

IPRO 341- Developing a Prototype Cardiovascular Display for the Prenatal-to- Newborn Blood Flow System

Corporate Sponsor:

Museum of Science and Industry

Students Involved:

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Faculty Sponsors:

Dr. Paul Fagette and Dr. Eric Brey



Basis for the IPRO

- Initially brought forth through the IIT Biomedical Engineering Society and the Museum of Science and Industry
- Working towards creating a prototype exhibit for the newborn and neonatal area of MSI



Significance of the IPRO

- MSI was interested in having us:
 - Create a novel interactive display to show changes in the cardiovascular system from fetus to newborn
 - Highlight the physiological and mechanical changes that take place during birth
 - Help educate the public



The IPRO Team

- Consisted of students from Applied Mathematics, Biomedical Engineering, Electrical Computer Engineering, Molecular Biochemistry & Biophysics, and Biology
- Used various strengths to divide project among several teams

Team Divisions

- The two initially-created teams:
 - Presentation/ computer animation team
 - Macromedia Flash and other necessary software/hardware
 - Research and Presentation/ Display team
 - Prenatal Cardiovascular System
 - Postnatal Cardiovascular System
 - Moment of Birth and Transition Period

The IPRO Teams – Research

- Utilized *Textbook of Fetal Physiology*, *Fetal and Neonatal Physiology*, and *Guyton's Medical Physiology* and additional resources a basic understanding on fetal physiology was gained





The IPRO Teams – Research

- The teams met with Sylvia Botros-Brey, M.D., an Obstetrician/ Gynecologist, to aid us in our understanding of the changes in the circulatory system that occur at birth
- The teams then condensed the knowledge they acquired and designed the text that would be used for the Flash presentation



The IPRO Teams – Computer Animation and Presentation Group

- The Computer Animation and Presentation group started working with the research groups to create proper visual displays
- A Mechanical Model group also formed to design and construct a visual display that would supplement the Flash presentation



The IPRO Teams – Computer Animation and Presentation Group

- An additional goal of the presentation was to make the computer animation accessible to a wide range of viewers
- Sub-levels were created to allow viewers of all backgrounds to personalize their learning experiences

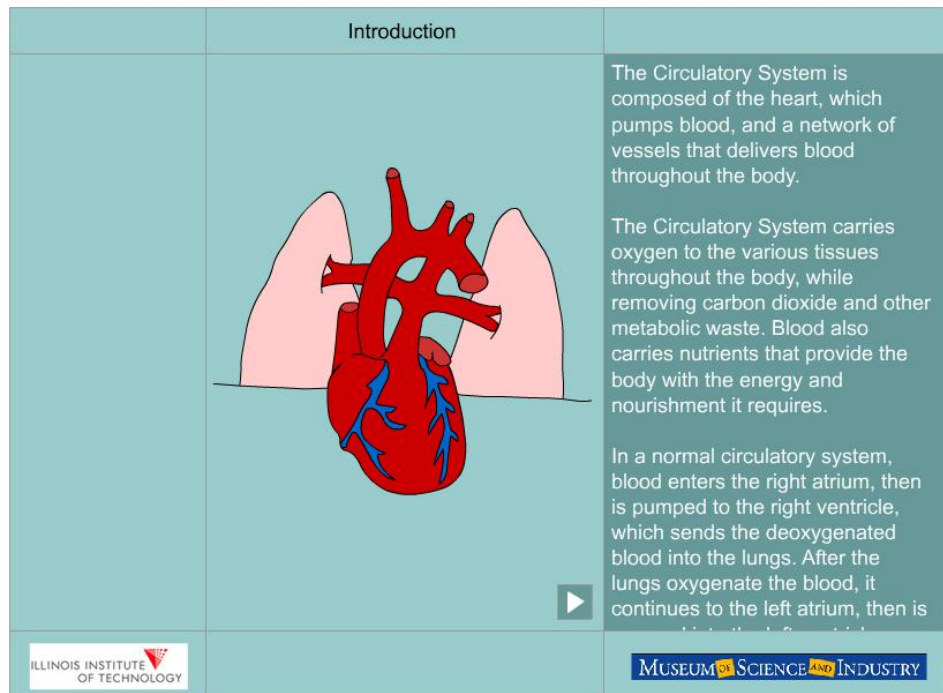


The IPRO Teams – Final Product

- The final steps were to finish the two different presentation models and finalize the IPRO presentation and reports
- With our efforts both the model and presentation were finalized and made presentable to the public

The Presentation

- Using Macromedia Flash and the research collected by the team, an interactive presentation was created.



Screen Capture from the Flash Presentation



The Presentation

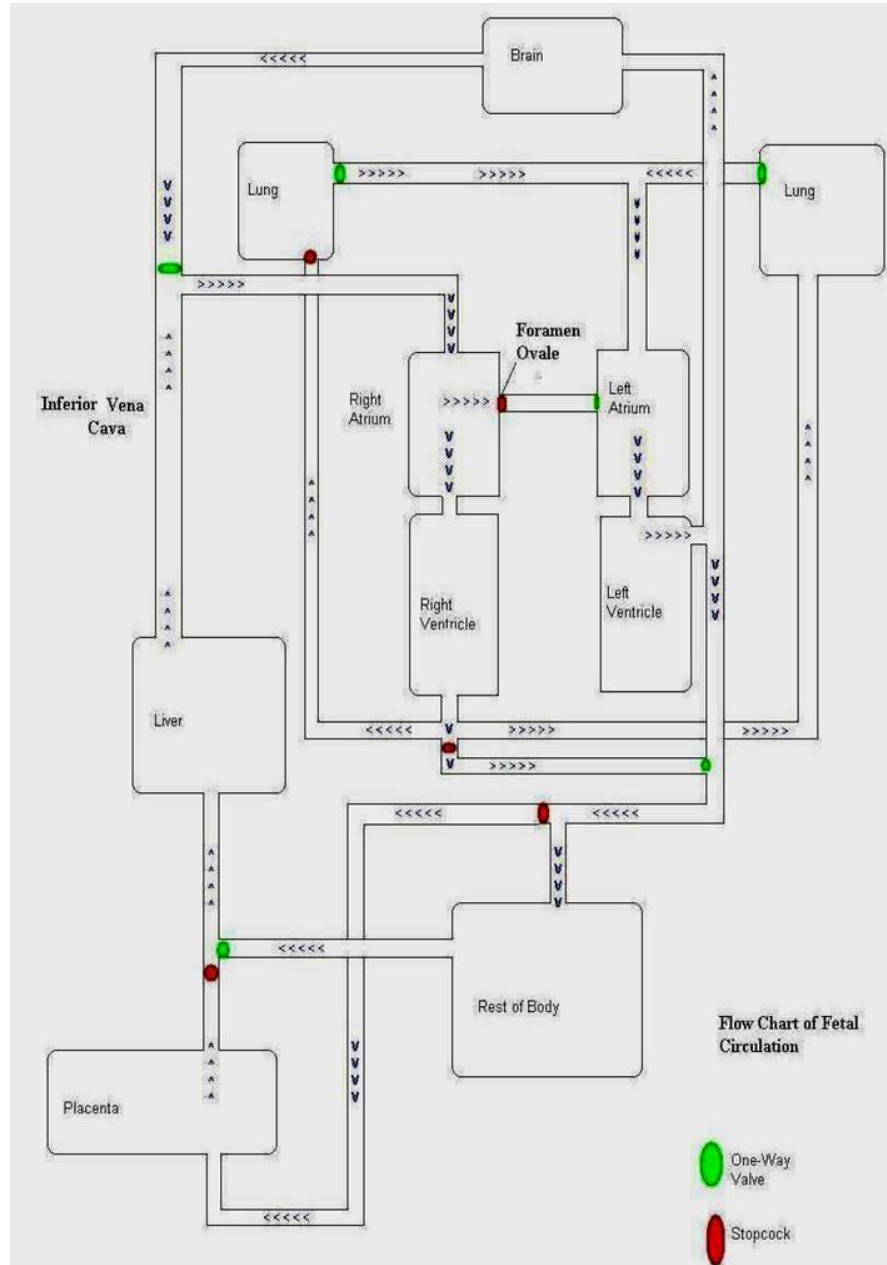
- Interactive menu allows viewers to select what part they want to learn about as well as simply letting the software serve as a “tour guide”
- Animated images help in guiding the viewer’s understanding of the material
- Featured sublevels allow the viewers gain more in-depth information

The Model

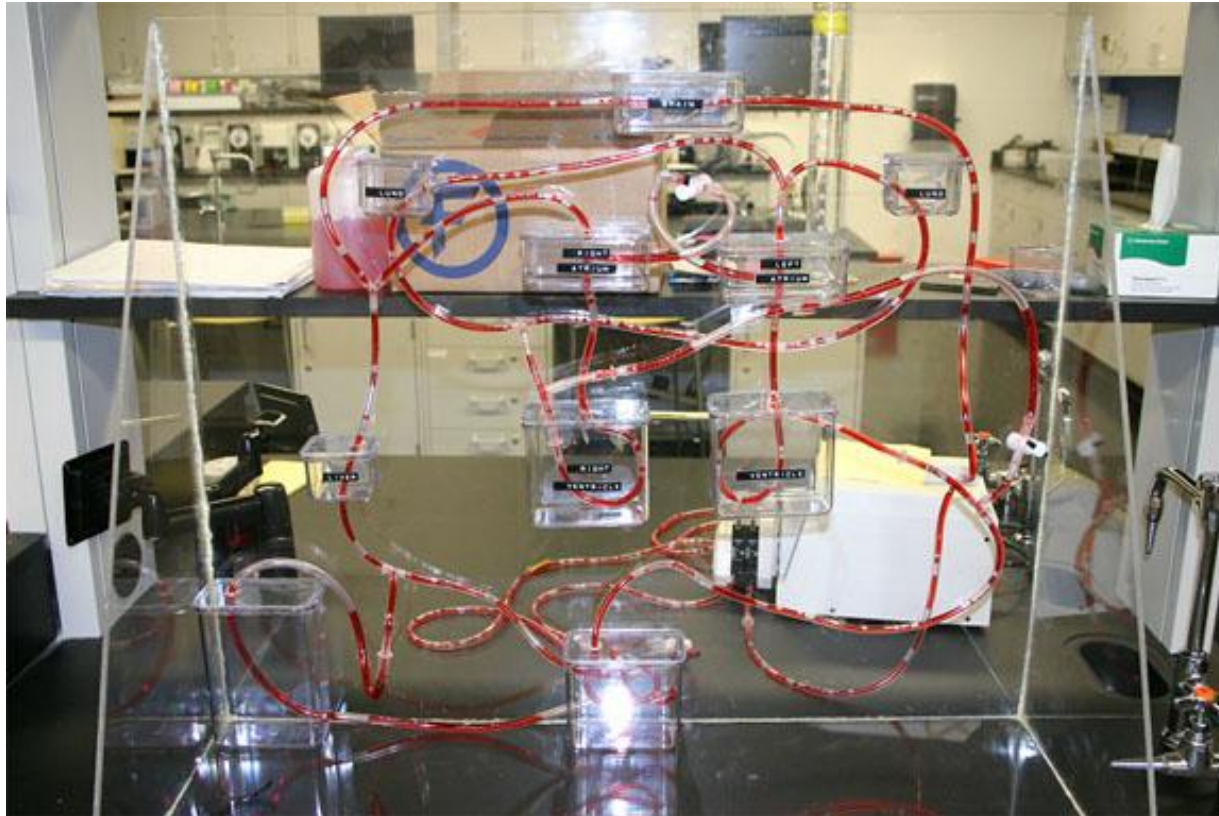
- Created a visual simulation of the blood flow changes that occur from fetus to newborn
 - Utilized plastic containers to symbolize organs and Tygon tubing to represent the vascular system
 - Physical changes could be depicted by the opening and closing of valves

The Model

- Initially, a basic layout of the circulatory model was made.
- This served as a simple guideline



The Model





Future Recommendations

- Build on presentation after conducting marketing research of current prototype
- Improve bench-top model to be more aesthetically pleasing and to include a solenoid valve to regulate flow



Future Recommendations

- Incorporate light emitting diodes in the model to better represent venous and arterial blood flow
- To use a control board with the presentation and model so they are able to run in sync with each other
- Maintain relations with MSI and work towards final exhibition at the museum

Acknowledgements

- **Our advisors: Dr. Paul Fagette and Dr. Eric Brey**, for giving us tremendous support and guidance throughout the project as well as funding to accomplish our goals.
- **Dr. Sylvia Botros-Brey**: For providing us with additional material and proving to be an essential resource in our research.
- **Dr. Patricia Ward and Dr. Barry Aprison at MSI**: For their encouragement. We hope to continue to work with you to provide a final exhibit prototype.
- **WIIT**: For allowing the use of studio equipment to aid audio recordings.
- **Dr. Connie Hall**: For the allowing the use of the BME Fluids Lab and the pump used in the model as well as her guidance and advice.
- **Dr. Vincent Turitto**, Chair, Dept. of Biomedical Engineering: For his support, space, and encouragement.
- **Unilever**: For providing aerated viscous material initially representing the blood in the mechanical display model.
- **Computer Networking Systems**: For the availability of the software needed for the IPRO team to purchase.