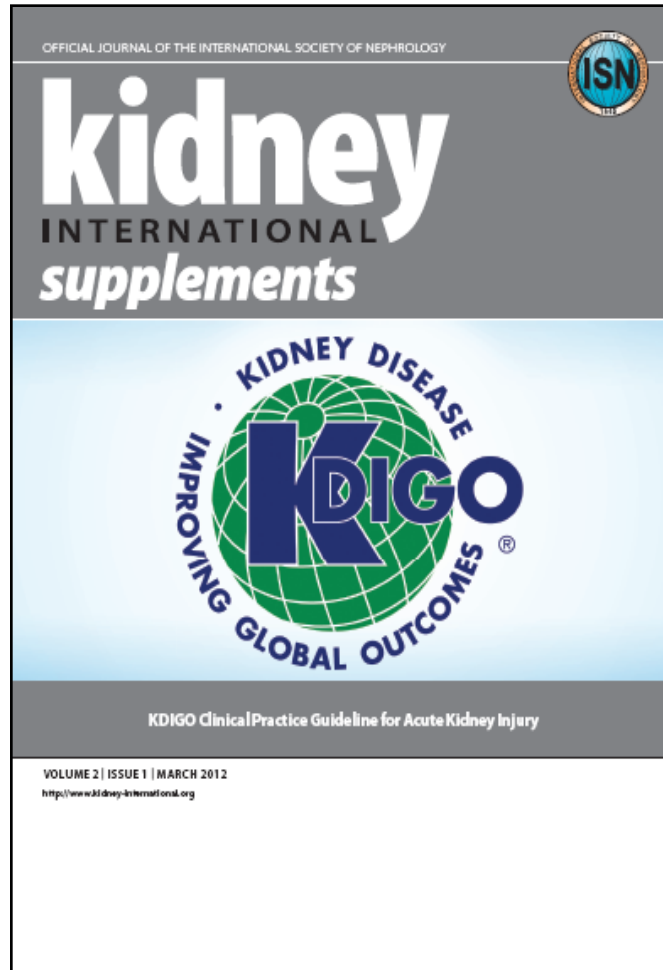


RRT: Modes and modalities

Marlies Ostermann

KDIGO AKI guideline



March 2012

Kidney International 2012; Vol 2: 1-141

http://www.kdigo.org/clinical_practice_guidelines/pdf/KDIGO%20AKI%20Guideline.pdf

Management of RRT in ICU: Mode

Management of RRT in ICU: Mode

Options:

Continuous modes

Continuous veno-venous haemofiltration

Continuous haemodialysis

Continuous veno-venous haemodiafiltration

peritoneal dialysis

Intermittent modes

intermittent haemodialysis

Slow Extended Dialysis (SLED) /

Prolonged intermittent RRT (PIRRT)

Management of RRT in ICU: Modality

Options:

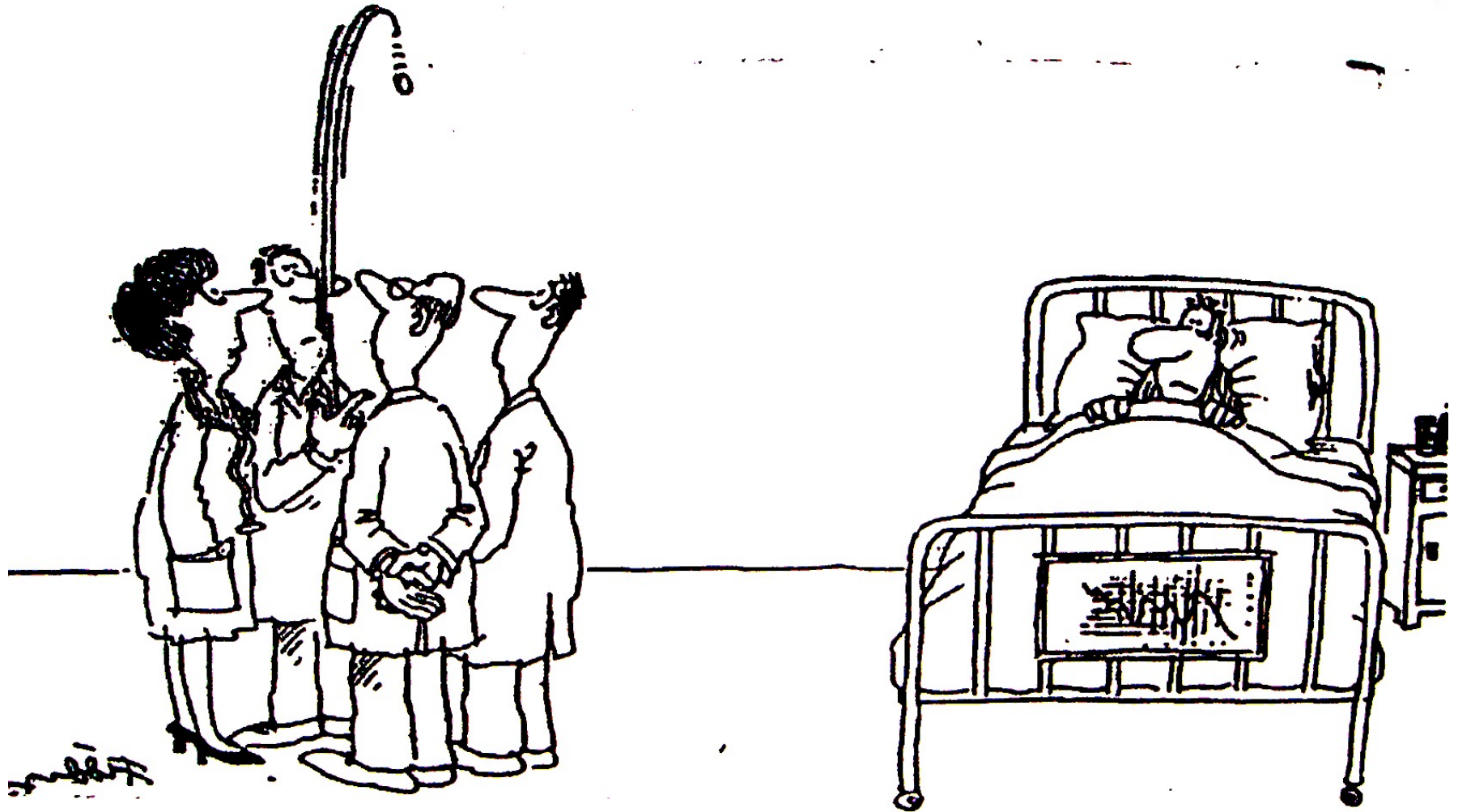
Haemodialysis

Haemofiltration

Haemodiafiltration

Peritoneal dialysis

Acute RRT: Which type?



Aims of acute RRT in ICU

- to achieve and maintain euvolaemic fluid balance
- to achieve electrolyte, acid-base, and solute homeostasis
- to prevent non-renal organ dysfunction
- to allow supportive treatments ie. large volumes of fluid
(TPN, antibiotics, blood etc)

Aims of acute RRT in ICU

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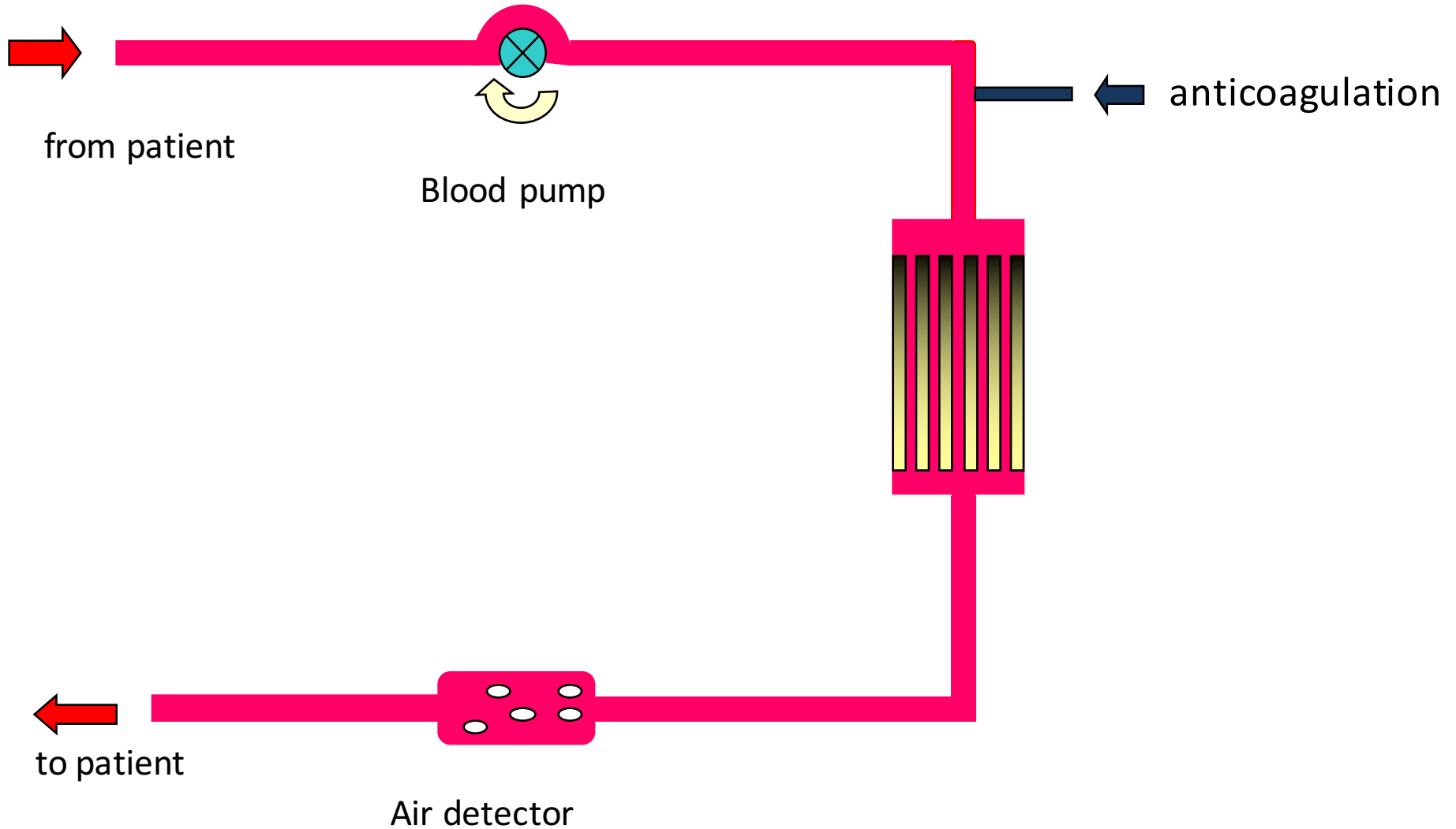
Plus:

- to prevent further insults to the kidney
- to permit renal recovery

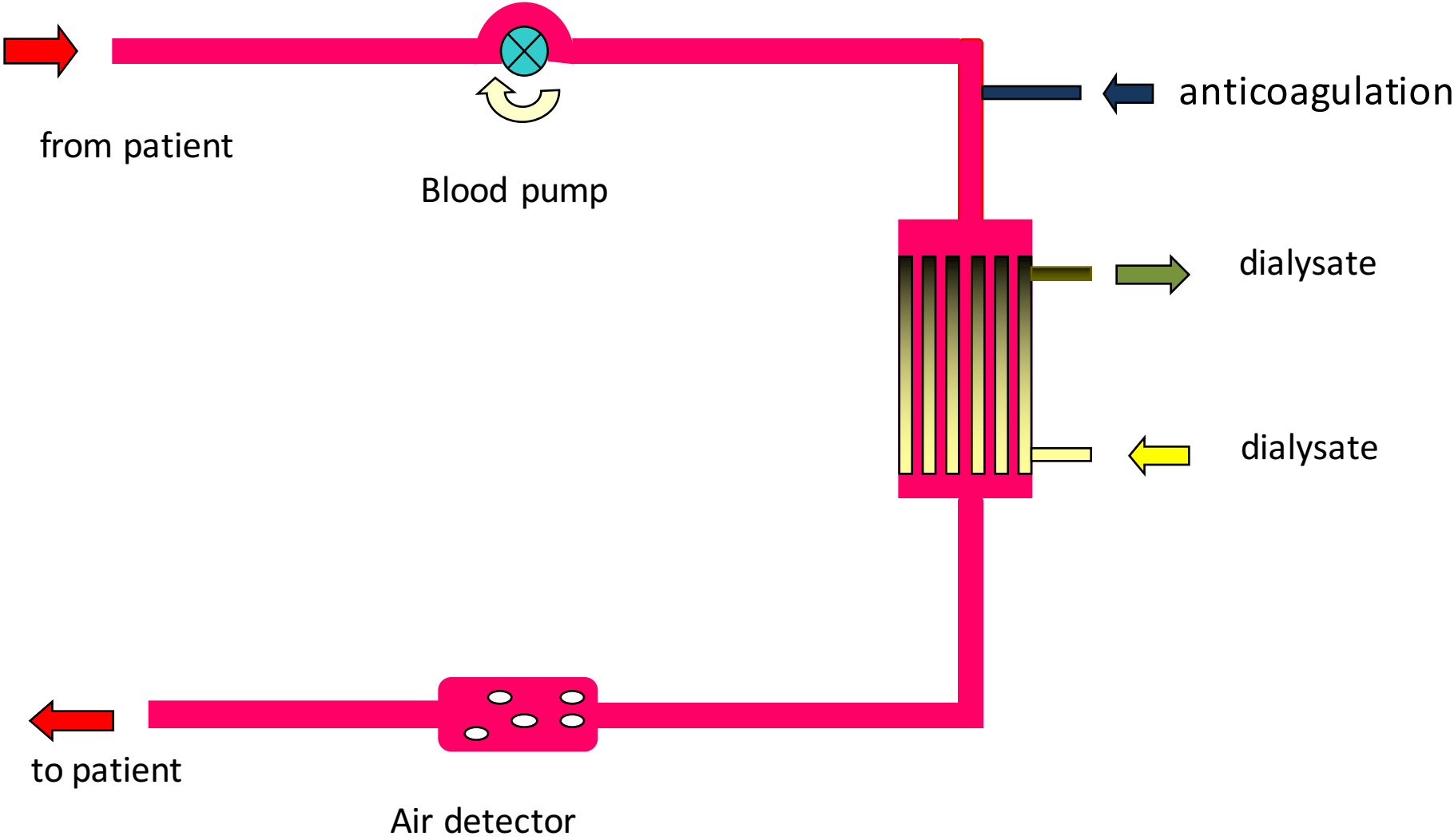
Management of RRT in ICU: Modality



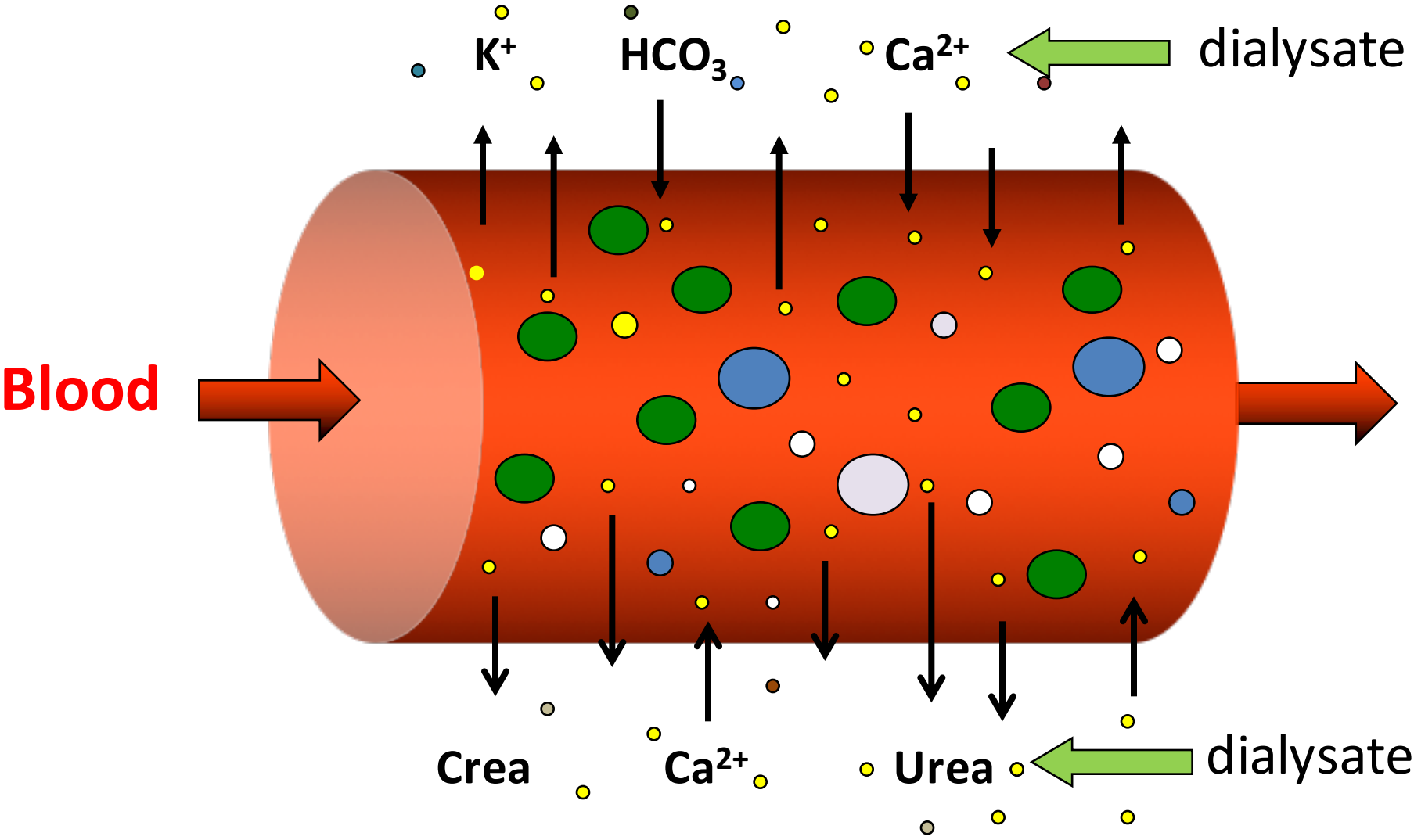
Principle of RRT



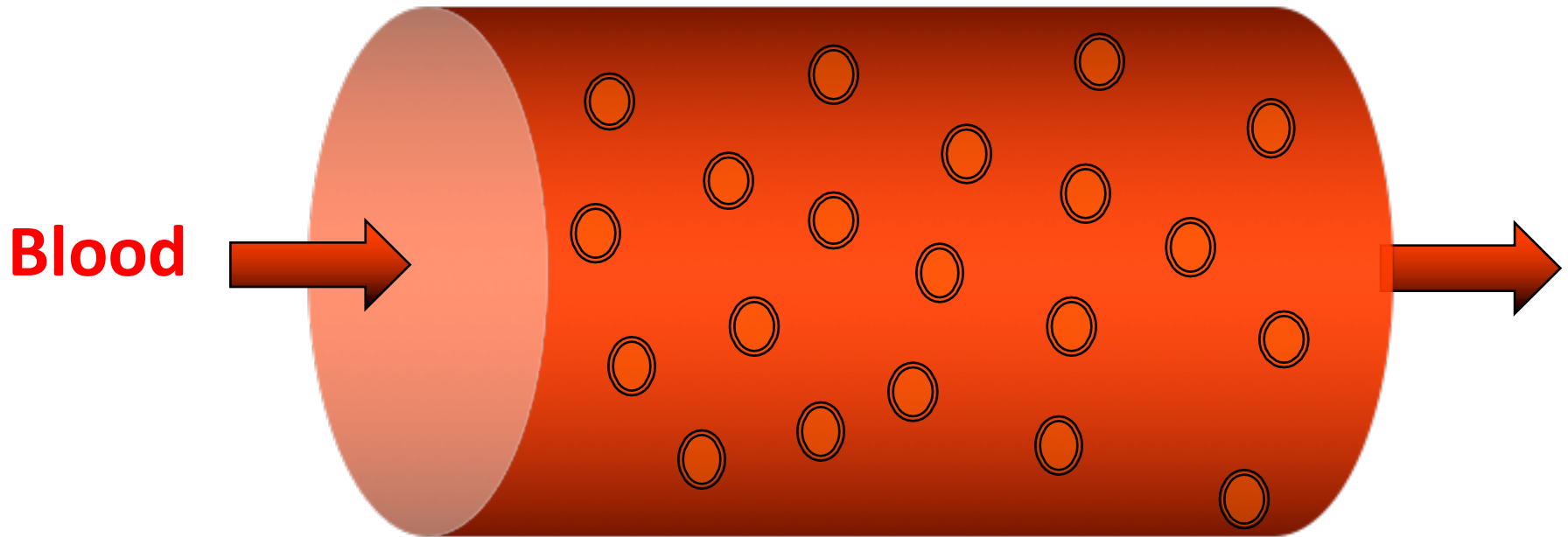
Haemodialysis: Principle of diffusion



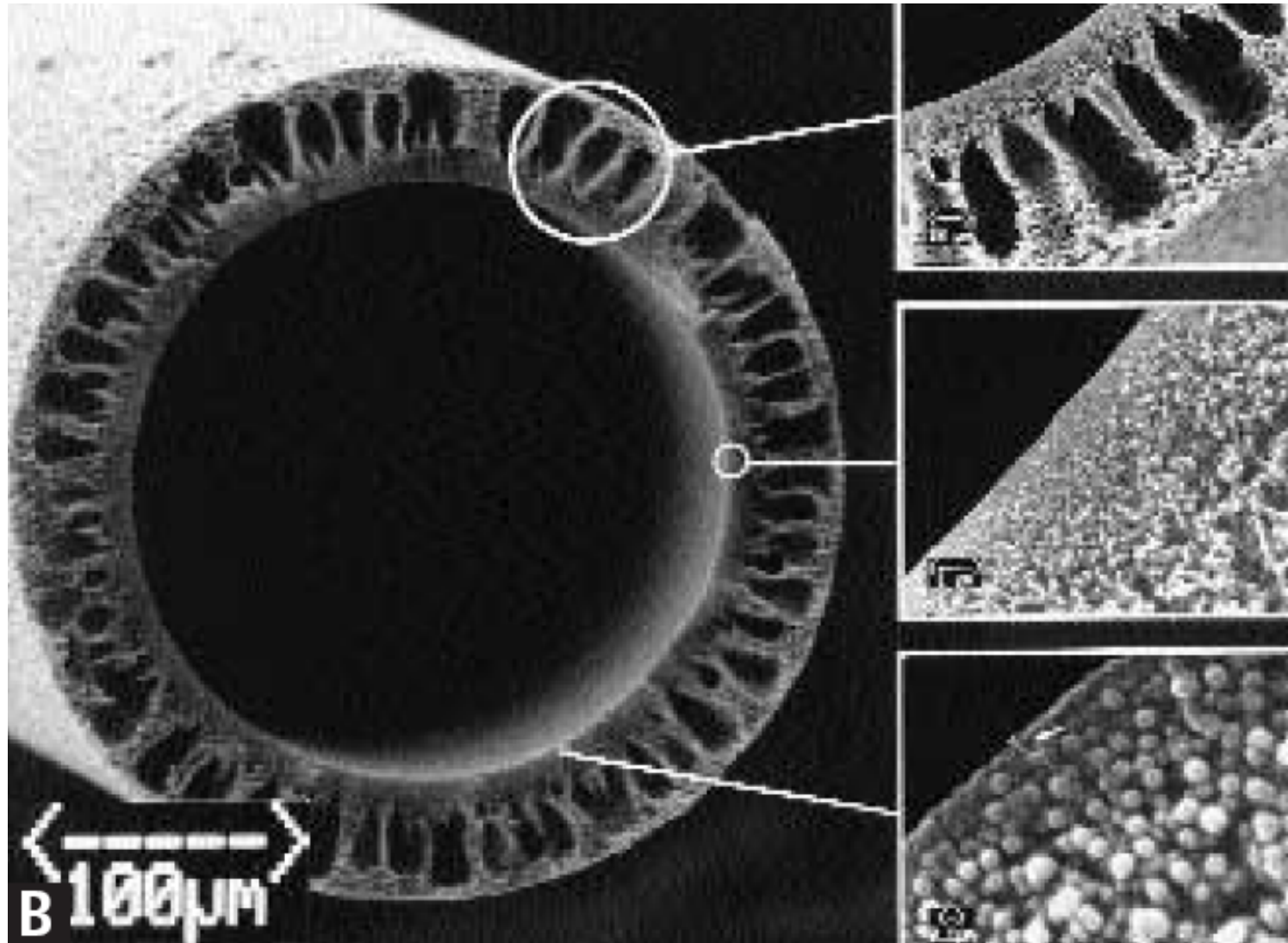
Haemodialysis: Principle of diffusion



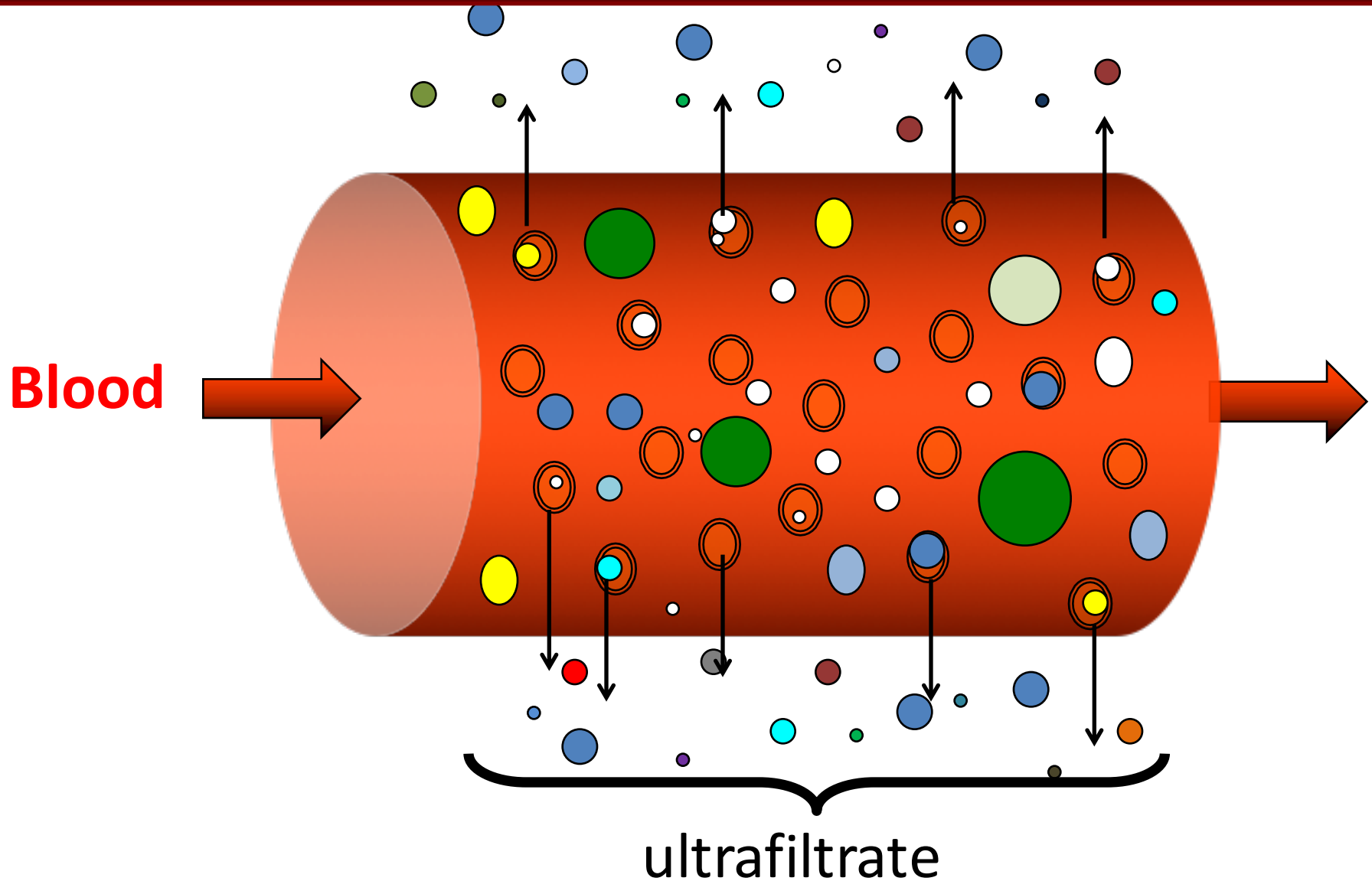
Haemofiltration: Principle of convection



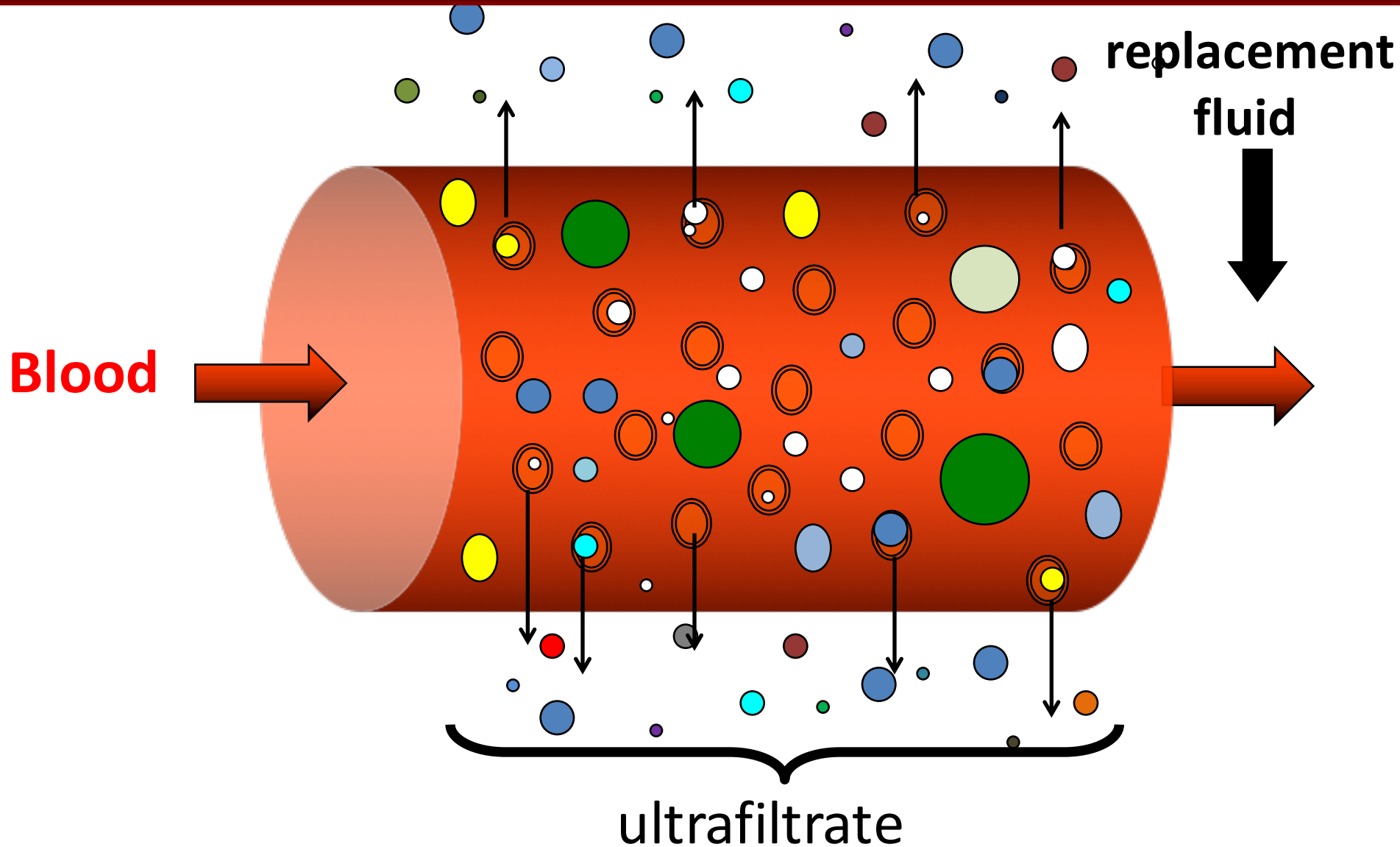
Haemofiltration: Principle of convection



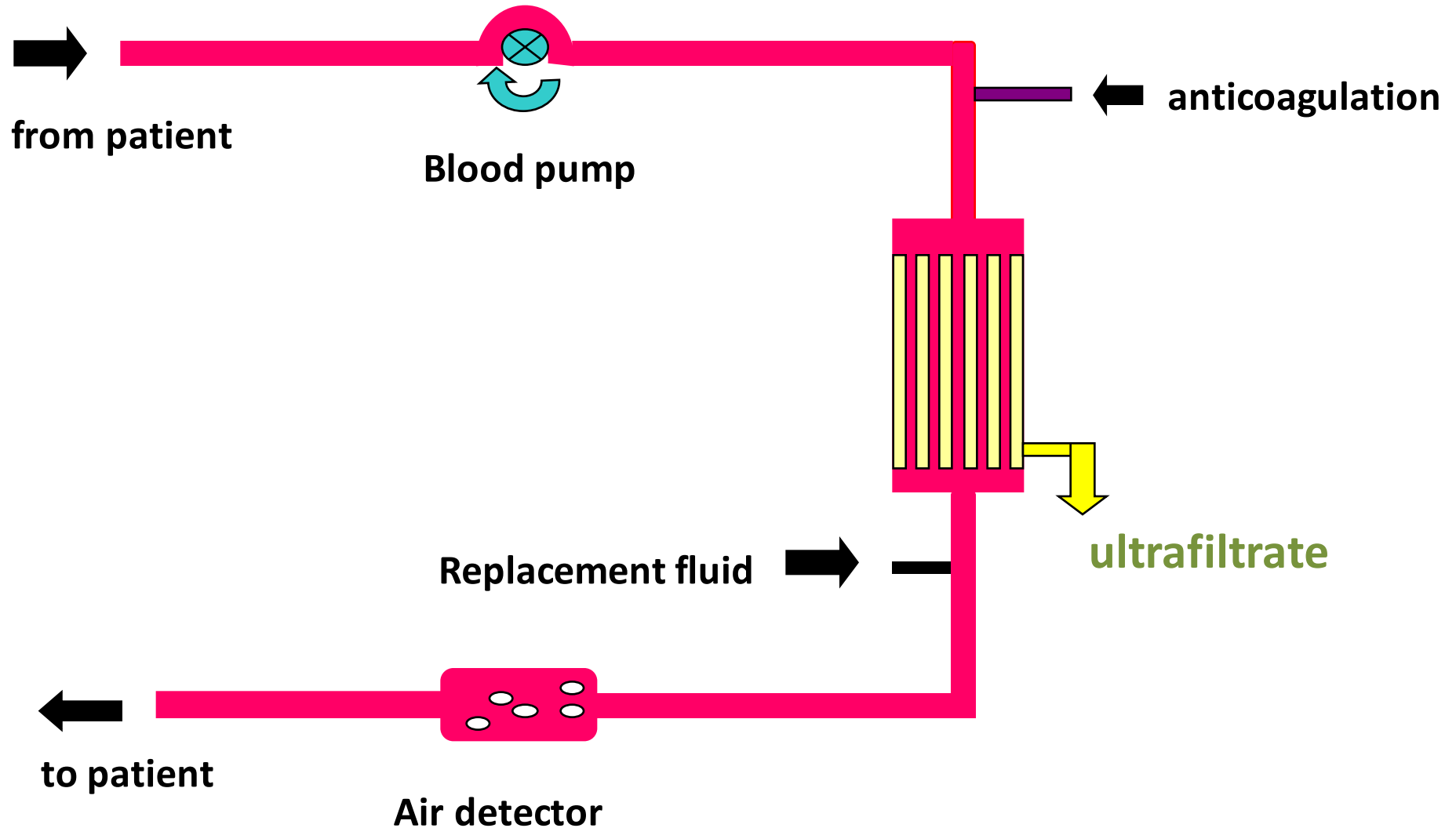
Haemofiltration: Principle of convection



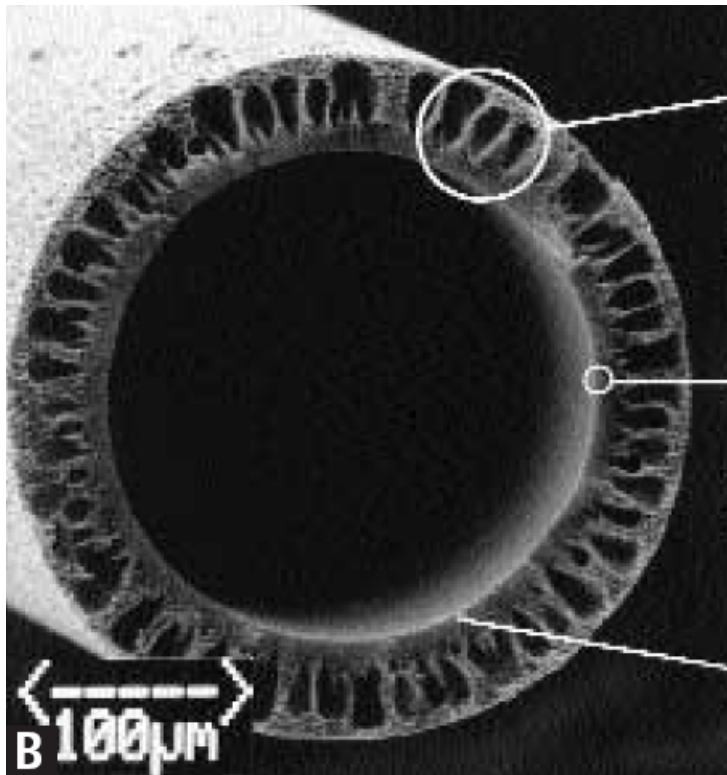
Haemofiltration: Principle of convection

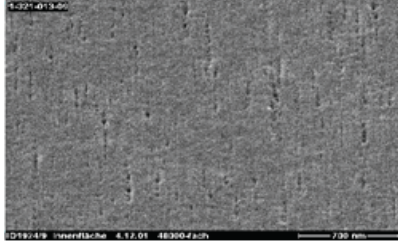
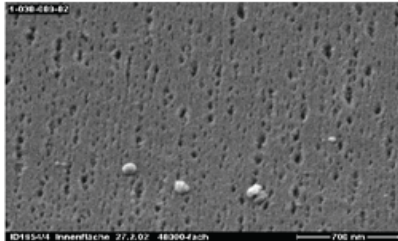
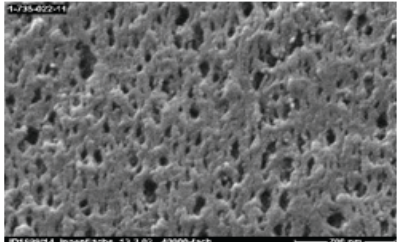
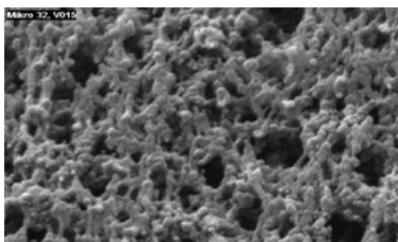


Haemofiltration: Principle of convection

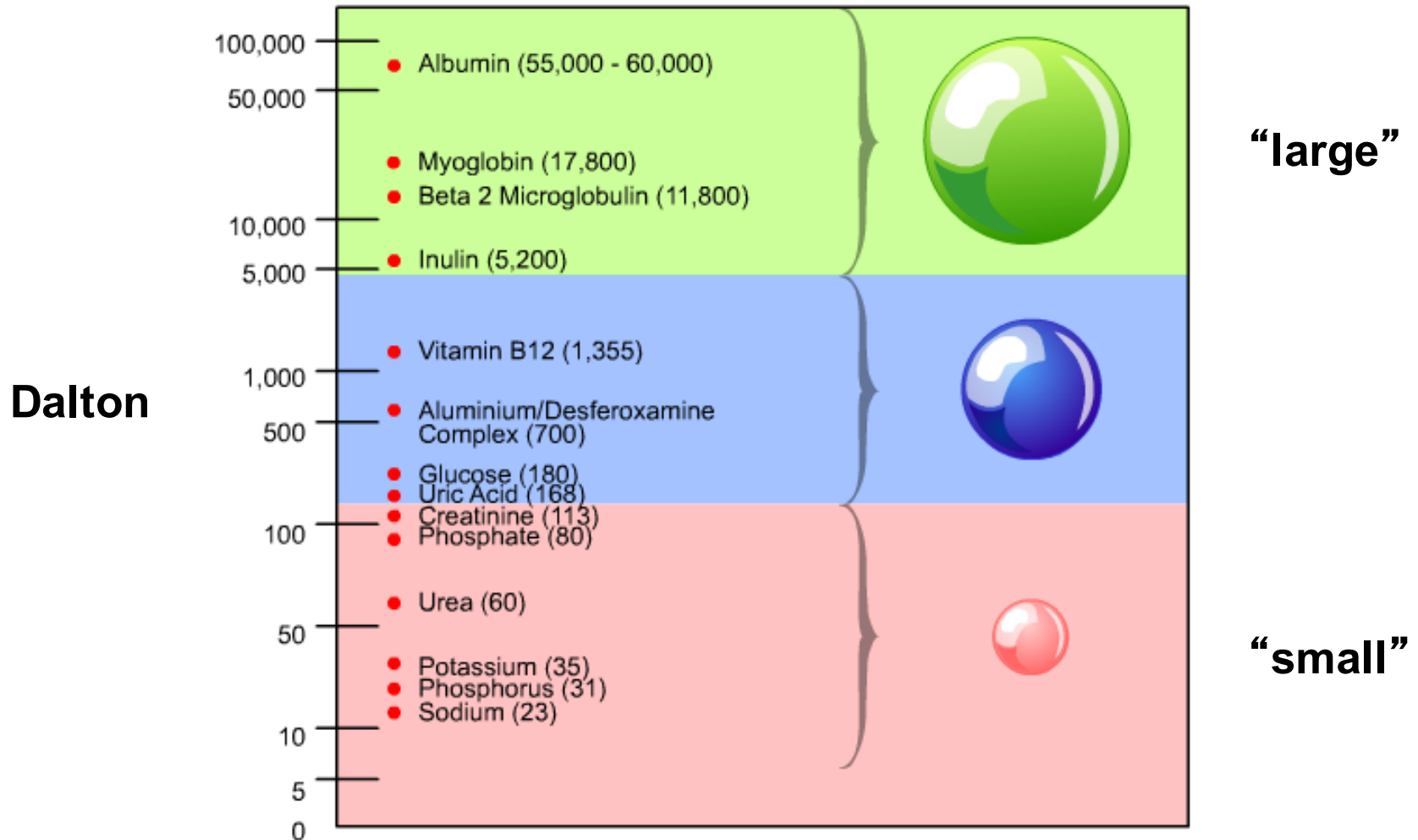


Types of membranes



	<u>Pore diameter</u>	<u>Type of membrane</u>
 <p>700 nm</p>	< 0.01 μm	High flux
	< 0.02 μm	High cut-off
	0.09 μm	For protein separation
	0.30 μm	Plasma filter

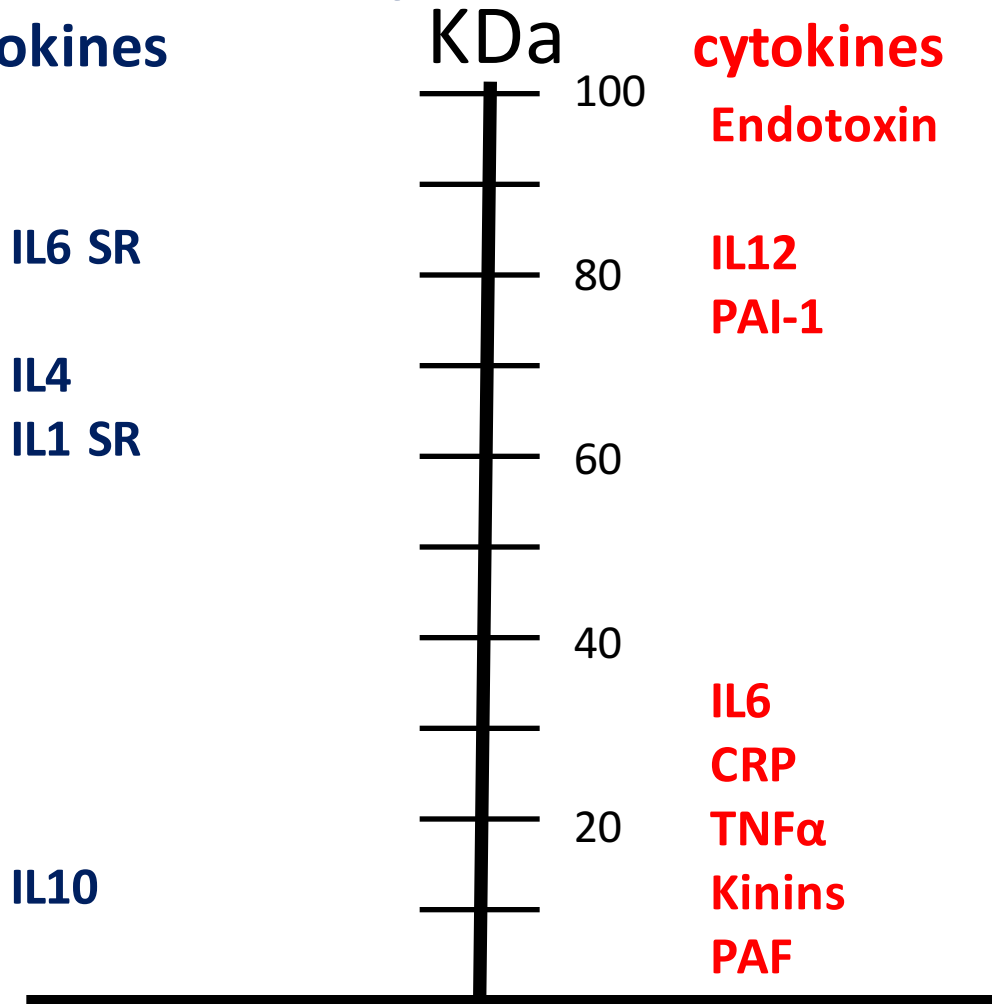
Molecular weight of solutes



Molecular weight of cytokines

**Anti-inflammatory
cytokines**

**Pro-inflammatory
cytokines**



Membrane cut-off points

Polysulfone	30kDa
Polyamide	30kDa
AN69	50kDa
Polyamide100	100kDa

Management of RRT in ICU: Modality

Haemofiltration

Convection via highly highly porous membrane
(+ some diffusion + absorption)

allows removal of water

allows removal of substances
up to 50,000 Daltons
(depending on membrane)

Haemodialysis

Diffusion via semipermeable membrane

allows removal of water

allows removal of substances
up to 30,000 Dalton
(depending on membrane)

Management of RRT in ICU: Mode

continuous RRT

lower risk of haemodynamic
Instability

less fluctuations
(fluid status, acid base, uraemia)

anticoagulation necessary

intermittent RRT

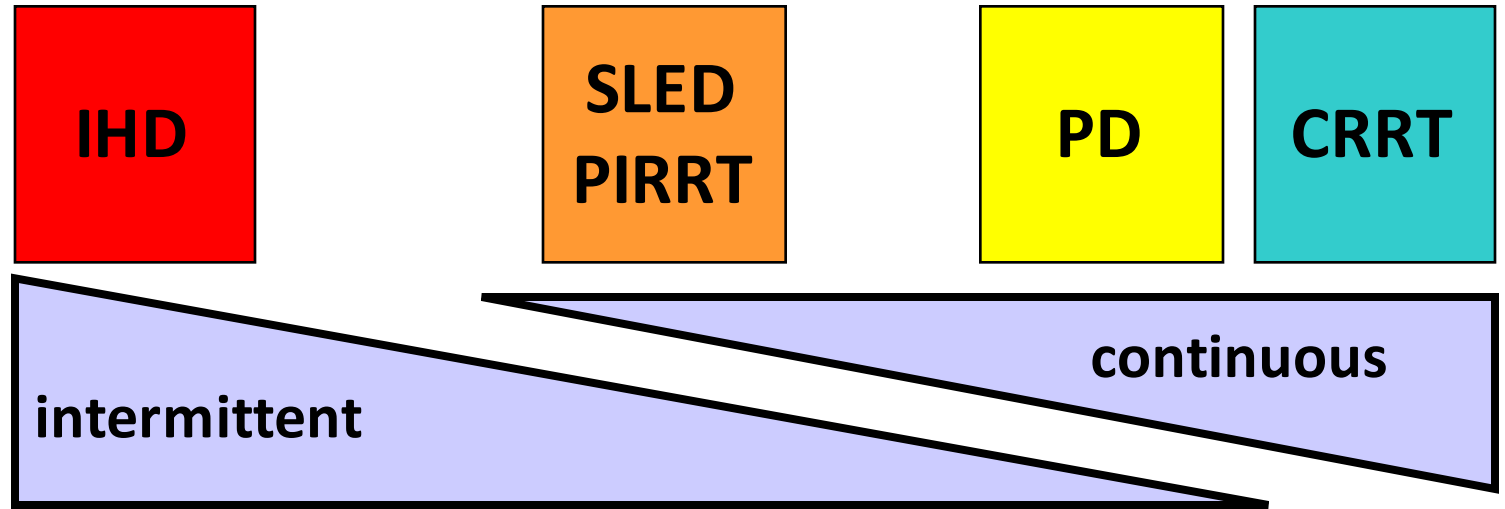
risk of haemodynamic instability

more fluctuations

anticoagulation not absolutely
necessary

more time for active rehabilitation

Modes / Modalities



Clearance
per hour

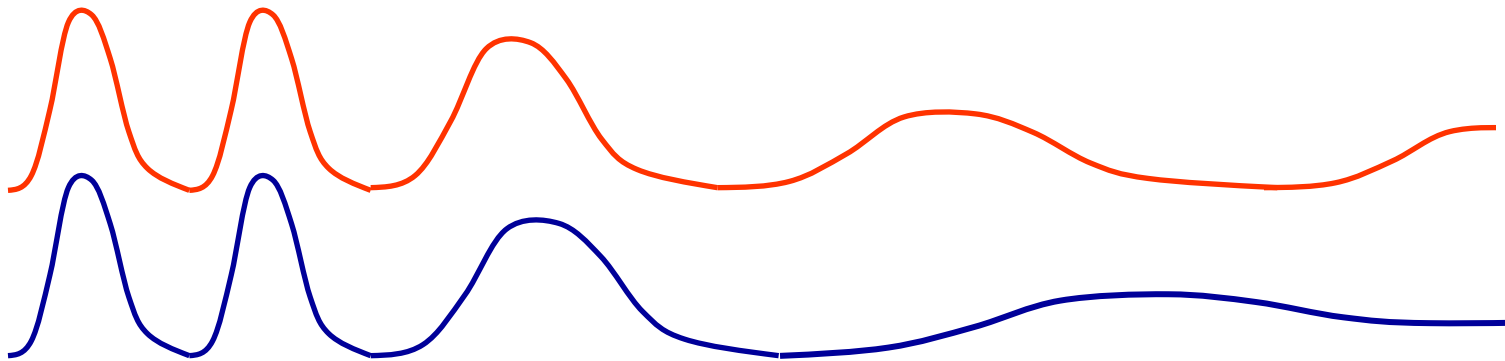
+++

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+

Fluid shifts

Changes in
urea/ NH_3 / Na^+



Comparisons between different types

	CVVH	CVVHD	CVVHDF	Intermittent HD	SLED / PIRRT	PD
Solute transport	Convection	Diffusion	Convection + diffusion	Diffusion	Diffusion	Diffusion
Therapy time/day	24 hrs	24 hrs	variable	4 – 6 hrs	6 – 12 hrs	24 hrs
Blood flow (ml/min)	100 - 250	100 - 250	100 - 250	200 - 350	100 - 300	none
Urea clearance (ml/min)	20- 40	25 – 45	25 – 45	150 – 180	90 – 140	15 - 35
Need for Anticoagulation	Yes	Yes	Yes	Not essential	Not essential	No

Haemofiltration vs Haemodialysis

No clear evidence that one mode is superior

Choice depends on availability

Clearance can be modified by choice of filter and duration of Treatment.

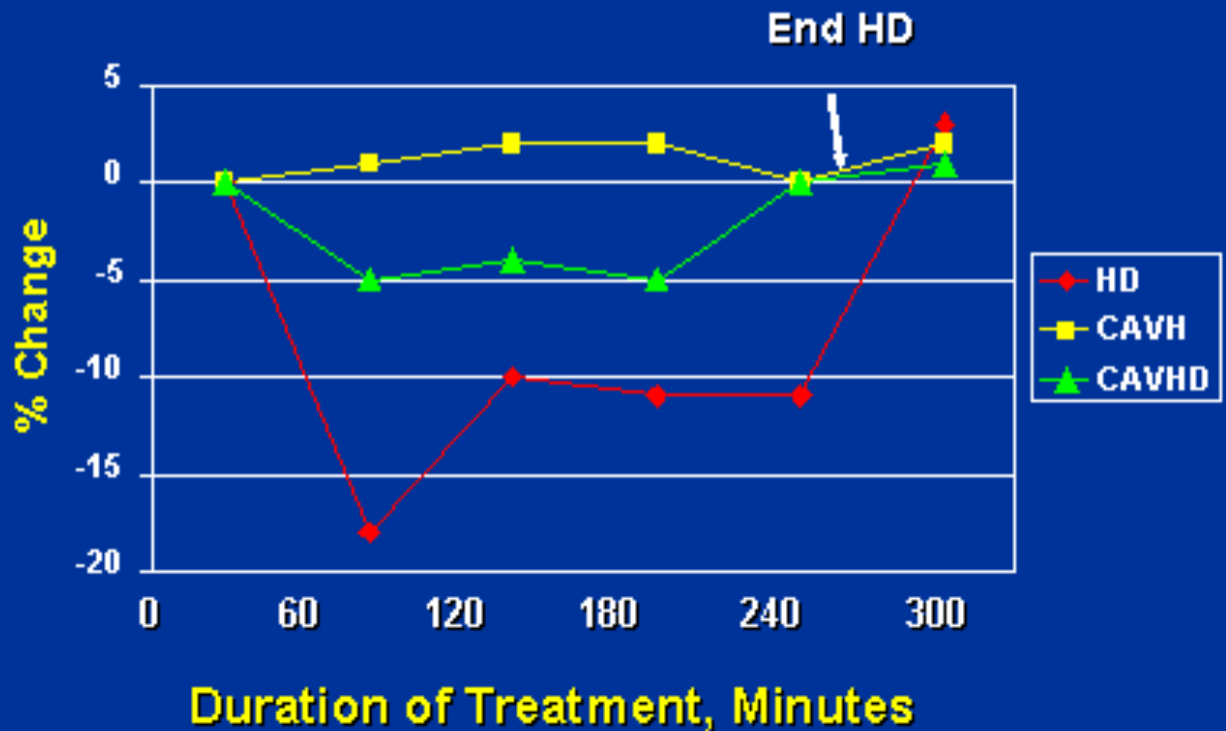
CRRT or intermittent RRT ?

Important factors:

- Degree of fluid overload and urgency of removing fluid
- Haemodynamic stability to tolerate fluid removal
- Presence of cerebral oedema
- Phase of critical illness (acute phase vs rehabilitation)

Modality: Effect on MAP

Percentage Change in Mean Arterial Blood Pressure During Treatment of Renal Failure

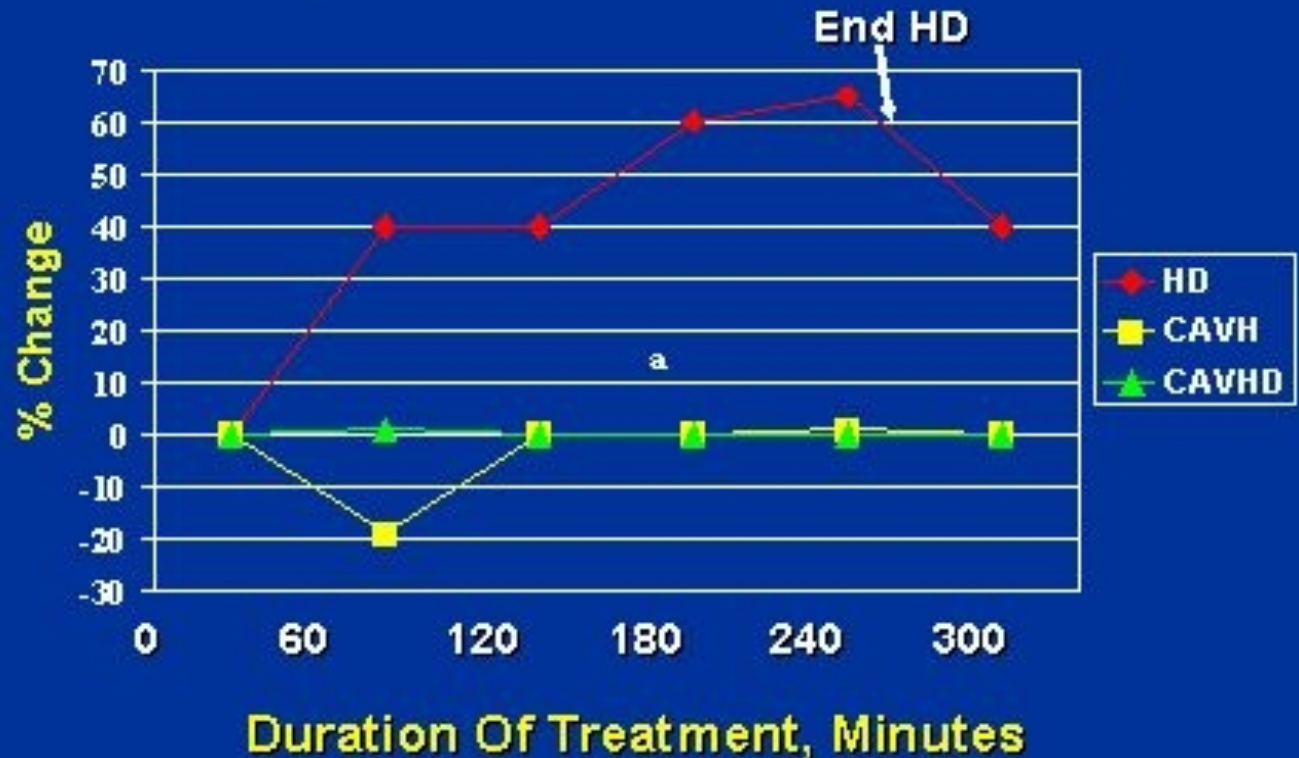


Davenport KI 43:s-245, 1993

30 patients with both fulminant hepatic and acute renal failure

Modality: Effect on ICP

Percentage Change in Intracranial Pressure During Treatment of Renal Failure



30 patients with both fulminant hepatic and acute renal failure

CRRT or intermittent RRT ?

No clear evidence that CRRT is superior to intermittent RRT in terms of mortality

Main aim: to identify optimal mode for individual patient

haemodynamic instability
severe fluid overload
brain oedema
liver failure



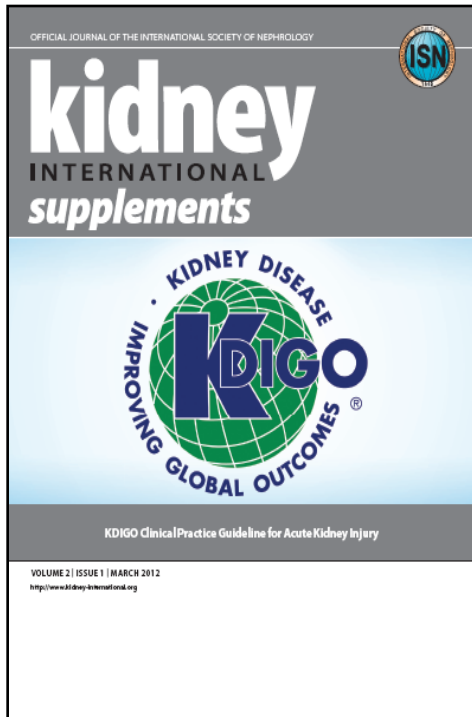
CRRT

recovery phase
able to tolerate fluid swings



IHD / SLED / PIRRT

KDIGO recommendation



5.6.1: Use continuous and intermittent RRT as complementary therapies in AKI patients.

5.6.2: We suggest using CRRT, rather than standard intermittent RRT, for hemodynamically unstable patients.

5.6.3: We suggest using CRRT, rather than intermittent RRT, for AKI patients with acute brain injury or other causes of increased intracranial pressure or generalized brain edema.

Modality: Effect on renal recovery

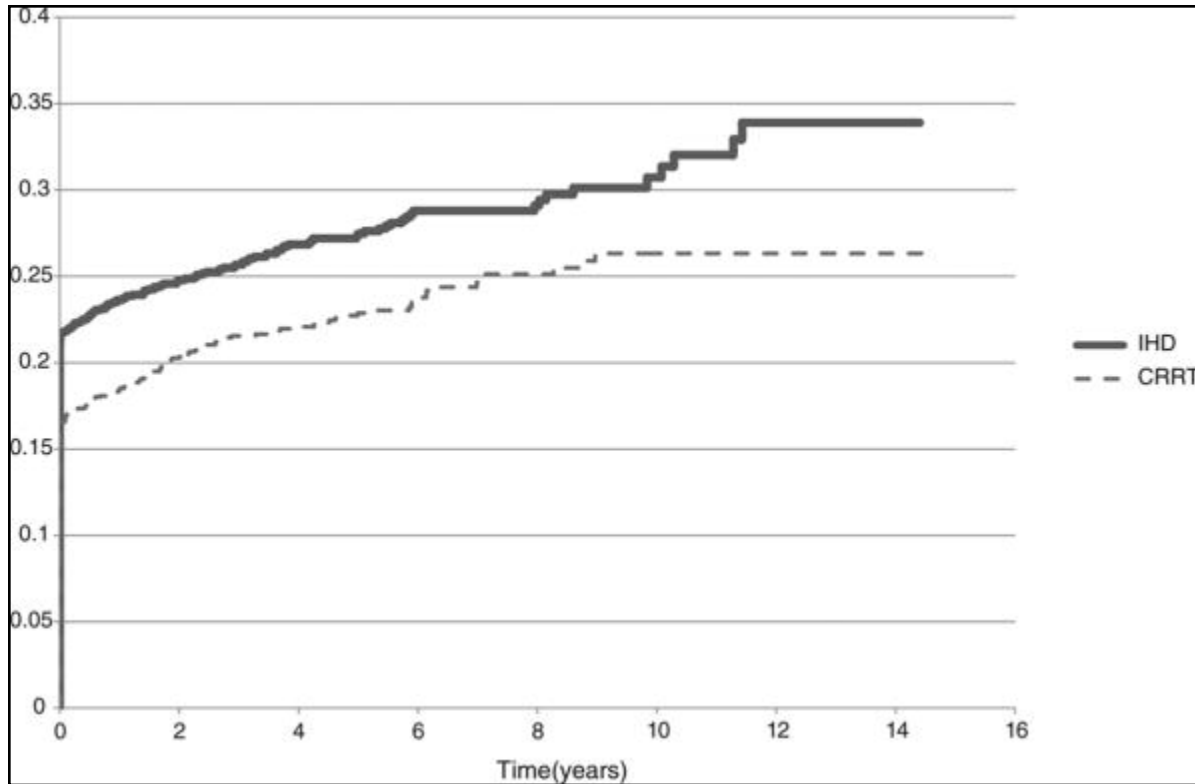
The association between RRT modality and long-term outcomes among critically ill adults with AKI:
A Retrospective Cohort Study*

Patient cohort:

Critically ill adults who initiated RRT for AKI between July 1996 - December 2009 and survived to at least 90 days after RRT initiation.

2,315 CRRT recipients of whom 2,004 (87%) were successfully matched to 2,004 intermittent hemodialysis recipients.

Modality: Effect on renal recovery



Conclusions:

Compared with intermittent hemodialysis, initiation of CRRT in critically ill adults with AKI is associated with a lower likelihood of chronic dialysis.

Conclusions

Blood
Purification

Blood Purif 2012;34:124–131

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Tailored Therapy: Matching the Method to the Patient

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.... and to the local expertise and availability