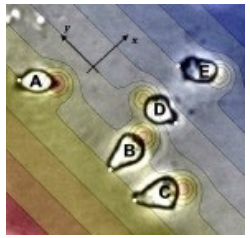
Physics 131- Fundamentals of Physics for Biologists I



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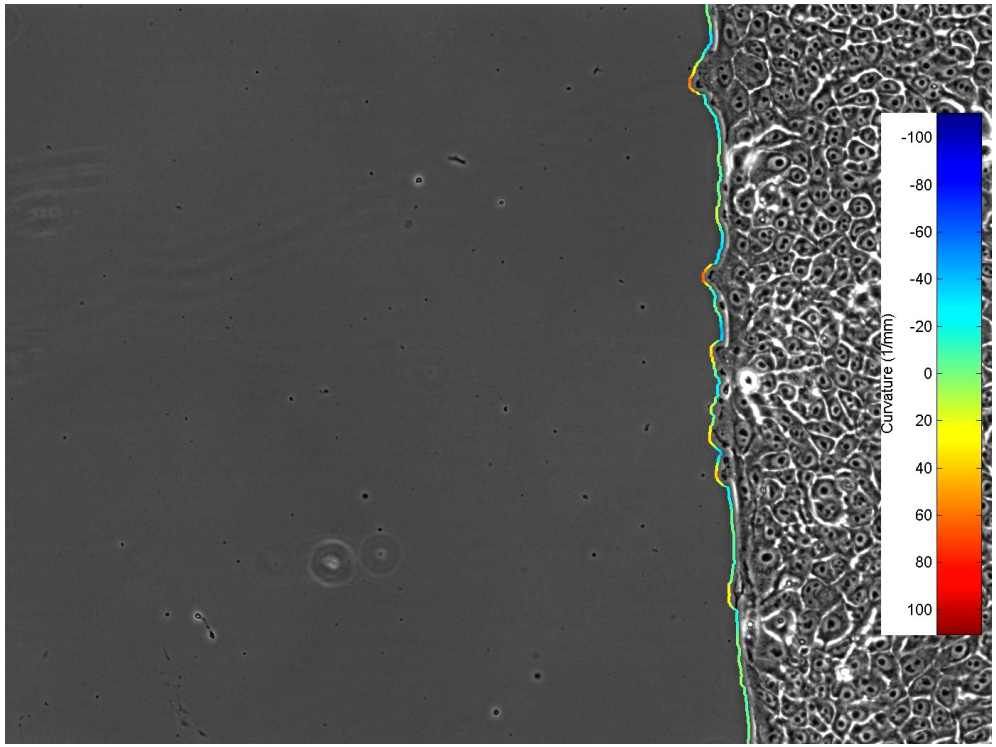
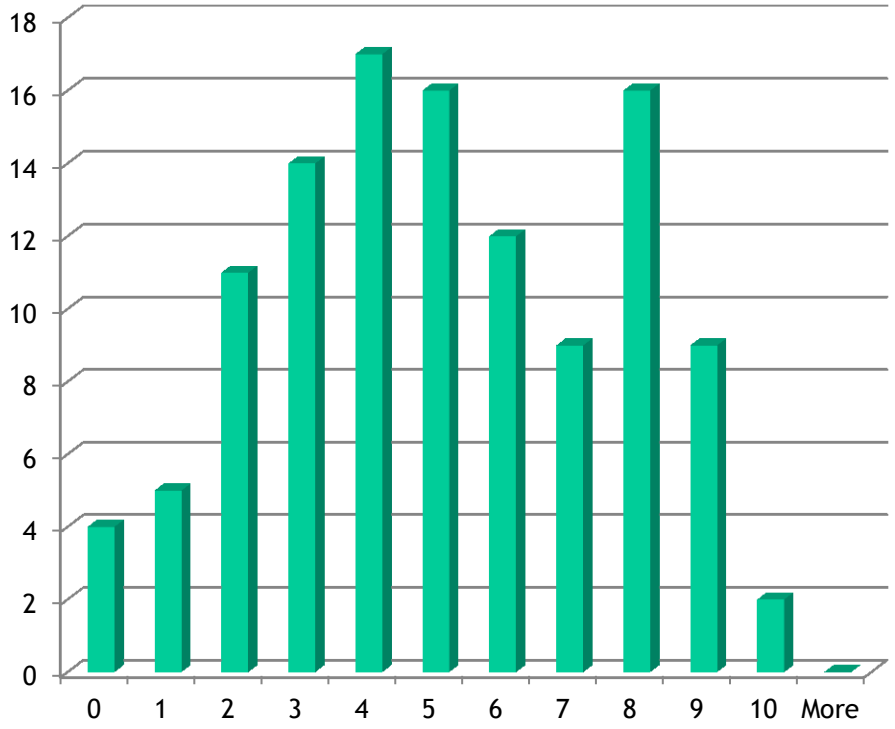


Wound healing, Rachel Lee (Losert Lab)

Quiz 2

Average: 5.1



RED

ORANGE

GREEN

BROWN

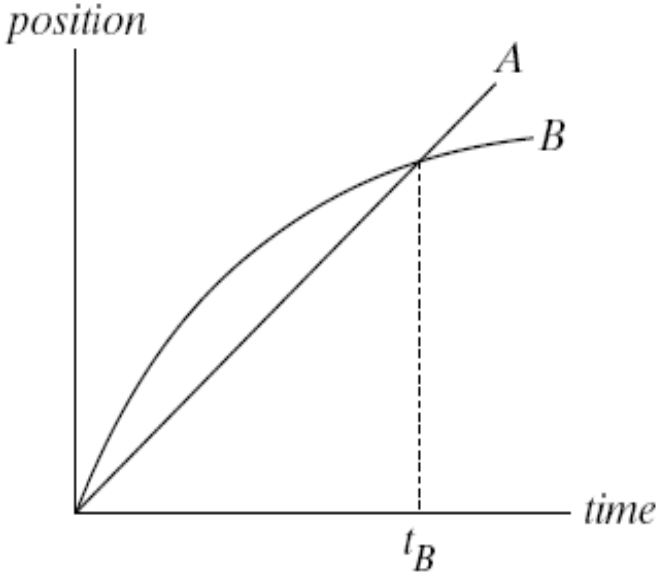
PINK

Avoid one step recall!

The graph shows position as a function of time for two trains running on parallel tracks. Which is true:

(from E. Mazur, "Peer Instruction: A users manual", Prentice Hall 1997)

1. At time t_B, both trains have the same velocity.
2. Both trains speed up all the time.
3. Both trains have the same velocity at some time before t_B.
4. Somewhere on the graph, both trains have the same acceleration.

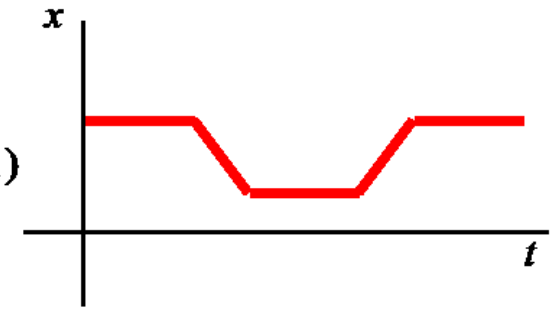


Velocity: Slope of position vs time graph

A ball rolls is rolling at a constant speed along the horizontal part of the track. It comes to a hill and has enough speed to get over it. By thinking about its speed as it goes, sketch a graph of the

Position / Velocitv of the ball as a function of time.

(1)



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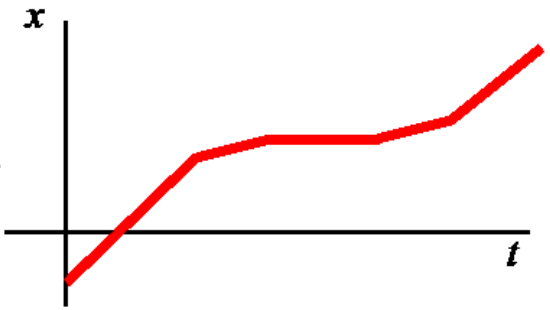

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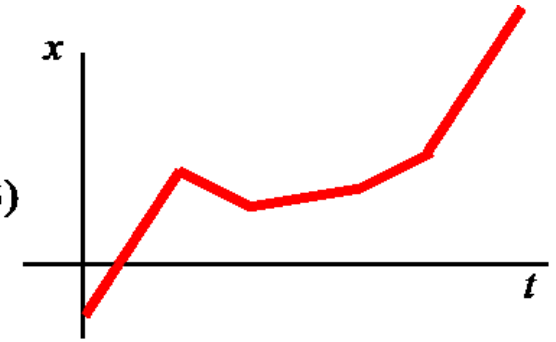

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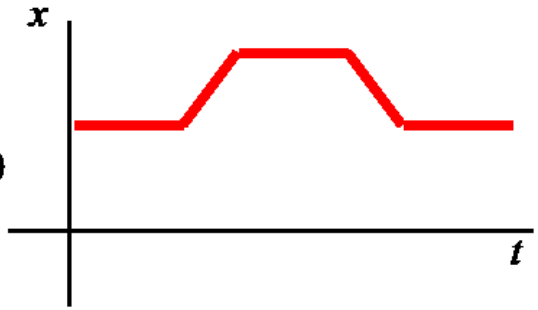

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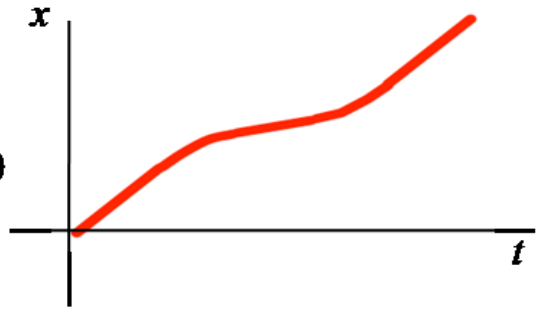

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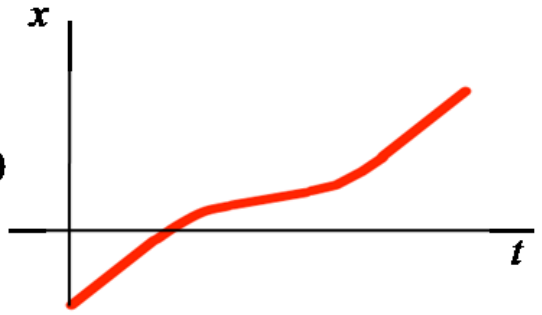


As discussed in recitation, many organisms grow isometrically, meaning that each linear dimension increases by the same factor. Let's assume that a young butterfly has a surface to volume ratio of $1\frac{1}{mm}$. If it doubled its lengths when grown up, calculate the ratio of surface to volume for the grown-up butterfly.

Area: Increases by factor 4

Volume: Increases by factor 8

Area to Volume ratio 4:8 $\frac{1}{mm}$ or 1:2 $\frac{1}{mm}$

Are you taking BSCI 330 with Dr Ades?

1: YES
2: NO
3: Not sure?

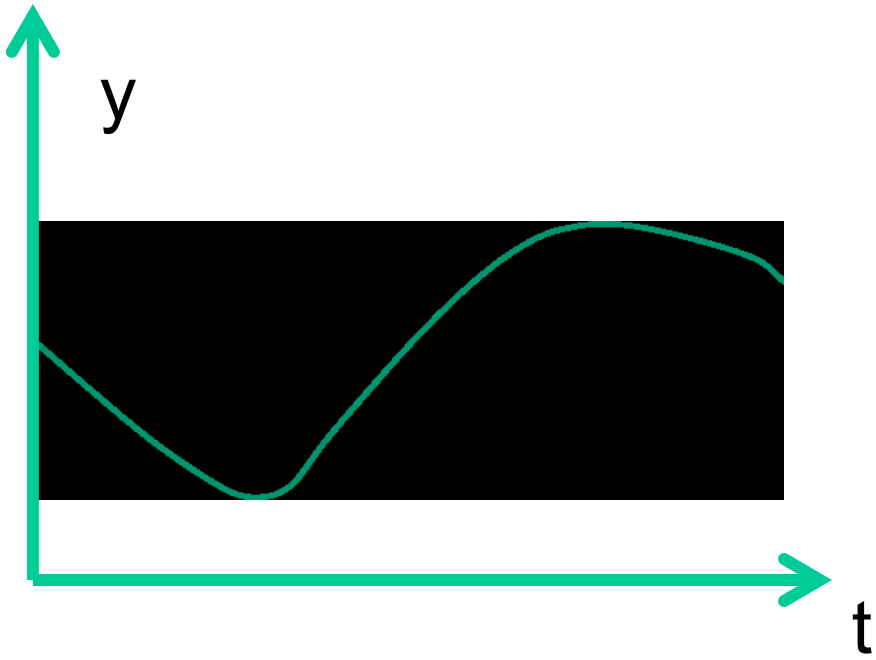
Kinematics and Dynamics

- Kinematics: Describing motion (Chapter 3)
  - Acceleration
- Dynamics: What causes motion
  - Forces and Newton's laws (Chapter 4)

Juggling Example
whiteboard

- Draw the position of one of the juggled balls during one throw y vs t

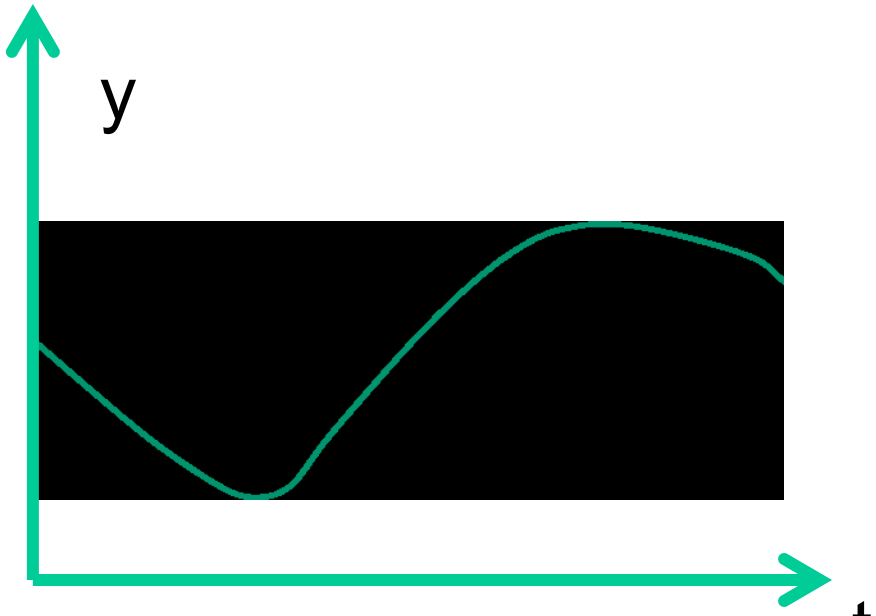
Leave space to add more words or graphs!



You are throwing a ball straight up in the air.
At the highest point, the ball's

1. velocity and acceleration are zero
2. velocity is nonzero but its acceleration is zero.
3. acceleration is nonzero, but its velocity is zero.
4. velocity and acceleration are both nonzero.

As always, you can use your whiteboard to answer this question

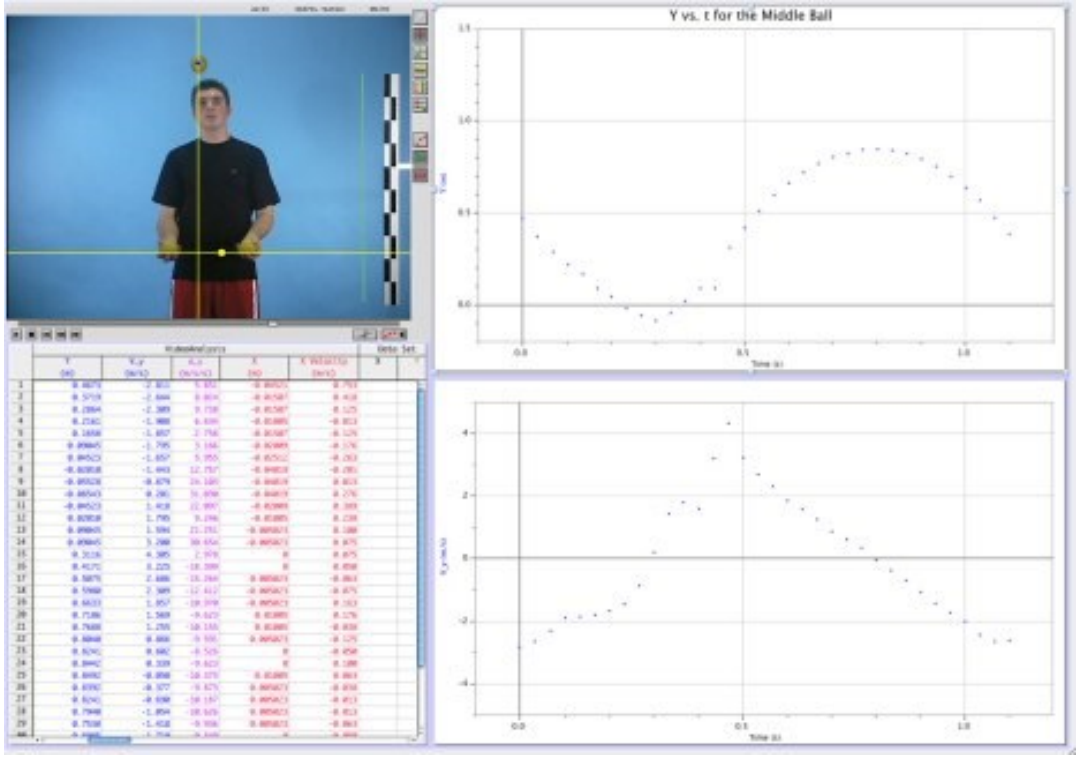


(from E. Mazur, "Peer Instruction: A users manual", Prentice Hall 1997)

Figuring out acceleration
whiteboard

- Looked at the y-t
- PLOT v_y-t plots for a ball going up and down.
- PLOT $a_y(t)$

$$\vec{a} = \frac{d\vec{v}}{dt}$$



We learned about Kinematics

- Position $\vec{r} = \ldots + yj$ (where x and y are signed lengths)
- Velocity $\langle \vec{v} \rangle = \frac{\Delta \vec{r}}{\Delta t}$ $\vec{v} = \frac{d\vec{r}}{dt}$
- Acceleration $\langle \vec{a} \rangle = \frac{\Delta \vec{v}}{\Delta t}$ $\vec{a} = \frac{d\vec{v}}{dt}$
- Connecting different representations of motion
  - Graphs of Position, Velocity, Acceleration
  - Text
  - Equations

Since we can calculate velocity as the rate of change of distance over a time interval, and acceleration as the rate of change of velocity over a time interval, is there a quantity that is the rate of change of acceleration over a time interval?

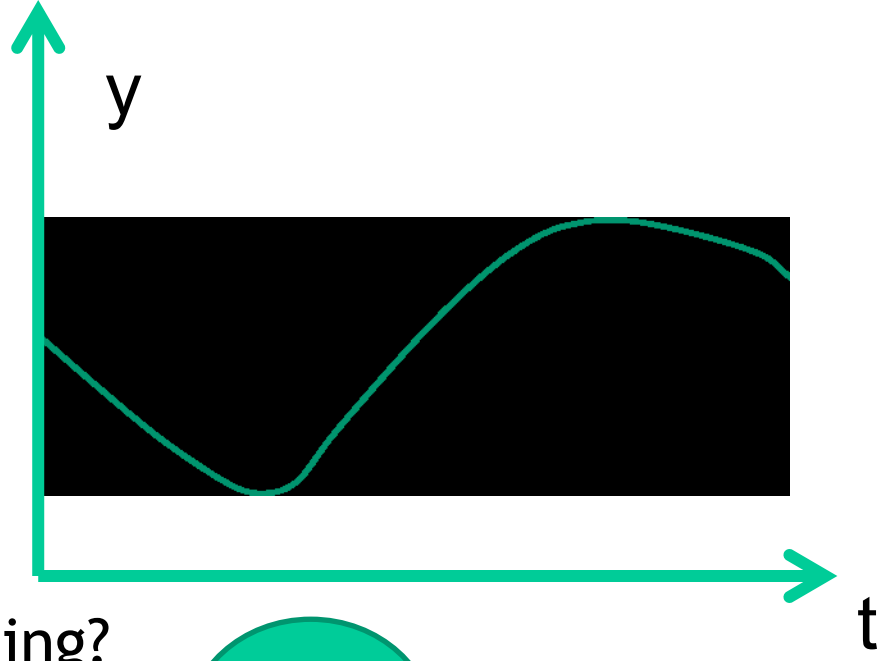
YES – It is called "Jerk", which is defined as the change in acceleration over a time interval.

Our body can only take a limited range of acceleration AND a limited amount of Jerk

Kinematics and Dynamics

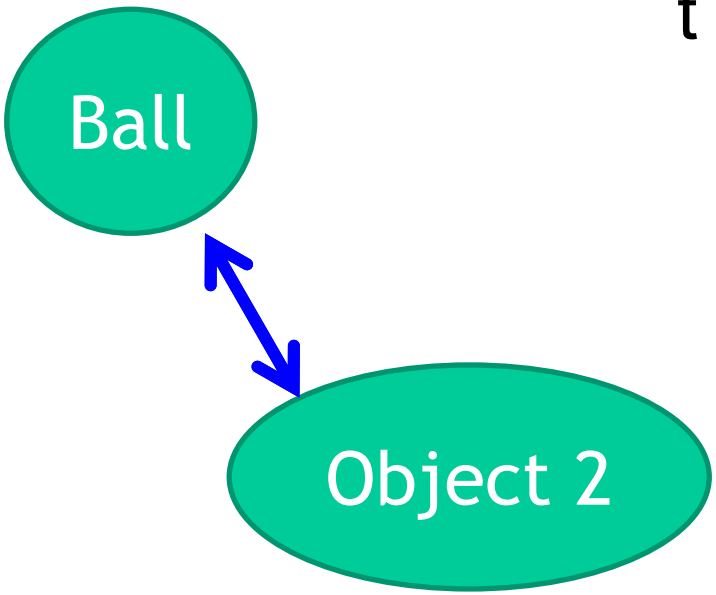
- Kinematics: Describing motion (Chapter 3)
  - Acceleration
- Dynamics: What causes motion
  - Forces and Newton's laws (Chapter 4)

What causes Motion?



Whose motion we are describing?

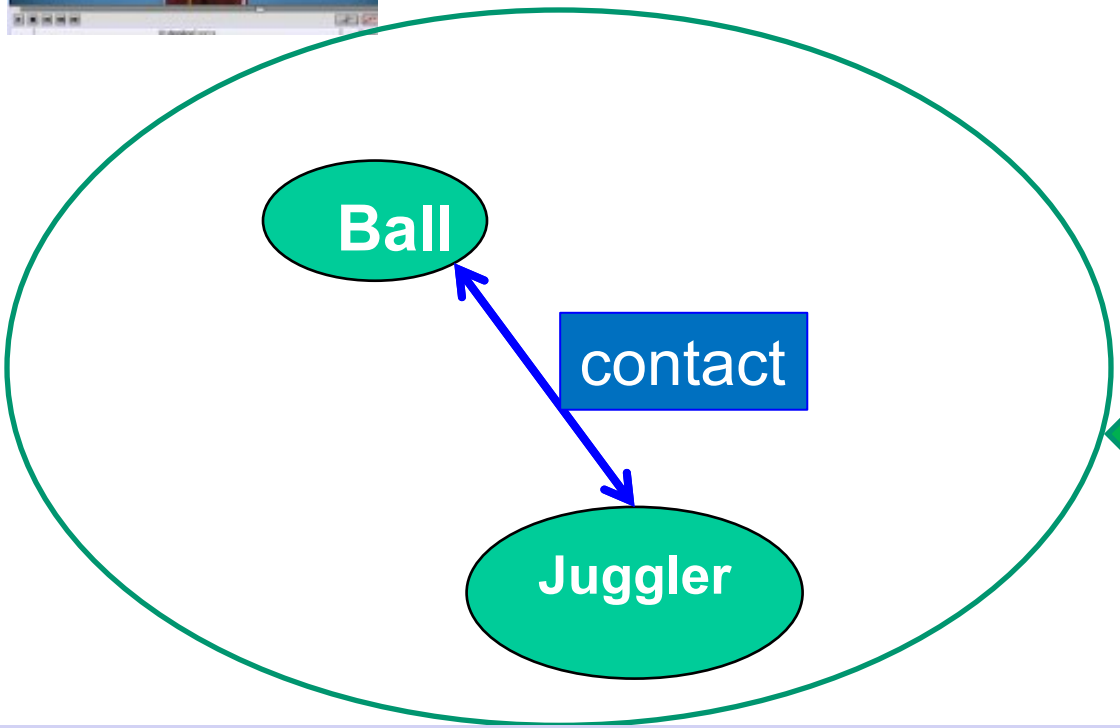
An object of interest (the ball)



What Causes its motion?

Other objects interacting with ball

System Schema



The Ball interacts with other objects, it is part of a system

How can we take all of these concepts into consideration when we are dealing with more than two objects?

How exactly would this principle be applied to … living organisms?