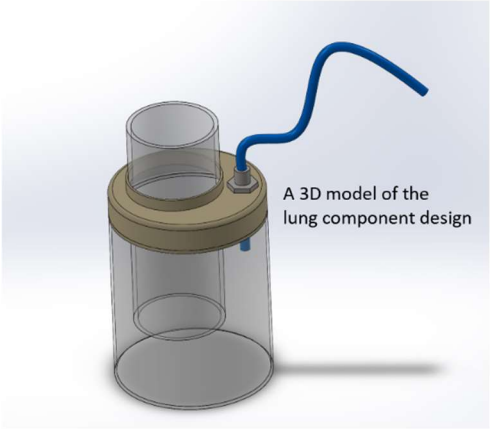
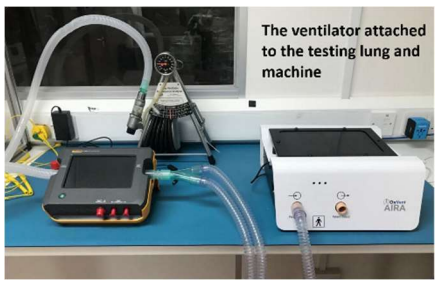
Biomedical Engineering Internship

Over the course of the summer vacation I had the unique opportunity to experience working as a biomedical engineer in both research and in industry by splitting my time between the Oxford Institute of Biomedical Engineering (IBME) and OxVent, a start-up originating in the response to the UK ventilator challenge and the Covid 19 pandemic. The work I did at both the IBME and OxVent looked at the effects of respiratory diseases, particularly coronavirus, and how these diseases can be identified and treated.

My first week at the IBME started with reading and understanding the theories that my supervisor for the project, Dr Andrew Farmery, had published about this area. Particularly looking at his recent method for measuring both the volume and the uniformity of the lungs as one of the significant discoveries from people suffering from chronic respiratory diseases is that their lungs often do not perform uniformly. His theory suggested that if this uniform response and volume of the lungs could be measured initially in patients it would give a more detail to clinicians as to the severity of the patient's respiratory disease. However, although they found a method to measure these values they realised that they could not prove the data collected was correct as there are actually no other methods for measuring either the volume or the uniformity of lungs. This is where my project came in as I was tasked with designing and building a lung model in which the values of these two things could be set to a range of appropriate data and then the method used to measure this and prove the theory. Over the course of the next few weeks I designed and ordered parts to build a lung model made of 7 individual components as seen in the rough 3D model shown. One of the main things I designed was a lid that could be 3D printed to allow the necessary components to both fit through and still be able to remain air tight once sealed. Once the 7 components were built and sealed I could fill them with different amounts of water to change the volume and uniformity of the test lung and hopefully prove the measuring method works.

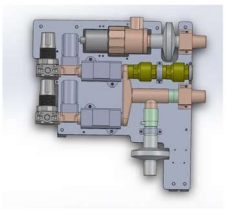

A 3D model of the lung component design

My first week at OxVent, at the same time I was reading the theoretical papers at the IBME, was very different as I arrived to a very busy small team who had just received a ventilator from the American Ventilator challenge. Much to their dismay though it had arrived in pieces as the 3D printed plastic materials were not strong enough to survive the rough postal journey from America to Pakistan and finally Oxfordshire. My main task over the next few weeks would be to redesign the main hardware that held all the delicate components together as well as redesign many of the mechanical ventilator components to ensure everything fit together effectively and any future posting would not cause the same damage. The aim for this ventilator is to sell to developing countries as an emergency response ventilator and so the ability to ship to remote areas without damage will be essential. I really enjoyed working on this as I had the freedom to be creative about solutions and some of the components I designed were even 3D printed and on the main ventilator within days. During this

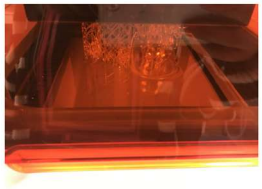

The ventilator attached to the testing lung and machine

time not only did my knowledge of 3D CAD software and using a 3D printer develop I also got to experience first-hand the manufacturing process for a medical grade device. It was definitely very rewarding being able to experience the full process from design through to 3D printing and sterilising and then assembling the components and into the ventilator being tested.

My 3D CAD model of the ventilator

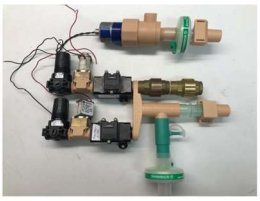


Some of the components I designed being 3D printed



Me assembling the ventilator airway components in the clean room

The airway component path ready to go into the ventilator



My final couple of weeks at OxVent were spent creating a full 3D assembly of the entire ventilator with over 80 individual components having to be adjusted to ensure the components all fit correctly and there would be no movement when the ventilator is being moved around. Whilst creating a virtual assembly I also wrote a set of assembly instructions with 5 different sub-assemblies that would ensure a full manufacture of a ventilator. This was a perfect way to wrap up all the work I had done whilst at OxVent and ensure that all the designs I'd come up with would fit together.

Overall, I finished my summer with much more experience of not only biomedical engineering but an array of engineering disciplines related to the field. Thanks to the Rokos funding I got the opportunity to experience biomedical engineering for the first time and continue into the 3rd year of the degree confident that I have chosen a specialism that has many exciting opportunities to look forward to.