



A Peritoneal-Based Automated Wearable Artificial Kidney (AWAK)

Martin Roberts^{1,2}, and David B.N. Lee^{1,2},

¹VA Greater LA Healthcare System, North Hills, CA. David Geffen School of Medicine at UCLA, Los Angeles, CA, USA. ²AWAK Technologies, Burbank, CA, USA & Singapore.

ISBP 2010 September 24-26, 2010 Marina del Rey, CA





Disclosure

Chief Scientist

AWAK Technologies, Burbank, CA
and Singapore






Why a Continuous Wearable Artificial Kidney

Provides continuous dialysis

- Steady-state physiologic and metabolic control
- Higher clearance of solutes

Patient freedom from need to:

- For HD go to dialysis unit 3 days a week for 3-4 hrs
 - For CAPD take 30 min every 4 hrs to drain and infuse PD solution
 - For APD set up cyclers every night and clean up in the morning
- 



Continuous Wearable Artificial Kidney

- Extracorporeal
 - Hemofiltration
 - Hemodialysis
 - Peritoneal Dialysis
 - CAPD
 - APD
- 



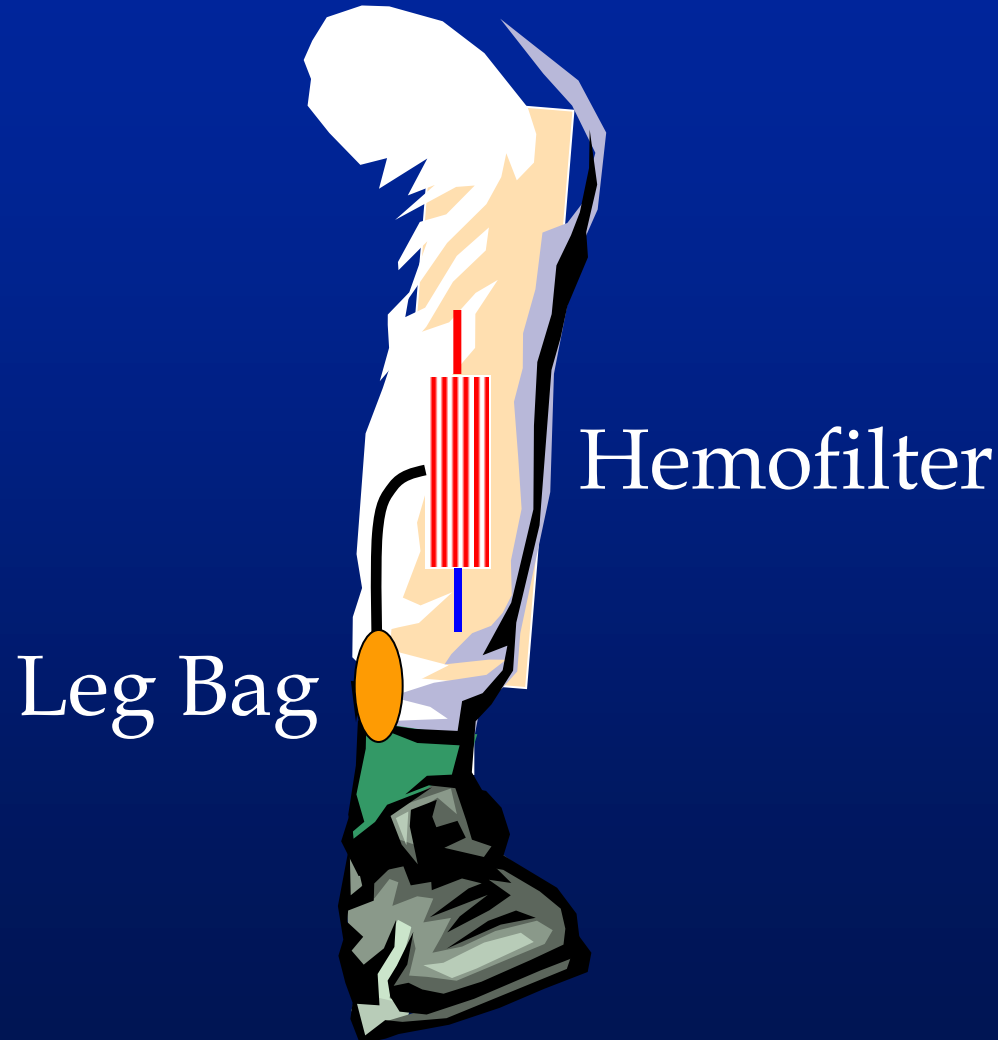
Continuous Wearable Artificial Kidney

(Continuous use more than 16 hr/ day)

- Hemofiltration
 - Neff
 - Murisasco

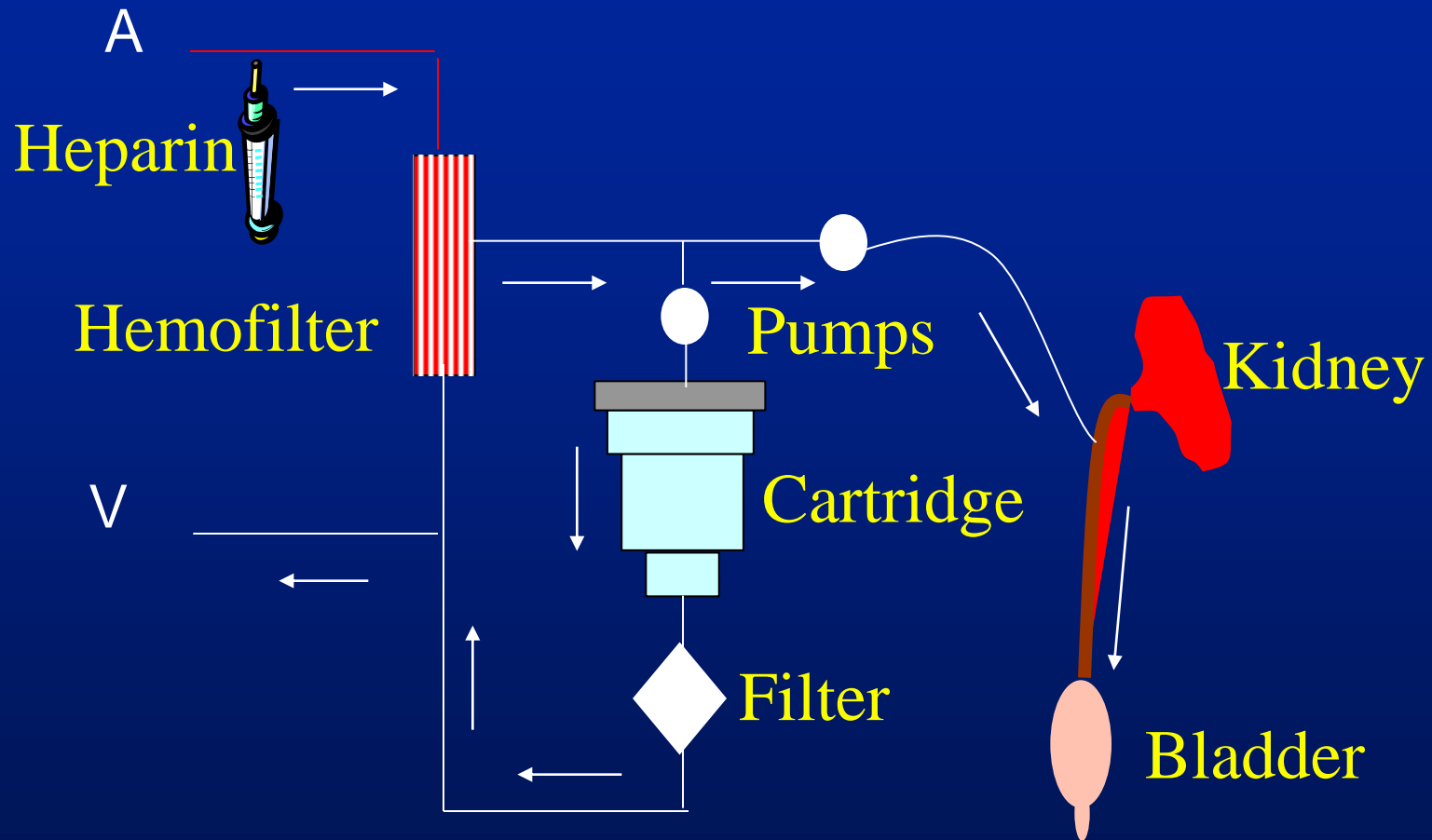


Neff Wearable Artificial Glomerulus*



*Neff, et al: *Trans Amer Soc Artif Intern Organs* 25:71-73, 1979


Murisasco Continuous AV HF*



*Murisasco, et al: *Trans Amer Soc Artif Intern Organs*, 32:567-571, 1986



Disadvantages of Extracorporeal Wearable Kidneys

- Coagulation even with anticoagulant
 - Need for anticoagulation
 - Internal hemorrhage
 - Accidental disconnects resulting in fatal bleeding
 - Interaction between blood and plastics
 - Deposition of protein on membranes
 - Extracorporeal wearables failed
- 



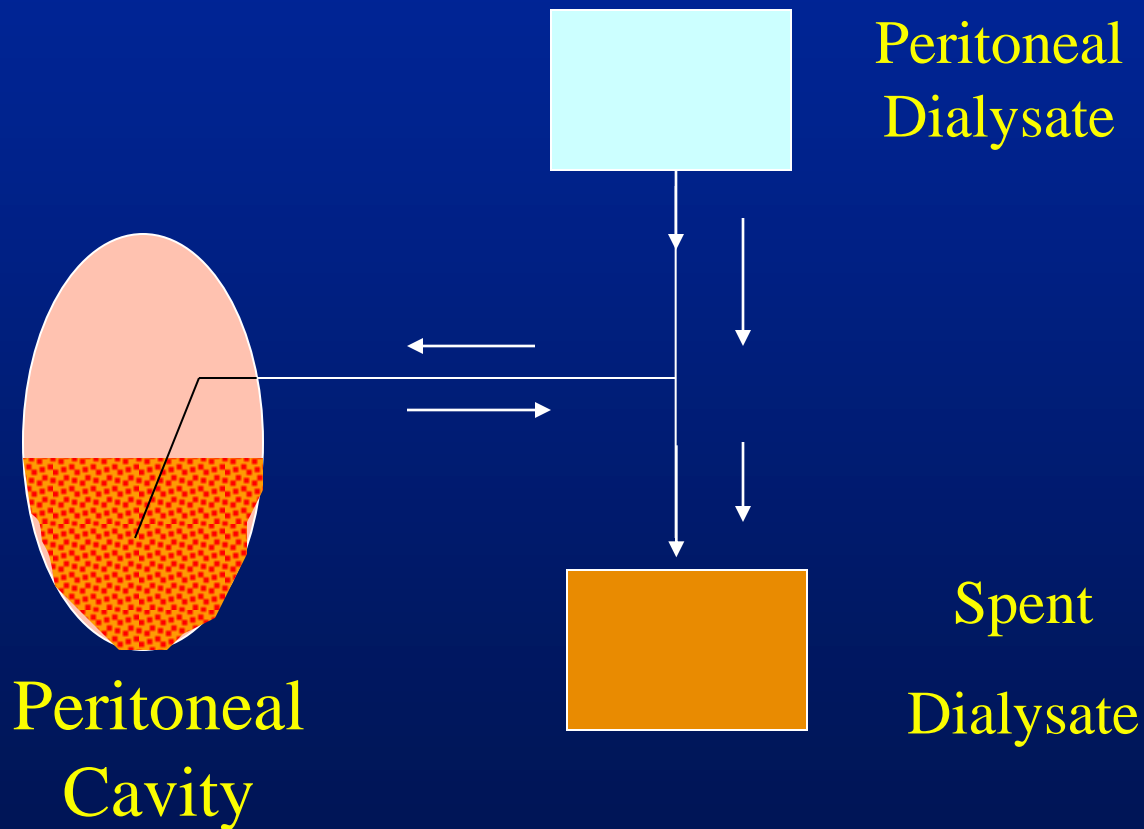
Continuous Wearable Artificial Kidney

(Continuous use more than 16 hr/ day)

- Peritoneal Dialysis
 - Popovich




Portable/Wearable Equilibrium Dialysis Technique* (now CAPD)



*Popovich, et al: *Trans Amer Soc Artif Intern Organs*, 5:64, 1976



Disadvantages of CAPD

- Minimum Dialysis
 - Patient Fatigue
 - Peritonitis
 - Exit-Site Infection
 - Hernias
 - Ultrafiltration Failure
 - Peritoneal Membrane Sclerosis
- 

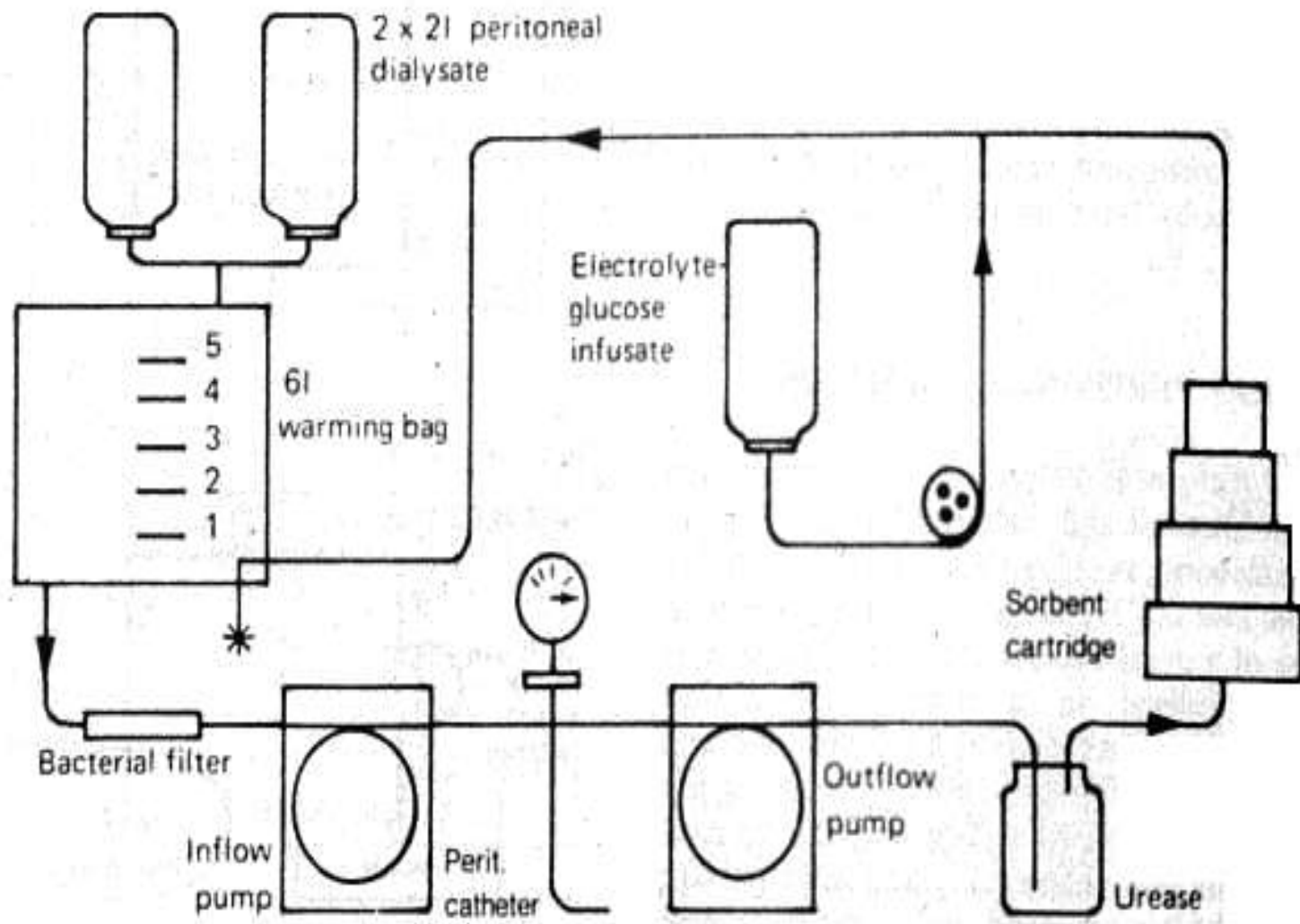


Why Peritoneal Based?

- “Bloodless”
- “Waterless”: regenerate used dialysate
- Regenerate & recycle proteins
 - No protein loss
 - Removes protein-bound toxins



Sorbent PD



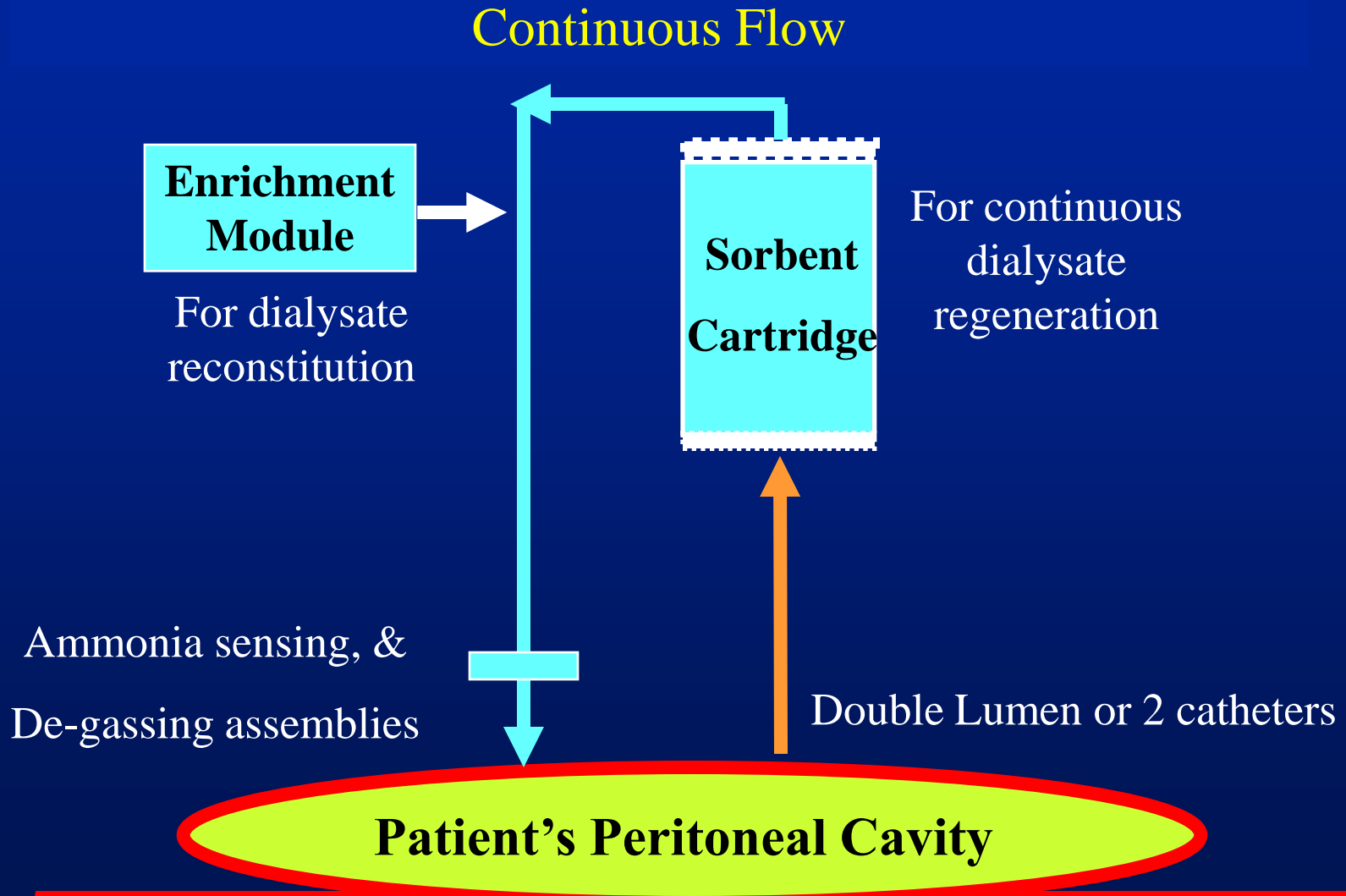
Flow diagram of the Sorbsystem (Redy) regenerating peritoneal dialysis system 1974



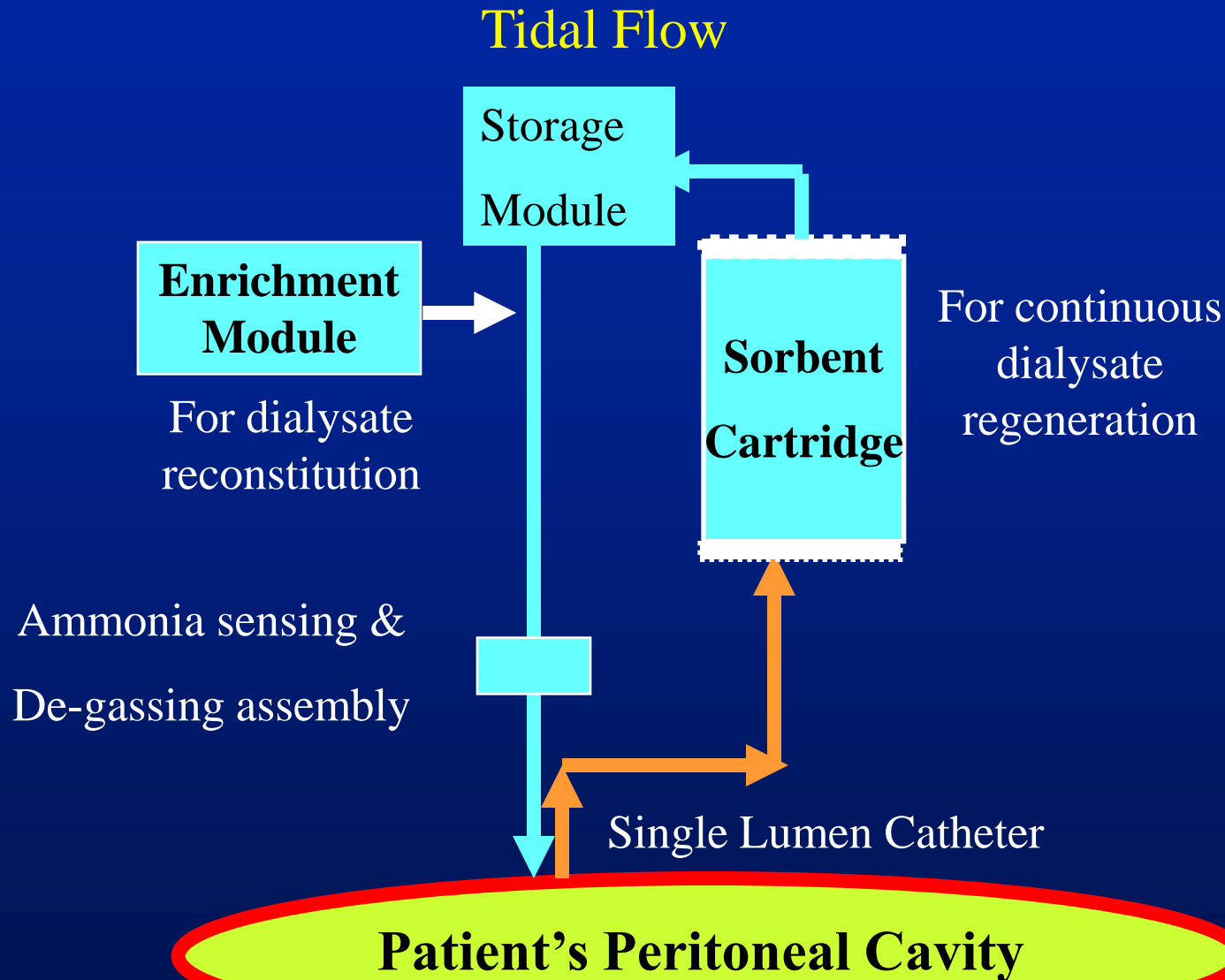
Sorbent PD



Automated Wearable Artificial Kidney (AWAK)



AWAK: Basic Components:





Tidal PD Study

Method

Baxter HomeChoice PD Machine

- Average flow 4 L/hr
- Zero dwell
- Zero UF
- 5 hr of dialysis
- Dialysate – 1.5% Dianeal neutralized with sodium bicarbonate





Tidal PD Study

Reserve and tidal volume combinations

Reserve Volume (ml)

Desired(Actual)

250 (250)

250 (262)

250 (240)

500 (487)

500 (500)

500 (525)

1000 (960)

1000 (975)

Tidal Volume (ml)

Desired(Actual)

250 (250)

500 (488)

1000 (960)

250 (263)

500 (500)

1000 (975)

250 (240)


500 (525)



Tidal PD Study

Conclusions

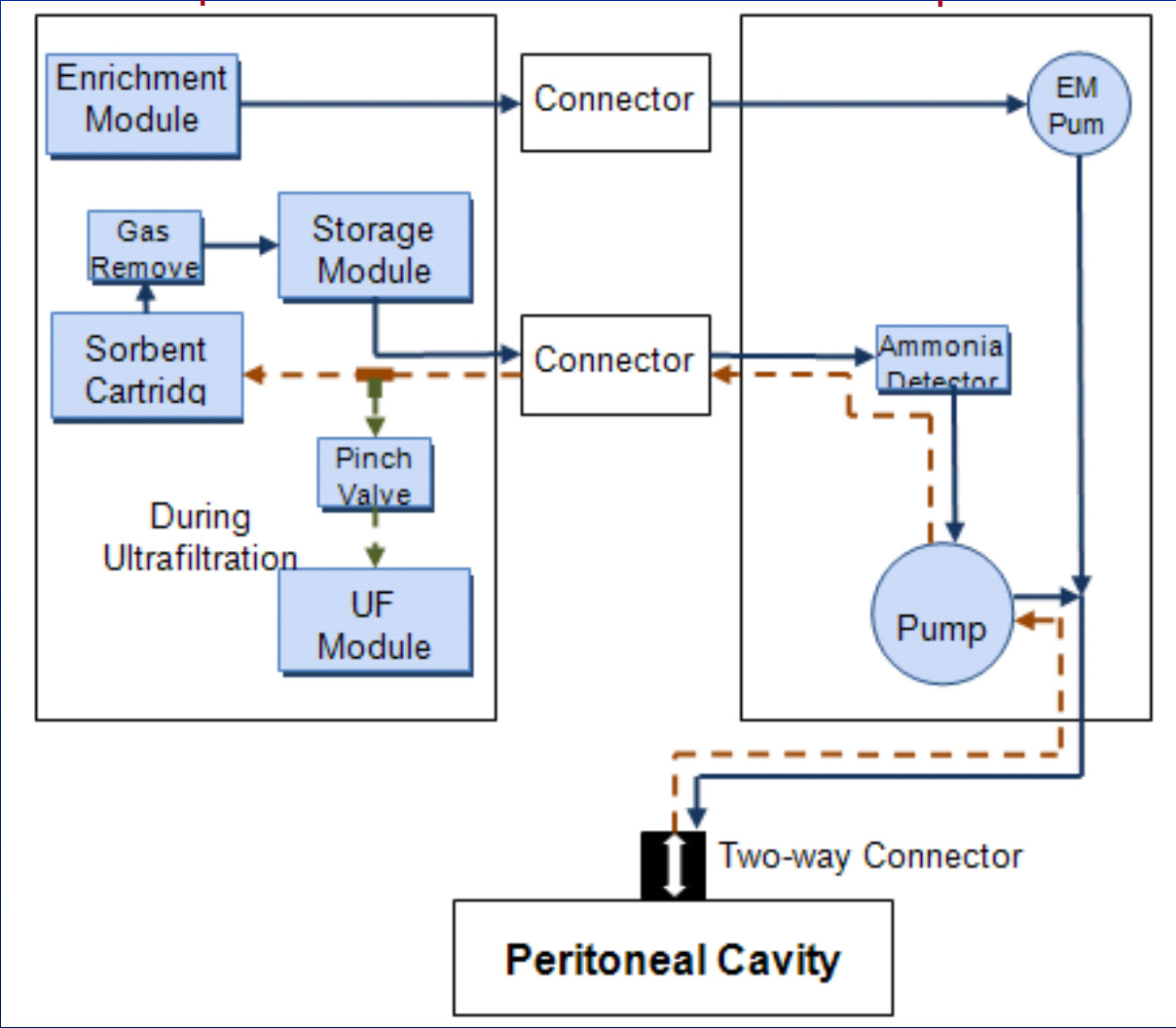
At a flow rate of 4 L/hr and dialysate glucose of 1.31%, extrapolated results indicate :

1. Adequate daily UF even in average high transporters (1.8-2.3 L/24 hr)
 2. High weekly Kt/V even in average low transporters (3.4-5.9)
- 

AWAK Flow Diagram

Disposable

Non-Disposable



Automated Wearable Artificial Kidney AWAK



2 lbs/1Kg Prototype (Development)



6 lbs/3Kg Prototype (Functional)

COPYRIGHTS © AWAK TECHNOLOGIES www.awak.com

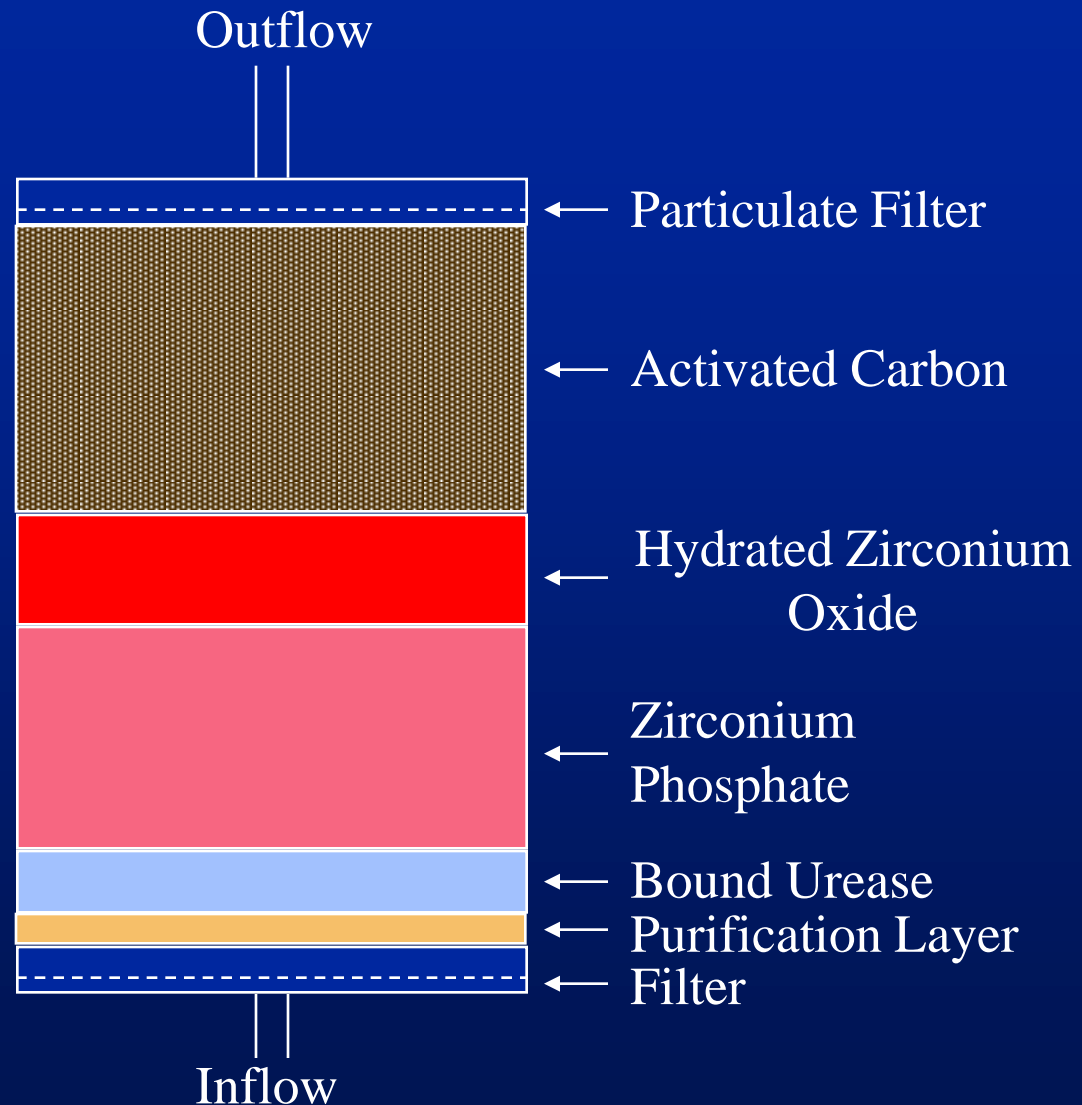
 **AWAK** Technologies
Saving, Sustaining & Enhancing Lives



END



Sorbent Cartridge





Advantages of Protein Regeneration & Recycling

- Prevents endogenous protein-loss
 - Oncotic pressure reduces glucose requirement for ultrafiltration
 - Removes protein-bound (middle molecule?) toxins
 - Selective protein plasmapheresis
-
-
-