



**SNS COLLEGE OF ALLIED HEALTH SCIENCES**  
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**DEPARTMENT OF CARDIO PULMONARY PERFUSION CARE**  
**TECHNOLOGY**

**COURSE NAME : PRINCIPLES OF PERFUSION TECHNOLOGY II**  
**III YEAR**

**TOPIC : BIOMEDICUS PUMP**



# Non occlusive pump Or Centrifugal pump Or biomedicus pump



- Rhone-Poulec in France originally designed a non-occlusive roller pump for use in routine CPB procedures
- This pump became known world wide after its successful use in neonatal respiratory support
- The pump was further developed overtime for routine CPB and mechanical support
- The MC3 pump is a passive filling , peristaltic pump that combines many advantages of both the centrifugal and the roller pump.
- This pump is nonocclusive and should be used as for all nonocclusive pumps, in combination with a flow meter .
- It consists of a completely flat pump chamber that is wrapped under tension around rollers.
- The rollers are mounted on a rotor.
- Rotations of the rotor imparts a peristaltic motion to the blood within the pumping chamber
- When the inlet of the chamber is supplied with blood at a pressure above ambient , blood is moved toward the outlet .
- Because of its design, the pump chamber can only get filled when there is a positive hydrostatic pressure at the inlet .



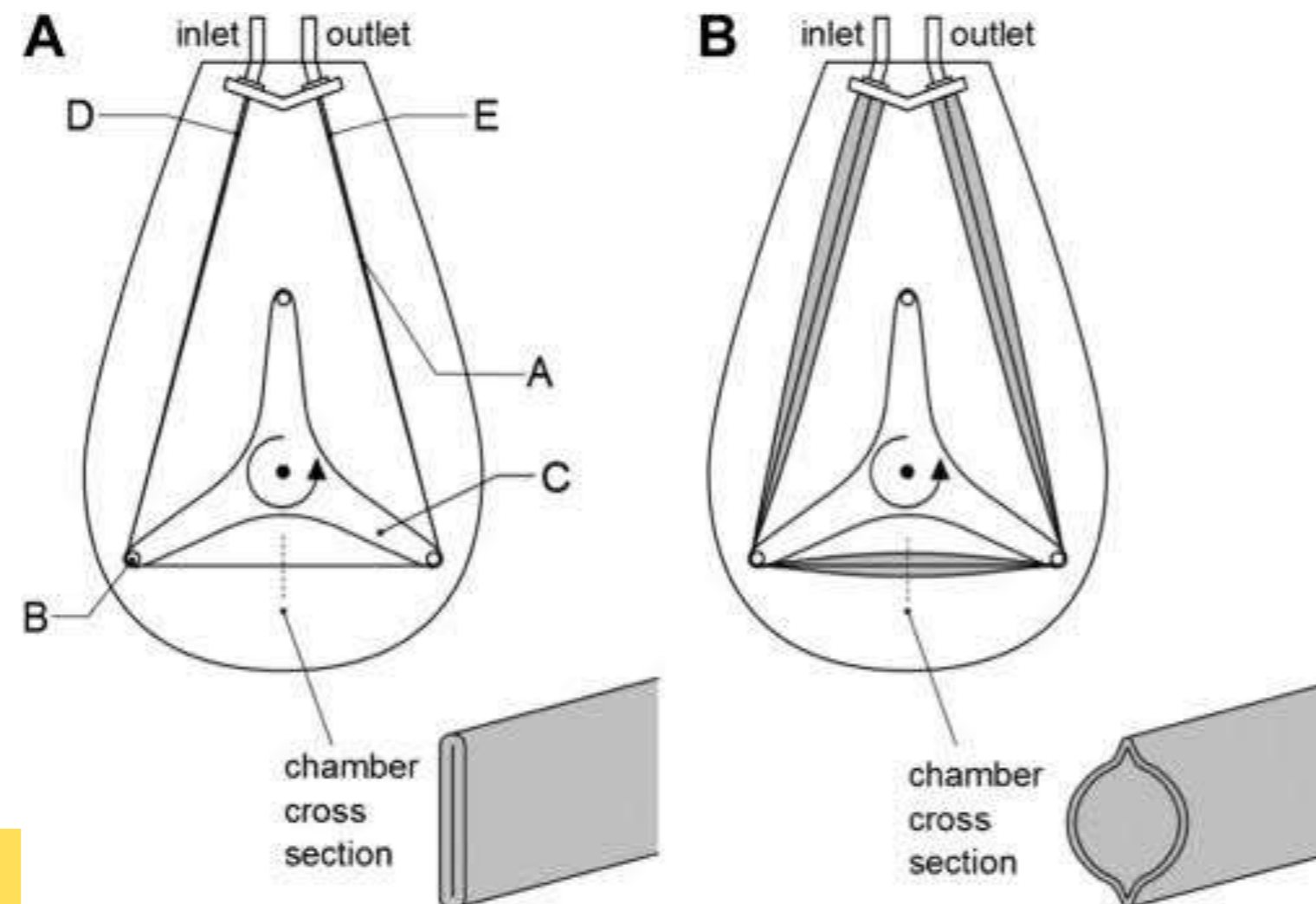
- When there is no fluid in the chamber or when the pressure is below or equal to the ambient pressure , the pump chamber will be completely flat in the portion engaged by the rollers.

## **ADVANTAGES**

- This pumping concept offers some unique safety benefits
- Air cannot be pumped because the pump needs a preload, which is only present with fluid in the reservoir .
- The natural flat shape of the pump chamber allows for a total collapse , thereby preventing retrograde flow when the pump is stopped.
- As the pump cannot generate negative pressure will minimize the blood damage and reduce microbubble generation



- The non-occlusive nature of the pump will prevent failure of tubing connections
- Although little research has been done, the MC3 seems to be least as hemocompatible as a centrifugal pump
- In vitro results showed a lesser activation of neutrophils and platelets as well as lower hemolysis level than in a centrifugal pump.
- Although this pump is available commercially , and appears to have major advantages, it has never become popular for clinical routine



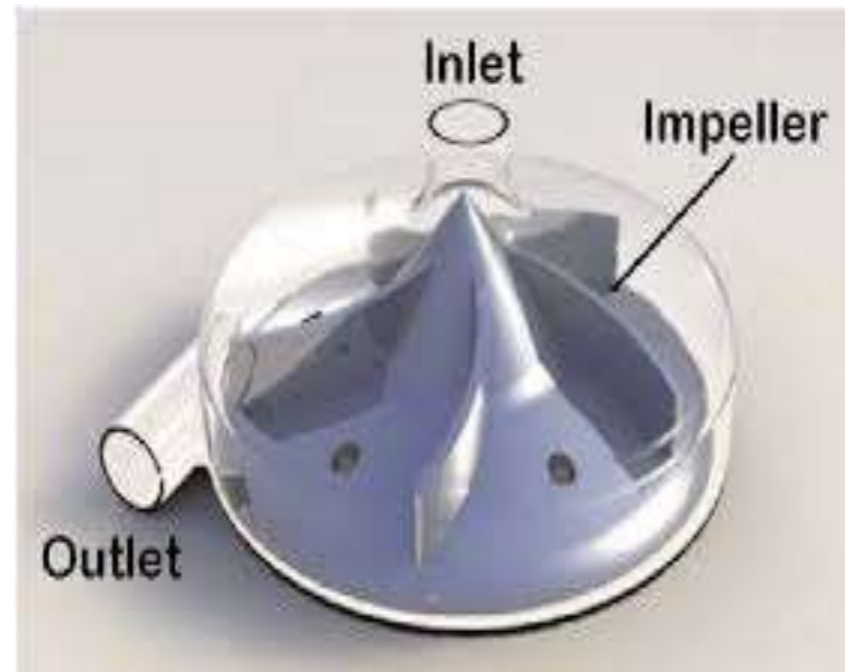


# Rotary pumps



## CENTRIFUGAL PUMP

- Centrifugal pump produce flow by imparting kinetic energy to the fluid in rotating head
- In the early 1970s, research related to the development of an artificial heart was the basis of the development of centrifugal pumps for cpb.
- The biomedicus 600 became available in 1973.
- Together with the roller pump, the centrifugal pump is the most used pump for routine cpb.





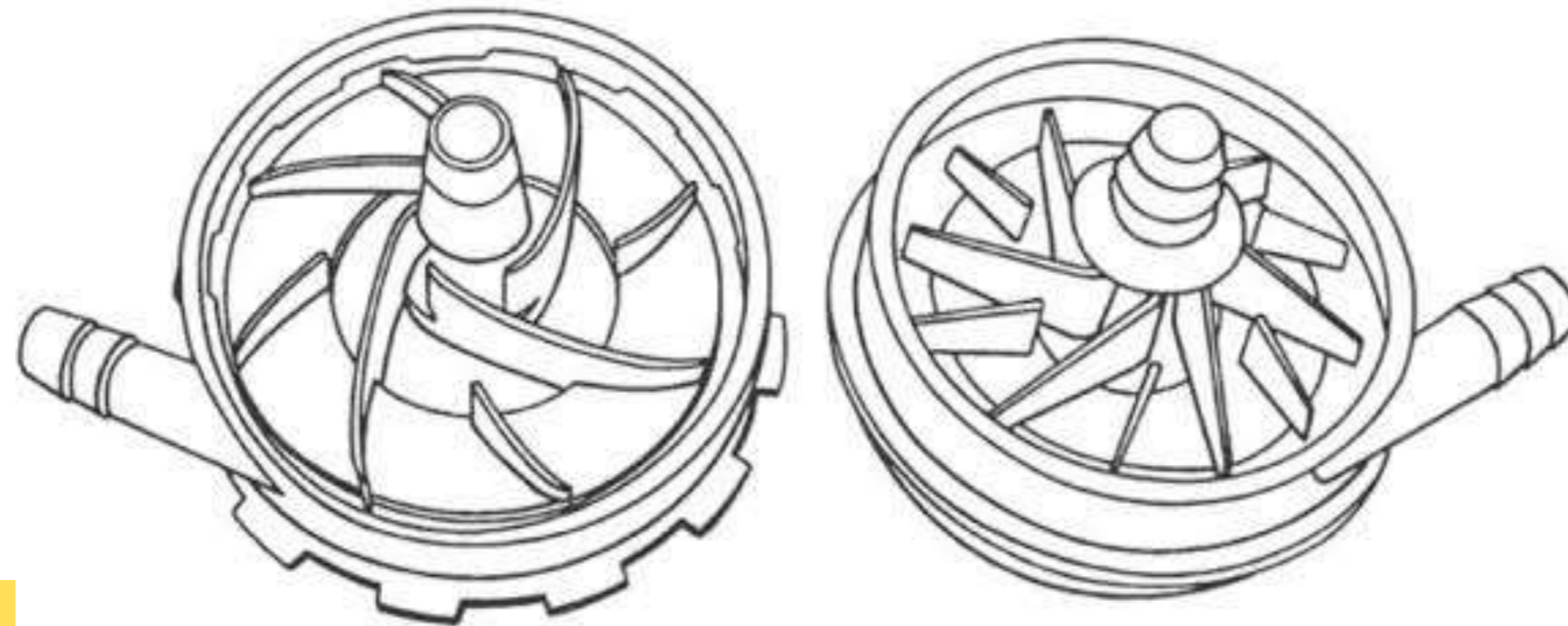
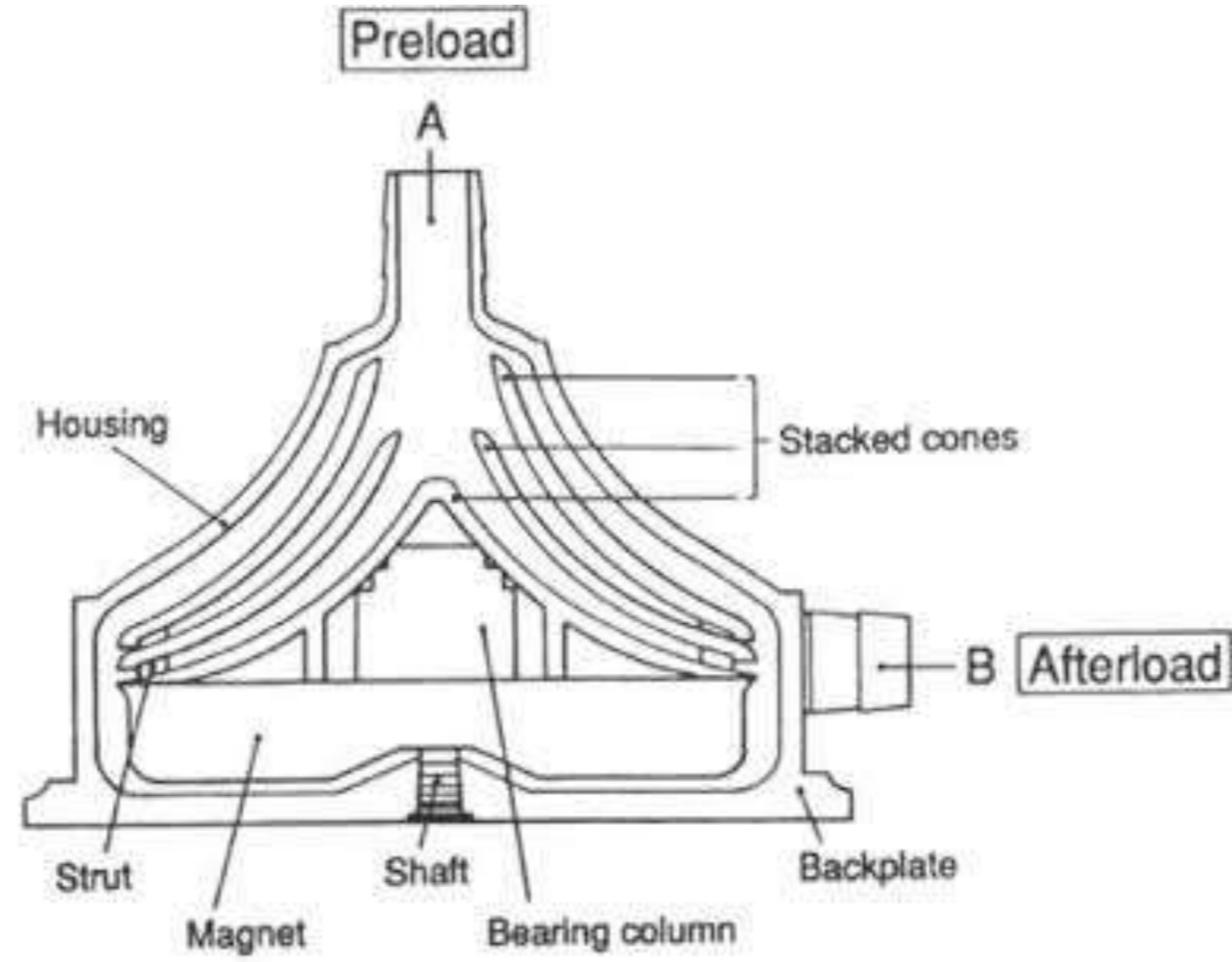
# CHARACTERISTICS OF CENTRIFUGAL PUMP



- The basic design of centrifugal pump consist of an impeller arranged with either varies of smooth plastic cones inside a plastic housing .
- Blood enters at a point at the centre of the nested corners and exist in another point.
- The spinning cones create a negative pressure that pulls blood into the pump. Once the blood is inside the pump head, energy is imparted to blood by spinning cones, forming a vortex . The vortex is then constrained by the outside plastic housing , generating pressure to pump the blood at outlet



- The cone spin by means of an indirect magnetic connection to a drive shaft on the centrifugal pump console.
- Between inlet and outlet there is no occlusive device in the pump . If the corner were not spinning fluid could flow through the head in either direction
- During bypass flow is affected by preload and afterload
- PRELOAD- Pressure at the inlet point
- AFTERLOAD- Pressure at the outlet point
- The disposable pump head is placed in a permanent console







Two major types,

- The first type consists of a nest smooth plastic cones , contained within plastic housing.
- The second type consists of a vanes impeller , inside the conical plastic housing.
- The cones or impellers are rotating by coupled the base of the plastic housing (magnetic coupling) to an electric motor ,rapidly rotated lead to impart of kinetic energy to the blood , inducing forward flow.
- The centrifugal pump is non occlusive ,and flow is dependent on the pressure change created by the spinning cone within the pump.
- The flowrate is affected by the aortic cannula size , tubing length ,tubing diameter , restrictions in the tubing , and changes in the patient's systemic vascular resistance(svr).



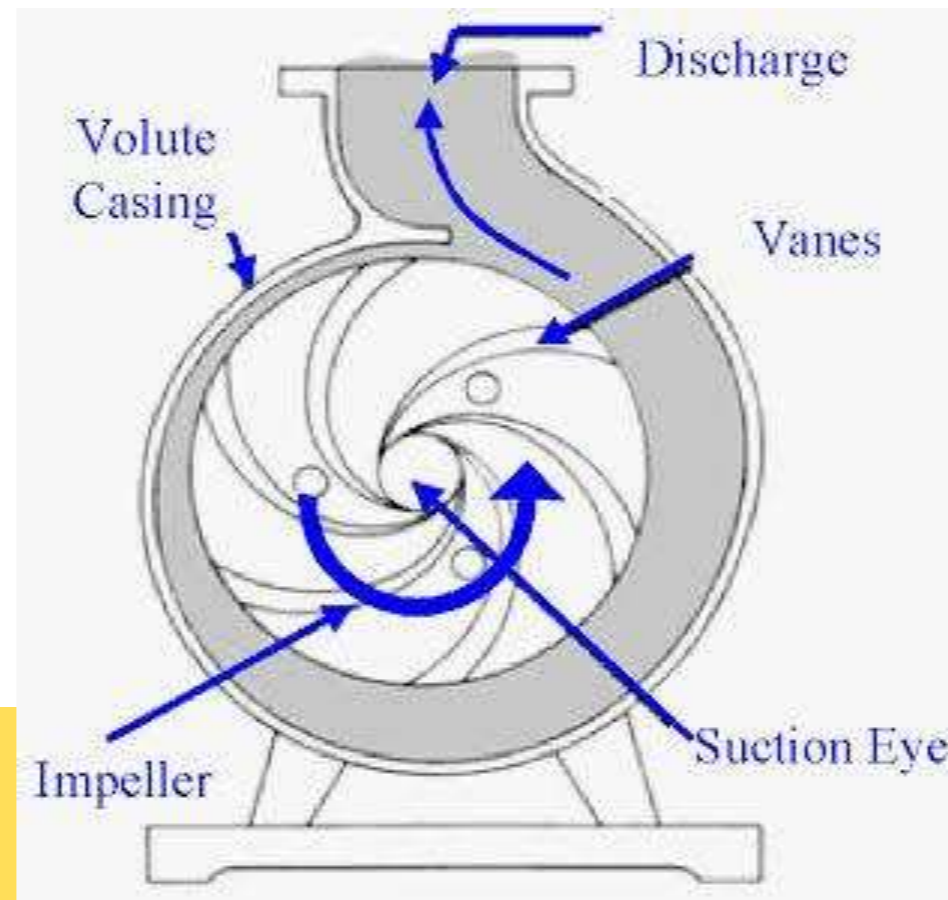
- The blood is driven through the plastic housing by a pressure differential, which results from the difference of the velocity of the narrow portion of the impeller cone (at the top) as compared with the wider portion of the cone (at the bottom) creates a pressure difference.
- When a centrifugal pump is used an electromagnetic flow meter probe must be placed to the arterial line to determine pump flow. It is placed often between the arterial line filter and patient to accurately determine the flow rate.
- If the centrifugal pumps become filled with air, it will not pump blood because they rely on centrifugal force to generate pressure.
- But small bubbles can be easily transmitted into the systemic circulation if they are present in the blood.



# SMOOTH PLASTIC CONE



# VANES IMPELLER





# Advantages



- Because of centrifugal pumps are sensitive to afterload pressure there is no possibility of excessive line pressure build up in arterial line of the pump ,because flow decrease when pressure increases.
- Have tendency not to pump air that may be introduced into the circuit .  
Because of high pressure at periphery and low pressure at the centre of the pump head
- Decreased blood trauma
- Less cavitation
- Elimination of tubing wear or spallation



# Disadvantages



- Different operation technique for initiation
- Flow meter is necessary
- Retrograde flow when pump slows or stops
- More expensive and non-reusable pump
- It is estimated that approximately 50% of all CBP procedure now use a disposable centrifugal pump head in the arterial position

## **SPECIFIC CLINICALLY AVAILABLE CENTRIFUGAL PUMP**

1. Biomedicus pump
2. Delpin pump
3. Life stream pump
4. Capiox pump
5. Nikkiso pump



**THANK YOU**