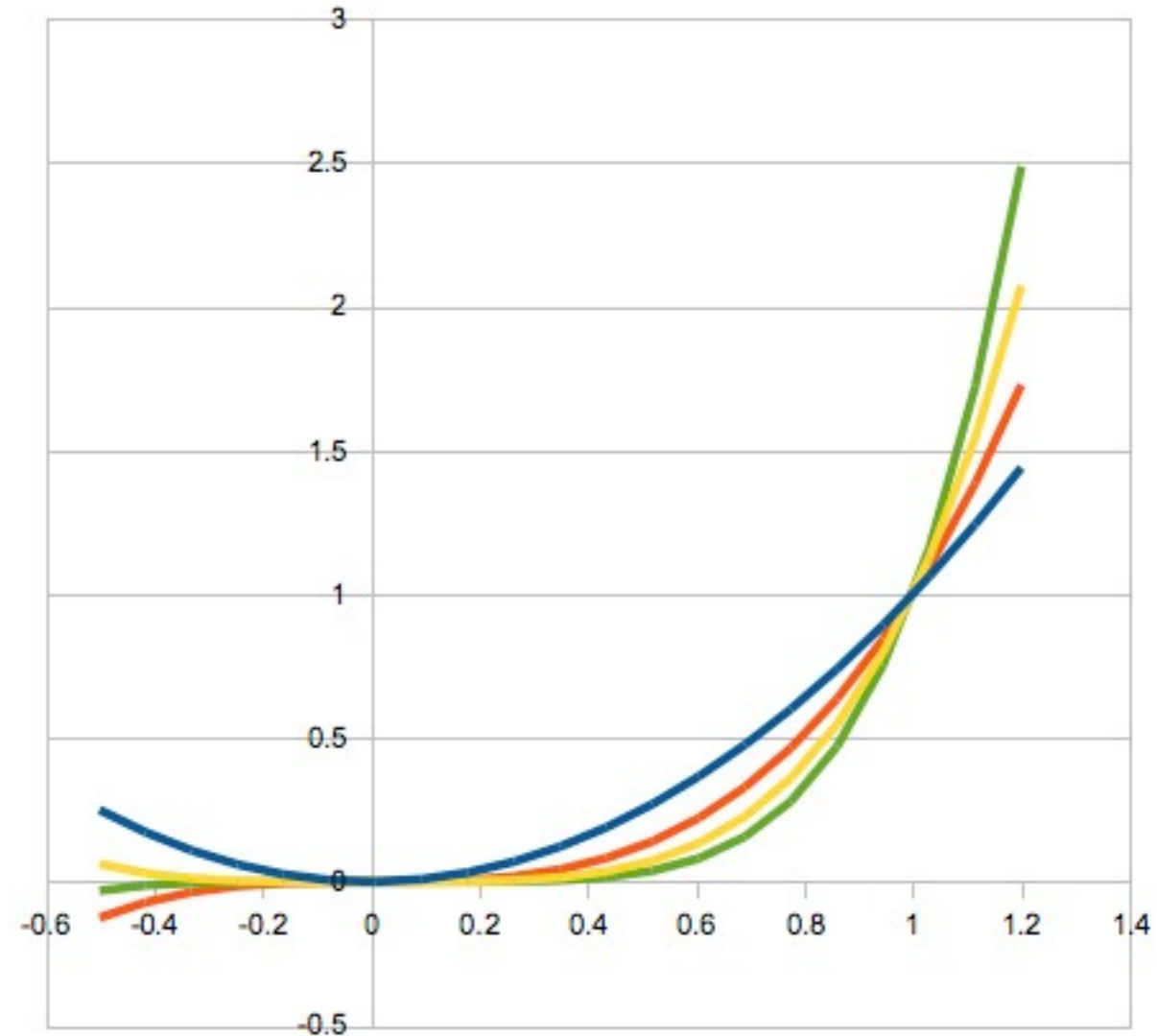
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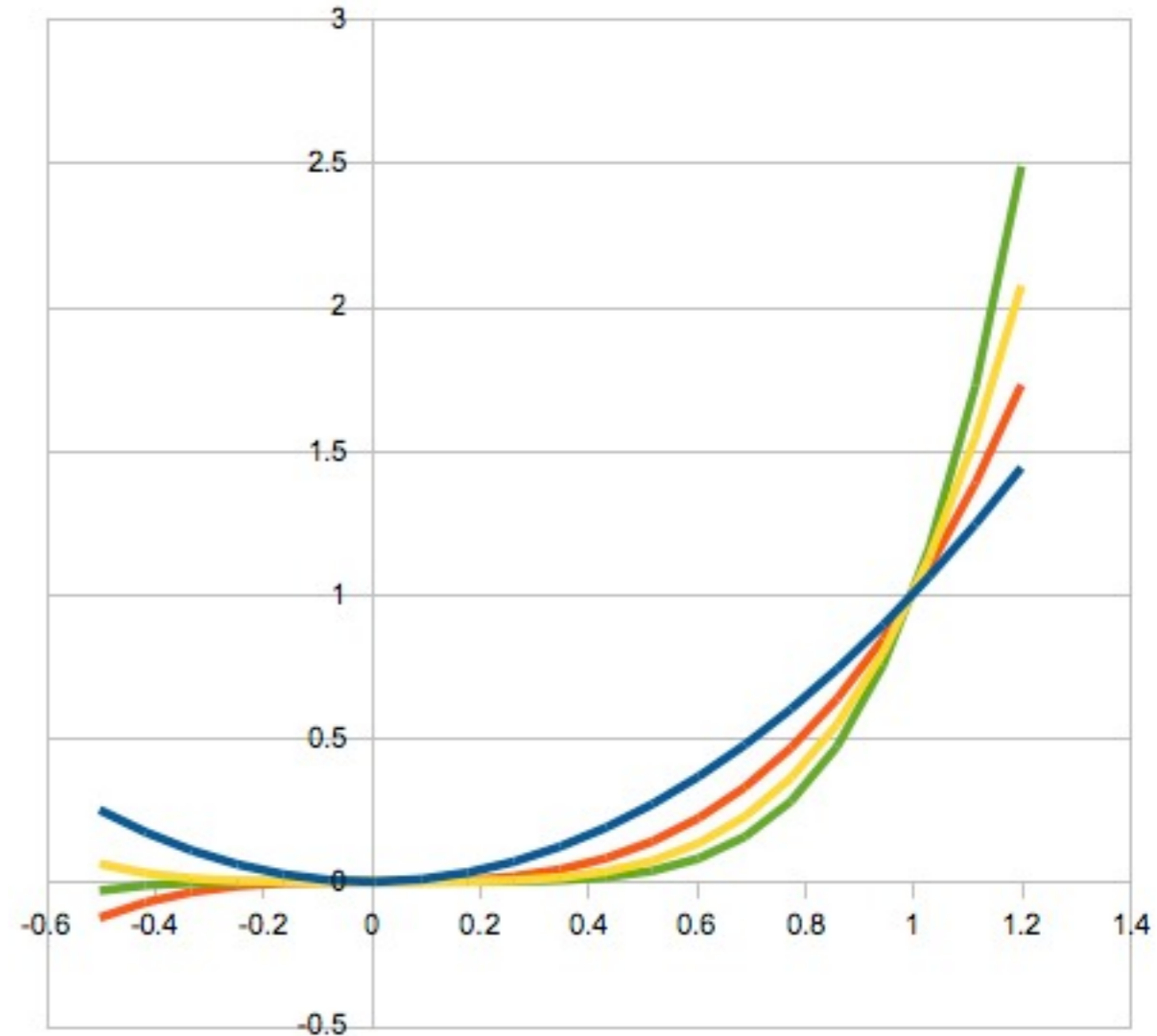
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stretch r$^2$ vertically

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- Solve for r in terms of other parameters:

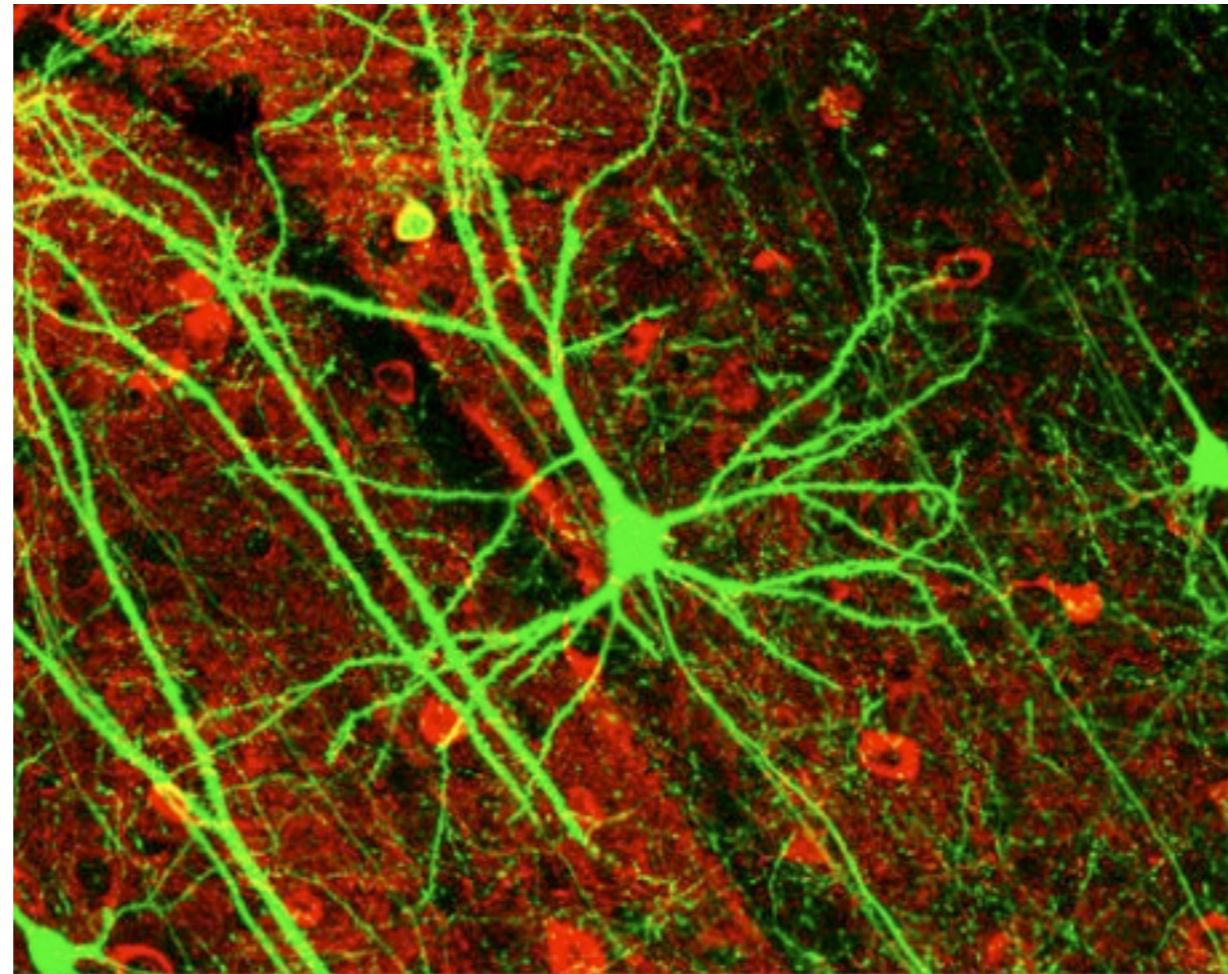# Limit on cell size

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- Solve for r in terms of other parameters:

$$r < 3\frac{k_1}{k_2}.$$

# The "biggest" cells around



Neuron (1 meter)

# The "biggest" cells around



Caulerpa prolifera (single cell, 1 meter)

# Getting around S:V issues

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- Don't be spherical if you want to be big.

# "Exceptions"



Kiwi egg (not the biggest but remarkable)

# "Exceptions"



Ostrich egg

Bad examples in this context - why?

# Coming up next class...

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- Even and odd functions

- Hill functions

  - Saturating functions (asymptotes).

  - Shape of graph.

  - Shape near origin.