

Bismillahirrahmanirrahim



ARTIFICIAL KIDNEY

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Limitations of Haemodialysis

- In hemodialysis instead of continuous blood filtration, it is intermittent. The hematology, biochemistry and fluid and acid – base level fluctuates and the patient's also gets ups and downs
- The survival rate after three years is only about 50 percent.
- The quality of life is not as expected.



Two Options

- **Wearable artificial Kidney**
 - **Bio-artificial kidneys**
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The main components of a wearable artificial kidney are, as follows:

- dialysis membrane
- dialysate regeneration
- vascular access
- patient monitoring
- power source
- pumping system

WAK - Basics

- The device includes
 - a miniature, battery-powered pump to power the flow of both the blood and dialysate,
 - and additional micro pumps to control ultrafiltration (fluid removal),
 - the infusion of anticoagulants,
 - and the delivery of other substances to the dialysate.
- Safety mechanisms include a bubble detector and wetness sensors at the arterial and venous access sites to detect blood leaks.

WAK - Basics

- ▶ Unlike hemodialysis systems intended for home use, which can require large volumes of purified water, the WAK requires only 400 mL of sterile water
- ▶ The WAK is worn on a belt around the waist and weighs approximately 5 kg.

The Wearable Artificial Kidney v1.2
US Patent No. 6,960,179 and other patents pending.




WAK

- A diabetic man ESRD patient was the first in the U.S.A to have one strapped on.
- Several studies are going on





Implantable Artificial Kidney

- An artificial kidney would provide the benefit of continuous blood filtration and increase the quality of life for patients.
 - While researchers have made the device implantable—driven by the body's own blood flows.
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Bio-Artificial Kidney

The implantable device being developed by The Kidney Project consists of two components:

- **A hemofilter**, which removes toxins from the blood by passing it through silicon membranes fabricated with precisely shaped nanometer-scale pores;
- **A bioreactor**, which contains cultured human kidney cells intended to perform other kidney functions, such as maintaining adequate fluid volume and blood pressure, adjusting salt levels, and producing essential hormones.



Bio-Artificial Kidney

- The silicon membrane filters is engineered with biologically friendly molecules to avoid clotting.

Bio-Artificial Kidney

- The Kidney Project is led by
 - Prof Shuvo Roy, and
 - Dr William H. Fissell,

Working for more than a decade to develop an implantable bio-artificial kidney



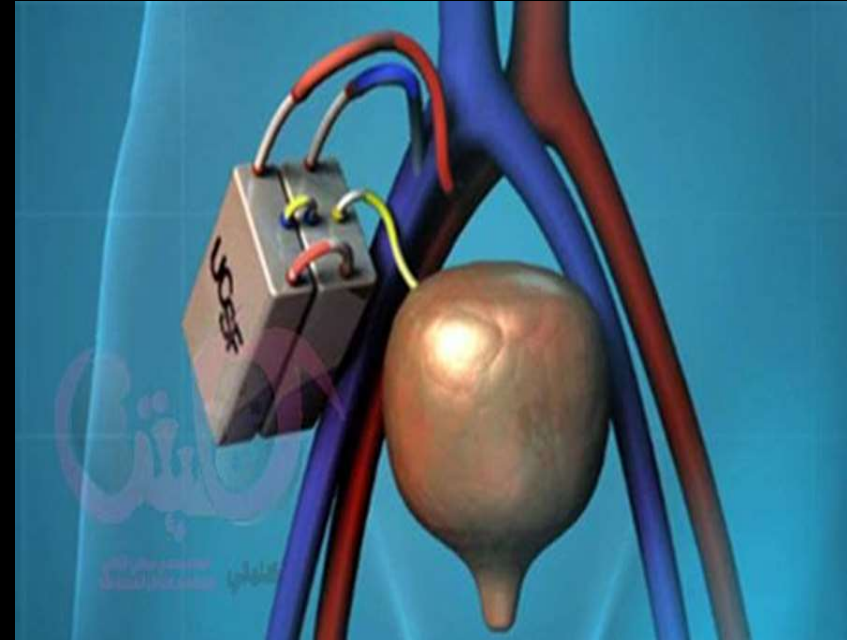
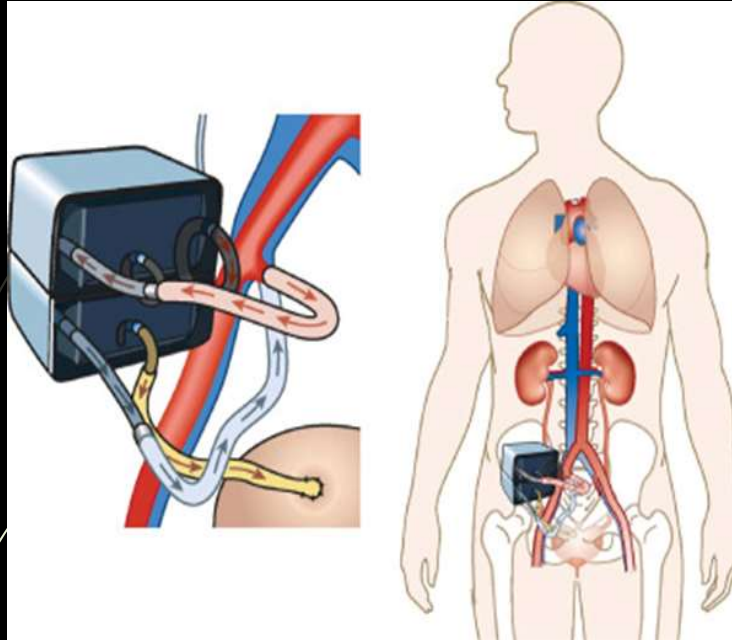
Bio-Artificial Kidney

- UC San Francisco scientists have successfully implanted a prototype kidney bioreactor containing functional human kidney cells into pigs without significant safety concerns.
- The device, which is about the size of a deck of cards, did not trigger an immune reaction or cause blood clots in the animals, an important milestone on the road to future human trials.



Bio-Artificial Kidney

- "The first demonstration of this bioartificial kidney was demonstrated in this month on 7th at ASN at Washington.
- The implanted kidney working successfully in a pig without immunosuppression and remain healthy enough to perform their function.
- The device, which is about the size of a deck of cards, did not trigger an immune reaction or cause blood clots in the animals, an important milestone on the road to future human trials.



Schematic design for an implantable artificial kidney device, using iliac vessels for arterial blood inflow and venous return, with ultrafiltrate draining into the bladder.

Courtesy Prof Shuvo Roy, UCSF.



Bio-Artificial Kidney

- How the silicon membranes inside the implanted bioreactor protect the enclosed human kidney cells from the host immune system by keeping blood-borne immune cells and proteins out of the device is not disclosed.
- Fact is that the does not require immunosuppression.



Bio-Artificial Kidney

- ➔ The Implanted bio-artificial kidney is so far working smoothly and the team is now proceeding for human trial.

HAVE ANY
QUERY?





*Thank You for Your
Continued Patience*