Automated Cell Washer
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Background
- Any wet lab that works with cell culture requires washing and changing media in a cell dish
- This is a tedious and time consuming process
- Wanted to create a single machine that could be placed within a lab setting and used to simplify lab work
  - This would allow researchers to focus more time on other tasks
- Industrial 96-well plate washers exist, but can cost several thousand dollars
  - Also wanted to design a plate washer that could handle a larger dish of cells, since a “stock” of cells will often be grown in a larger area for convenience

Skills Developed
- Circuitry
  - Configured stepper motor components with motor driver and power supply for peristaltic pump
  - Connected simple circuits to control servo motors
- Coding
  - Created a single program with separate classes to control different parts of the pump
  - Coded using Arduino (C++) language
- Computer-Aided Design
  - Learned how to design many of the cell washer parts using Solidworks
  - 3D printed components at UCLA Boelter Makerspace

Future Directions
- Several further additions can be made to improve current design
  - Automatic cell plate sorter that feeds cell plates into the washer
  - Add more pumps to allow for different solutions to be used to wash
  - Add another peristaltic pump for more continuous liquid flow
  - Develop a method to aspirate and dispense using one rotating pump only
  - Create better cell plate shaking and securing mechanism

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Dispensing mechanism
- Several different ways to pump liquid
- Decided on peristaltic pump for practicality and functionality

Aspirating mechanism
- Wanted to either utilize the vacuum in laboratory biosafety cabinets or use a reverse pump mechanism

Cell plate shaking
- Needed to find mechanism to spread solution across all cells in plate
- Aseptic technique
  - Wanted a way to allow researcher to switch out pipettes or pipette tips to keep them sterile

Peristaltic pump used for dispensing PBS and/or media
- Good for aliquoting accurate amounts (mL) and is rate is easily controlled
- Servo motors used to rotate shaking platform and to move aspirating/dispensing pipette
- SolidWorks implemented to 3D print parts of pump, base, and shaking platform
- Used Arduino Uno/Nano as microcontroller
  - Connected to driver boards to control motors
- Design included aseptic technique in mind
  - O-ring clamping allows for easy switching of pipettes or pipette tips