PowerPoint Presentation

Mechatronics Rendering of Cellular Active Transport (Sodium-Potassium Pump)

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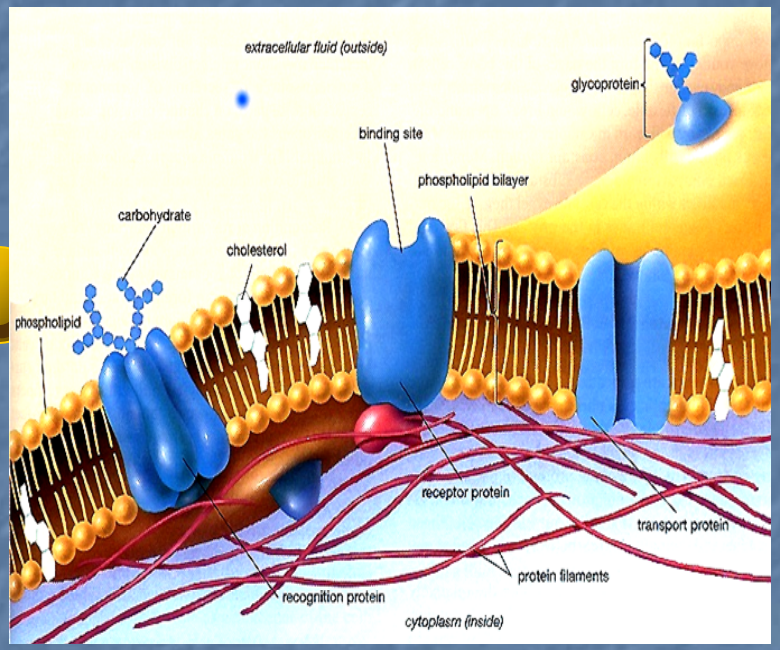
By:

HAROLD MEISELMEN
Clara Barton High School

ANALIE NARCA
Philippa Schuyler Middle School for the Gifted and Talented (I.S.383)



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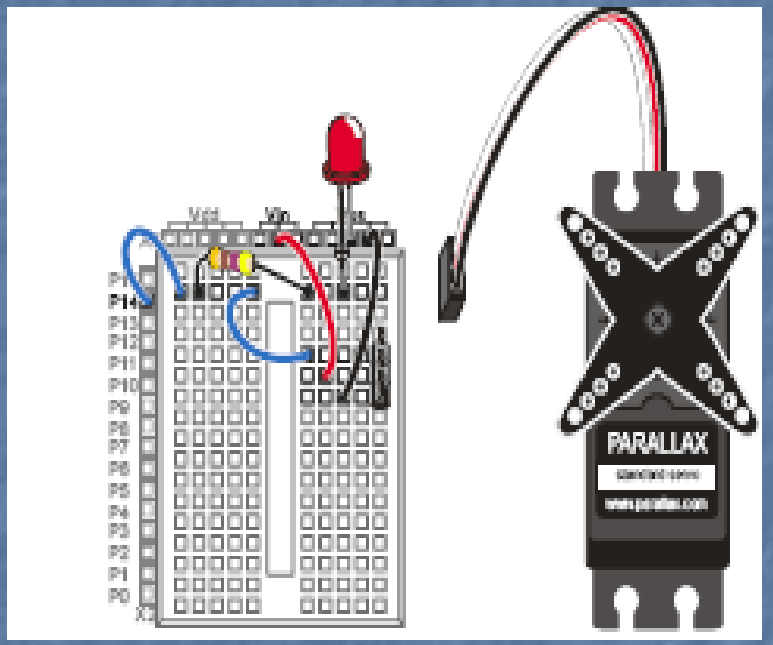


BIOLOGY (cell membrane)

MECHATRONICS

BIOLOGY (cell membrane)

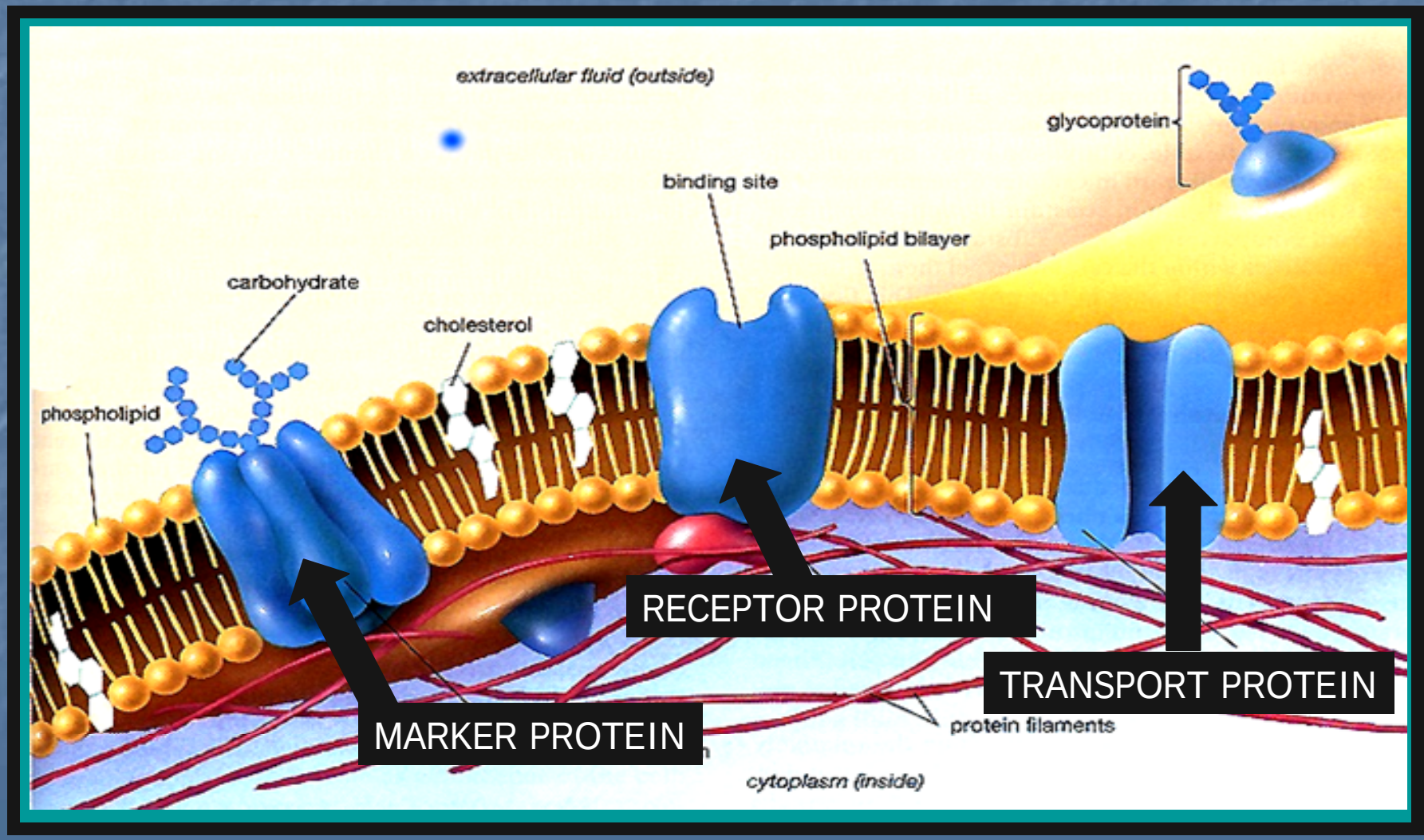
Mechatronics Rendering of Cellular Active Transport (Sodium-Potassium Pump)

PROJECT GOALS

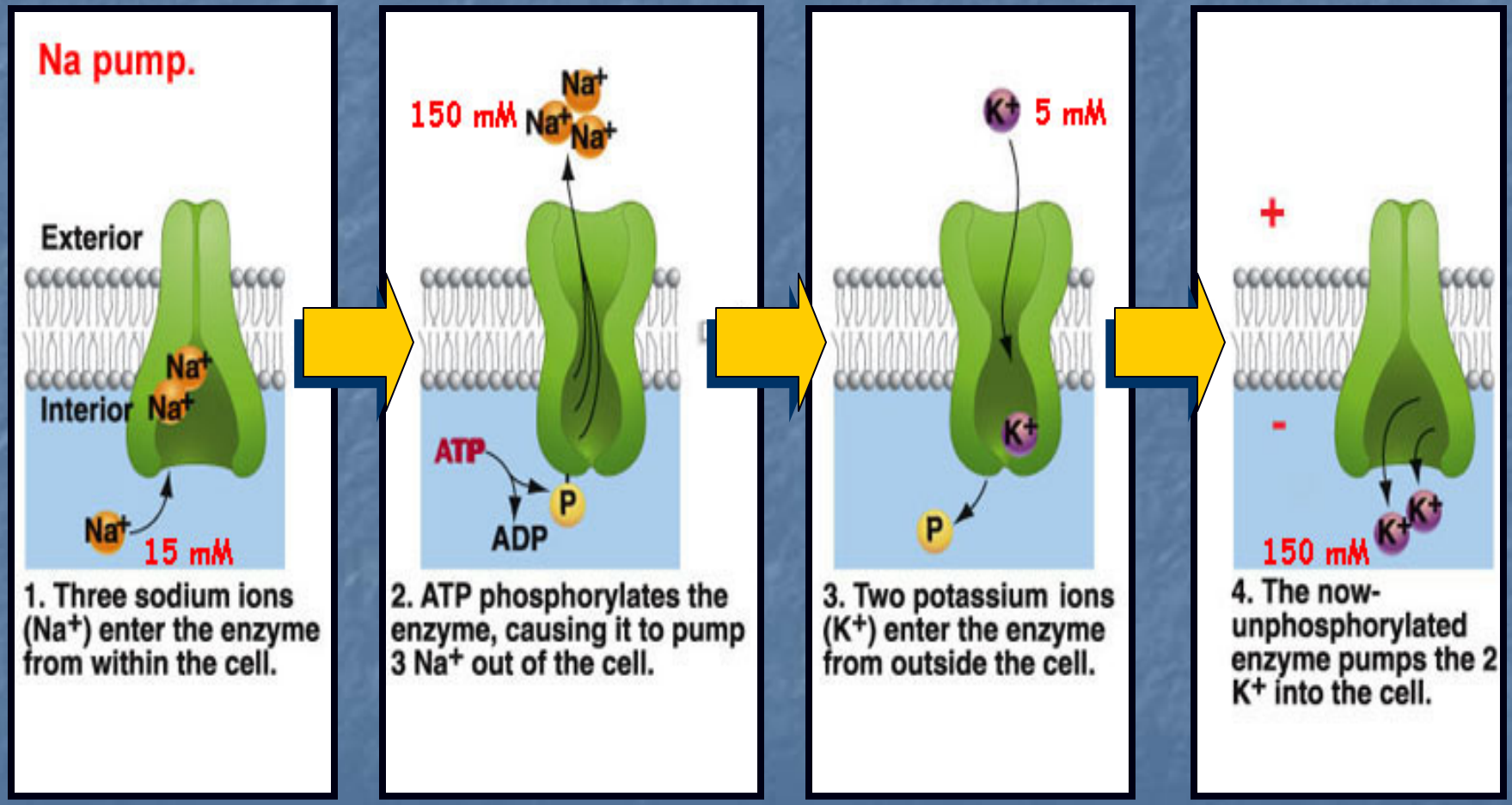
- To provide a visual model and demonstration of the sodium-potassium active transport pump

- To show the conformational change in the membrane protein during cellular active transport

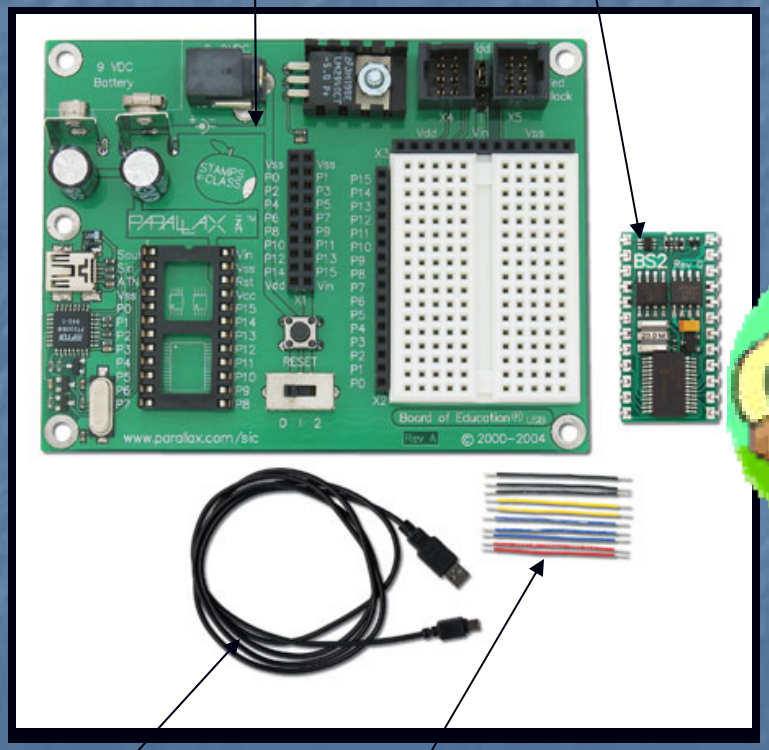
CELL MEMBRANE STRUCTURE & FUNCTION



SEQUENCE OF EVENTS



PARTS AND COMPONENTS



PARTS AND COMPONENTS

CONTROL DEVICE

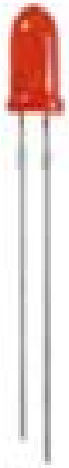
Servo motor

Servo motor controls the closing - opening of cell membrane Protein, ATP and sequence of events.

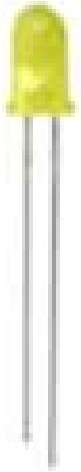
PARTS AND COMPONENTS

Light Emitting Diode

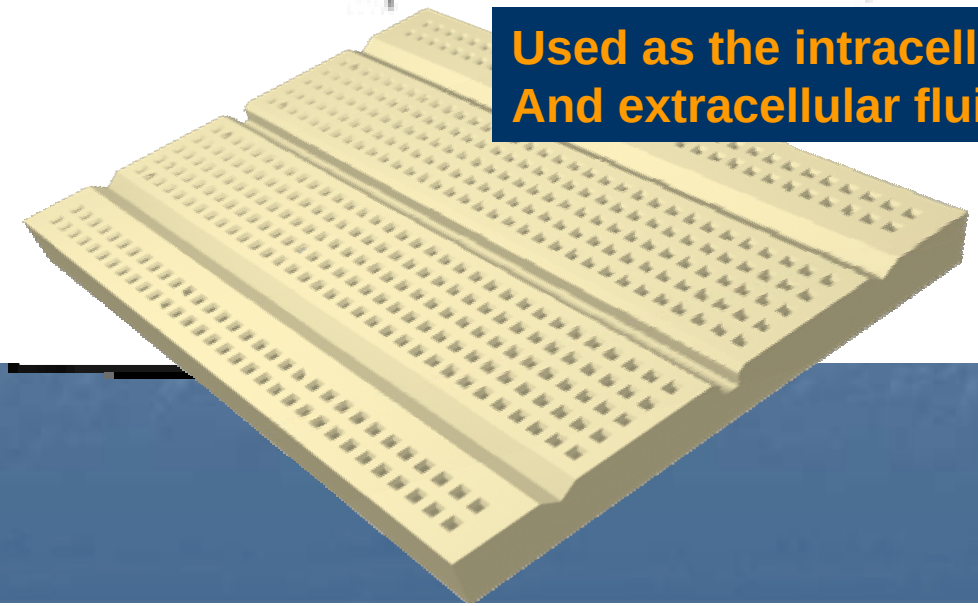
Used as K+ ions



Used as Na+ ions

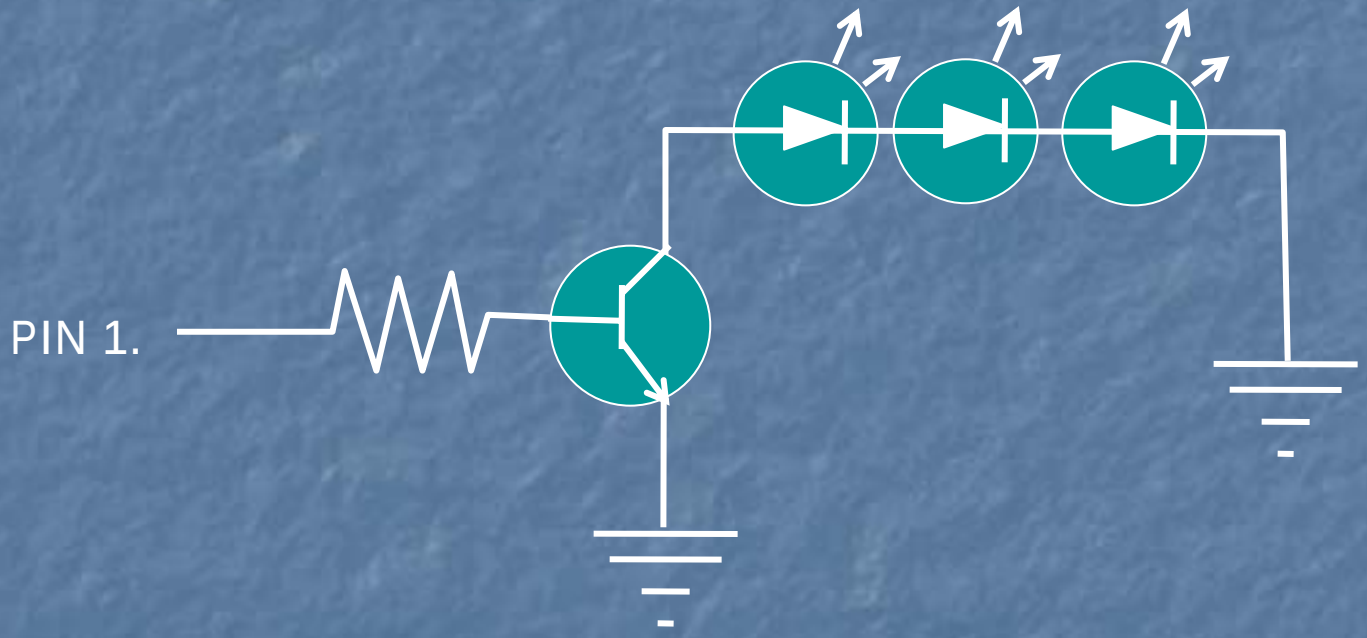


Used as ATP



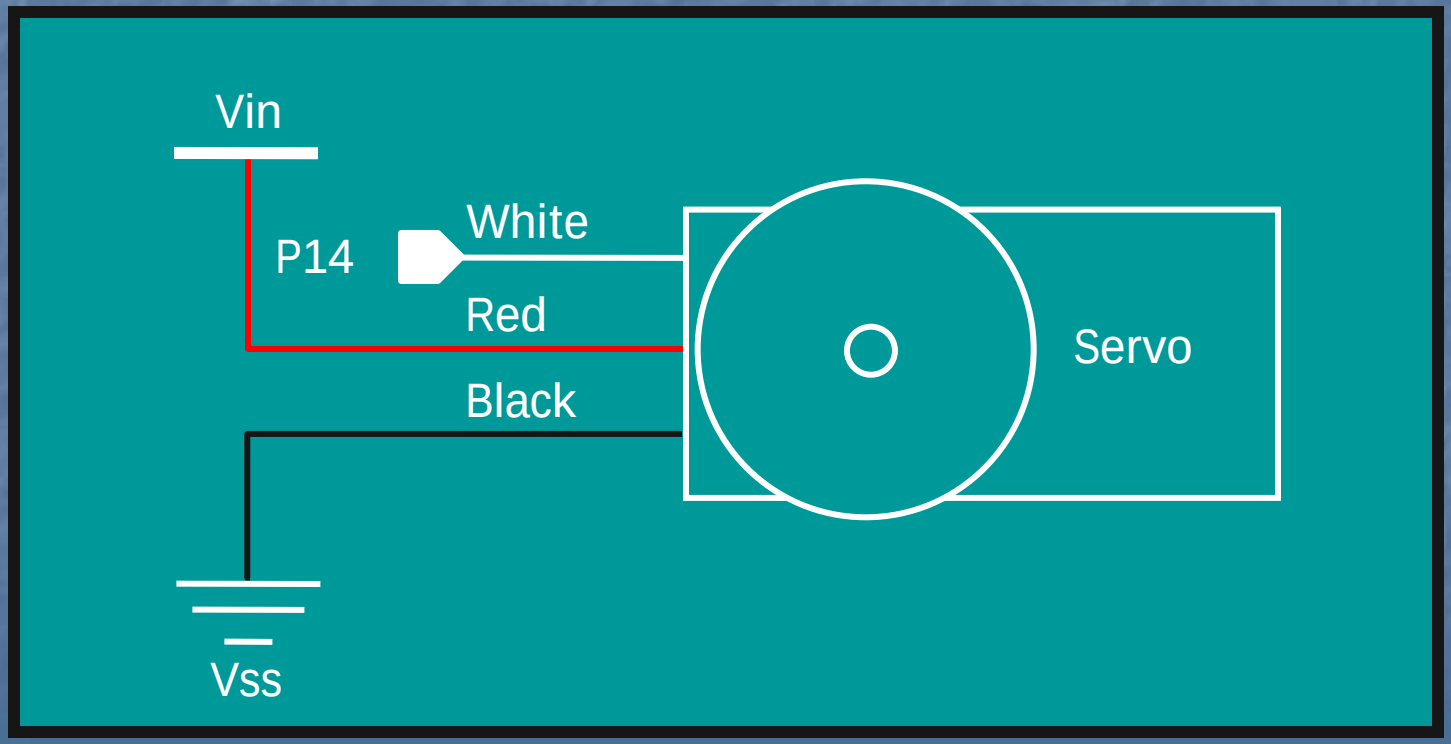
Used as the intracellular And extracellular fluids

LED CIRCUIT



SERVO CIRCUIT

- Pin 13 servo 2 - ATP binding site on protein
- Pin 14 servo 1 - Protein channel
- Pin 15 servo 3 - Caption- steps of the process



HOW IT WORKS?

- **Na+** (Red LED) ions attracted to the binding site of protein
- 3 **Na+** (Red LED) bind to protein
- Protein changes shape exposing **ATP** binding site
- High-energy **phosphate** (Yellow LED) attaches to the protein
- Protein changes shape exposing **Na+** (Red LED) to the outside of cell and the 3 sodium ions are released
- 2 **K+ ions** (Green LED) attach to the protein
- High-energy **phosphate** (Yellow LED) is released from the Protein Binding site
- Protein channel returns to its original shape bringing the **K+** ions (Green LED) in to the cell

The IMPORTANCE OF MECHATRONICS IN TEACHING BIOLOGICAL CONCEPTS

By using Mechatronics we would be able to :

- explain biological processes in an engaging way for students
- make complex concepts in biology tangible and easier to understand
- allow student's participation through manipulation and control of Mechatronics rendering of certain biological concepts (future development)
- show the use and potential of Mechatronics in the teaching and learning process not only for Science and Math but also for other subject areas .

NEXT STEP

- Expansion of the use of the model by increasing interactivity, including manipulation of ion and ATP concentrations, showing the effect of chemicals on the process.
- Use of this model to further explain the role of this process in muscular contraction and nerve impulses conduction.

WORK IN PROGRESS

PICTORIALS

PICTORIALS

DEMONSTRATION

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