

# IPRO 314: First Artificial Kidney Building a Replica of Kolff's Rotating Drum

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Sponsored By: The Museum of Science and Industry, Chicago, IL

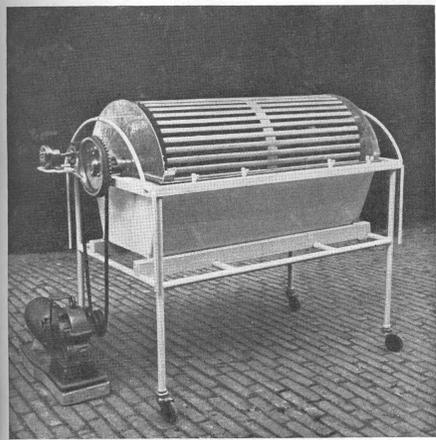


Fig. 15.  
The latest model of an artificial kidney. The cylinder is made of varnished lathwork, and rotates with its lower segment through a tank with rinsing-liquid. The splashboards are seen on either side of the cylinder.

## OBJECTIVE

The objective of this IPRO was to create a working replica of the first artificial kidney, created by Dr. Wilhem Kolff 1942.

## BACKGROUND

➤ Dr. Wilhelm Kolff produced the first artificial kidney in 1942. He worked in Nazi occupied Netherlands. Due to the circumstances under which he was forced to work, Kolff used any materials available to him.

➤ The artificial kidney works under the principles of diffusion and convection. Kolff utilized the Archimedes screw principle to get movement of blood across the device.

## ORIGINAL BLUE PRINTS

➤ Due to the lifesaving ability of this device Kolff decided that the technology should be available to everyone. Kolff and his assistant Dr. VanNordwijk wrote a book called The Artificial Kidney. In this book, they not only explained the principles behind the device, but also included a full set of blue prints so that any engineer could replicate the design.

➤ Working from the original blue prints created a special set of problems. The blue prints first had to be converted into a 3-D format. A program called Pro-E was used to model all of the components in 3-D, and then to put the components together and ensure that once the parts were machined they would all fit together.



Fig. 17.  
The frame with the animal tank and the outlet. The heating element has been brought in; the switch has been put on the tank at the back.

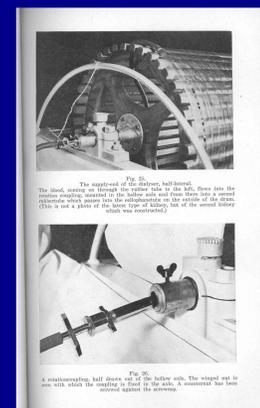
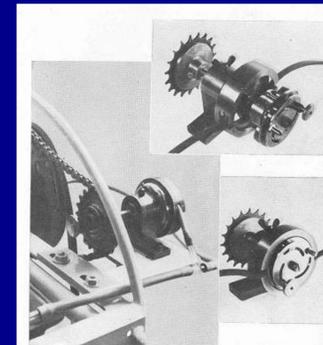


Fig. 18.  
The support of the drum, half-height. The blood enters on the right, flows into the drum, flows into the return outlet, passes in the drum and flows into the return outlet. (This is not a photo of the latest type of kidney, but of the original kidney which was constructed.)



## FABRICATING THE PARTS

➤ Following the completion of all of the modeling, the parts began to be assembled. Each major component was assigned to a subgroup. The parts were machined at **Quality Tool and Machine Inc.** Chicago, IL and **Miller Eureka,** Chicago, IL. The machining of the parts took most of this semester.

## MUSEUM OF SCIENCE AND INDUSTRY

The replica was presented to the Museum of Science and Industry on April 21<sup>st</sup>. The Museum hopes to use the replica as part of a newly revamped exhibit on the human body. Ideally they would like to involve the replica in a whole exhibit on Artificial organs!

## FUTURE WORK

- ASAIO Conference June 2006
- BMES Conference October 2006
- Finish a second replica for the BME department at IIT

## ACKNOWLEDGEMENTS

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