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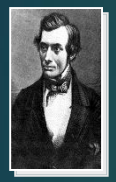
Fresenius Medical Care

History

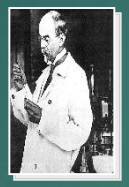
Home

History of Hemodialysis

Timeline of Major Events in HD

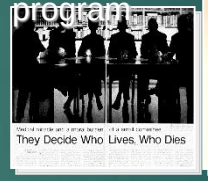


Diffusive membrane transport



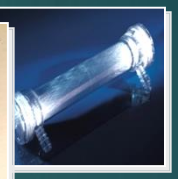
First animal dialysis

First patient surviving due to dialysis



First chronic HD program

First single pass machine for all types of dialyzers



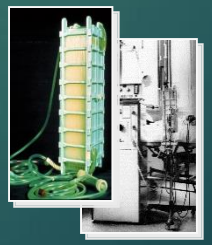
Fresenius Polysulfone®

1850 1860 1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000

First anticoagulant (hirudin)

First human dialysis

Natural occurring mammalian anticoagulant (heparin) for medical application



First high flux dialyzer & related machine

EPO

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1924: Georg Haas / Human Dialysis

1356 KLINISCHE WOCHENSCHRIFT. 7. JAHRGANG. Nr. 29 15. JULI 1928

Ammoniakzahl aber steigt nur langsam an, so daß zunächst im Verhältnis zur Harnreaktion wenig Ammoniak ausgeschieden wird. Auch hier findet sich ein vollkommener Parallelismus zur Nachphase der Acidose, wo wir (nach Ammonchloridverabreichung) die Rückkehr der Harnreaktion zu den Ausgangszahlen, oder sogar das Auftreten stärker alkalischer Harne mit hohem Ammoniakgehalt feststellen konnten. (Eine zweifelsfreie Beeinflussung des Säurebasengleichgewichtes im Blute fand sich in unseren Bicarbonatversuchen bei der gewählten Dosierung und Untersuchungszeit nicht.)

Es muß
mit niedrig
Ausdruck
Alkalose ge
diagnostisc
Blute nich
Feststellun
wird man
griffe Alka
identifizier

ORIGINALIE

ÜBER BLUTWASCHUNG*.

Von

Prof. GEORG HAAS.

Aus der Med. Universitäts-Klinik Gießen (Geh. Rat Prof. Dr. VOIT) und der Med. Universitäts-Poliklinik Gießen (Prof. Dr. HAAS).

Als ich während der Assistentenzeit bei meinem Lehrer FRANZ HOFMEISTER mit Problemen des intermediären Stoffwechsels beschäftigt war, speziell mit der Frage der intermediären Aminosäurenbildung, da trat zu einem gewissen Zeitpunkt der Arbeit die Frage auf, ob vielleicht die bis dahin negativen Ergebnisse der Versuche mit einer gewissen Unzweckmäßigkeit des Durchblutungsverfahrens in Zusammenhang stünden, und ob etwa durch ein geeignetes Abfangverfahren die rasch veränderlichen Zwischenprodukte der weiteren Verarbeitung durch die Leber entzogen werden könnten. Wir dachten damals daran, durch Dialysieren der Schwierigkeit begegnen zu können und an die Einschaltung von Schilfschläuchen in den Durchblutungsapparat. War doch gerade die Dialyse mit Hilfe von Schilfschläuchen von FRANZ HOFMEISTER als sehr geeignete Abtrennungsmethode von dialysierbaren Substanzen angegeben worden. Der weitere Verlauf

in Erwägu
die Atmun
eiweißkörp
maß angel
Stoffe. V
Durchführ
ein sehr w
denn kaur
ein weiter
zahlreiche
und wegen
werden.
Arbeit vo
faßte, ent
schaffen v
arbeitung
selben lern
Forschers
übersende
physiologi
Problem
und um es

Georg Haas about “Blood Washing” (1928)

Georg Haas dialyzing a patient with acute renal failu
(Giessen / Germany)

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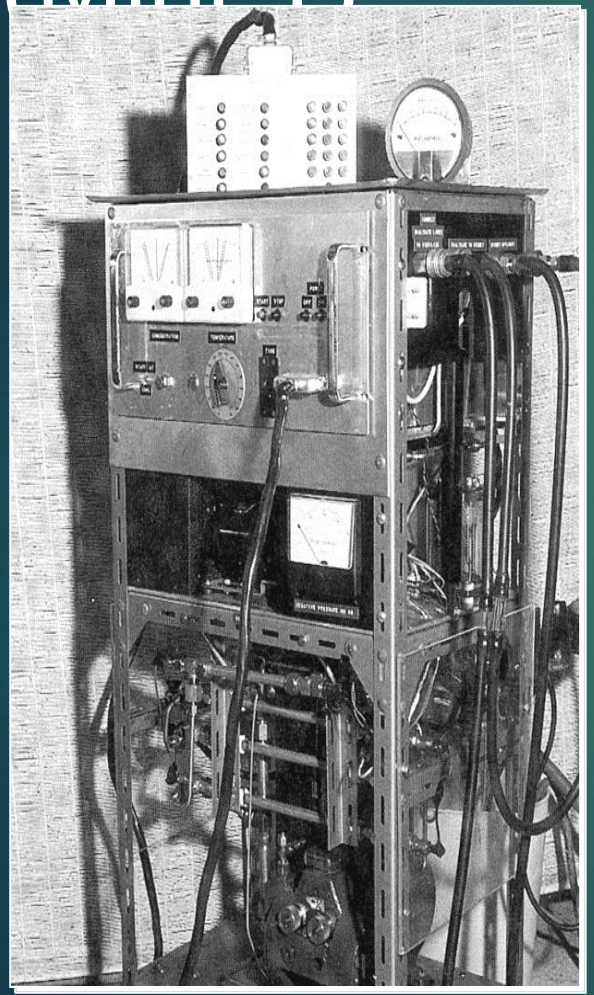
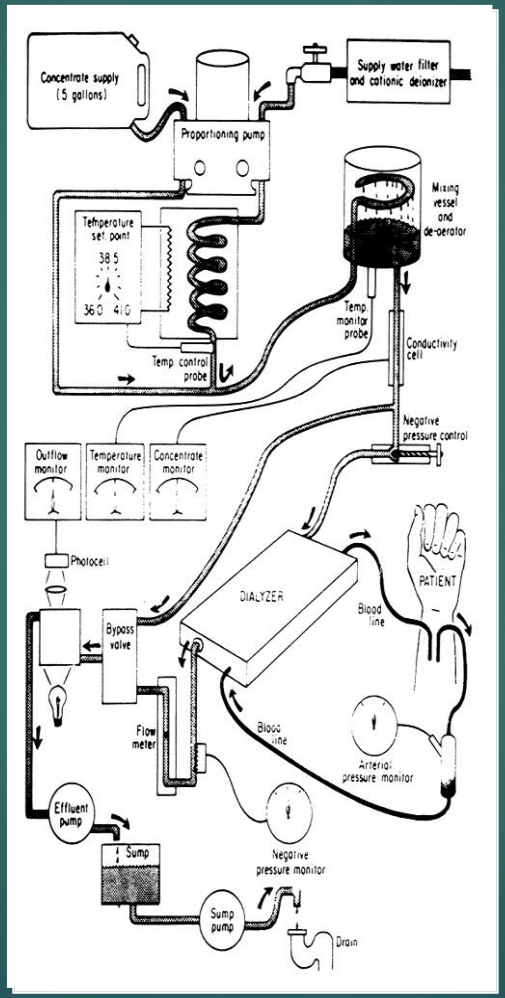
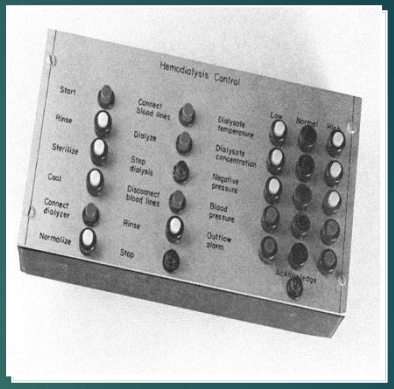
The First Modern HD Machine (Mini-1)







Babb AL: Design and construction of a portable, single patient, dialysate proportioning machine at the University of Washington 1964-65. ASAIO J 1995 Jan-Mar;41(1):1-10

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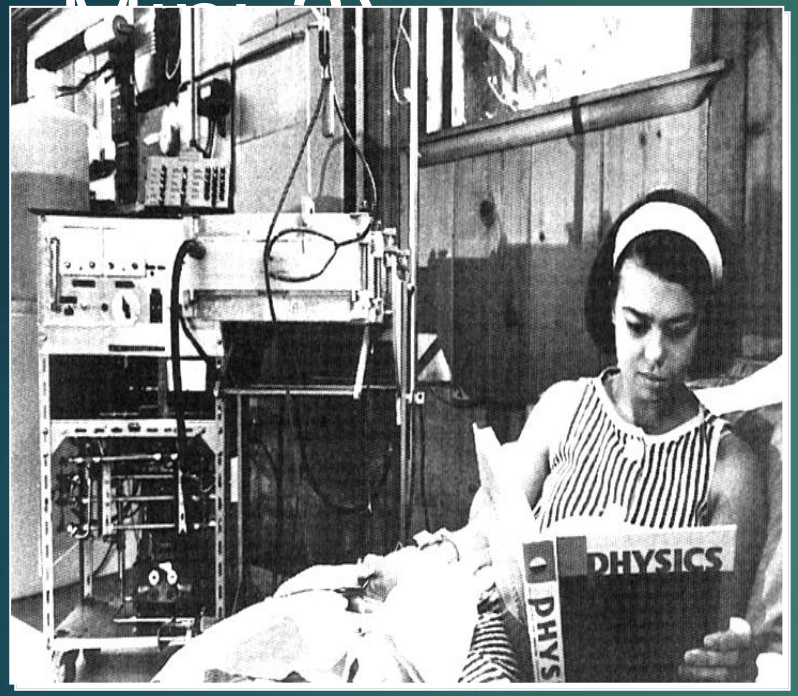
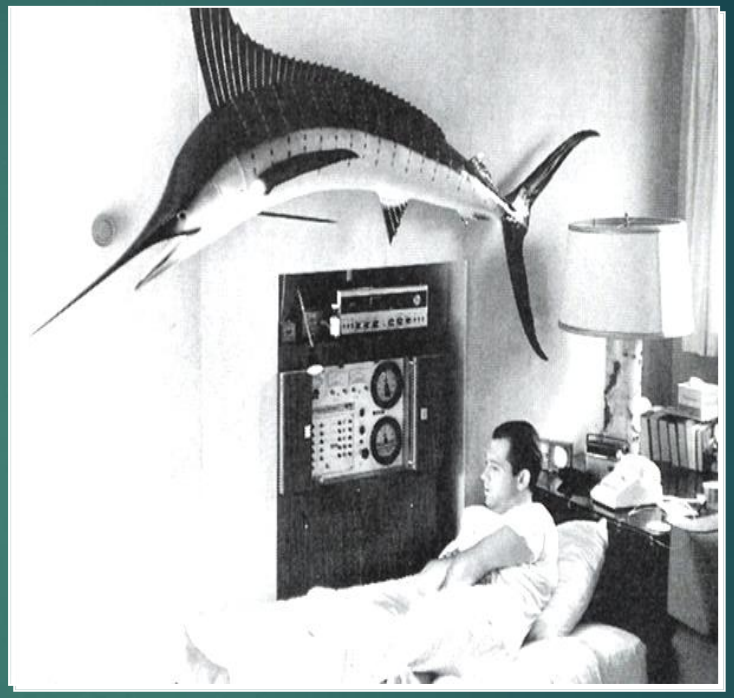
Home Hemodialysis (Mini-1, Mini-2)



Caroline Helm, on home hemodialysis, including unattended overnight dialysis, since July 1964

Photos from: Babb AL, 1995



„The patients are fully rehabilitated in their usual occupations and have not missed any work except during the training period and for an occasional recannulation.“

Eschbach JW Jr, Wilson WE Jr, Peoples RW, Wakefield AW, Babb AL, Scribner BH: Unattended overnight home hemodialysis. Trans Am Soc Artif Intern Organs 1966;12:346-56

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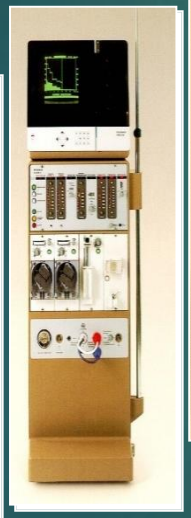
Most Successful HD Machine Series

A 2008 C

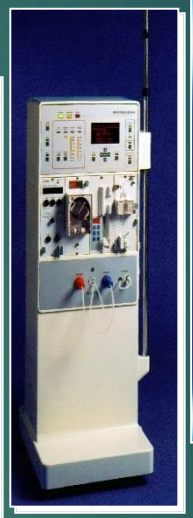


A 2008 C
CMS-08

A 2008 C
ABG-I

A 2008 D

2008E
ABG-II



2008 H

4008 H

4008 S

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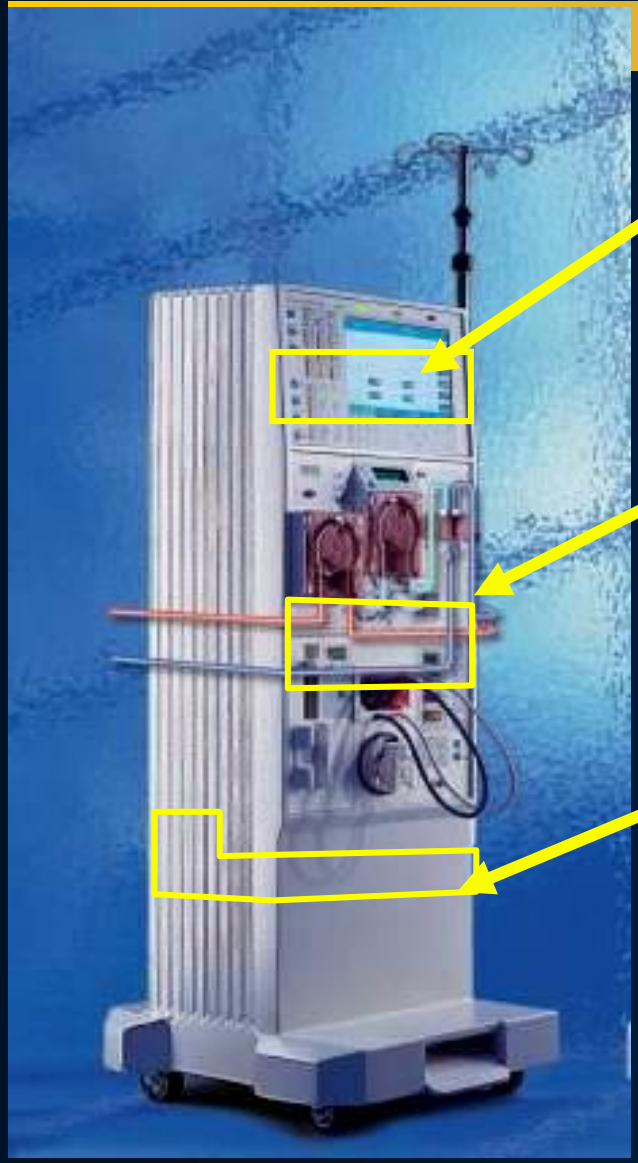
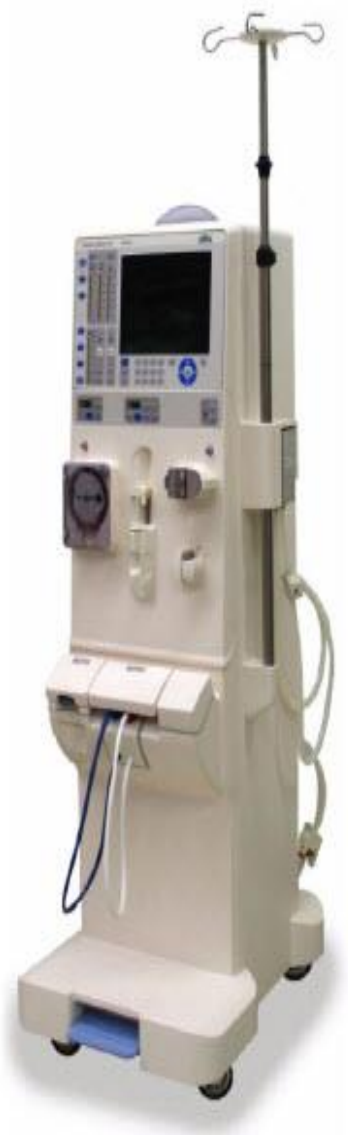
The parts of the machine

Home

The 4008 HD machine: components



- **The Monitor and electronics**
  - Ergonomical user interface
  - Every action is monitored!
- **The extracorporeal blood circuit**
  - To sustain a safe extracorporeal circulation of patient‘s blood
- **The dialysis fluid circuit**
  - To prepare the dialysis fluid containing all solutes which should not be removed for the patient.



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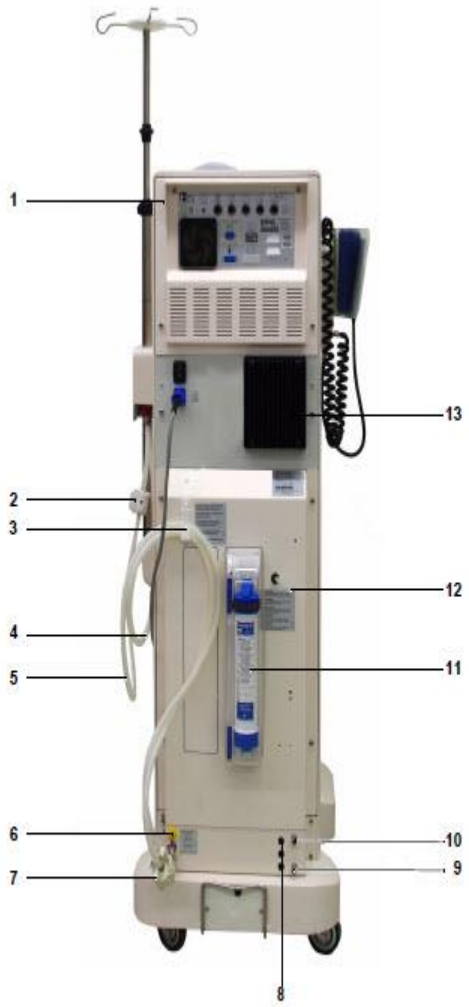
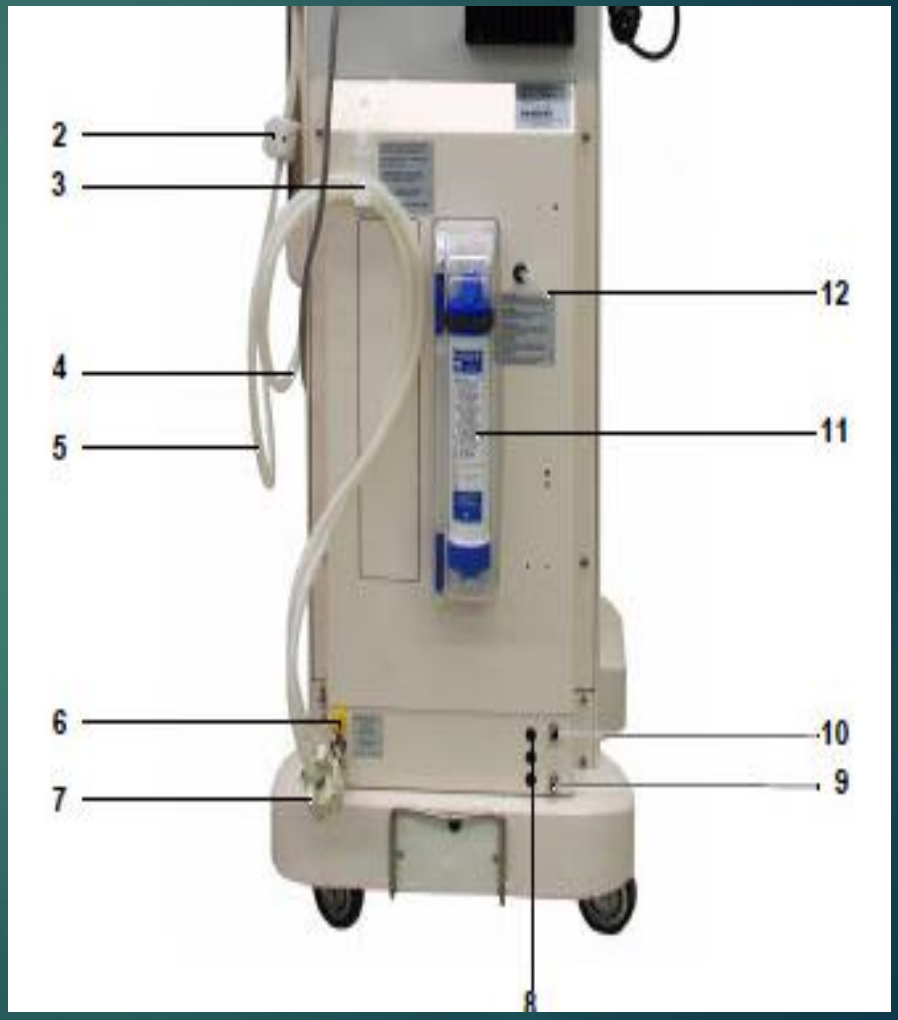


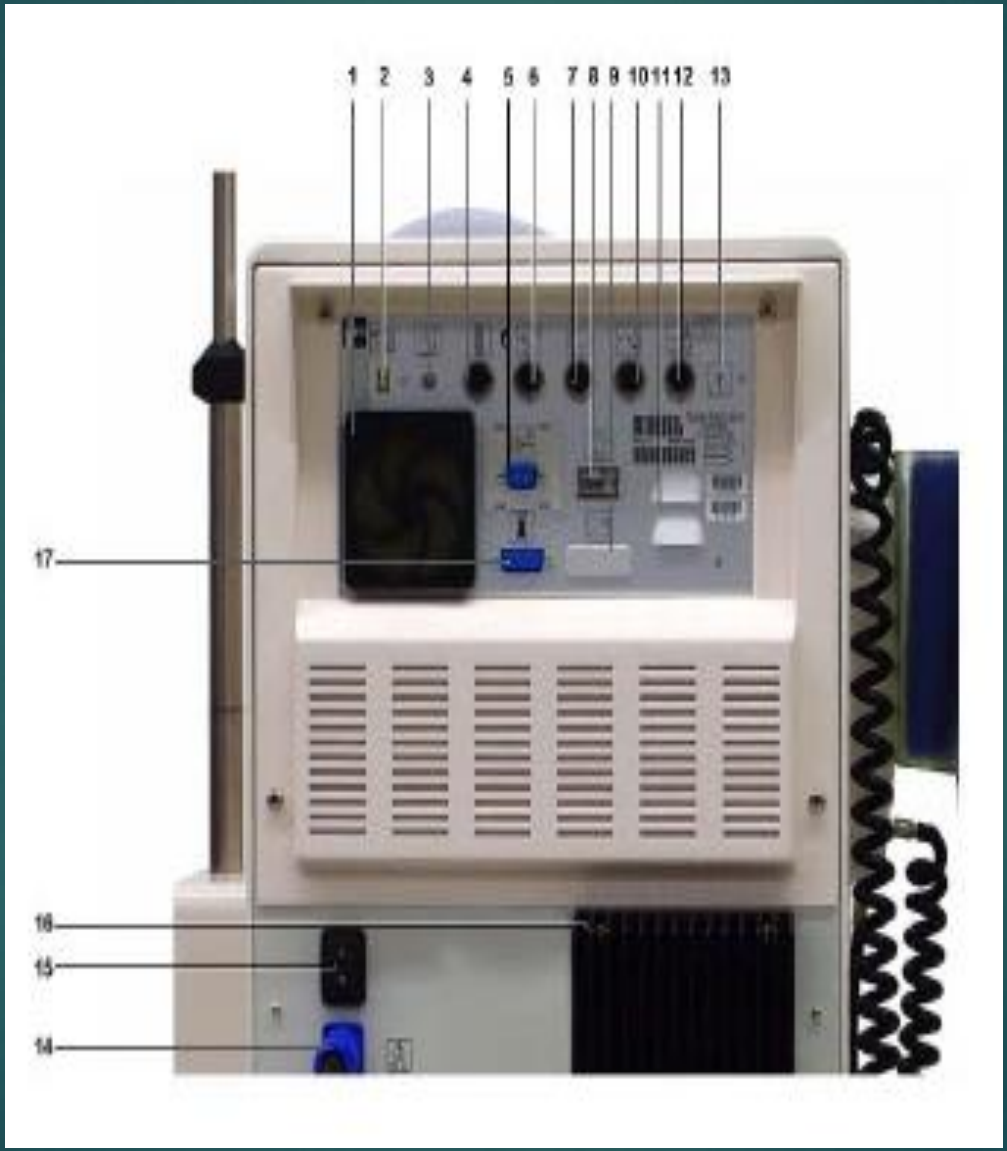
1 Monitor (rear view)

2 Sampling valve

3 Bracket for the dialyzer connection lines

4 Dialysate outlet tube





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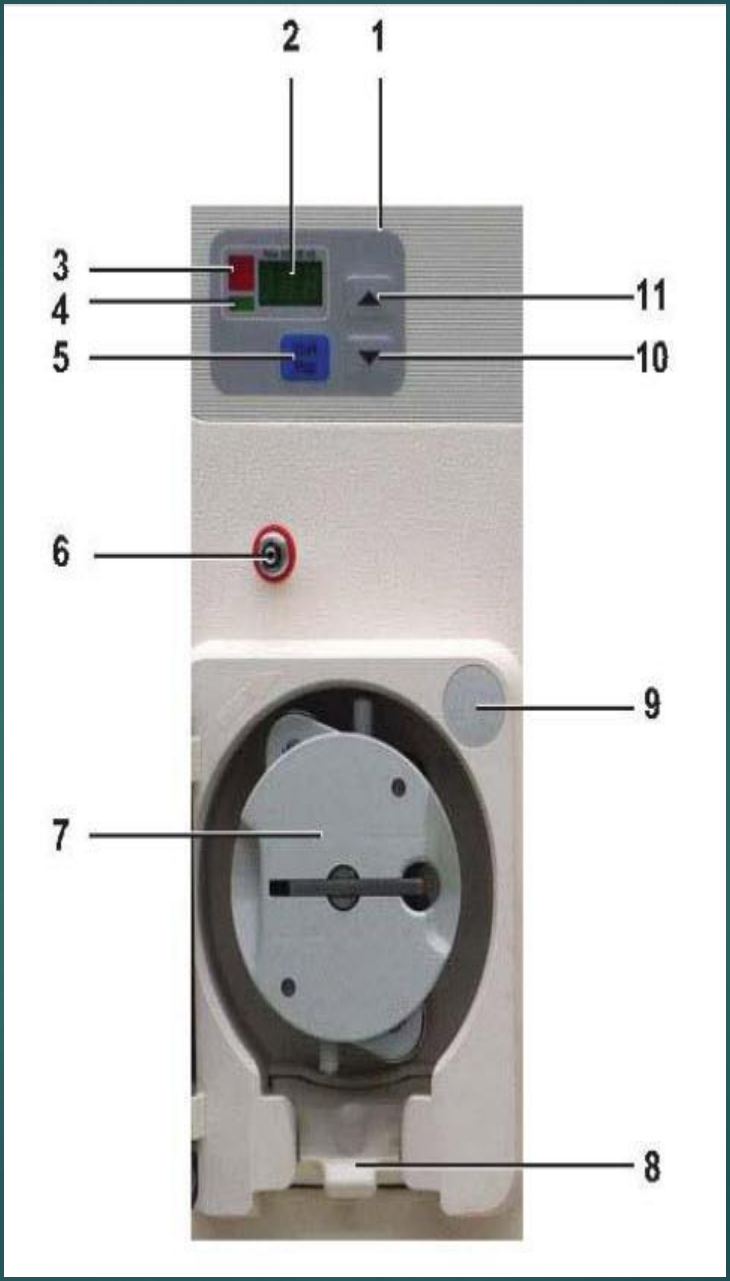

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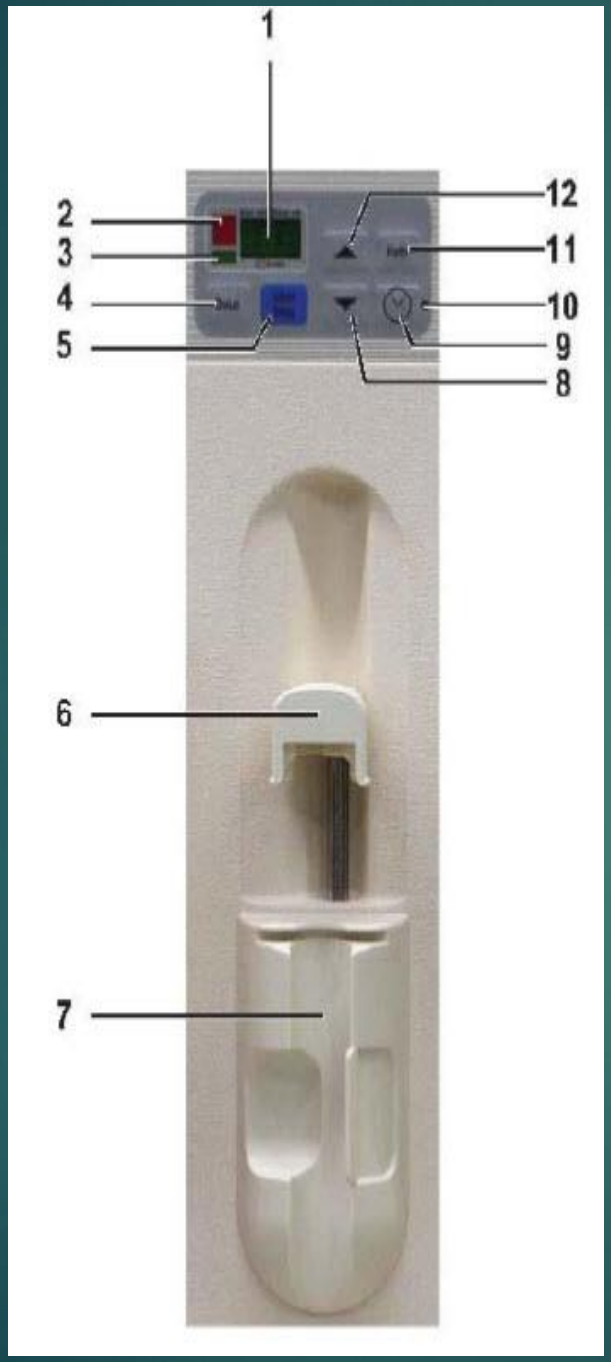

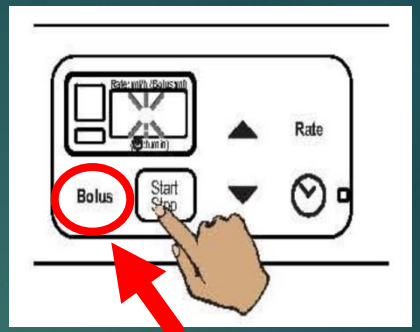

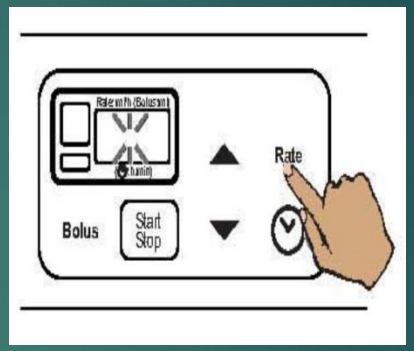

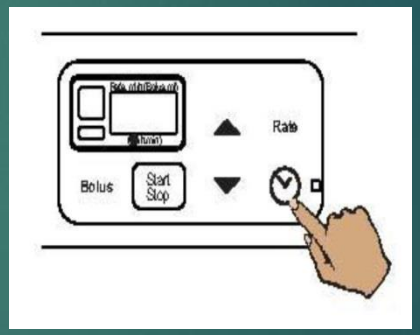

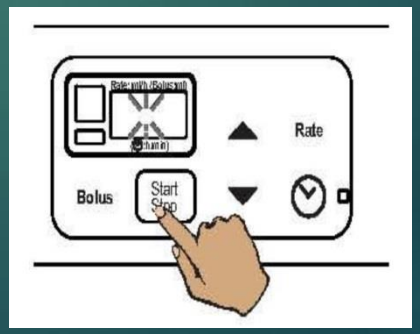

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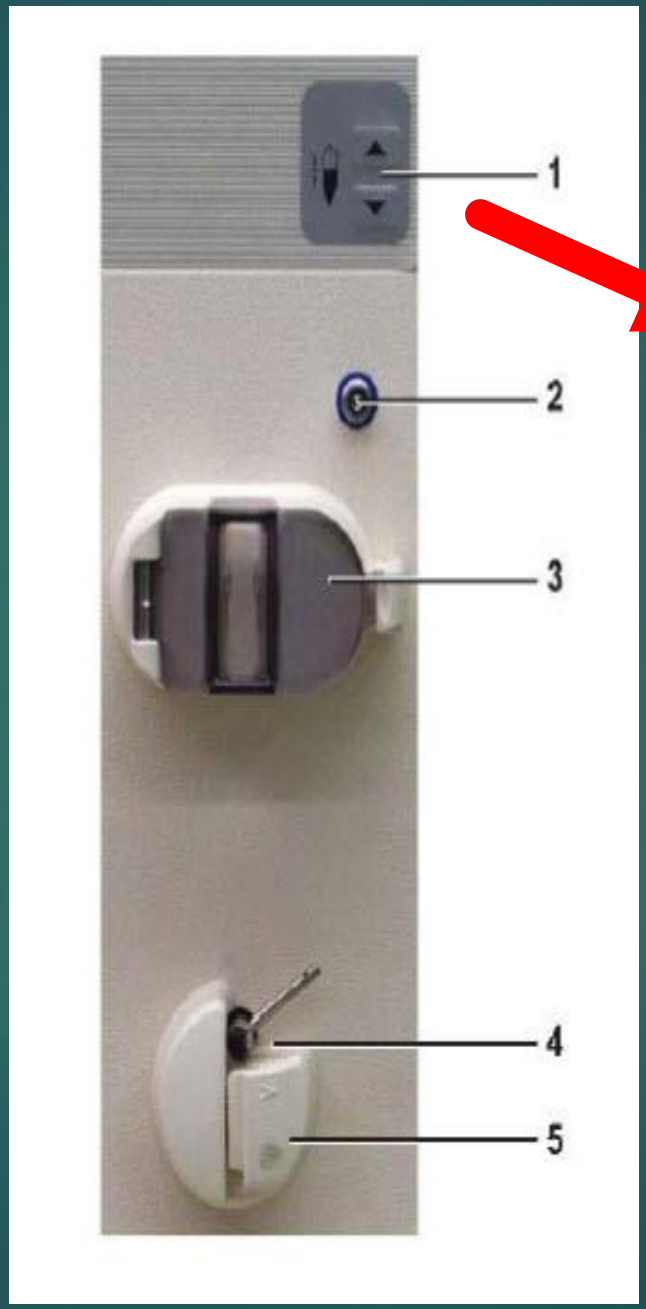

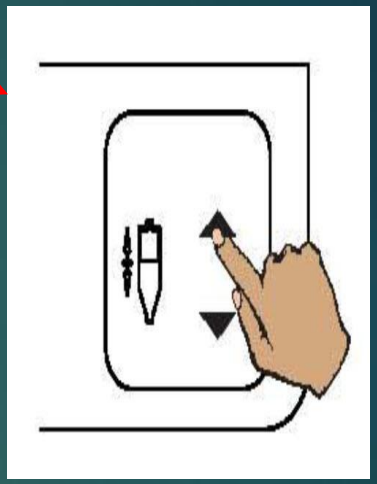

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Filters

Home

Renal Replacement Therapies

- Physical Principles
- Treatment modalities
  - Hemodialysis
  - Peritoneal dialysis
  - Transplantation

Fresenius Medical Care

- Semipermeable Membrane
- Diffusion
- Ultrafiltration
- Convection
- Osmosis

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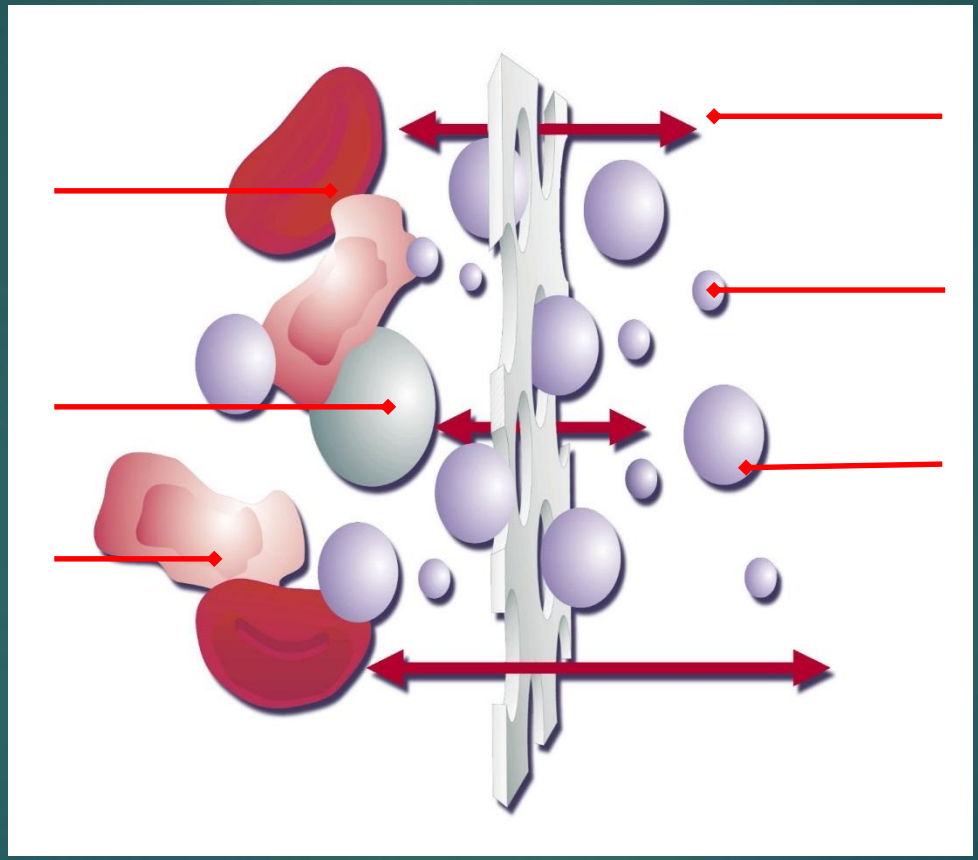
Semipermeable Membrane

Erythrocyte, red blood cell

Big protein, e.g. albumin

Leukocyte, white blood cell



Water flux has only a low resistance

Small molecules, e.g. urea

Medium sized molecules, e.g. β2-microglobulin

The semipermeable membran functions similar to a fine sieve,
only particles that are small enough go through.

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Diffusion

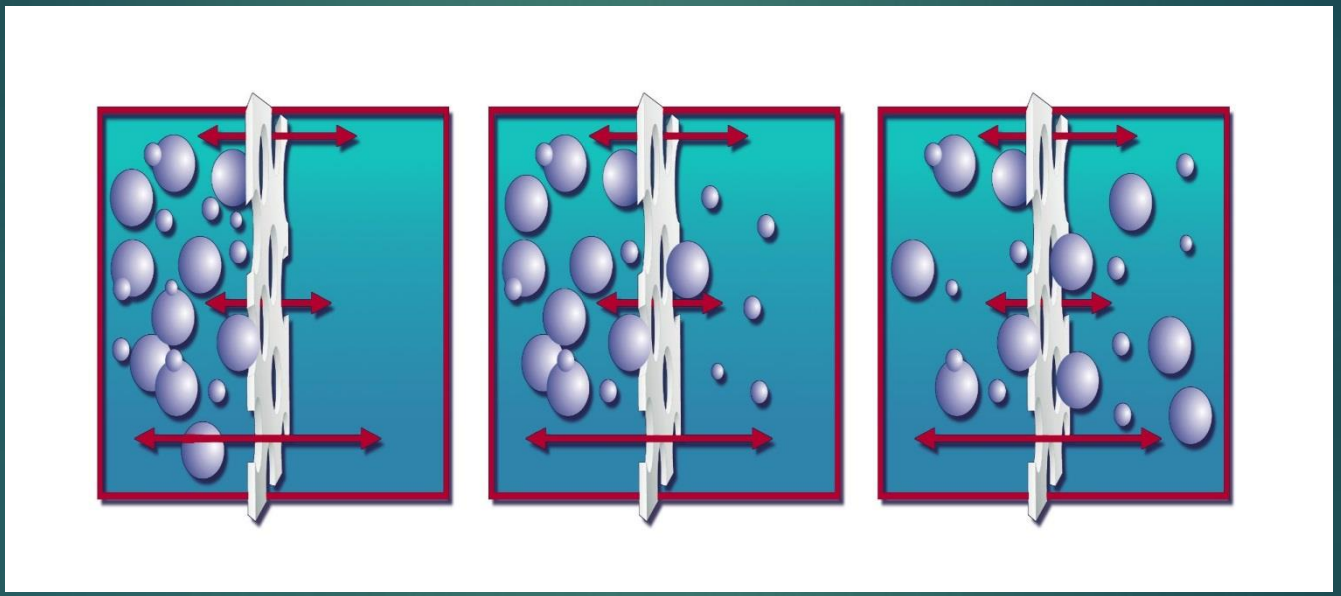
Start:

different concentrations

time

End:

equal concentrations on both sides of the membrane



Diffusion: due to the random movement of all molecules (Brown‘s molecular movement)

REMARK: Diffusion is faster for smaller molecules!

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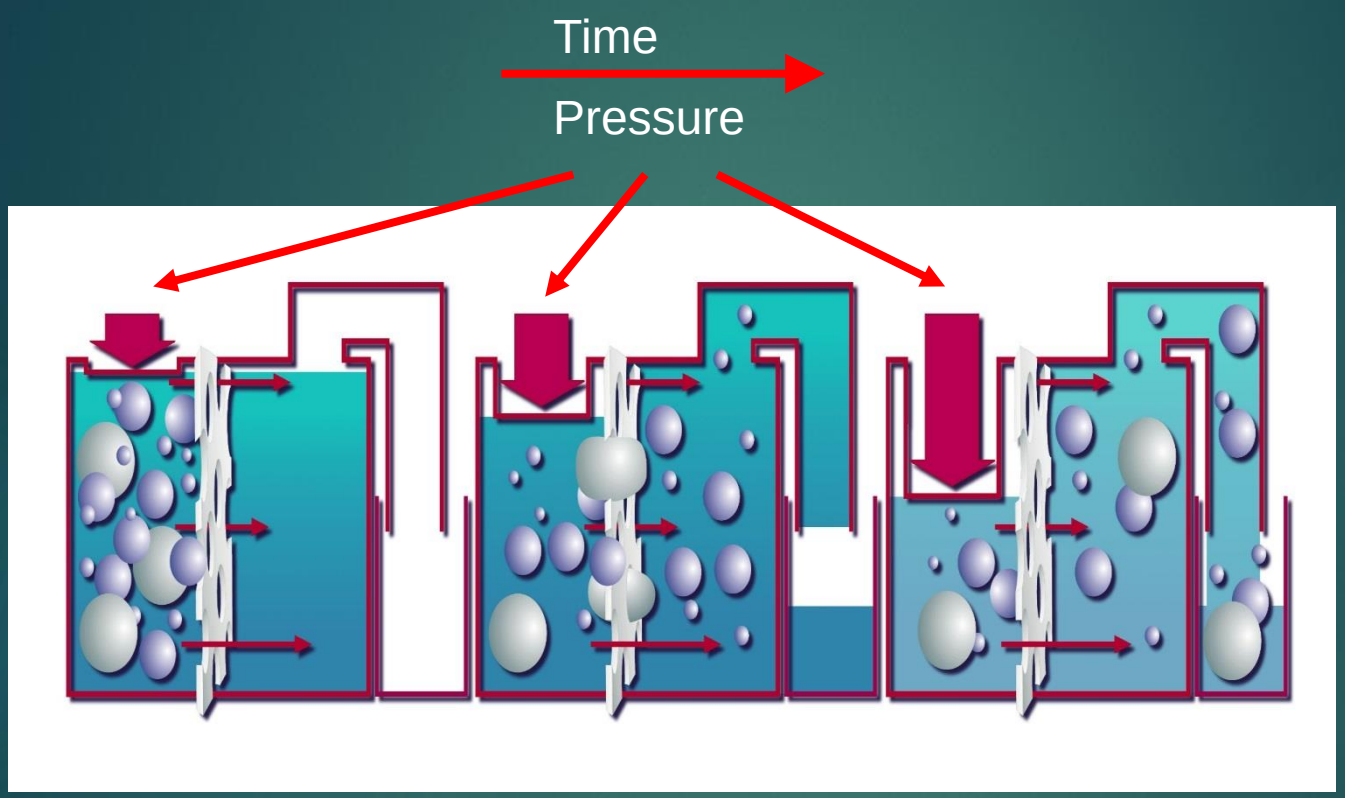
Ultrafiltration / Convection



Pressure: filtration of water and solved substances

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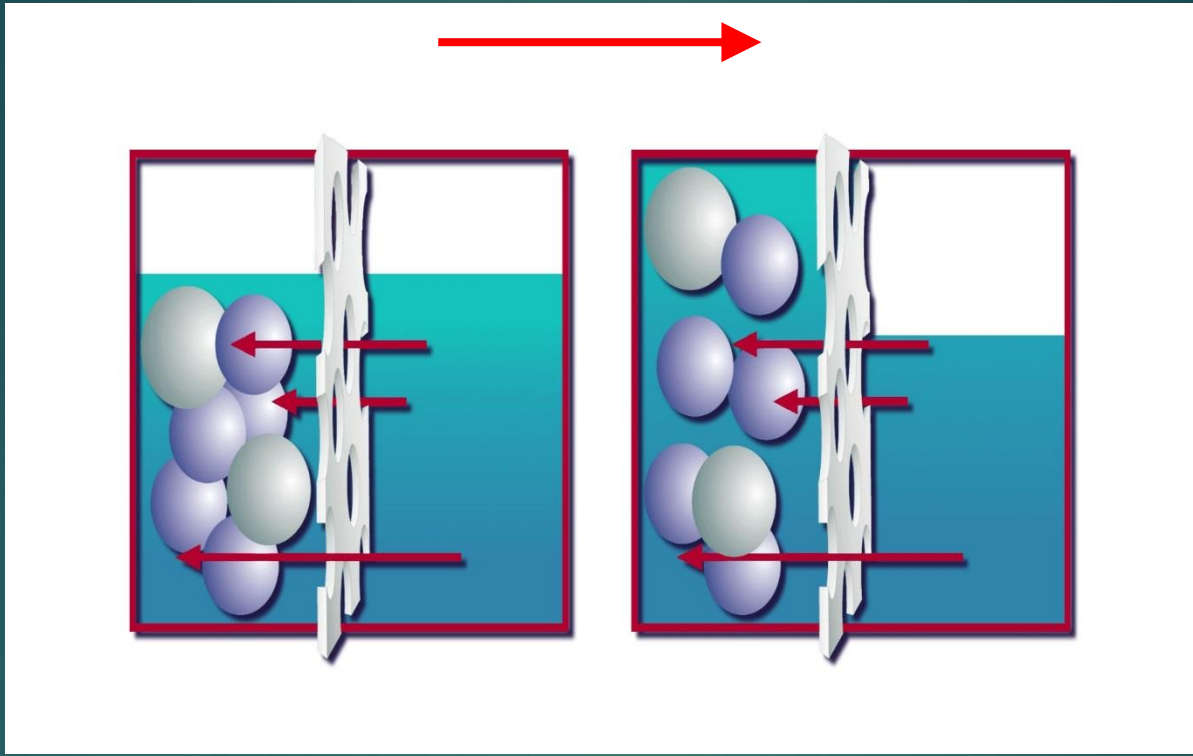
Osmosis



Solved molecules do not fit through the membrane:

Concentration gradient leads to water flux through the membrane

⇒Concentrations tend to equal out

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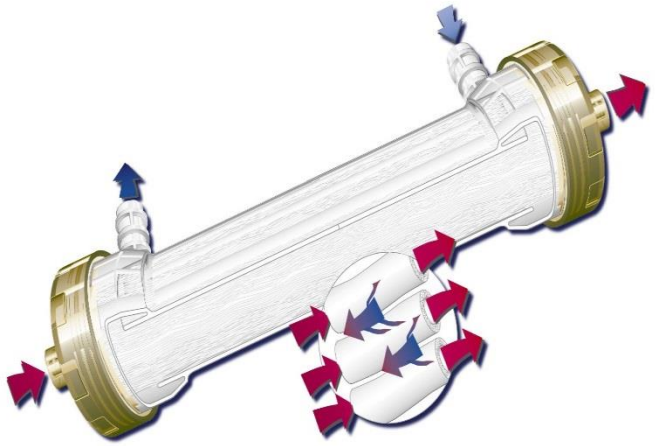
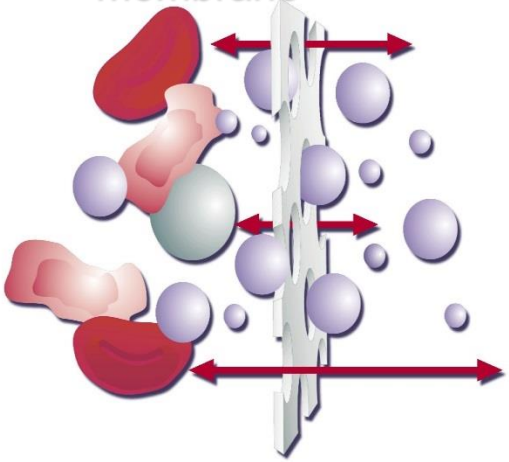
Diffusion in a Dialyzer

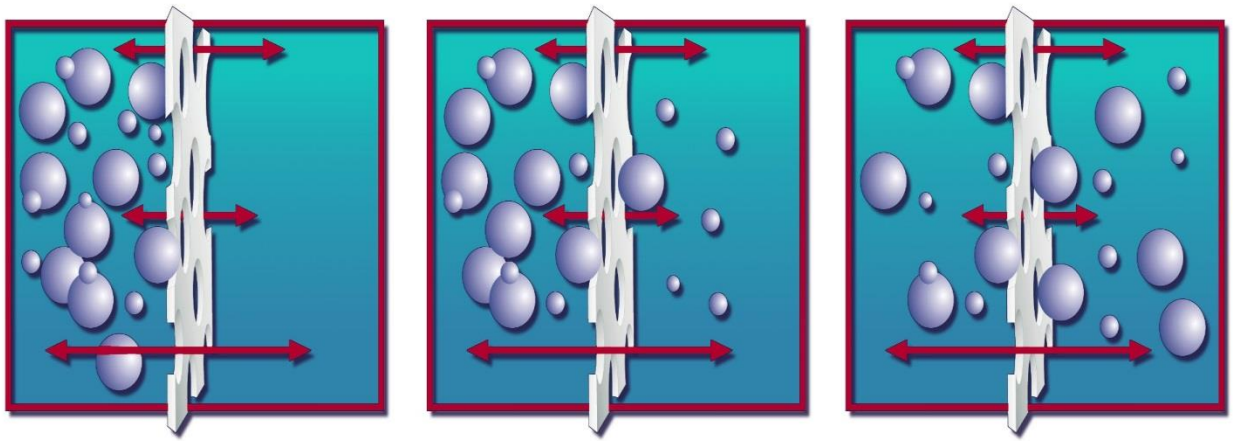
Dialyzer



Semipermeable membrane



Diffusion



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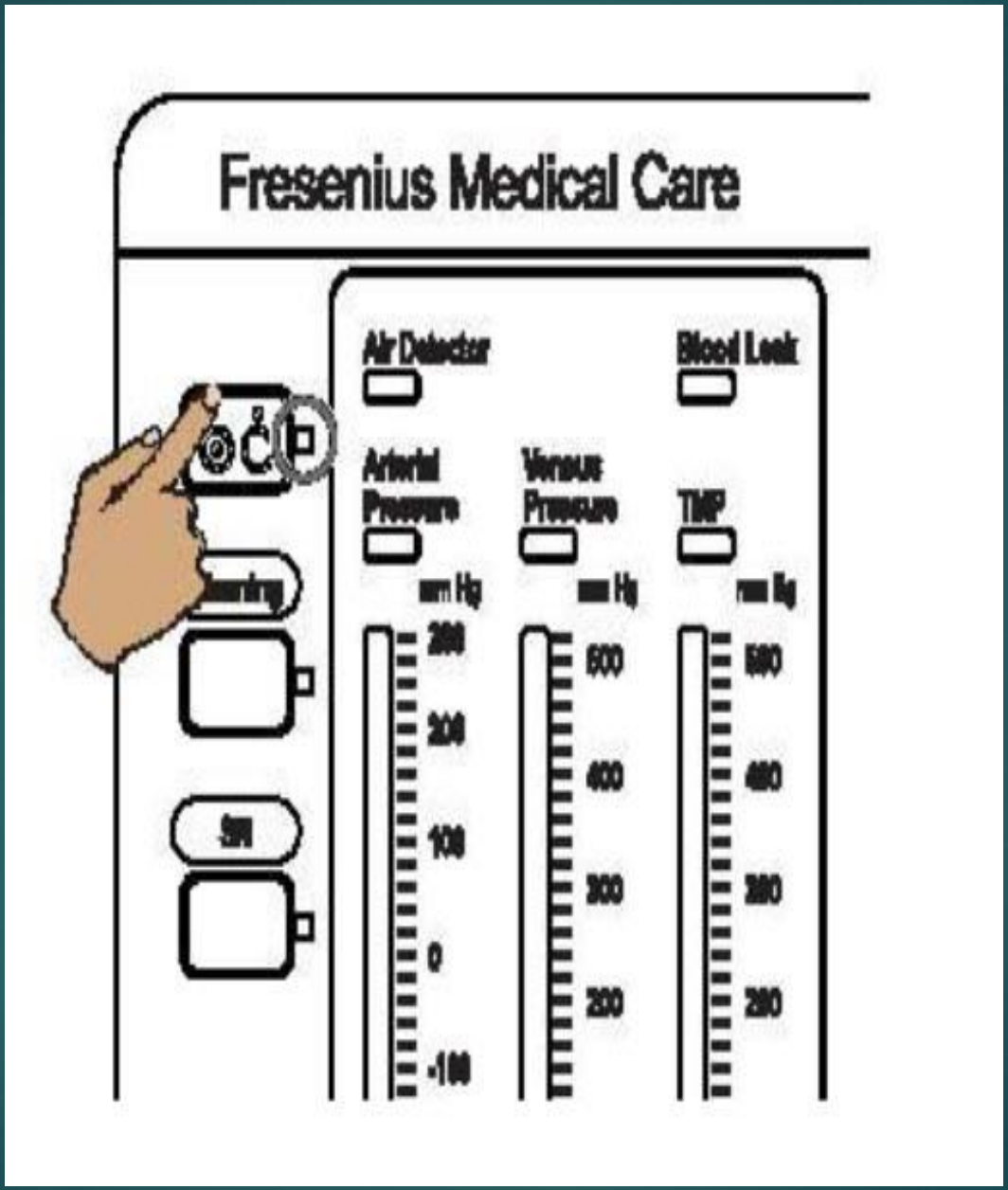
Instruction

Home



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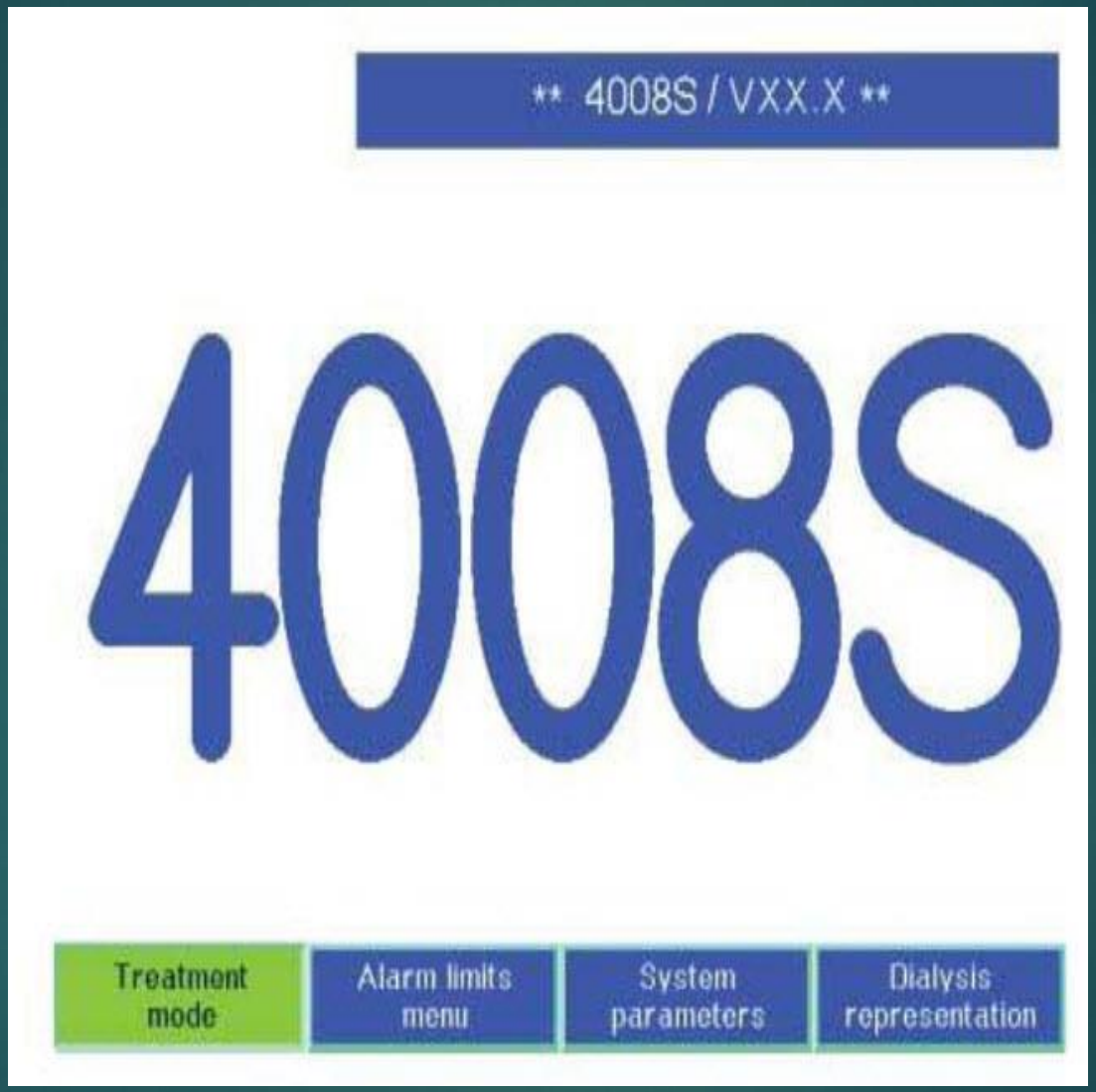

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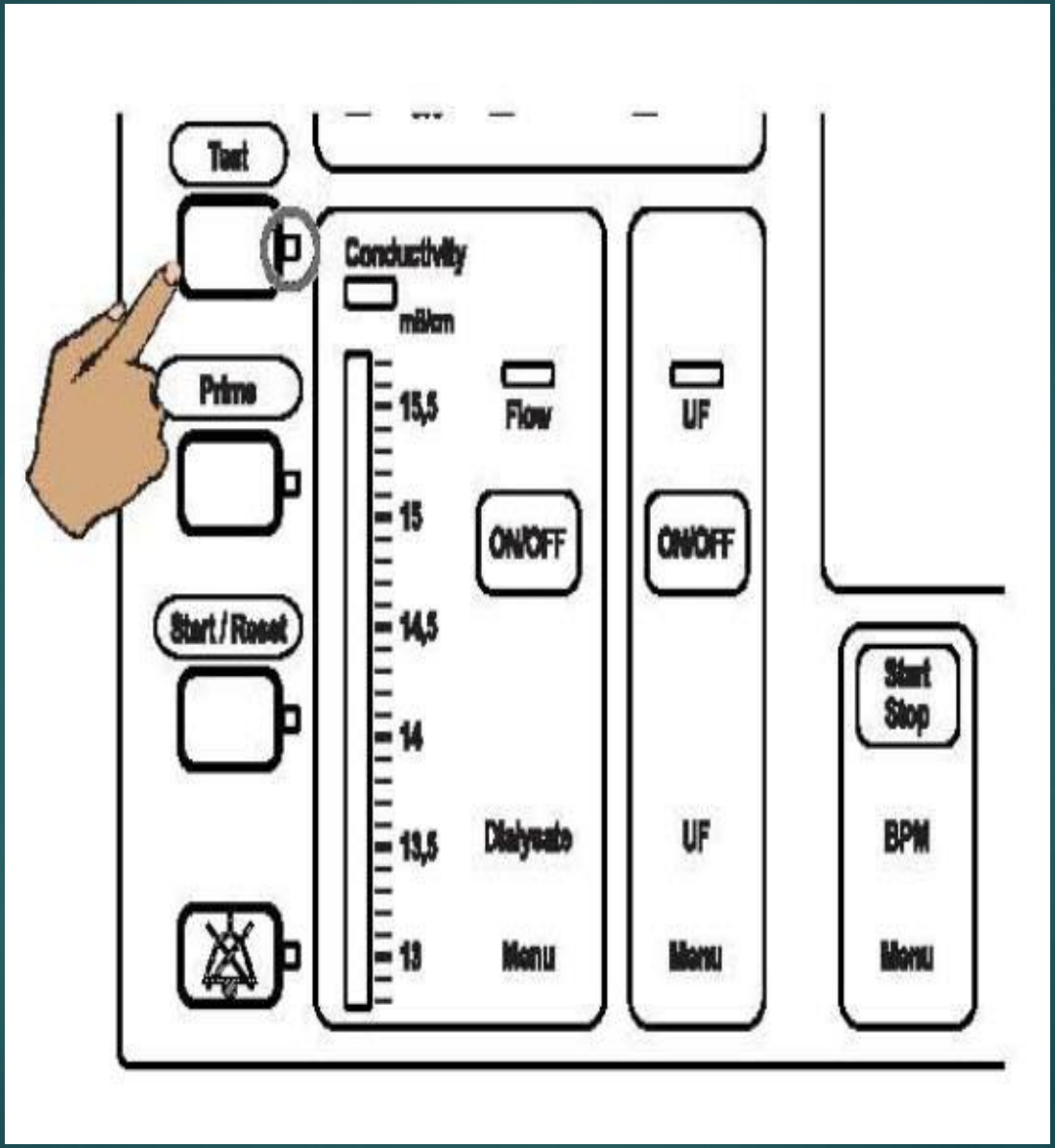
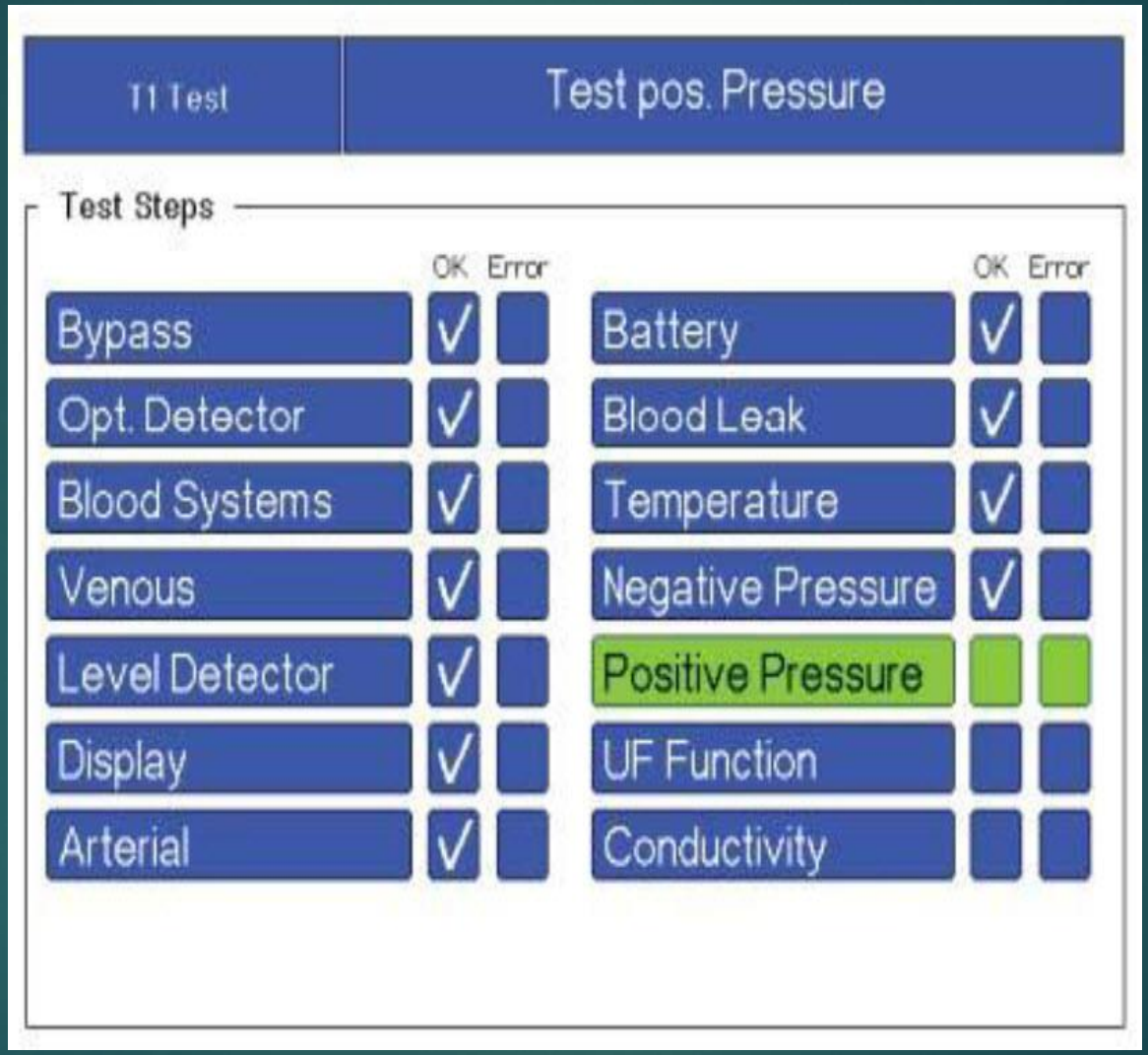


Fresenius Medical Care



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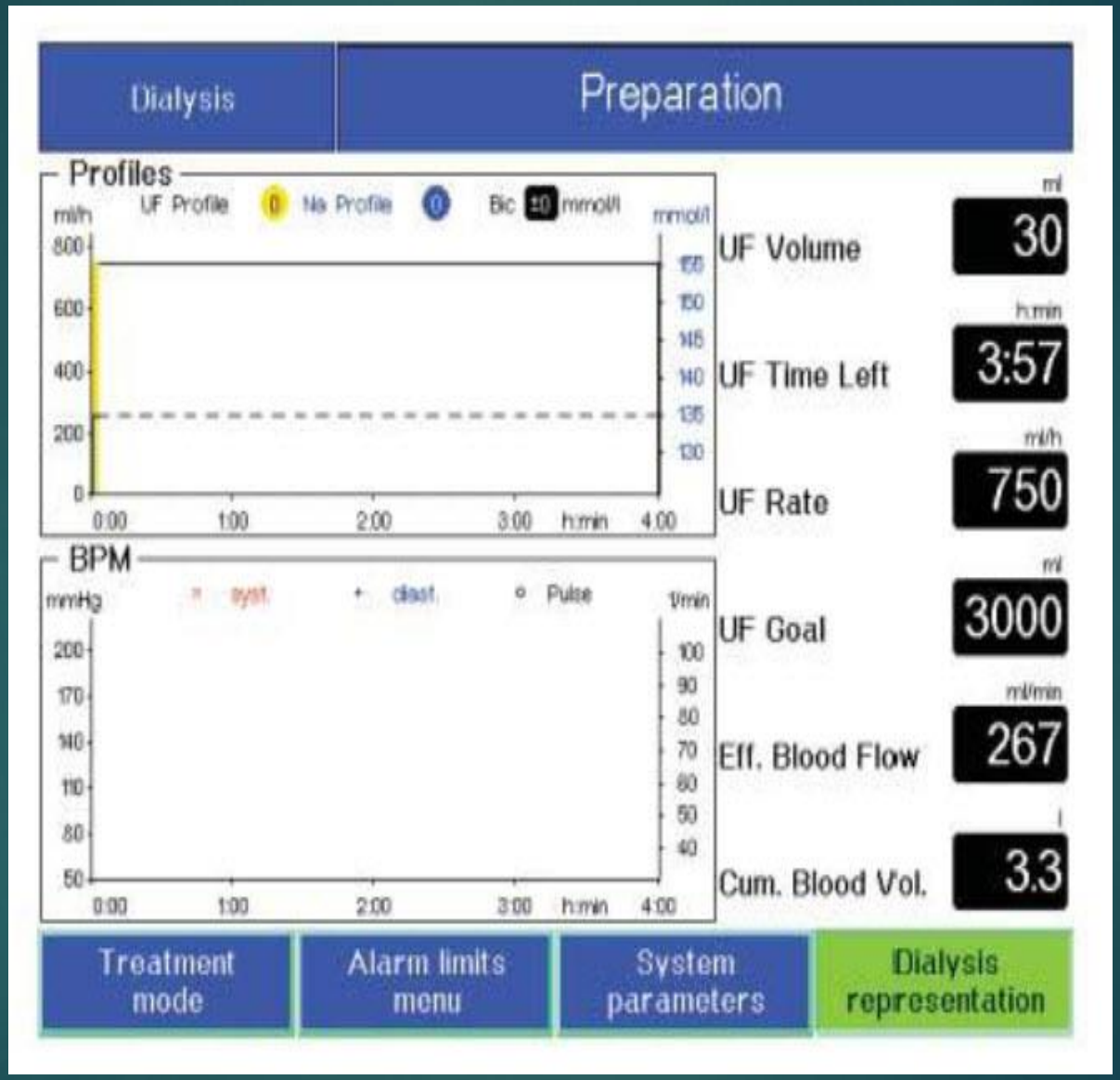

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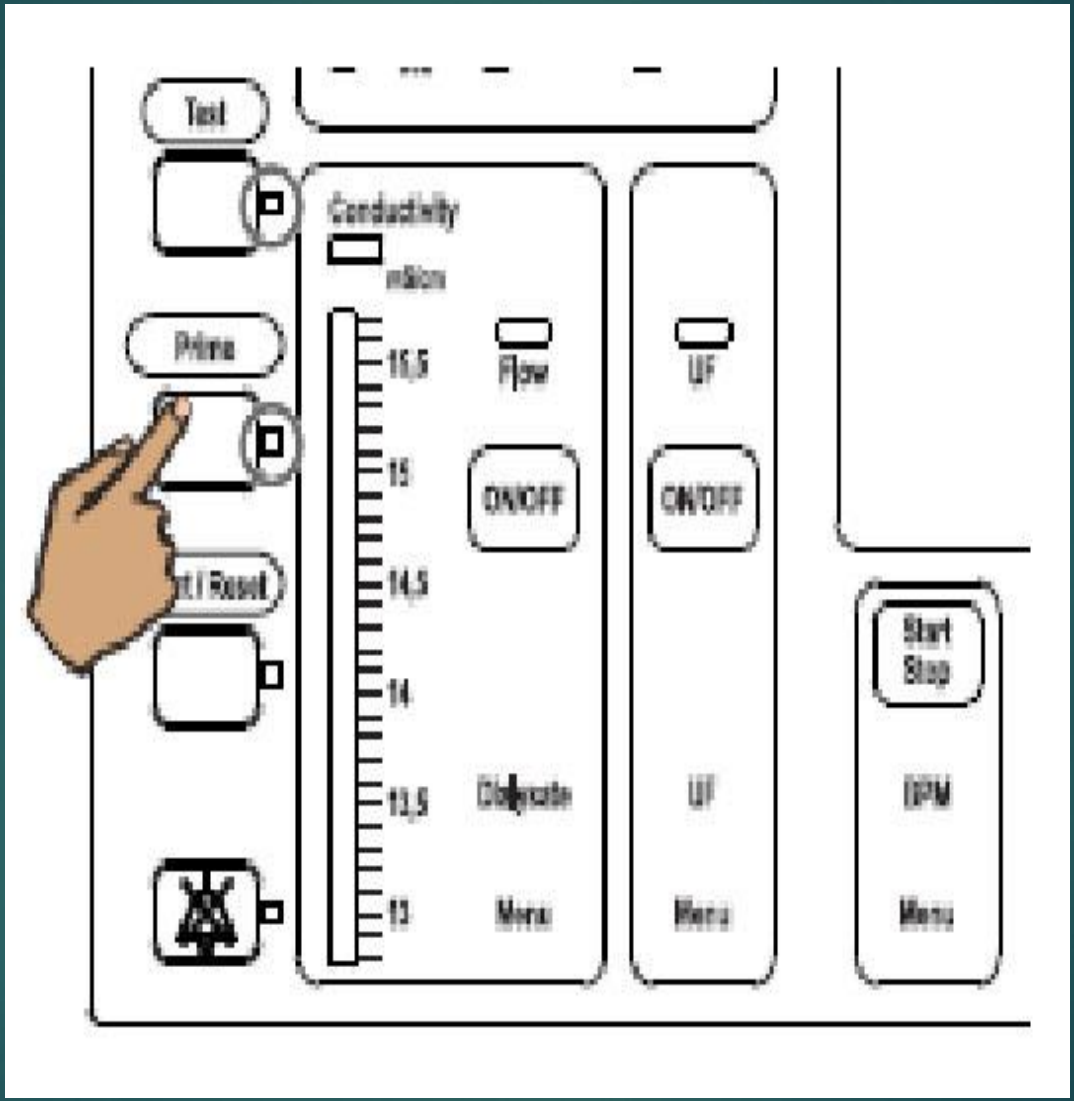

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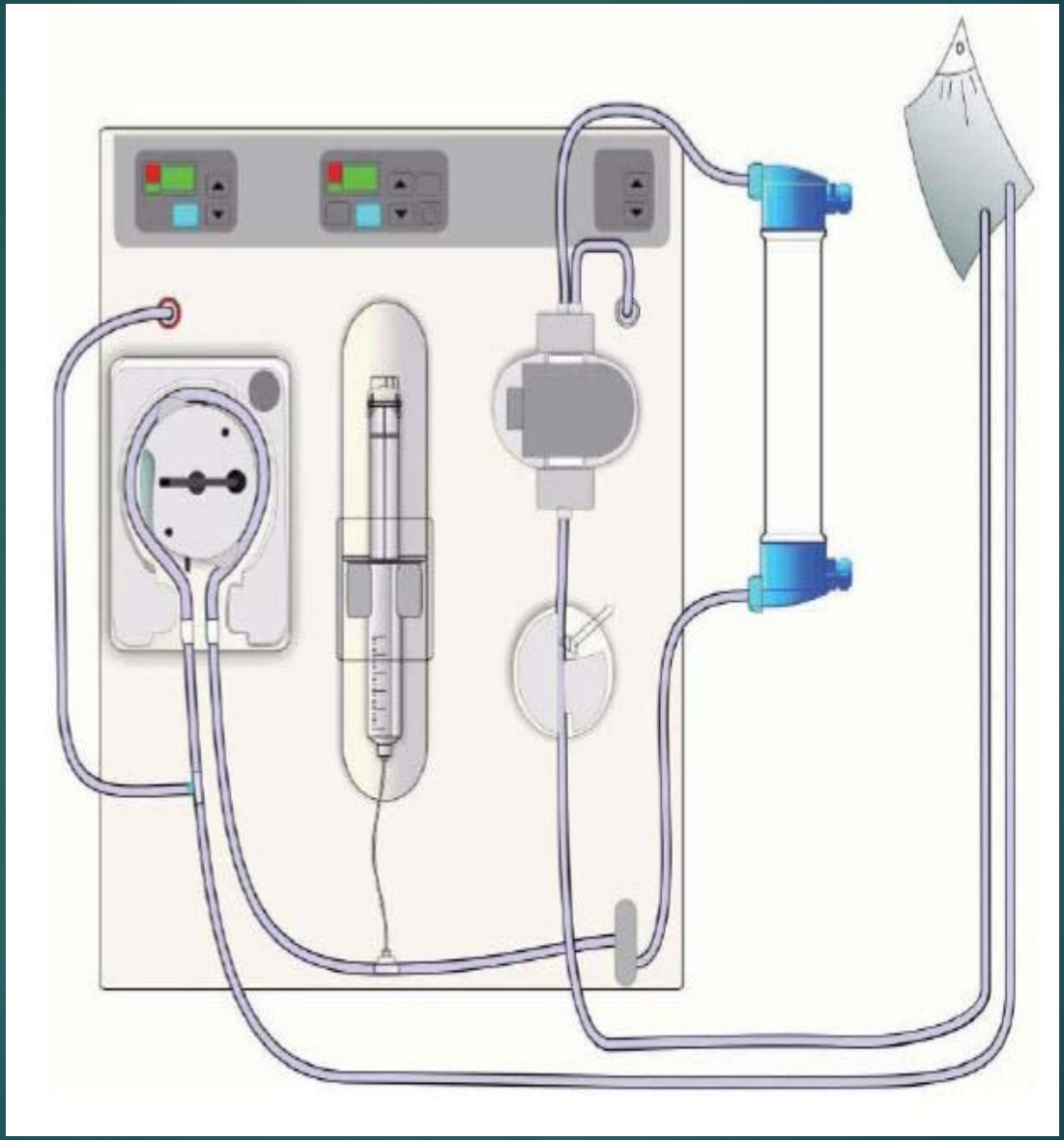

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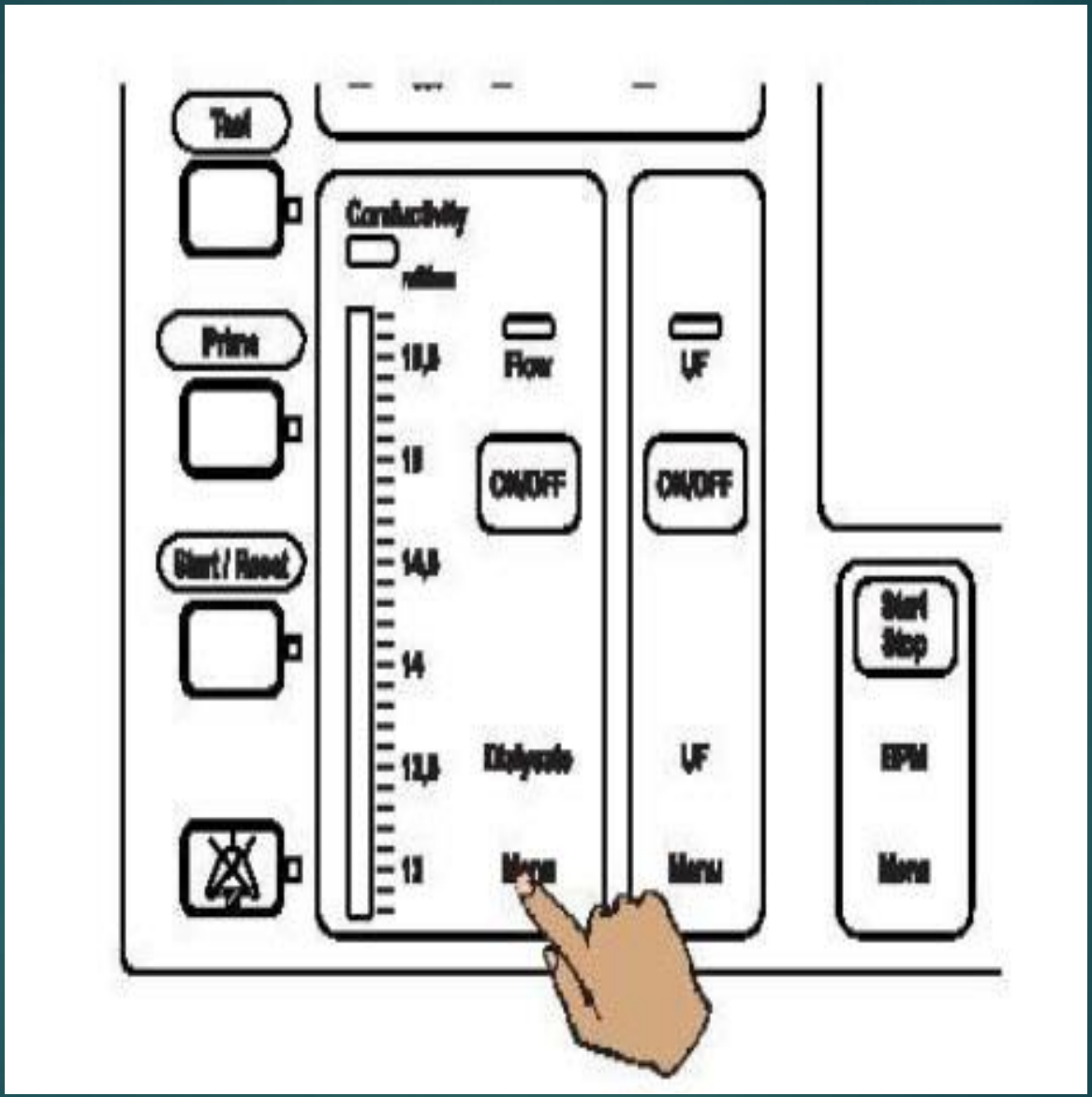

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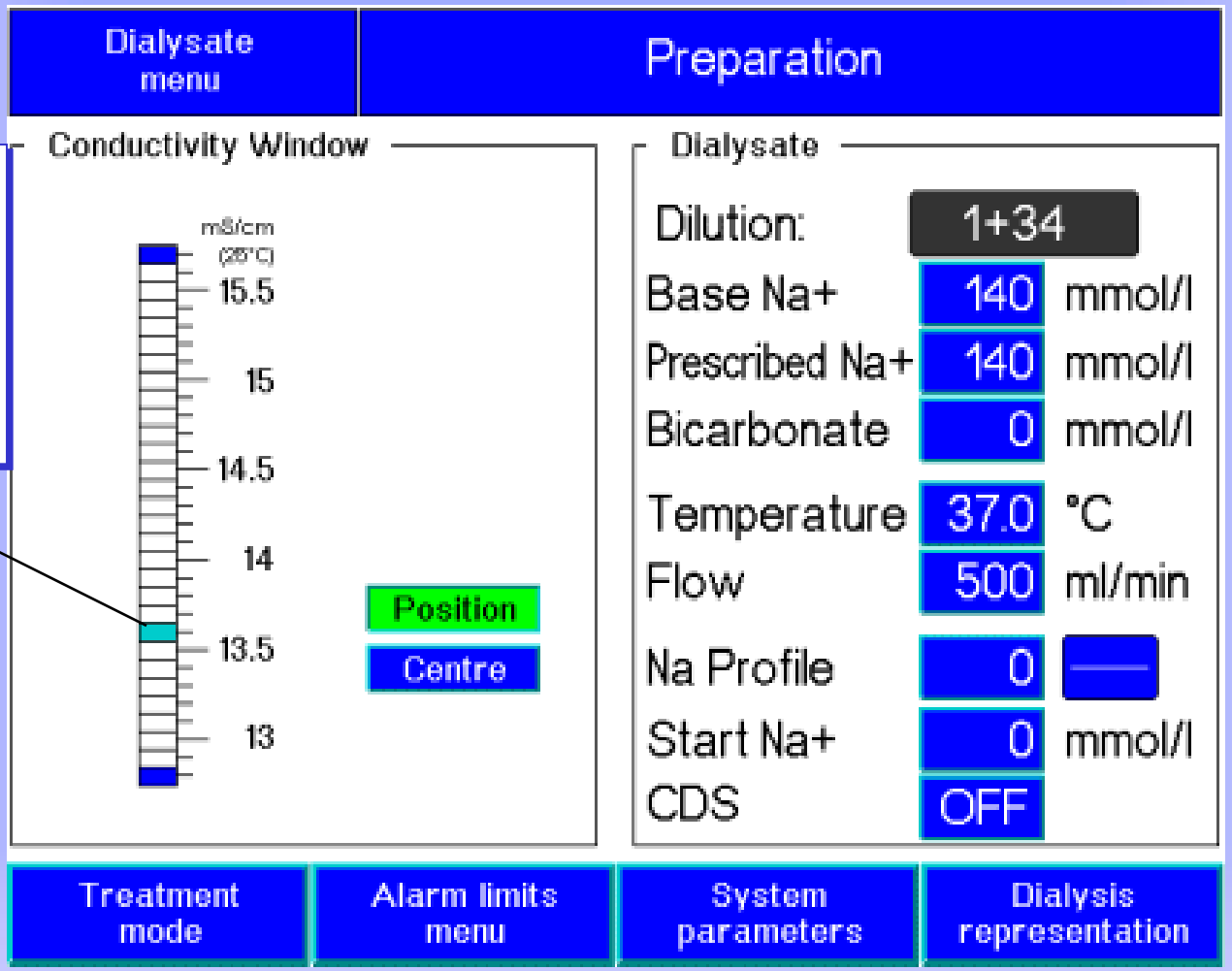
DIALYSATE CONCENTRATION

Fresenius Medical Care College

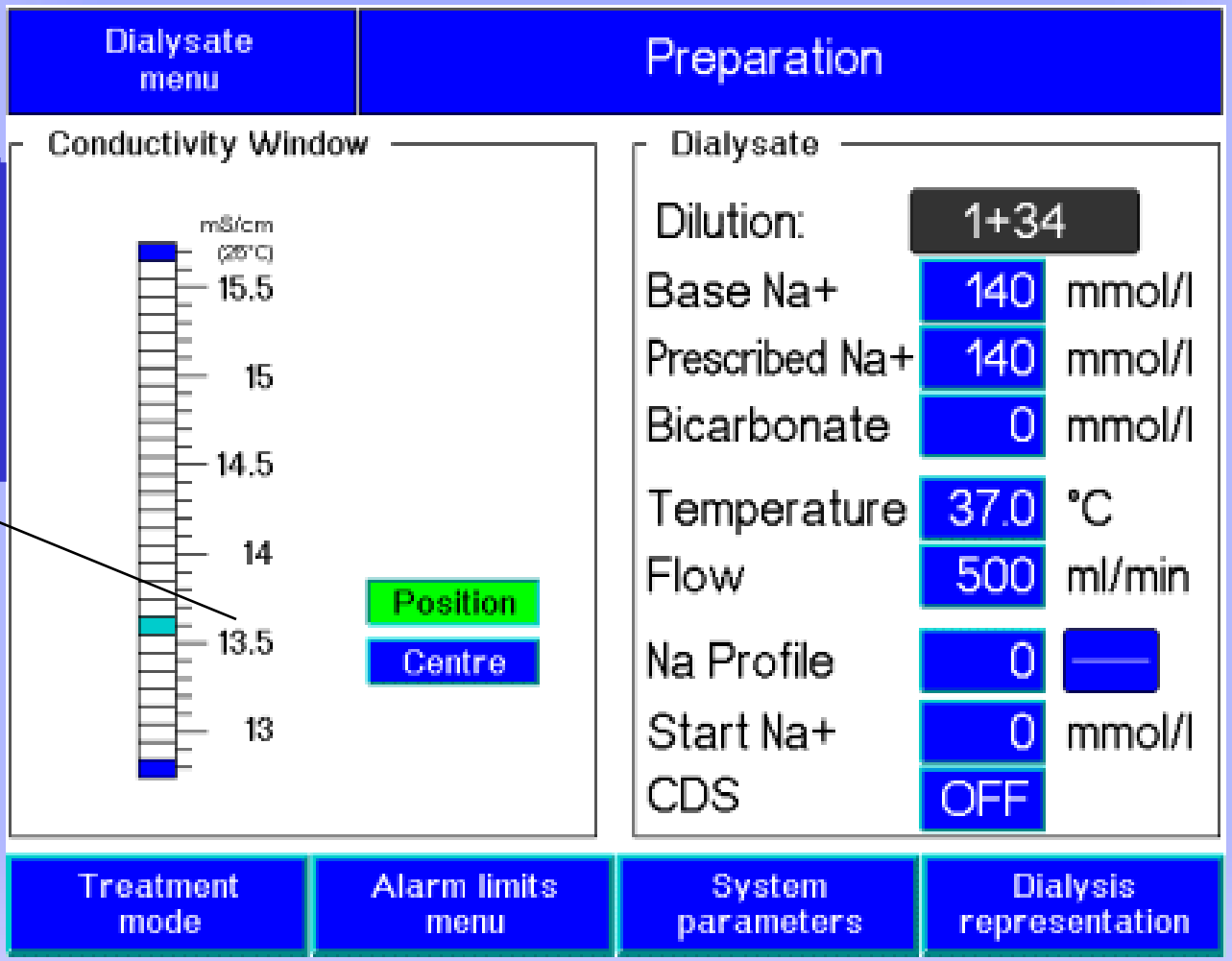
This conductivity level will change as a result of the data entered



Explanation of all these will be given

DIALYSATE CONCENTRATION

This conductivity level will change as a result of the data entered



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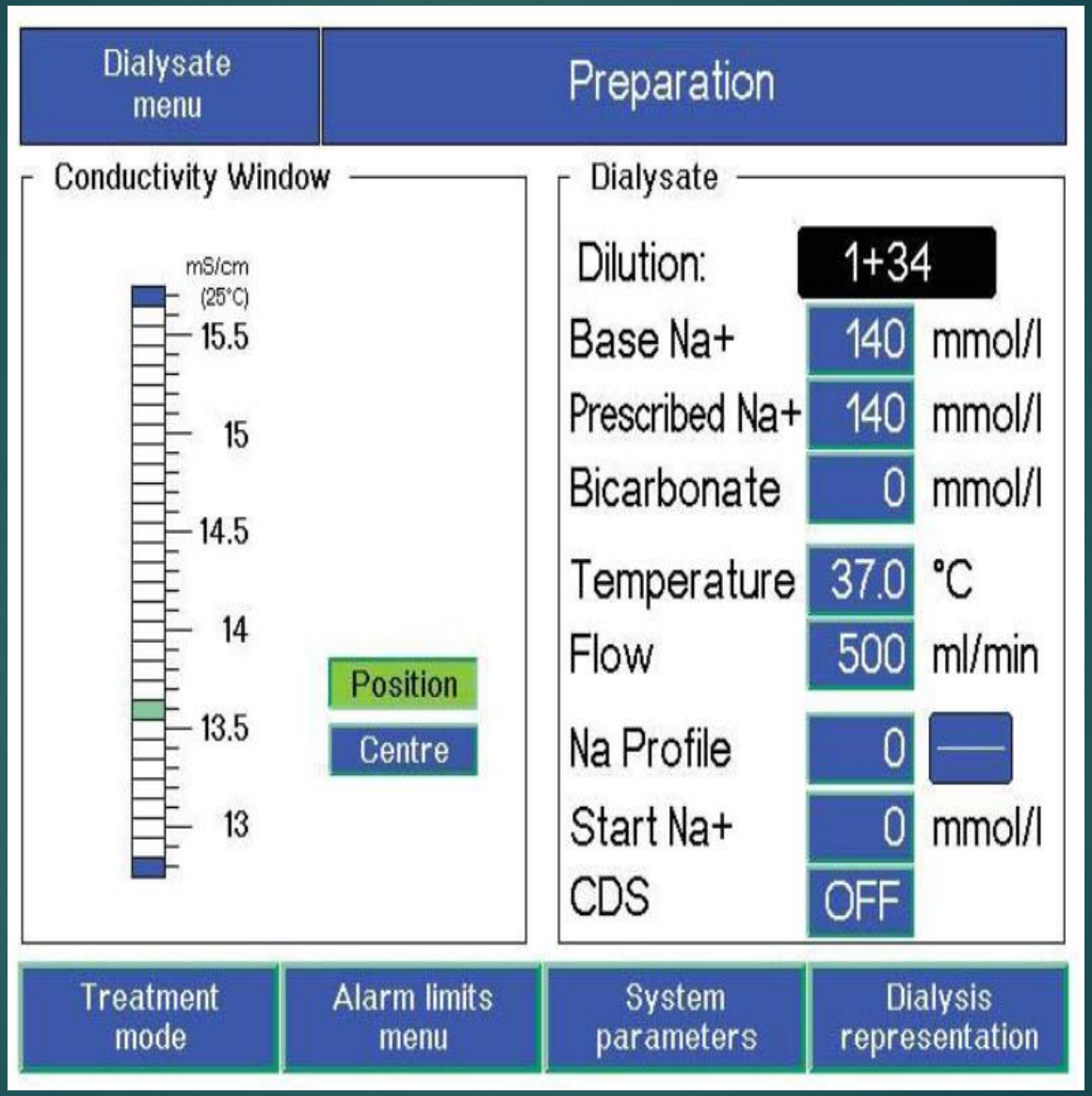
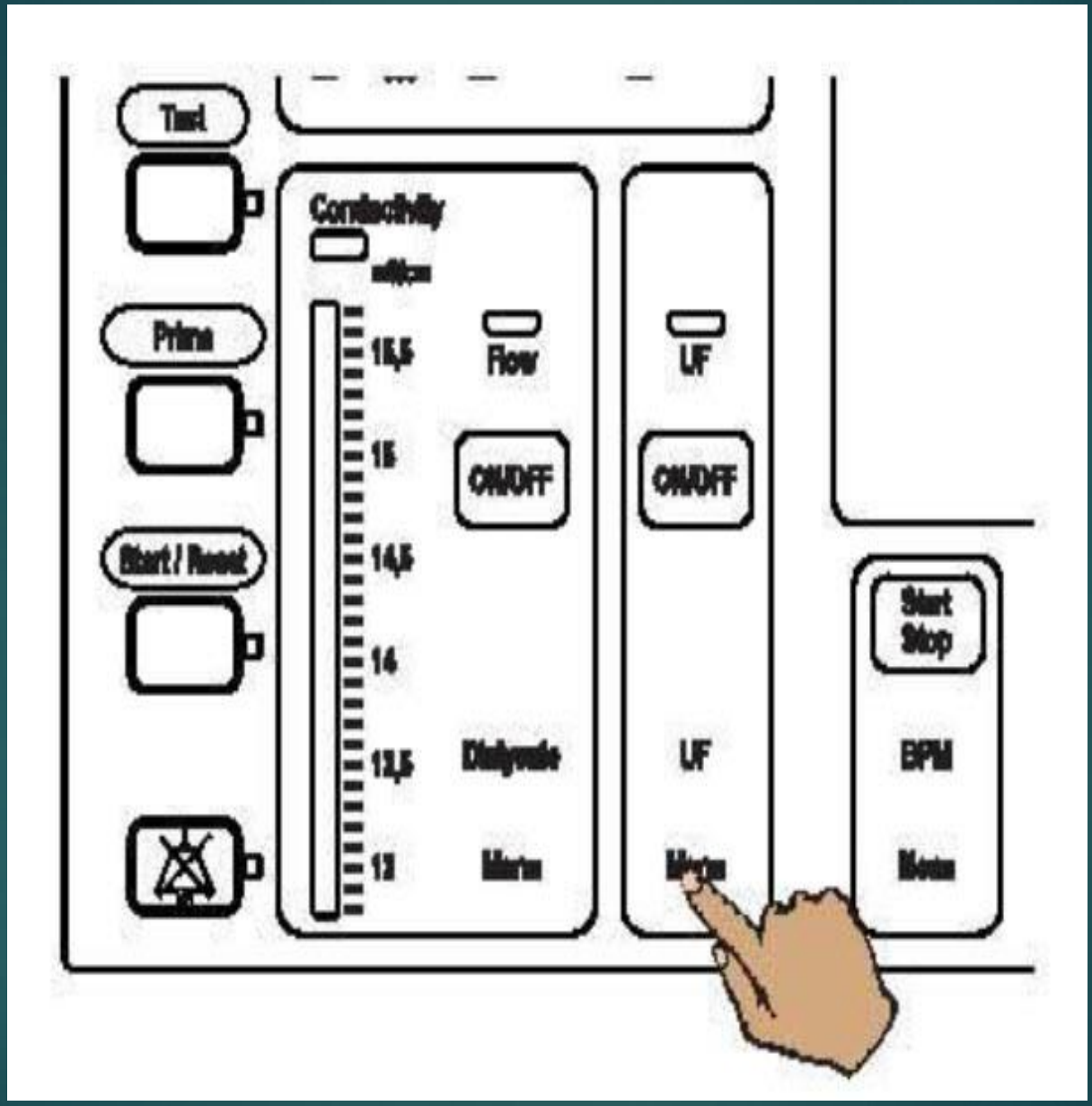
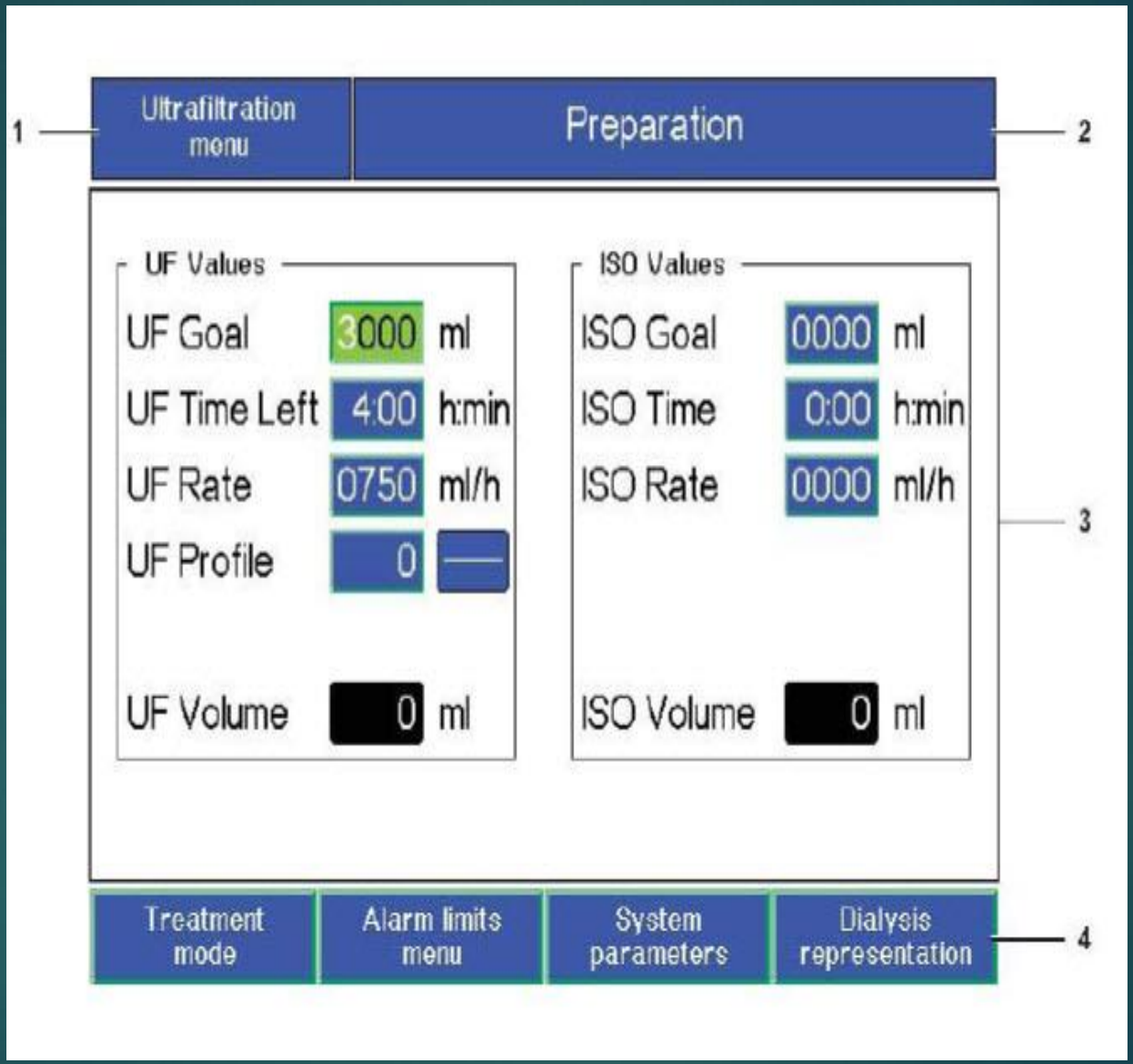


Fresenius Medical Care



Fresenius Medical Care

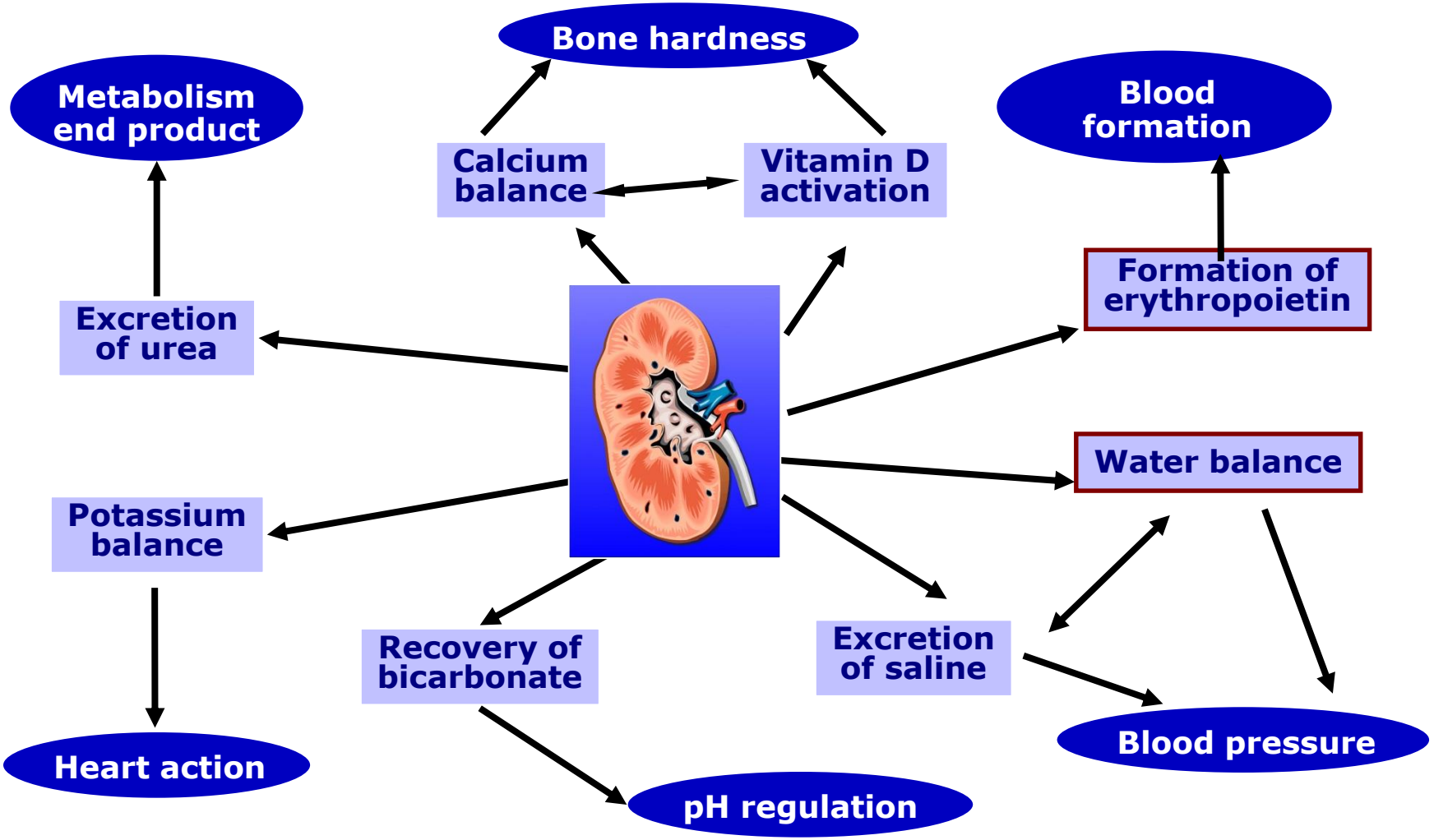


Fresenius Medical Care

Ultrafiltration and Sodium Profiles

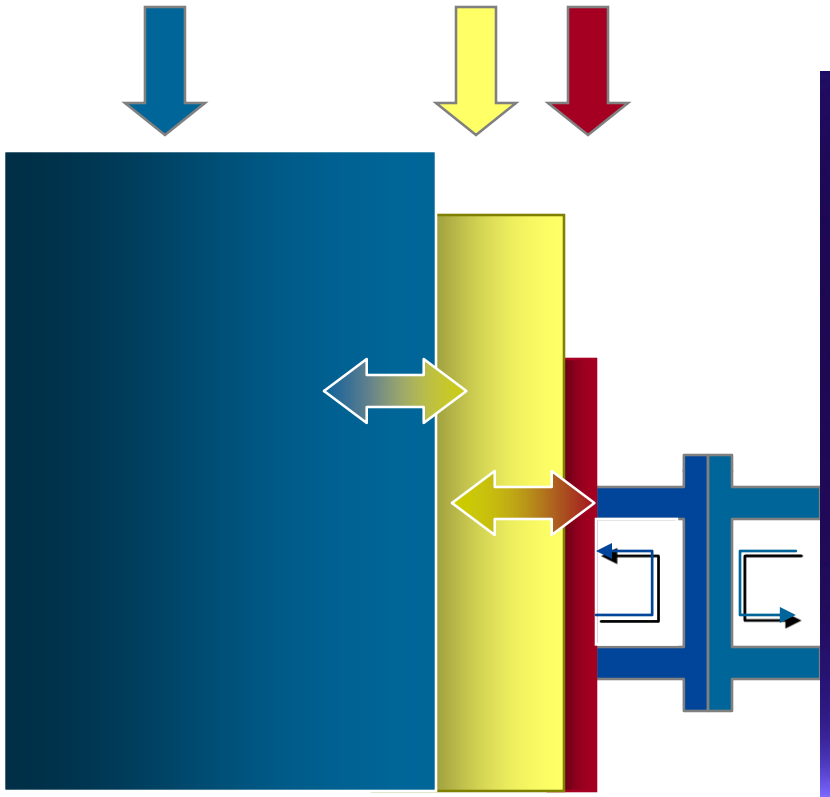
A module in the overall design of "physiological dialysis"

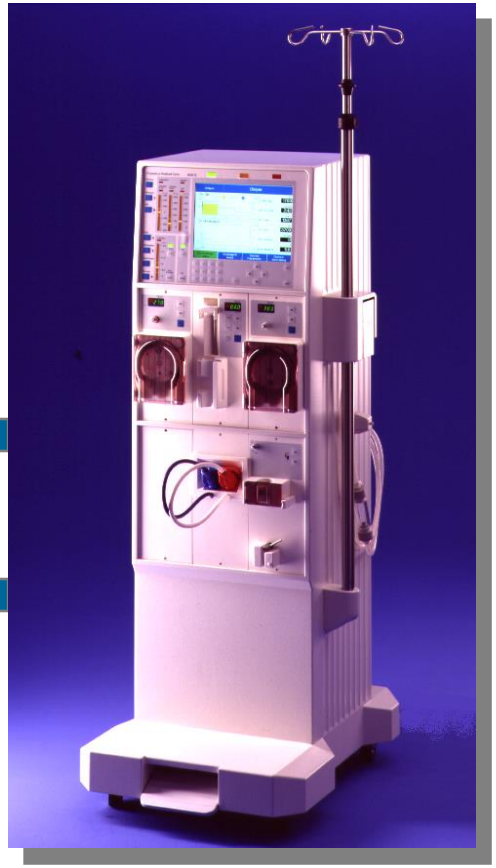
Kidney functions



FRESENIUS MEDICAL CARE

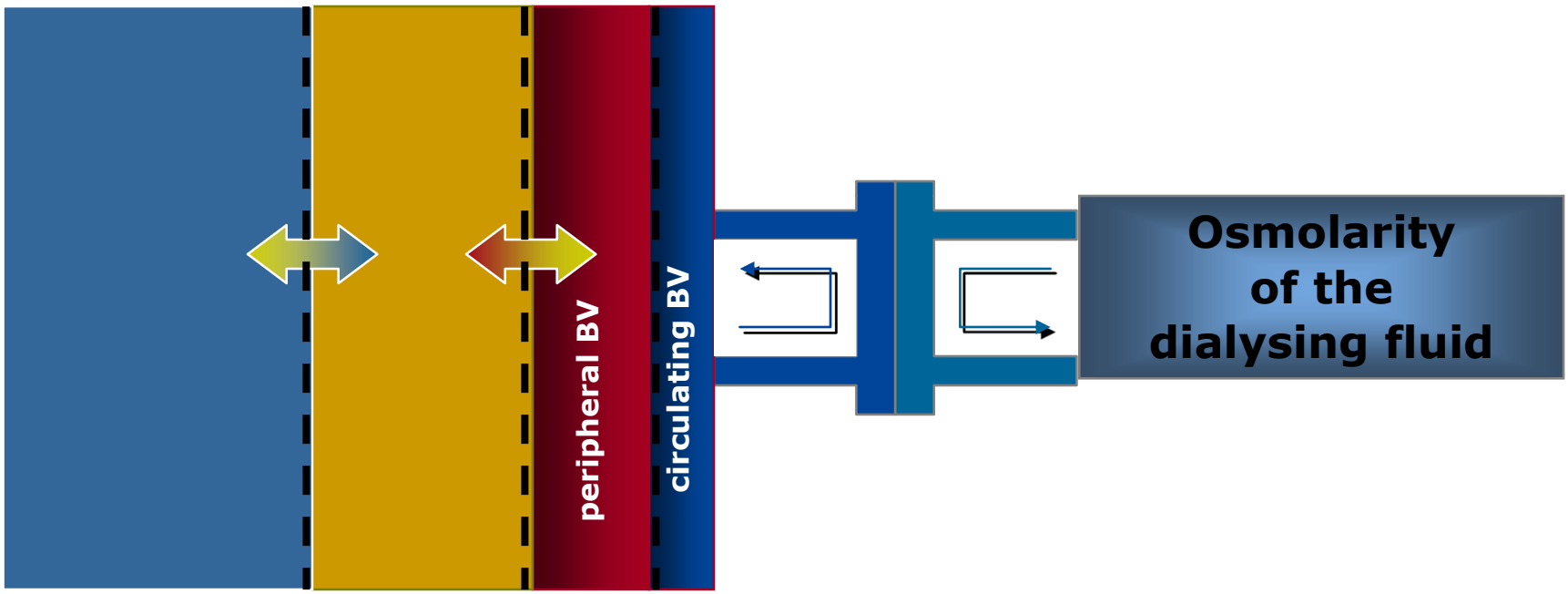
Water balance – ultrafiltration



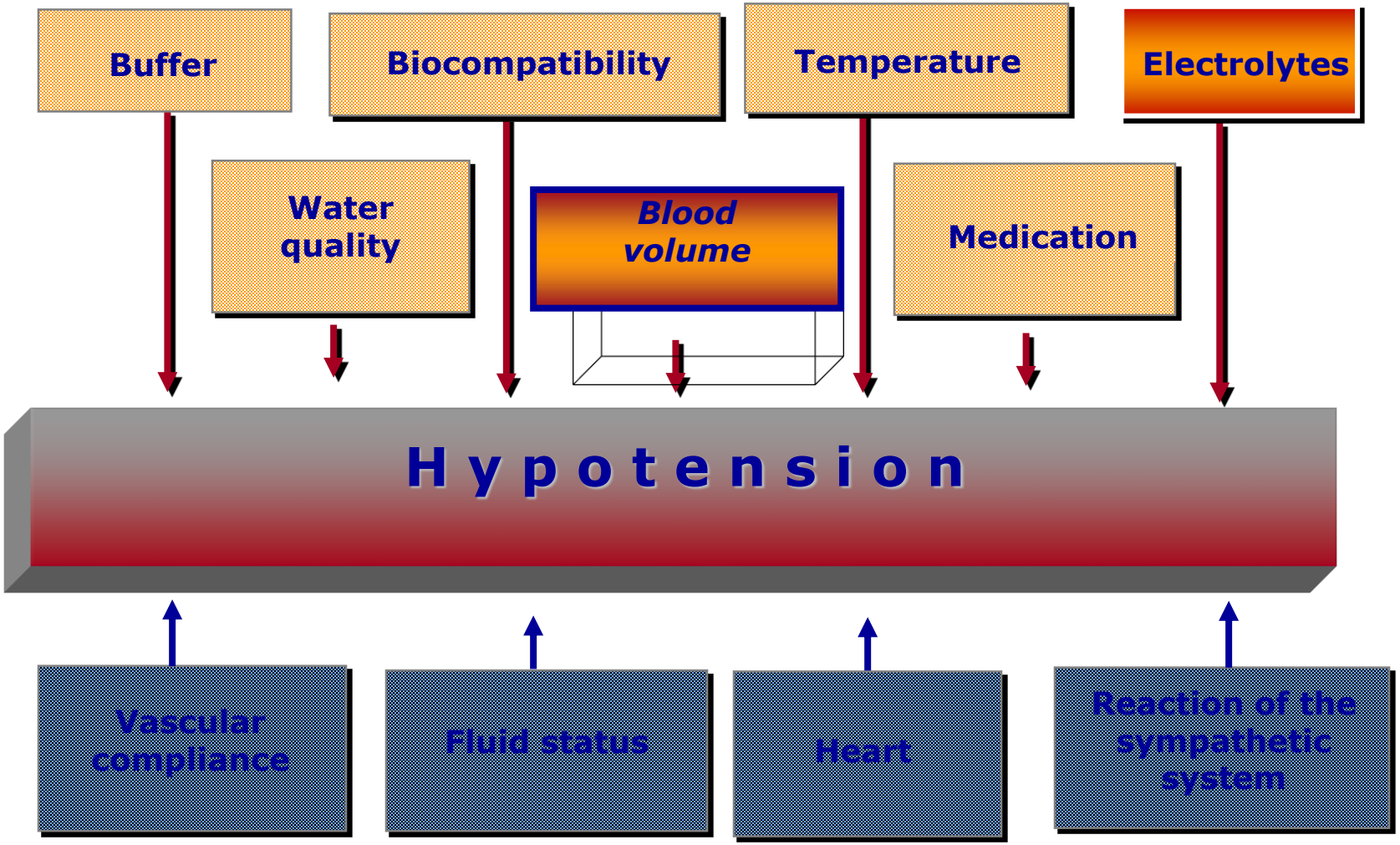


Intracellular water
Interstitial water
Plasma volume

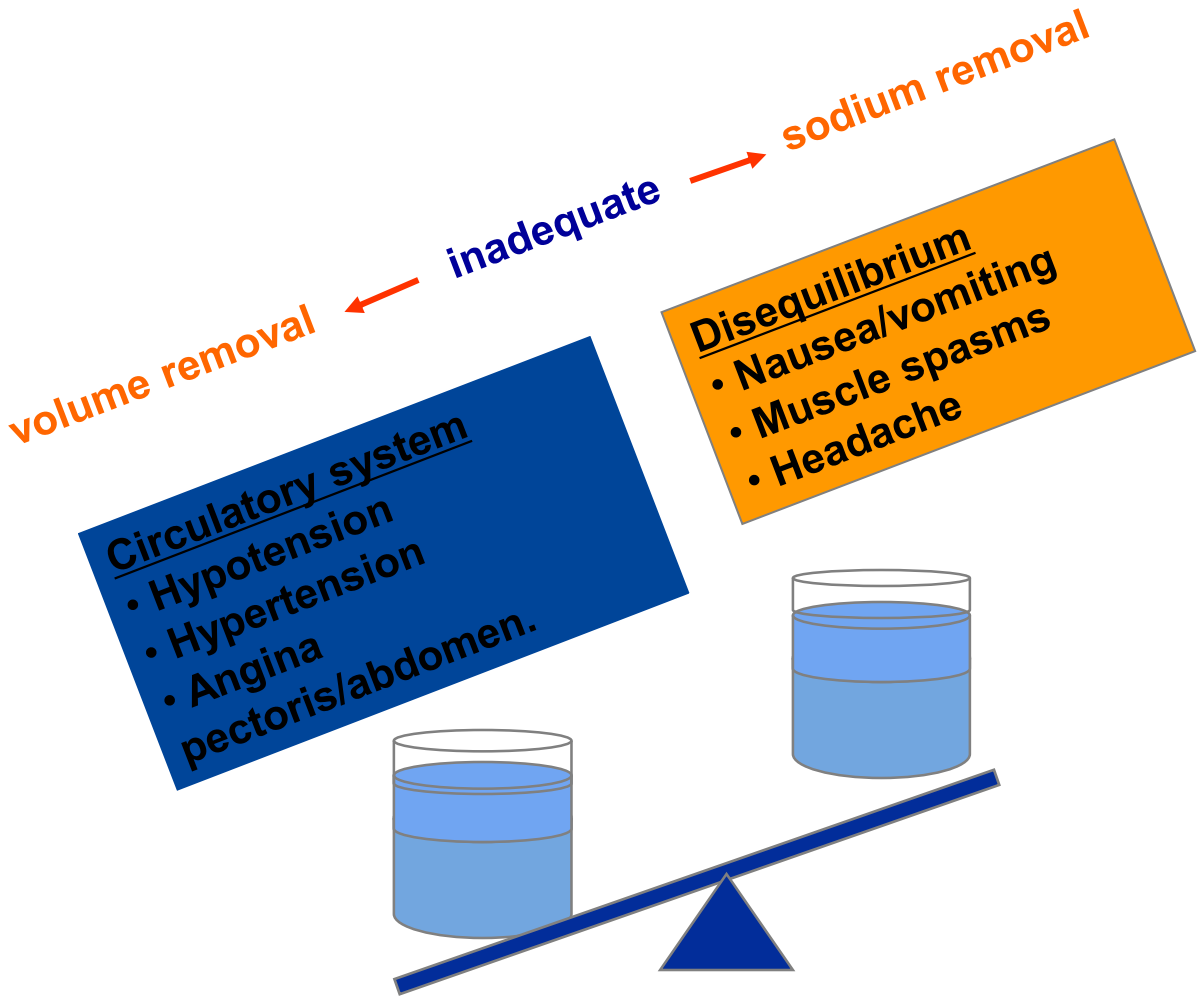
Electrolyte balance – diffusion



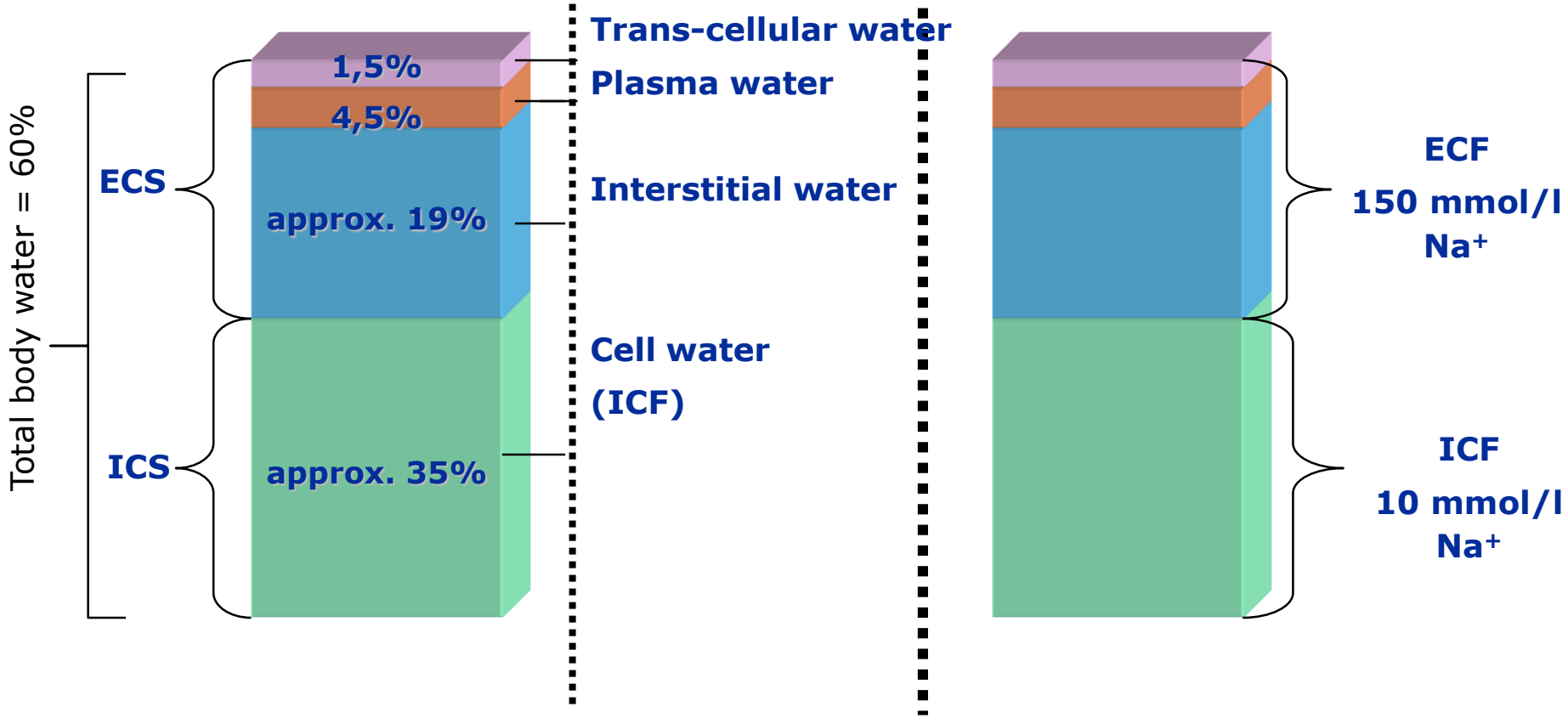
Causes of hypotension



Intradialytic complications

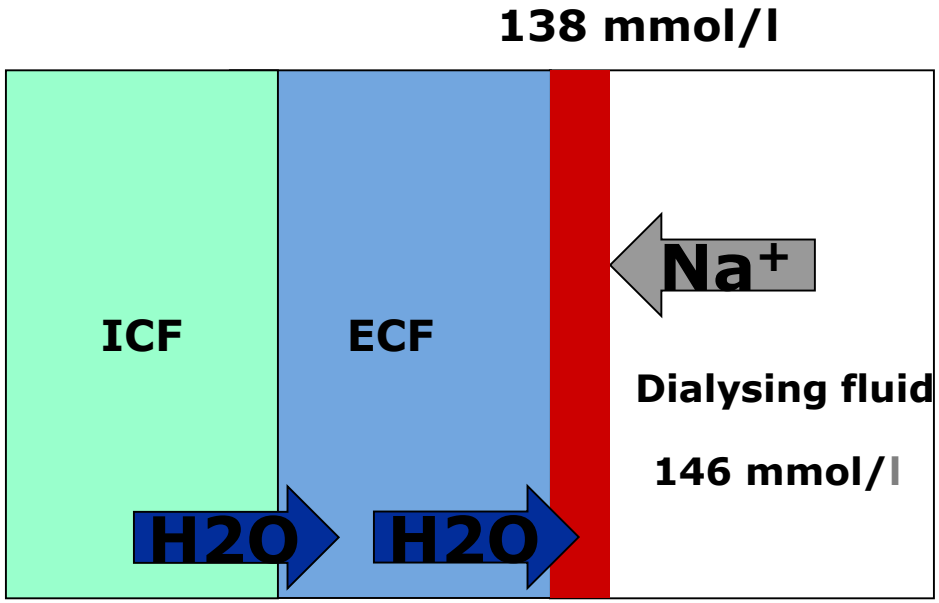


Distribution of water and sodium in the intra- and extracellular spaces



Fluid displacement through osmosis

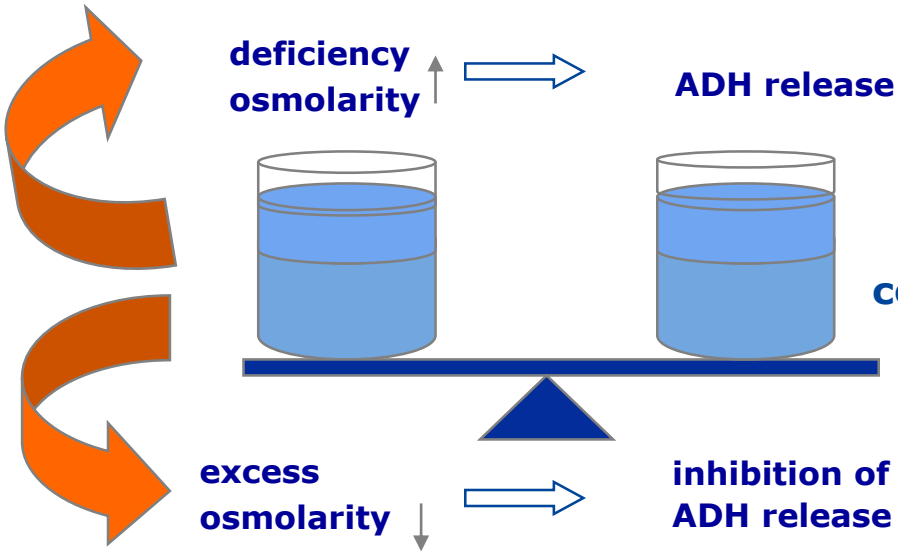
The increased plasma Na+ level causes the fluid to be displaced from the ICS to the ECS



Water balance

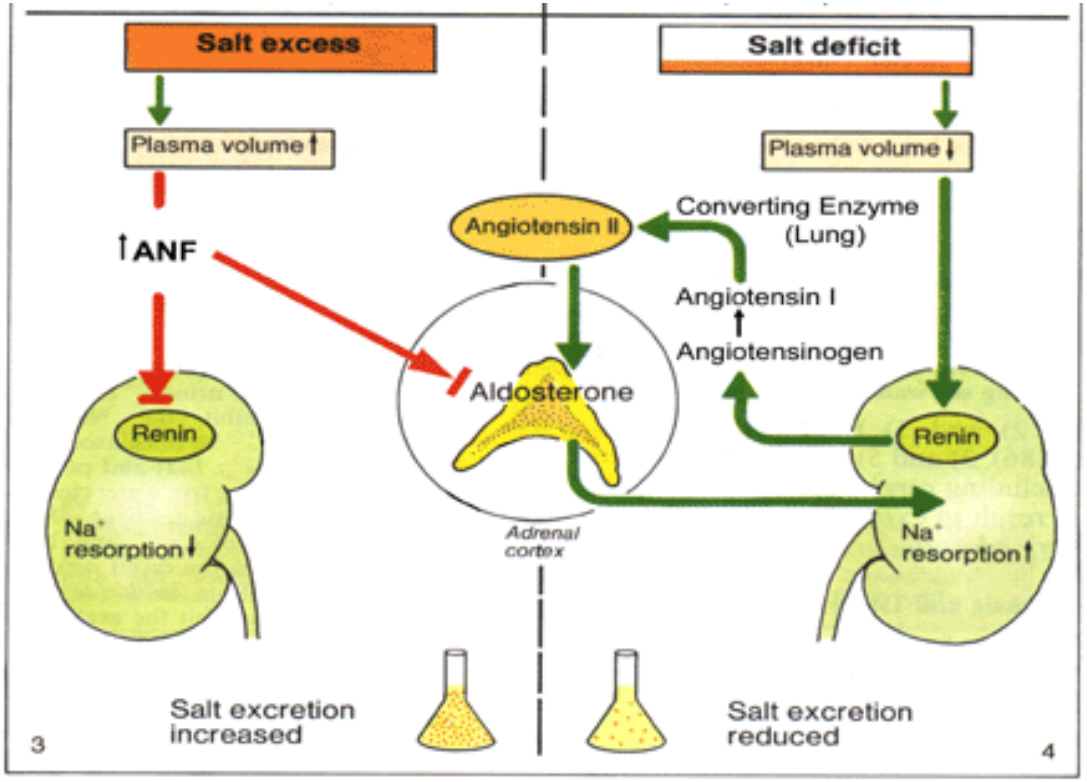
INPUT approx. 2.5 L/d
0.3 L oxidation water
0.9 L through nutrition
1.3 L through drinking

OUTPUT approx. 2.5 L/d
0.1 L through stools
0.9 L through breathing and skin
1.5 L as urine



Sodium balance

- Increased ADH release
- Expansion of heart atria
- Release of ANP
- Vasodilatation at the afferent vessel of the glomeruli
- GFR ↑
- Na+ re-absorption inhibitor
- Increased Na+ excretion



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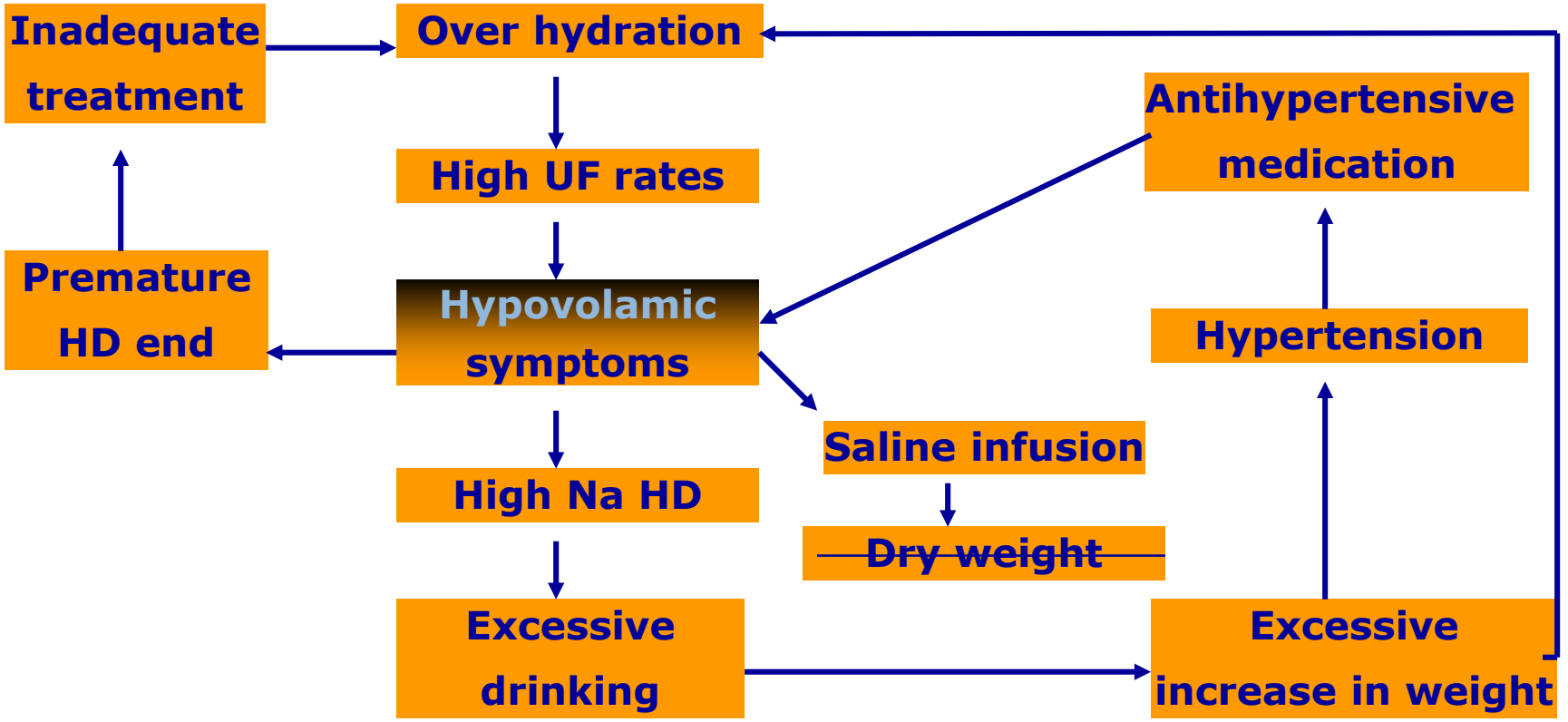
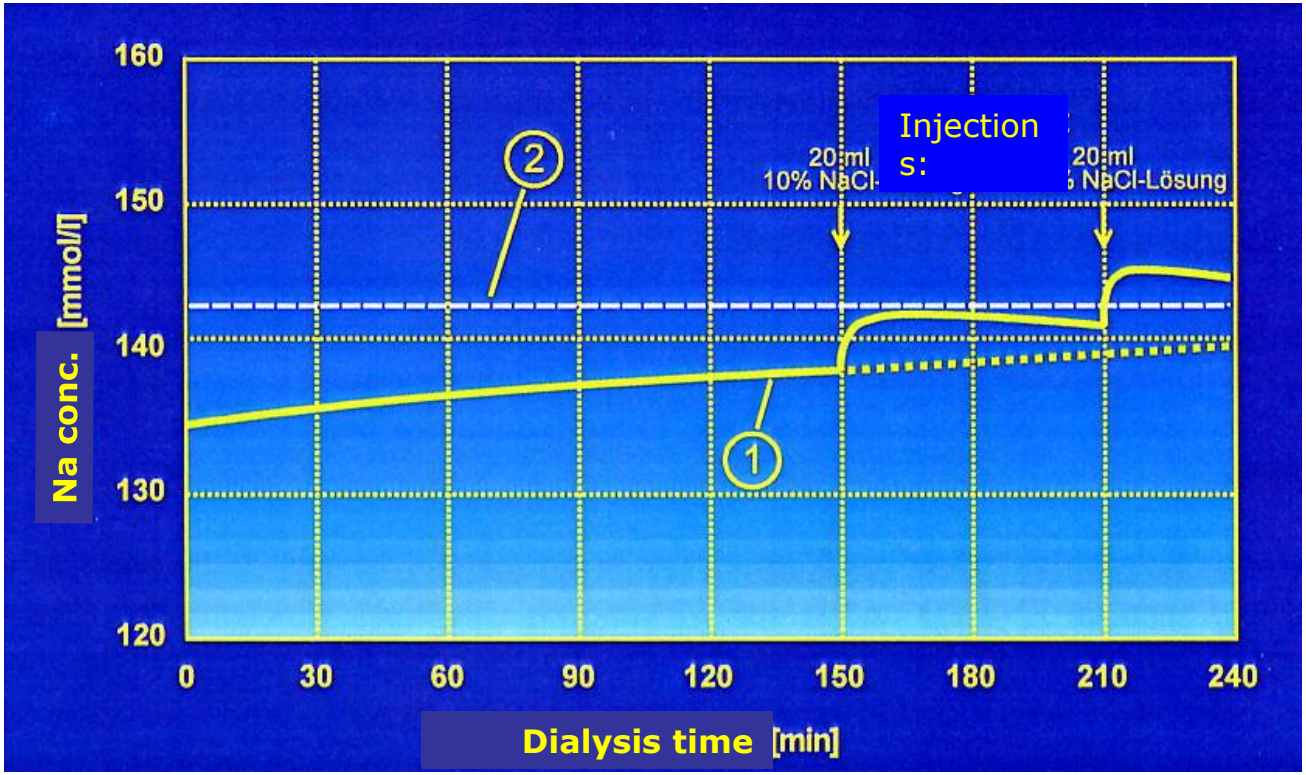
Consequences of high Na+ HD



Result of a saline injection



Patient's pre-dialytic serum concentration (135 mmol/l) (1)
Na concentration in the dialysing fluid (143 mmol/l) (2)

Treatment-induced fluid intake

Step 1: Determining the pre- and postdialytic plasma sodium levels

Step 2: Determining the patient's total body water

Step 3: Calculating the total body water volume (x) required to ensure that, in case of a postdialytic Na+ overload, the Na+ concentration in the total body water is again equal to the predialytic Na+ concentration.

Step 4: Calculating the volume of sodium-free water required for reaching the predialytic Na+ concentration in the total body water.

Calculation example

predialytic Na+: 135 mmol/l
postdialytic Na+: 145 mmol/l
total body water: 40.19 l

males: BW x 0.58
females: BW x 0.53

$$\frac{\text{total body water x postdialytic plasma sodium}}{\text{predialytic plasma sodium}}$$

$$X = \frac{40.19 \times 145}{135} = 43.17 \text{ Litres}$$

43.17 – 40.19 = 2.98 Litres

treatment-induced water intake

Possible solution: profiles

Clinical experience:

An increased plasma sodium level causes the fluid to be displaced from the ICS to the ECS

At the beginning of the treatment, the patients tolerate higher UF rates

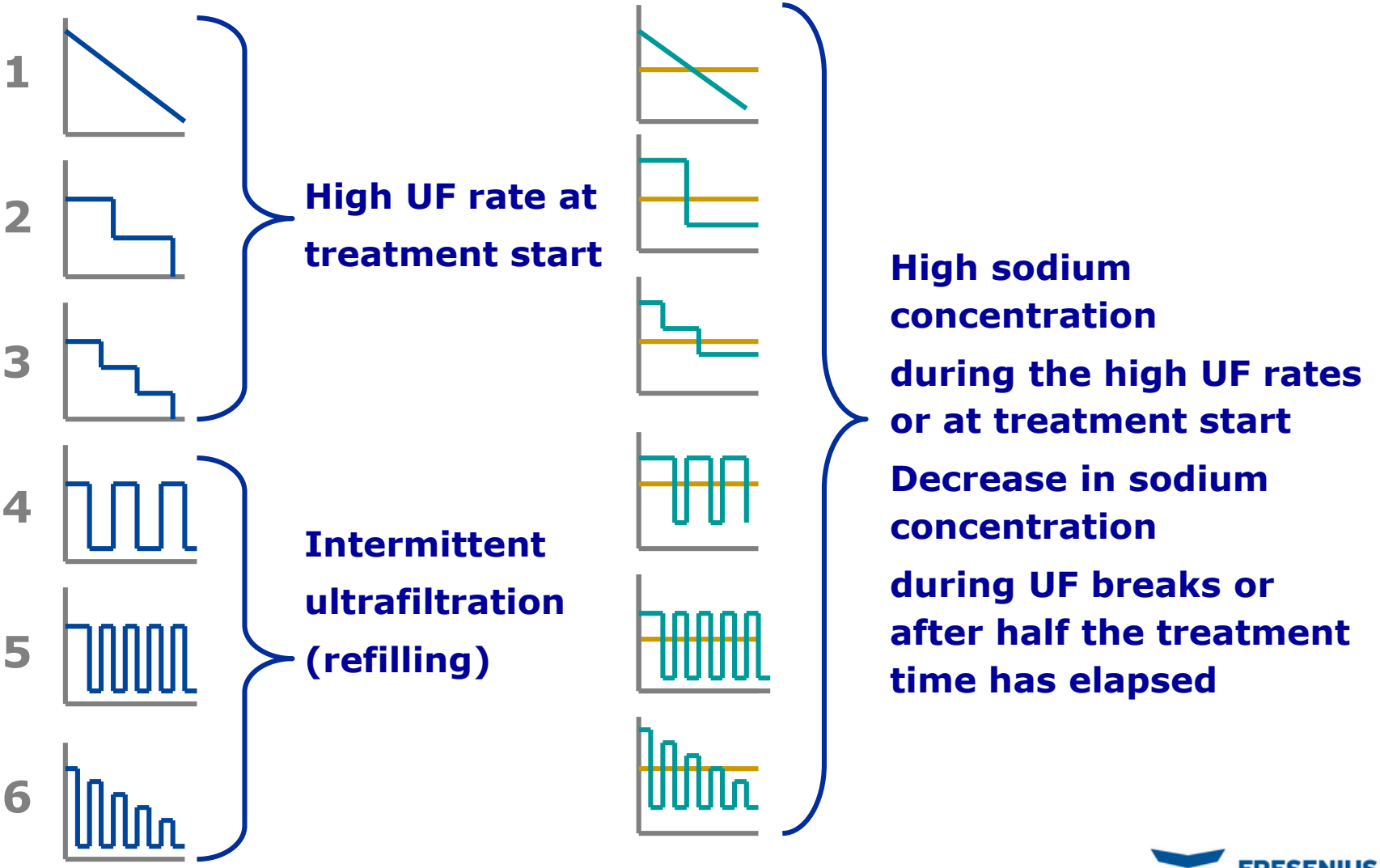
Requirements:

The increase in sodium must not lead to a postdialytic sodium overload.

The intradialytic sodium balance must be designed such that the positive (osmotic) effect of sodium is maintained and the drawbacks (postdialytic Na+ overload) are minimized.

High UF rates at treatment start

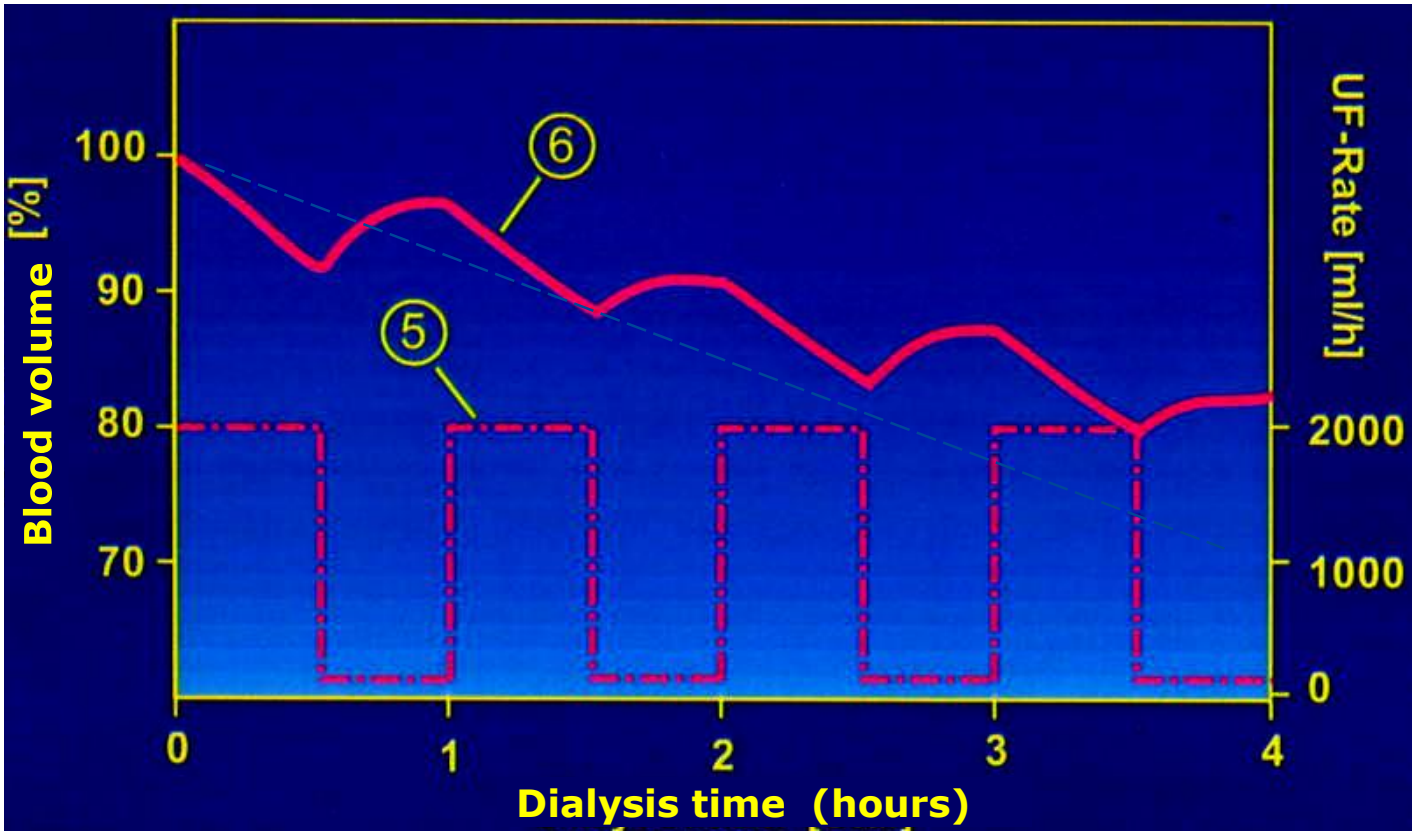
Neutral Na+ and UF profiles with regard to balance



Volume effect of UF profiles

- UF profiles produce a fluid current into the vascular space which is not driven by an osmotic gradient (refilling).
- The increase in volume that can be achieved through refilling usually exceeds that achieved through sodium.

Refilling effect – intermittent UF profiles

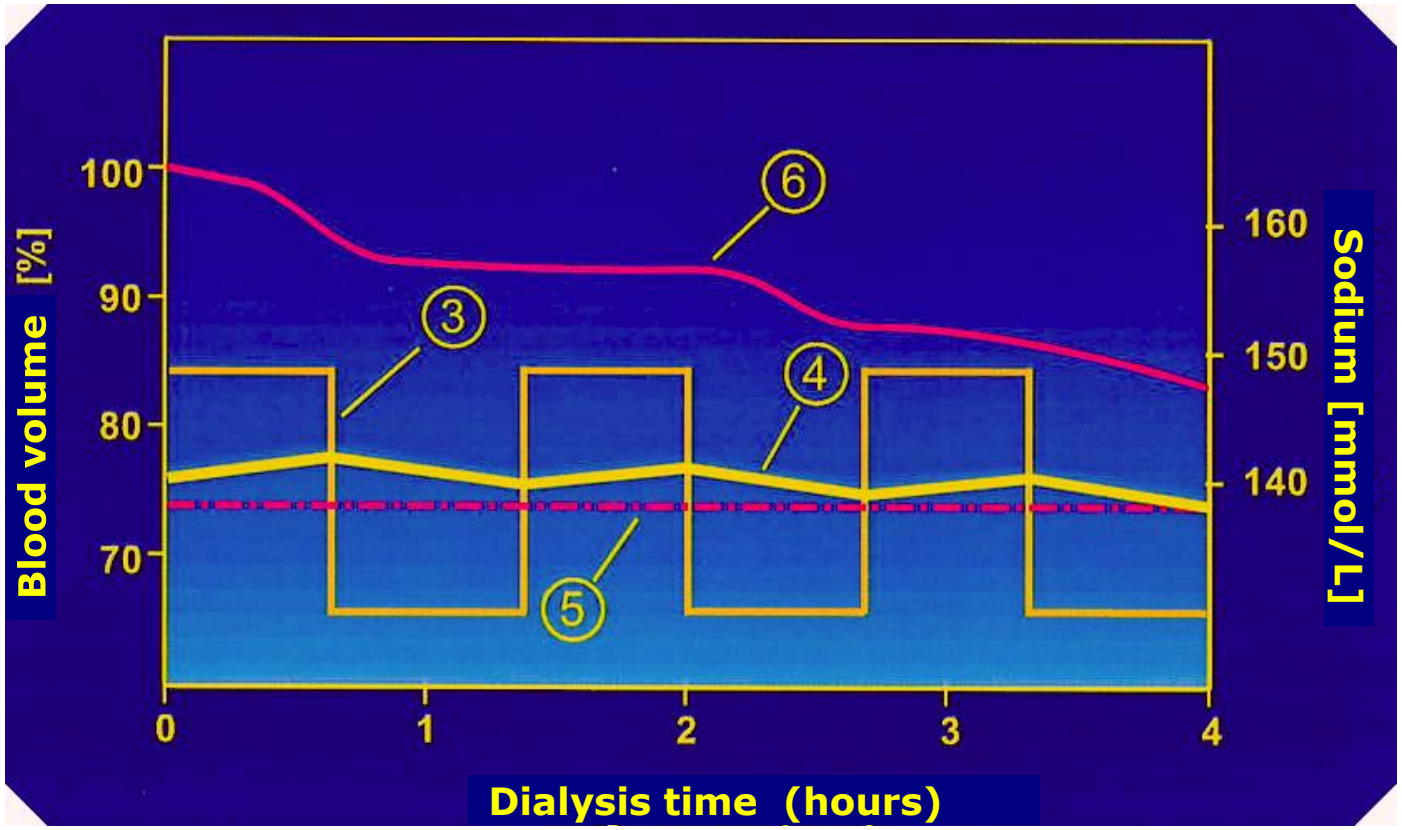


UF profile 5 (5)
Change in blood volume (6)

Volume effects of Na+ profiles

- An increase in sodium in the ECV by 1 mmol/L increases the ECV by 1.3% (ECV 10 L >>> 130 ml).
- Considering the ratio of the interstitial volume to the intravascular volume in the ECV, the blood volume in the intravascular space is increased by 30 ml.
- Mean fluid removal / dialysis = 3000 ml
  As a result, ultrafiltration causes a blood volume reduction of 600 to 1000 ml.
- If the Na^+ concentration changes by 5 mmol/l, the loss in blood volume through ultrafiltration is opposed by a gain in volume of 150 to 200 ml.

Osmotic effect of Na profiles

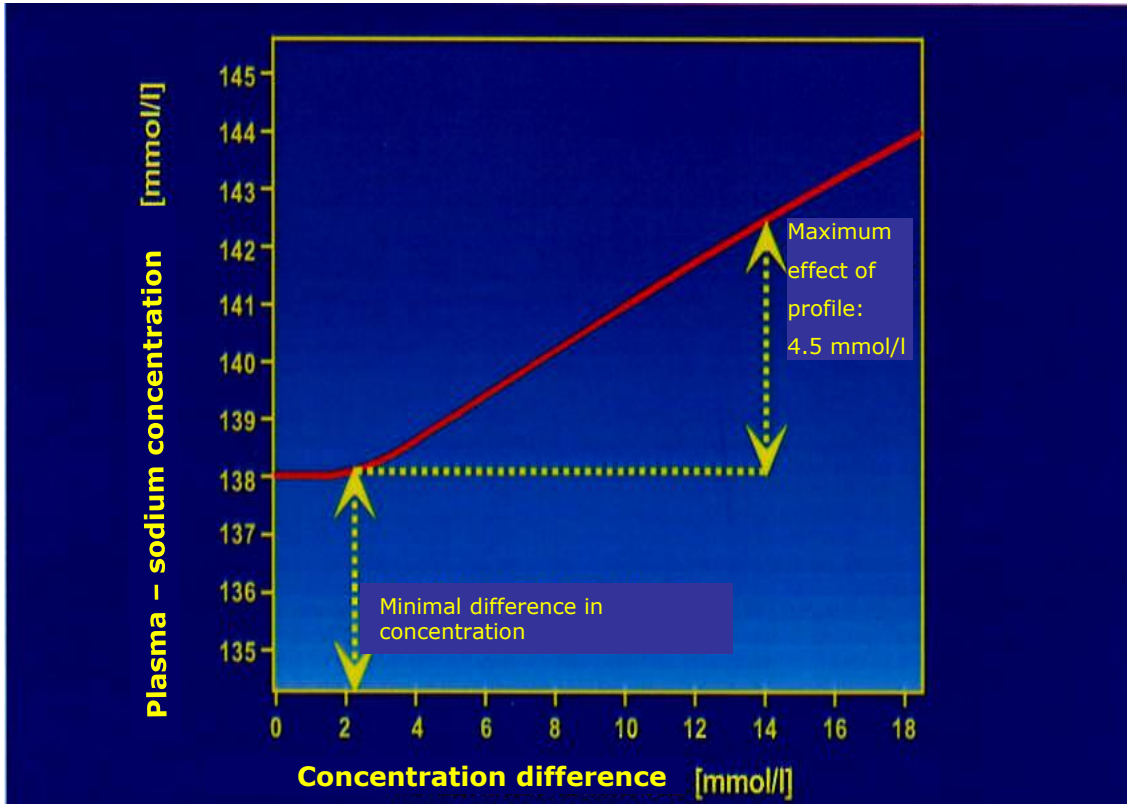


Na profile 4 (3)
Blood volume (6)
Basic concentration of the dialysing fluid (5) 138 mmol/L
Change in plasma sodium concentration (4)

Maximum initial sodium – reasons

Maximum increase

in sodium concentration with maximum initial sodium (151 mmol/L)



Select the maximum initial sodium because the gain in volume is very low as compared with the reduction in blood volume through ultrafiltration

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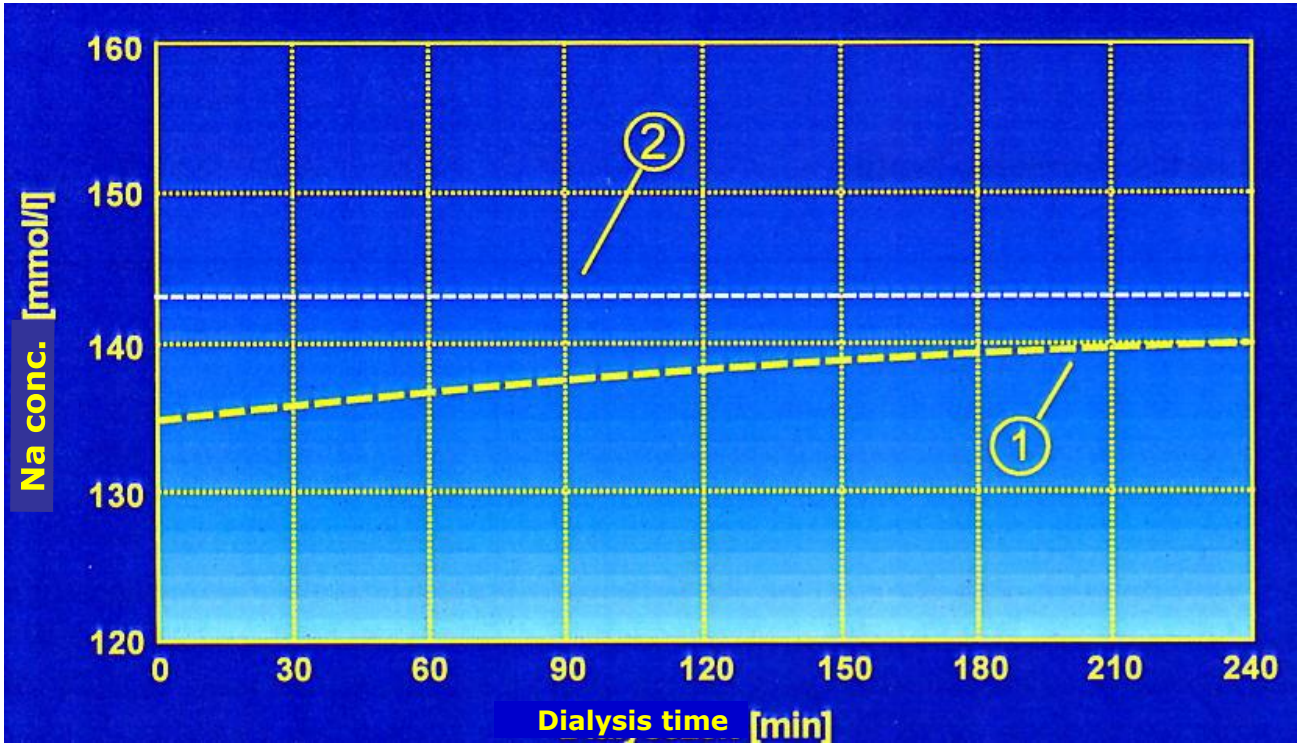
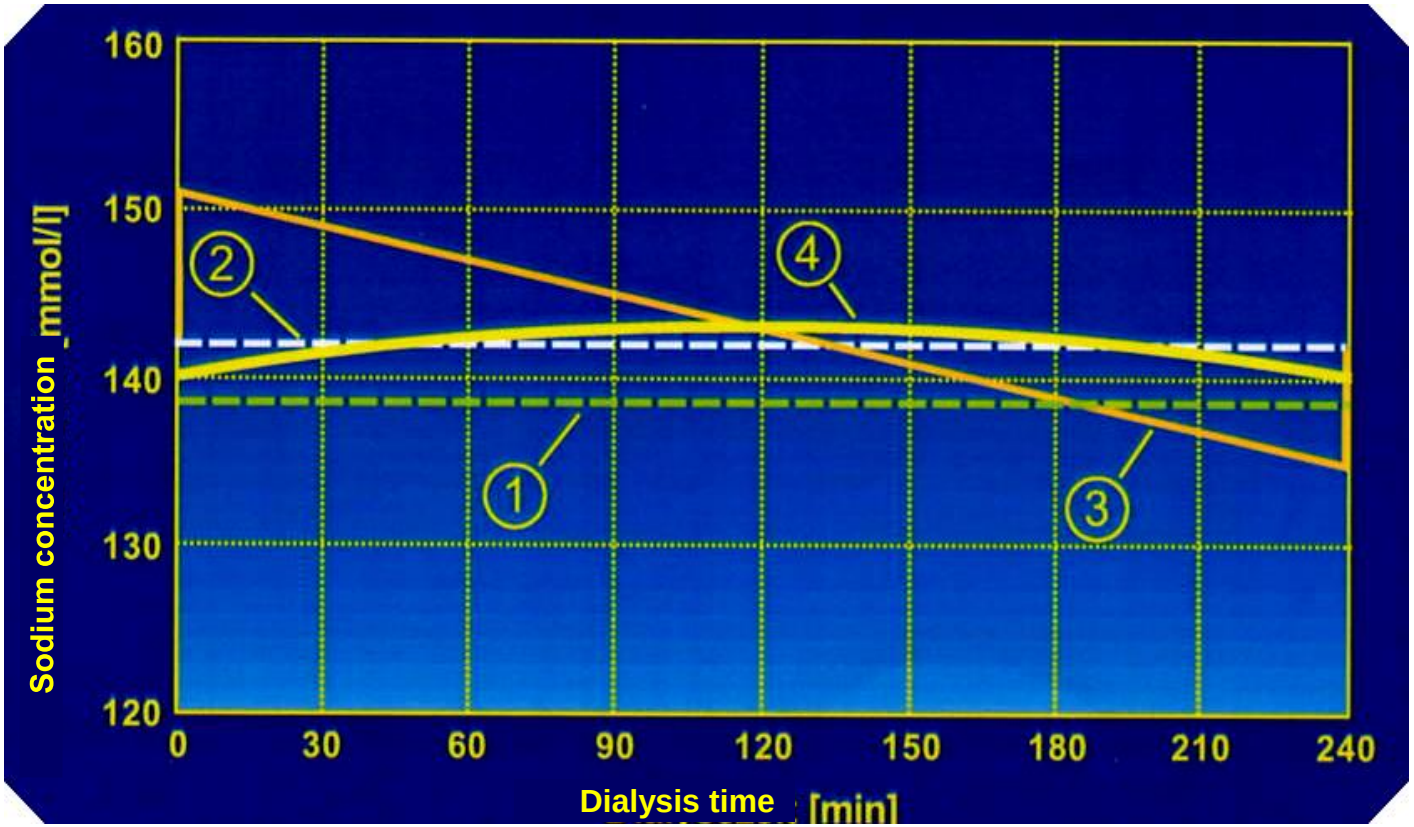
Changing the intradialytic plasma sodium concentration

Gibbs-Donnan effect



Result of the Na concentration gradient between a predialytic serum sodium concentration [1] of 136 mmol/L and a sodium concentration in the dialysing fluid [2] of 143 mmol/L

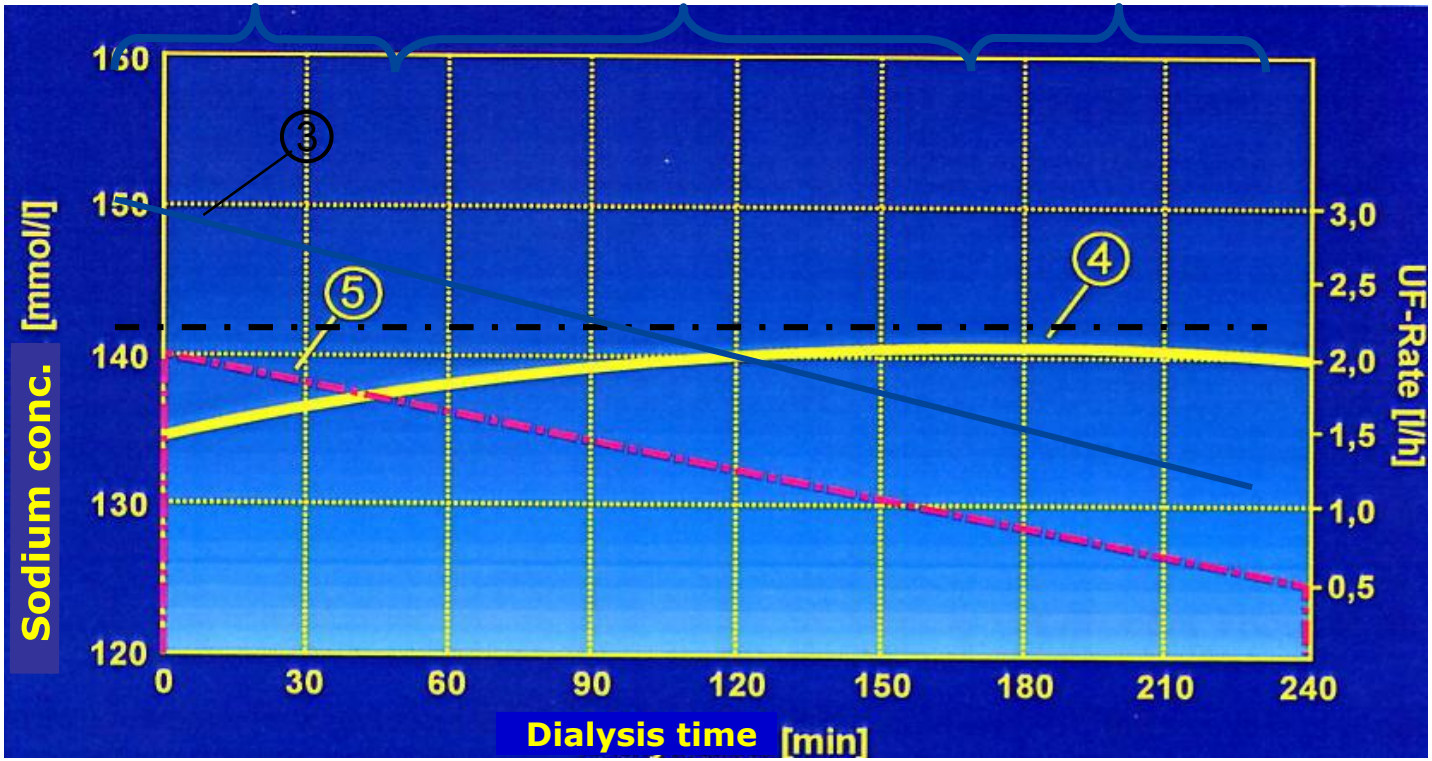
Changing the plasma sodium concentration



Sodium concentration in the dialysing fluid (2) 142 mmol/L
Change in serum sodium concentration without profile (1) 139 mmol/L
Na profile type 1 (3) Initial Na+ 151 mmol/L
Change in serum sodium concentration with Na+ profile (4)

UF profile 1 / Na+ profile 1

Plasma water excess High Na^+ saturation Na^+ at desired level



UF profile type 1 (3)
Na profile type 1 (151 mmol/L initial sodium) (5)
Change in plasma Na^+ with Na^+ profile 1 (4)
Desired Na^+ concentration in the dialysing fluid (142 mmol/L)

Basic requirements for working with UF and sodium profiles

- Minimum UF time: 2 hours
- Minimum UF rate: 100 ml/h
- Clarify the type of dialysis complication Disequilibrium symptoms (profiles 1 and 2) or hypotensive symptoms (profiles 5 and 6)
- First determine the patient's usual predialytic plasma sodium range.
- Check the basic and desired sodium values, taking the Donnan effect into account.
- Always start with the highest possible initial sodium.
  (Balancing neutrality is ensured at a Kt/V of 1.2!)
- If possible, do not stop the Na profile while the treatment is in progress because, otherwise, balancing neutrality would not be ensured any longer!
- When starting the profile, set the CD limits centrally about the actual value!

Procedural instructions

- The UFC of the dialyzer must correspond to the UF rate.
- If UF profiles are used in SN dialysis mode, high UF rates result in a increase in haemoconcentration. Select high values for the mean blood flow!
- If, up to now, you supported high Na+ therapy and no longer wish to do so, please proceed moderately and gradually.

Note regarding the dialyzer

The UFC of the dialyzer must correspond to the UF rate.
Example:

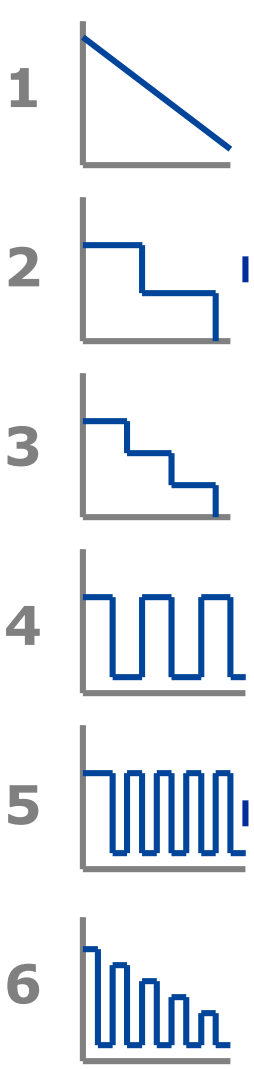
- **Mean UF rate: 1000 ml/h**
- **Initial UF rate: 2000 ml/h (profiles 4, 5, 6)**

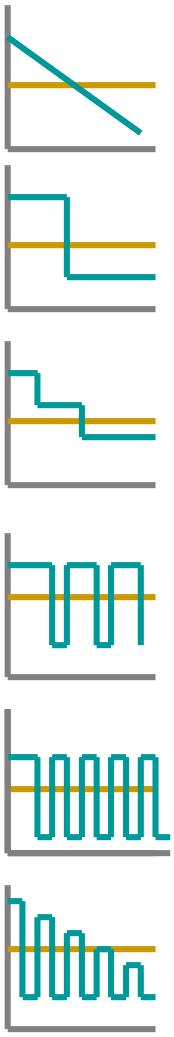
- **The following is applicable: UF factor x mean TMP = weight loss / h**
- **This means: UF factor = 2000 ml/h / 200 mmHg**
- **UF factor = 10 ml/h x mmHg**

Summary

Profiles do not constitute any miracle method but are a reasonable supplement to your therapy options!

Neutral Na+ and UF profiles with regard to balance





High UF rate at treatment start

Intermittent ultrafiltration (refilling)

High sodium concentration during the high UF rates or at treatment start

Decrease in sodium concentration during UF breaks or after half the treatment time has elapsed

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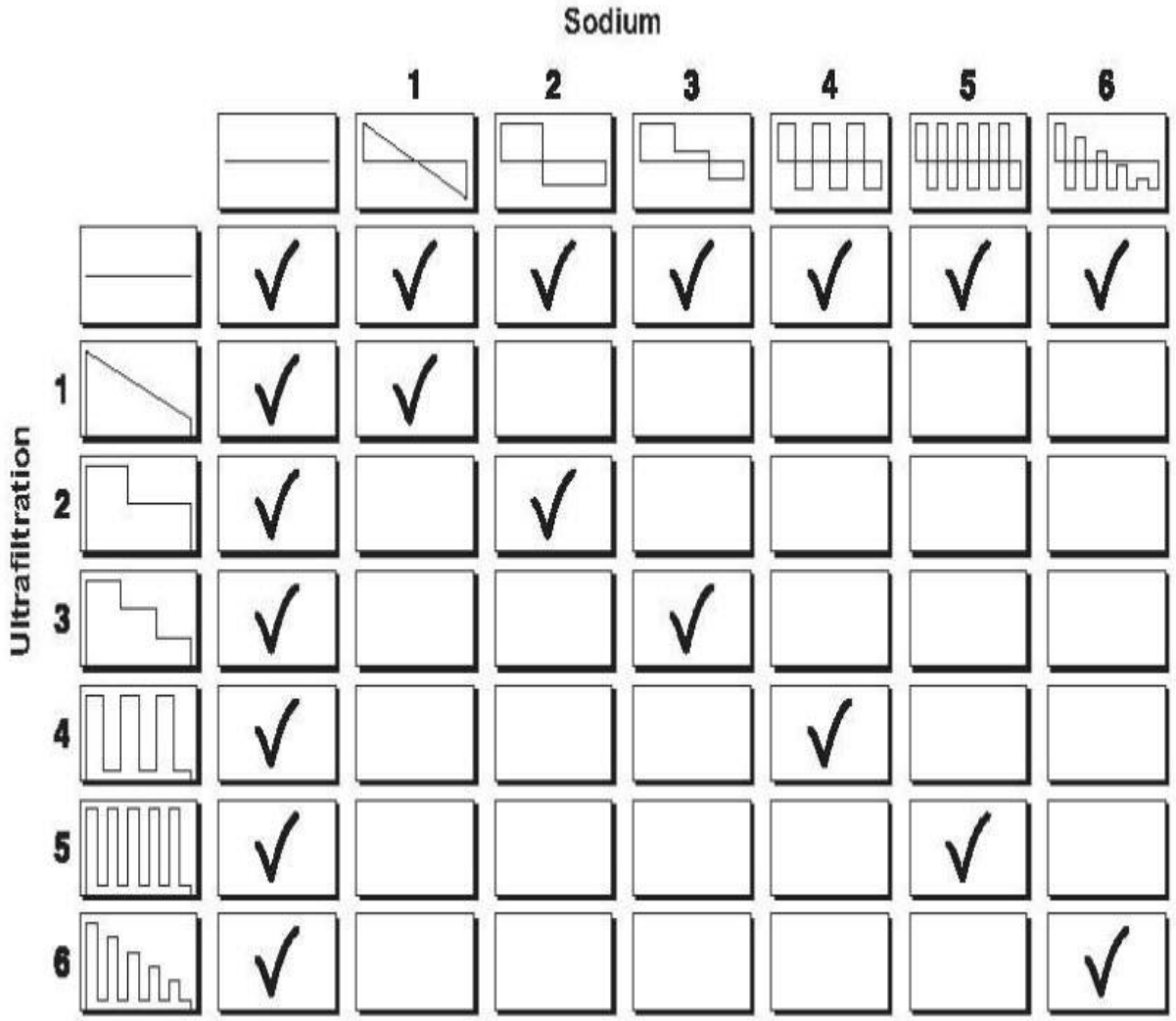

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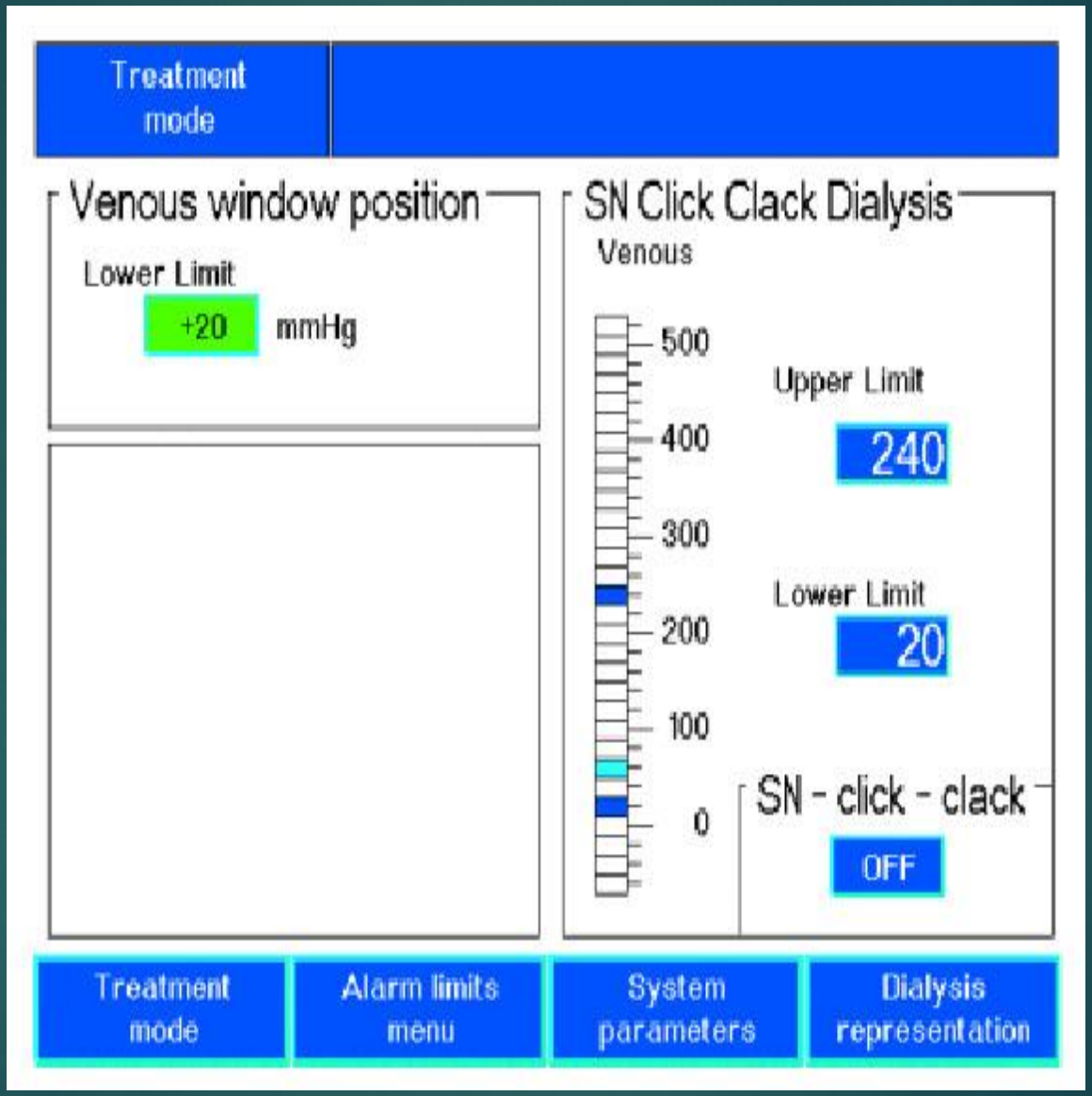
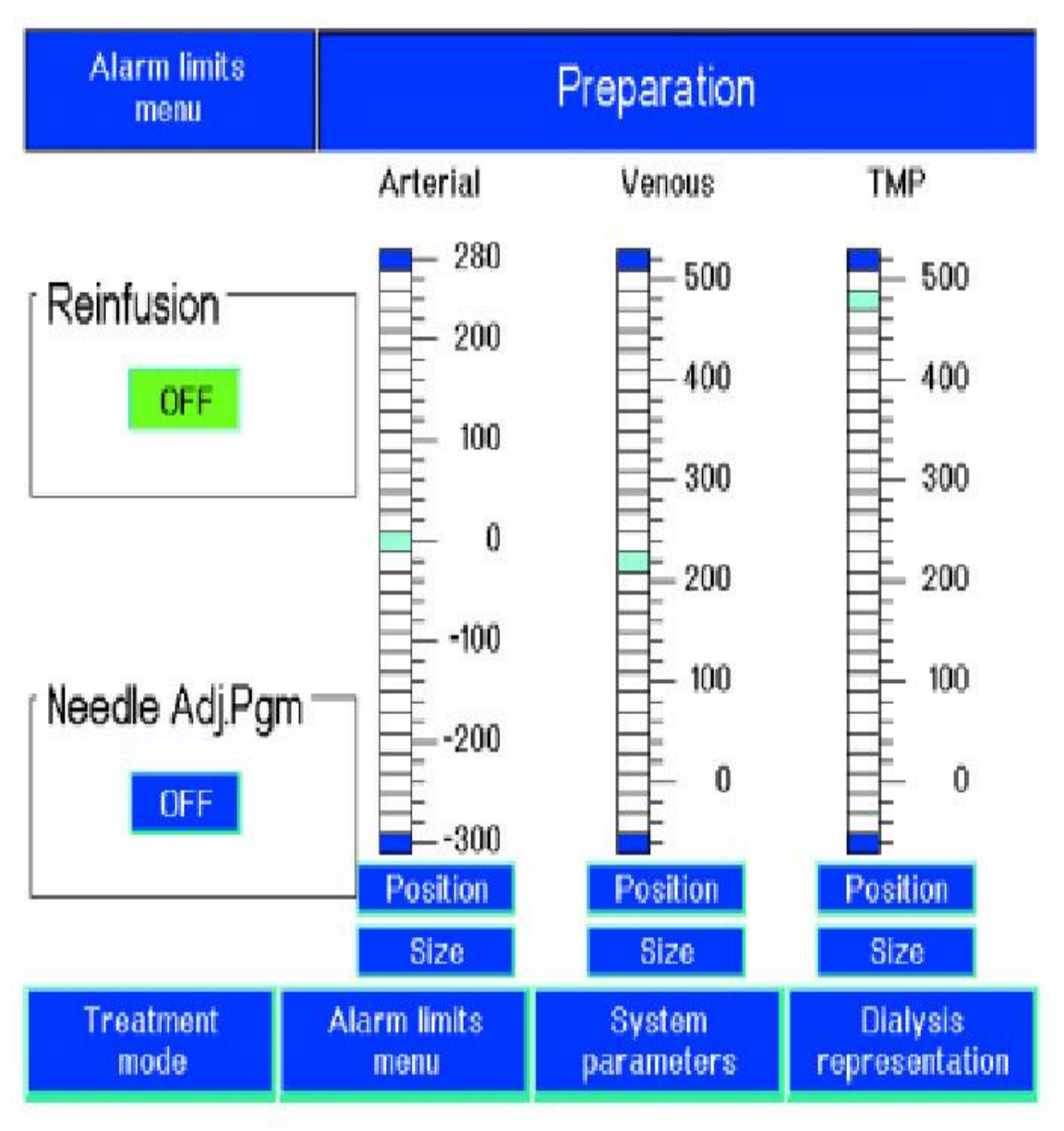
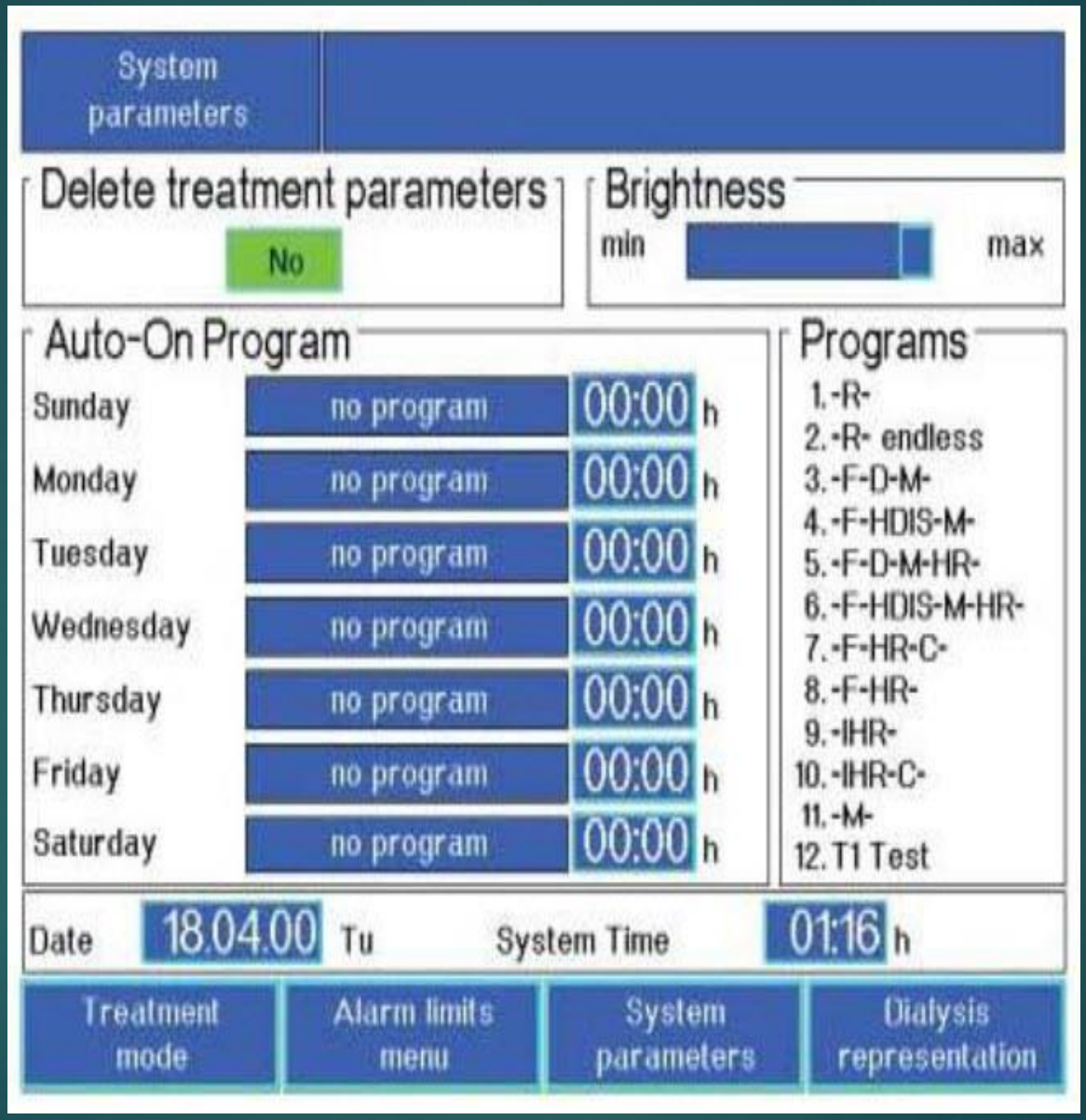


Fresenius Medical Care



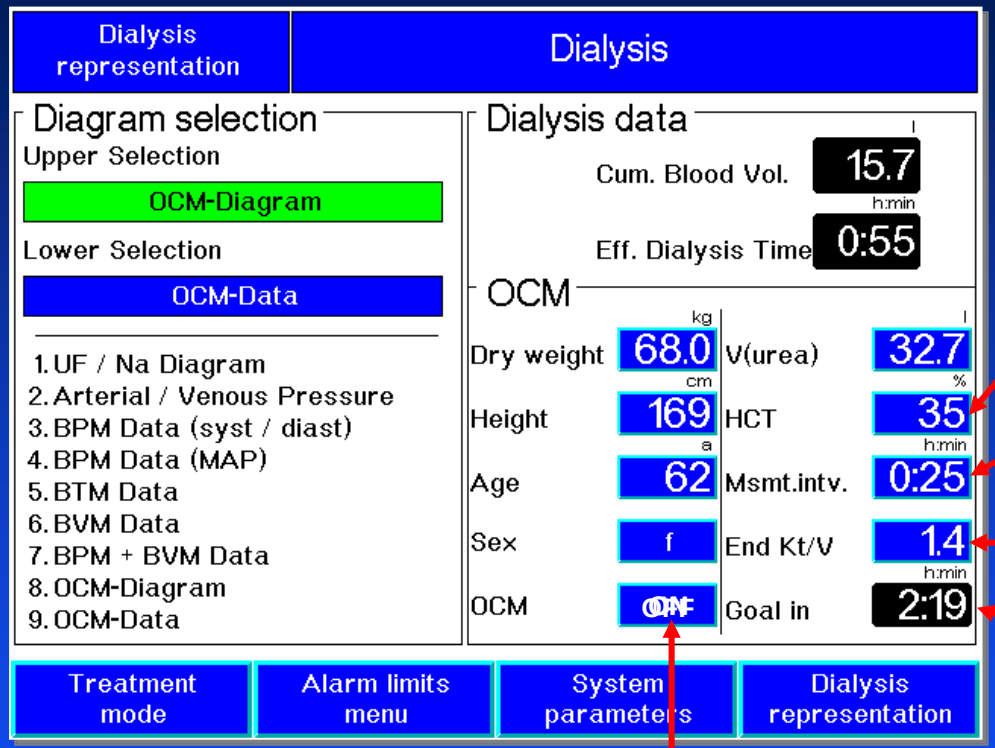
Fresenius Medical Care



Fresenius Medical Care

Data input for OCM® on 4008 H/S dialysis machines

Fresenius Medical Care College



Hematocrit (pre-set at 35%)

Measurement interval (pre-set to 50 min.)

Set Target-Kt/V

Estimated Time to target Kt/V

Measurement can be started manually or automatically!

Online Clearance Monitoring

Determining the Haemodialysis Efficiency

FRESENIUS MEDICAL CARE

What is clearance?

"Clearance"

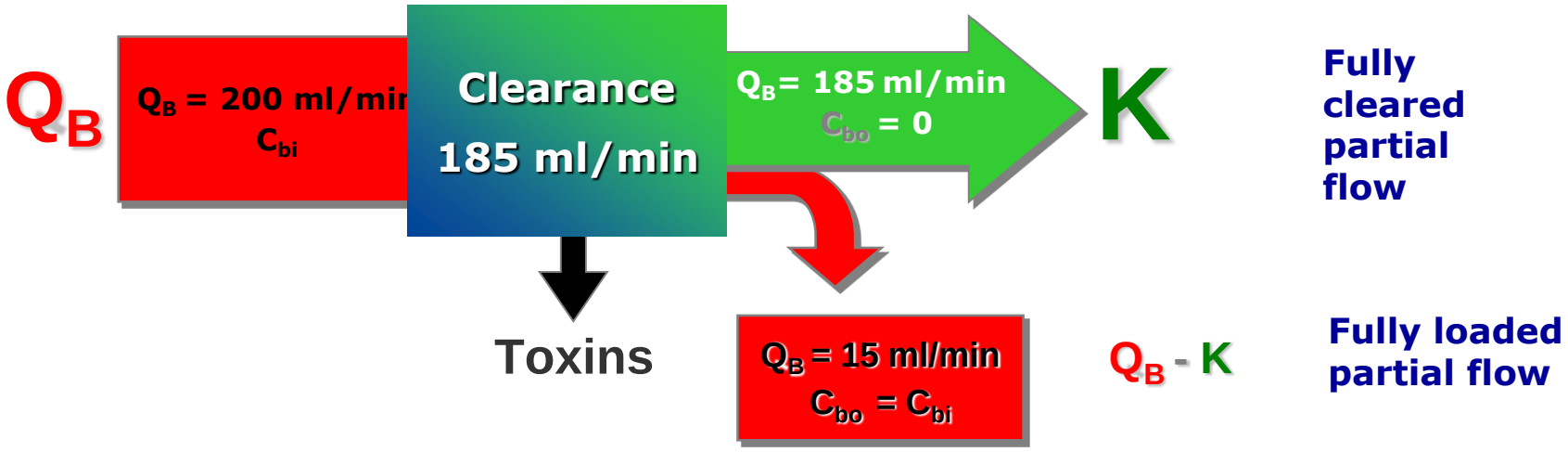
In haemodialysis:

- A performance parameter, which describes the capability of the extracorporeal detoxification unit (dialyzer) to eliminate a specific substance from the extracorporeal circuit.

In renal physiology:

- A diagnostic tool for determining the renal function with regard to the elimination of a specific substance from the blood circuit.

Clearance: in a graphical diagram



Definition of clearance K: [ml/min]

Clearance K is the (theoretical) part of the blood flow from which a specific substance (urea) has been removed completely.

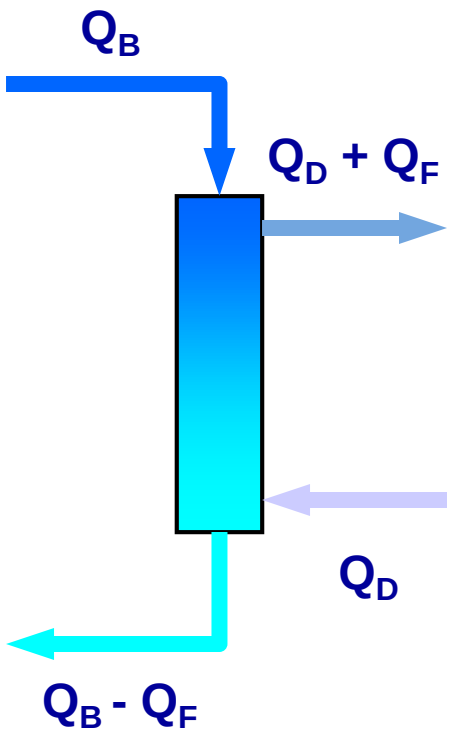
$$K = Q_B \cdot \frac{C_{bi} - C_{bo}}{C_{bi}}$$

Urea as marker substance!

- The natural kidney excretes urea in large amounts.
- Urea is the end product of protein metabolism. The kinetics of protein metabolism can be used to assess the intake of protein (nutrition!), the formation of urea in the body and the secretion of urea through dialysis.
- The concentration of urea is used to measure the degree of uraemia in uremic. (This does not mean that the urea itself is toxic!)
- Moving relatively quickly, urea spreads across all fluid compartments of the body.
- Urea can be transported rapidly through the membrane of red blood cells.
- In clinical laboratories, urea is a routine parameter which can be determined quickly and cost-effectively.

Clearance: in-vitro dialyzer clearance

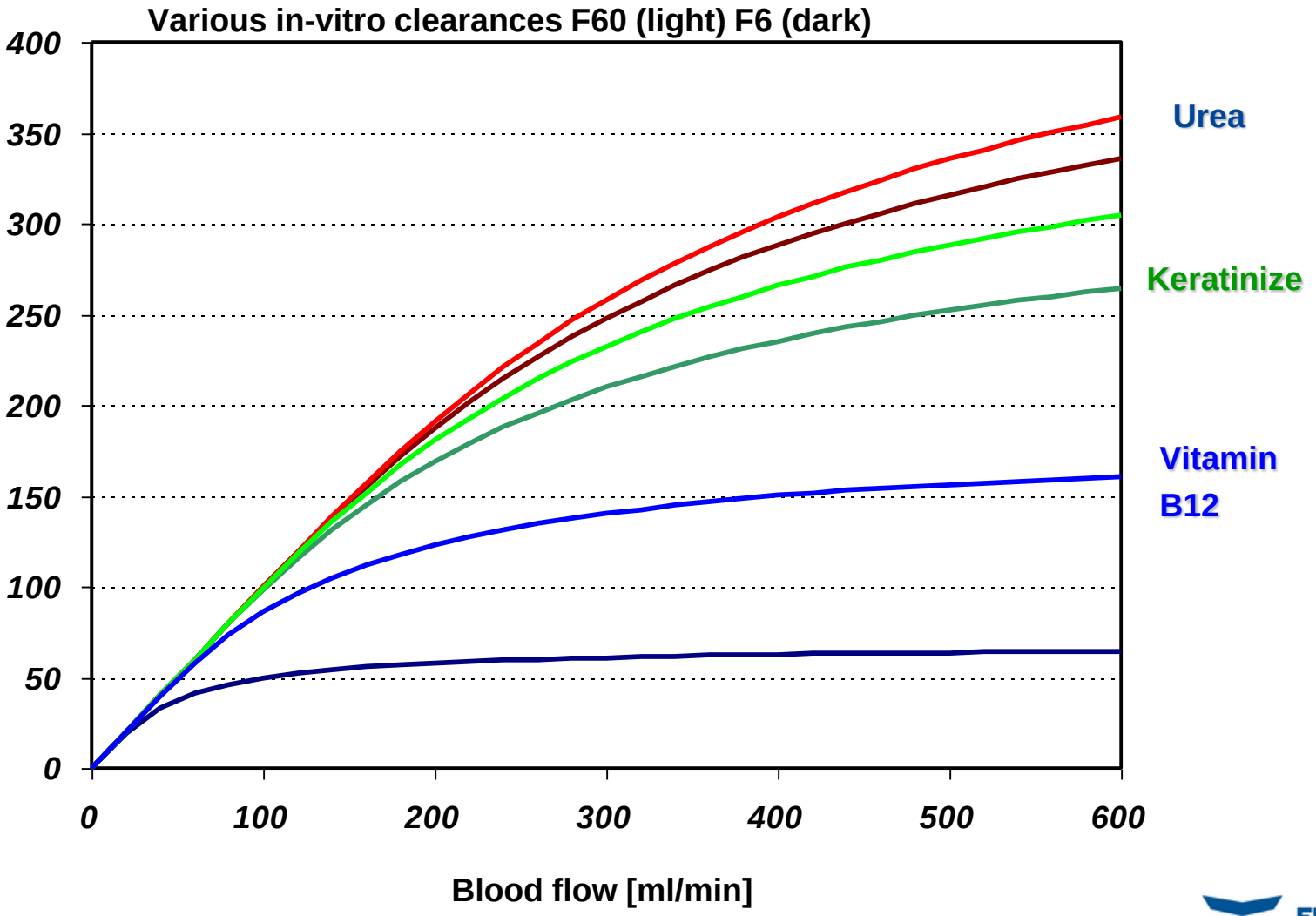
Symbol:	K_{vitro}
Reference:	Dialyzer under non-clinical conditions
Medium:	Marker substance in a standardized aqueous solution *)
In relation to:	- marker substance - dialyzer properties - blood and dialysate flows



*) Measurement rule acc. to EN 1283

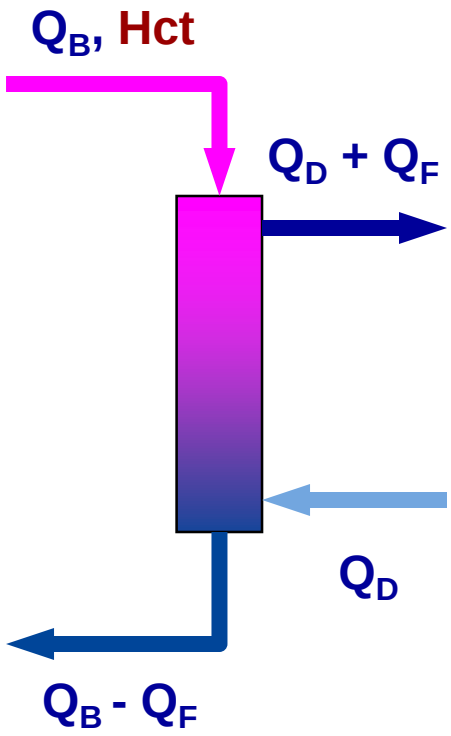
EN 1283: $Q_F = 0$

Dialyzer - clearances in clinical reality



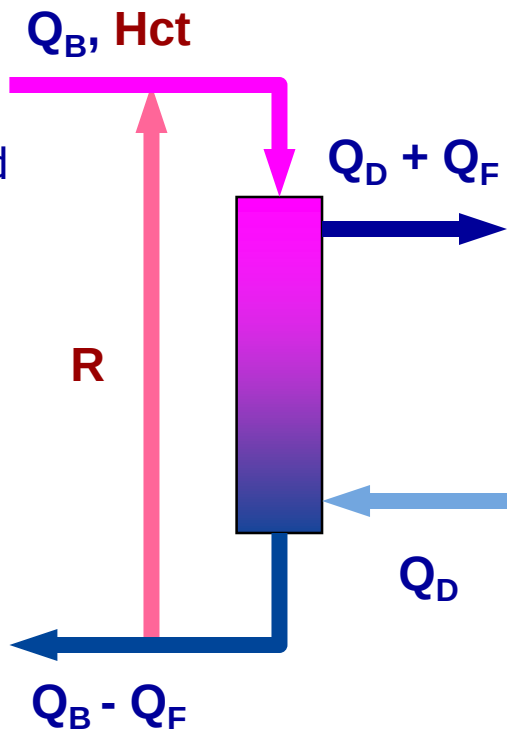
Clearance: in-vivo dialyzer clearance

Symbol:	K_{blood}
Reference:	Dialyzer
Medium:	Marker substance in whole blood
In relation to:	- marker substance
	- dialyzer properties
	- blood and dialysate flows
	- blood composition
	- (heparinization)



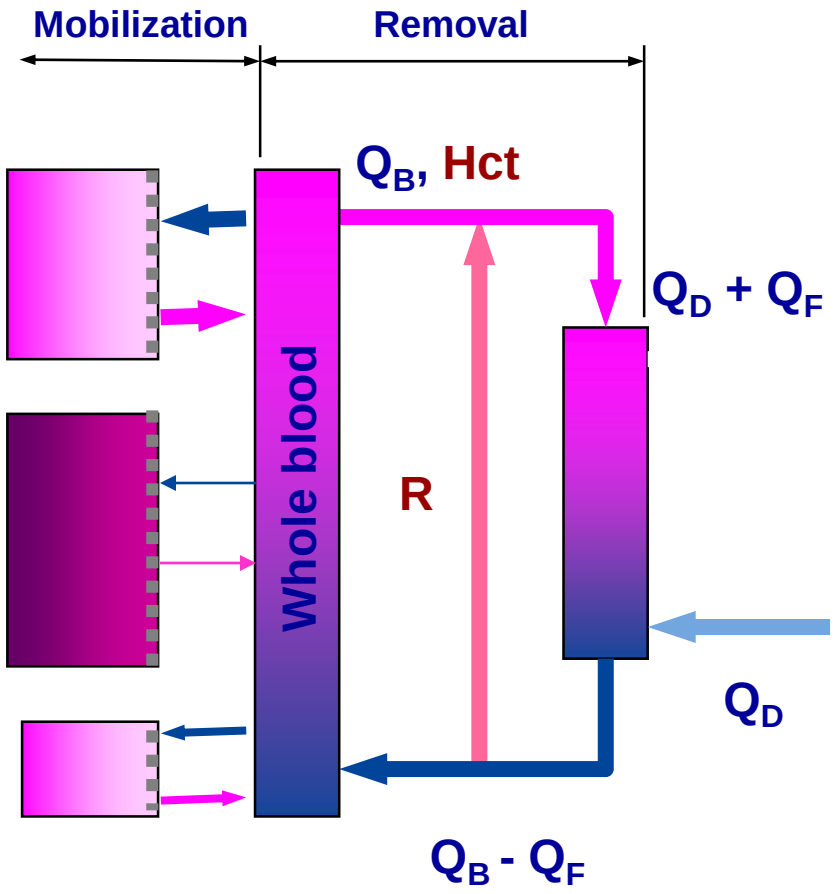
Clearance: effective whole blood clearance

Symbol:	K_{eff}
Reference:	Dialyzer + vascular access
Medium:	Marker substance in whole blood
In relation to:	- marker substance - dialyzer properties - blood and dialysate flows - blood composition - total recirculation (vascular access + cardiopulmonary)



Clearance: patient clearance

Symbol:	Kpat
Reference:	Dialyzer + vascular access + patient
Medium:	Marker substance in whole blood
In relation to:	- marker substance
	- dialyzer properties
	- blood and dialysate flows
	- blood composition
	- total recirculation
	- imbalances in the body



Reduction of urea clearance

K_{vitro} > K_{blood} > K_{eff} > K_{pat}

0 – 16%
proteins, cells

0 – 100%
recirculation

5 – 43%
Intra-corporeal imbalances

The OCM measures this parameter!

*) KRAEMER M, 1999

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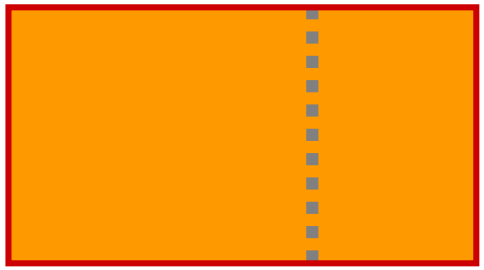
Urea distribution in the body

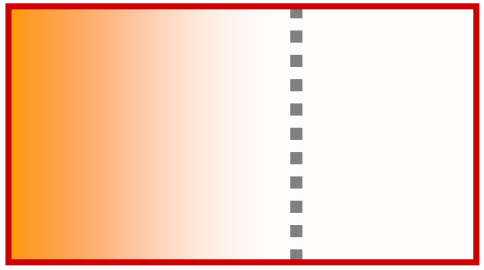
Treatment start:

- **There is a high concentration of urea stored in all body compartments.**



Treatment end:

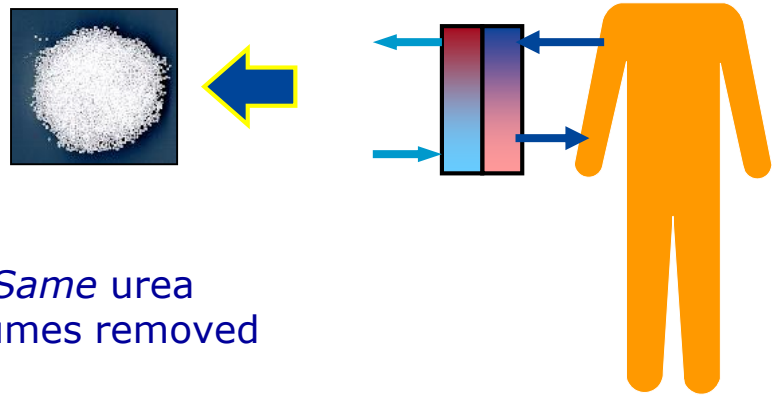
- **Urea was removed effectively during dialysis. Its concentration in blood is low, but in the intracellular space it's still high.**



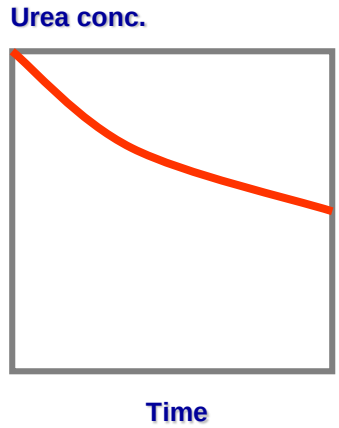
20 to 30 minutes after the end of the treatment:

- **Urea is again distributed uniformly in the extracellular and intracellular spaces and is lower than before the treatment; its concentration in plasma, however, is again higher than at the end of the treatment.**

Dialysis dose and body height

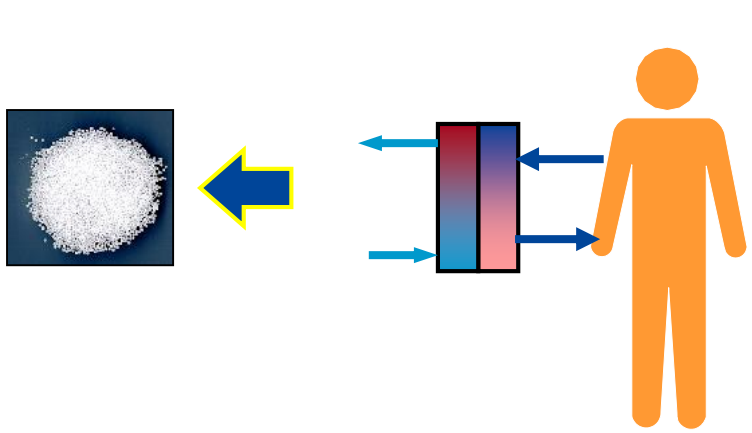


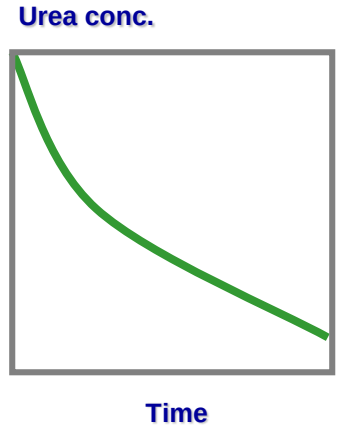
Same urea volumes removed



Low urea reduction, "low" dialysis

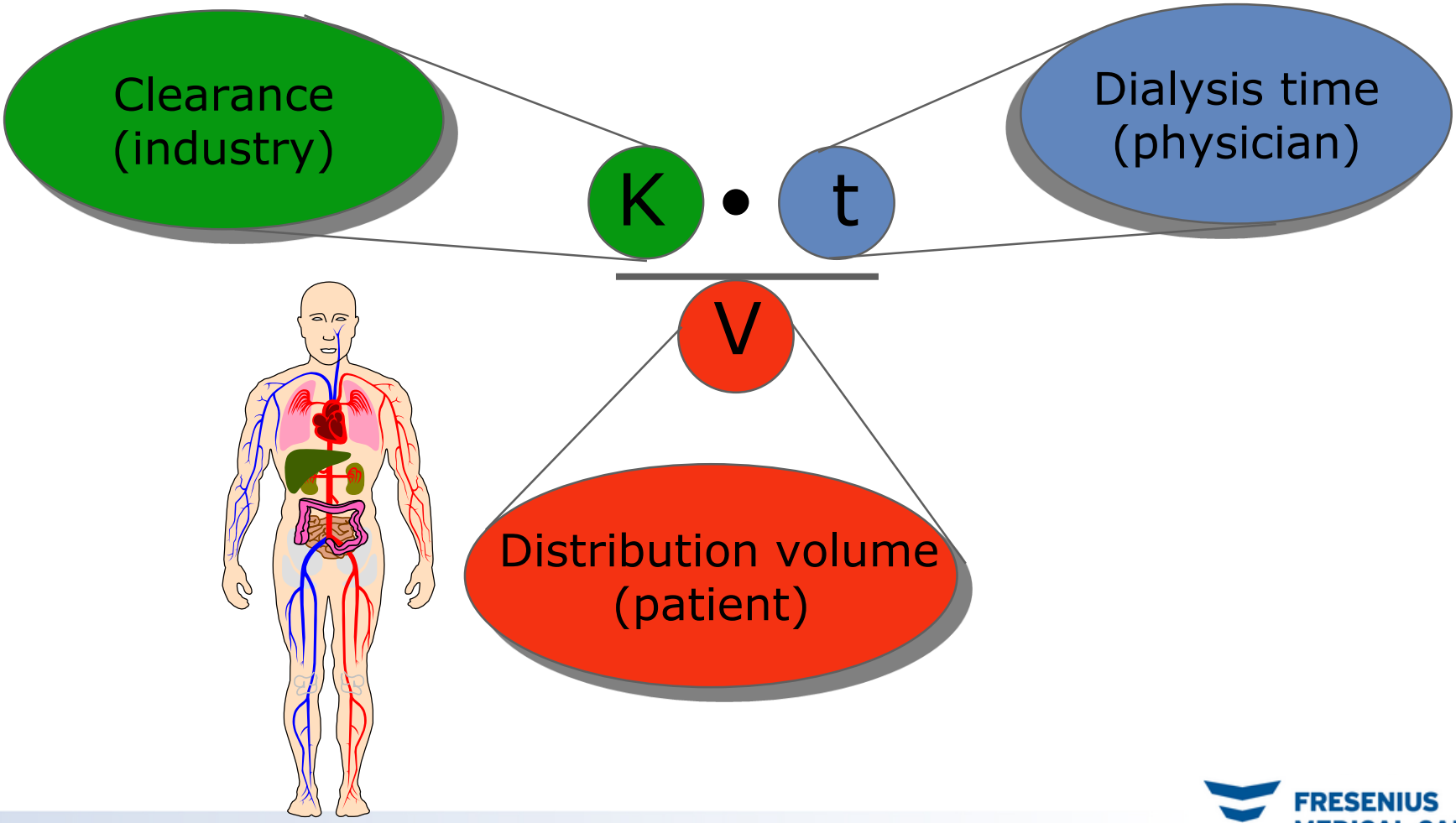
The dialysis volume must be set in relation to height or weight (it must be "standardized").





High urea reduction, "much" dialysis

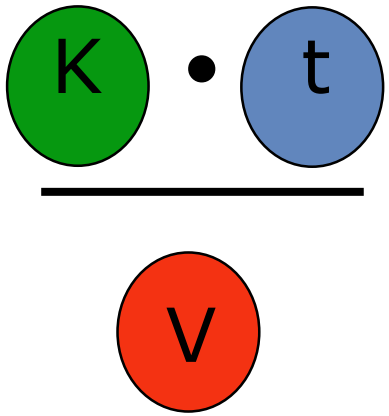
Kt/V - an indicator of dialysis efficiency



Which treatment-specific factors take an immediate effect on Kt/V ?

Clearance

- Dialyzer membrane
- Dialyzer surface
- Dialyzer de-aeration
- EBC anticoagulation
- Effective blood flow
- Recirculation content
- Dialysate flow



Eff. dialysis time

- Prescribed dialysis time
- EBC downtimes (e.g. alarms/bypass)
- Phases without dialysate flow (e.g. "flow off"/bypass)
- Interruption/premature termination of treatment (e.g. hypotension)

Distribution volume (V)

Preferably, the distribution volume should be determined using a kinetic model. But the 4008H/S systems also provide the possibility of determining V_{urea} anthropometrically:

HUME:

Male V_{urea} = 0.194786 x **height (cm)** + 0.296785 x **weight (kg)** - 14.012934

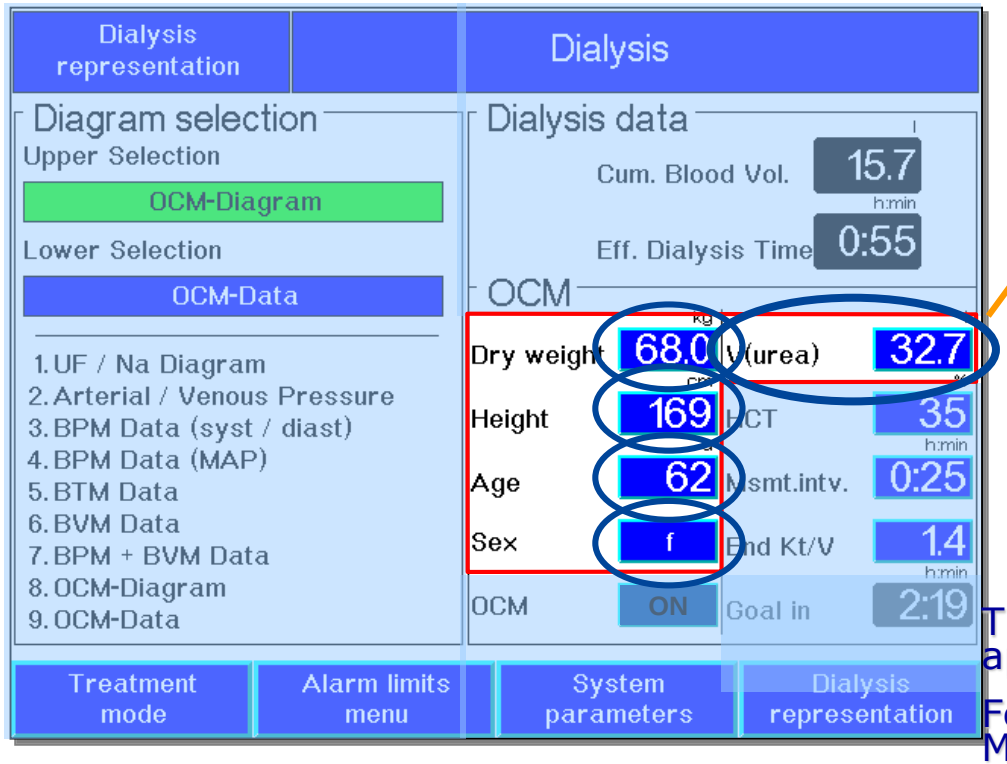
Female V_{urea} = 0.334547 x **height (cm)** + 0.183809 x **weight (kg)** - 35.270121

WATSON:

Male V_{urea} = 2.447 - 0.09516 x **age** + 0.1074 x **height (cm)** + 0.3362 x **weight (kg)**

Female V_{urea} = - 2.097 + 0.1069 x **height (cm)** + 0.2466 x **weight (kg)**

Distribution volume (V) anthropometrical



Anthropometrical V_{urea} determined according to Watsons Formula

- Dry weight
- Height
- Age
- Sex

The following weight formula should be applied to amputated patients:

Female: 53% of the body weight
Male: 59% of the body weight

E.g., individual deviations from Watson V are described in:

Kloppenburg et al., Kidney International 59 (2001) 1165-74
Johansson et al, JASN 12 (2001) 568-73
Cooper et al., Kidney International 58 (2000) 408-16

Kt/V – which dialysis dose?

Adults not suffering from diabetes:

min. recommended dose Kt/V = 1.2

min. prescribed dose Kt/V = 1.3

Children: prescribed dose Kt/V = 1.2 (recommended)

Adults suffering from diabetes: min. recommended dose

Kt/V = 1.4 (not discussed officially)

Dialysis Outcome Initiative, Practical Guidelines, Am J Kidney Dis, 30:3 (Suppl 2), 1997

Kt/V and mortality

Studies

Design:

- retrospective studies
- 2311 / 2479 patients
- > 1 year ESRD
- Average Kt/V = 1.1
  (5% < 0,72; 5% > 1.54)

Question:

- relation of dialysis dose and mortality risk or cause of death

Bloembergen WE et al.
Kidney int. 50, 557 – 565 (1995)
Held PJ et al.
Kidney int. 50, 560 – 566 (1996)

Results

Cause of death	Reduction per 0.1 Kt/V
Mortality	7 %
Coronary heart disease	9 %
Other heart diseases	12 %
Cerebra-vascular diseases	14 %
Infections	9 %
Stop of therapy	9 %
Malignomes	No difference
Valid to a Kt/V = 1.3	

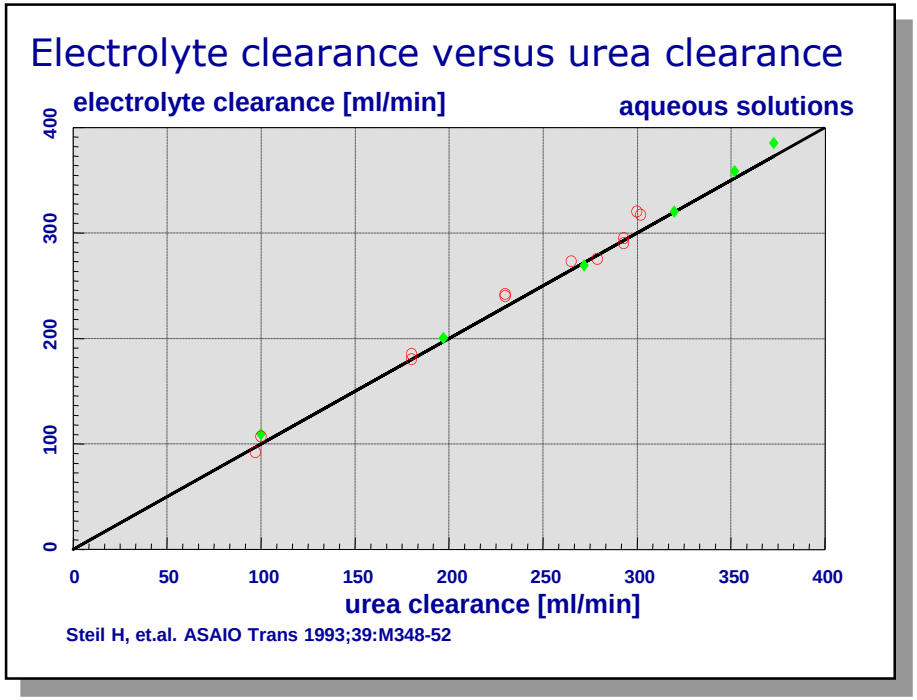
Distribution volume (V) kinetic

- Determines an accurate V urea from patient and laboratory data
- Calculates the dialysis patient's weekly urea profile
- Determines Kt/V and protein (PCR)
- Is different from established urea kinetics programs because the effective in-vivo clearance determined by the OCM is used instead of a theoretical clearance calculated from blood and dialysate flows.

Ion-selective clearance measurement

Electrolyte and urea clearances behave equivalently!

Diffusion coefficient at 37 ° C	
Na^+	Urea
$1{,}94 \bullet 10^{-5}$	$2{,}20 \bullet 10^{-5}$

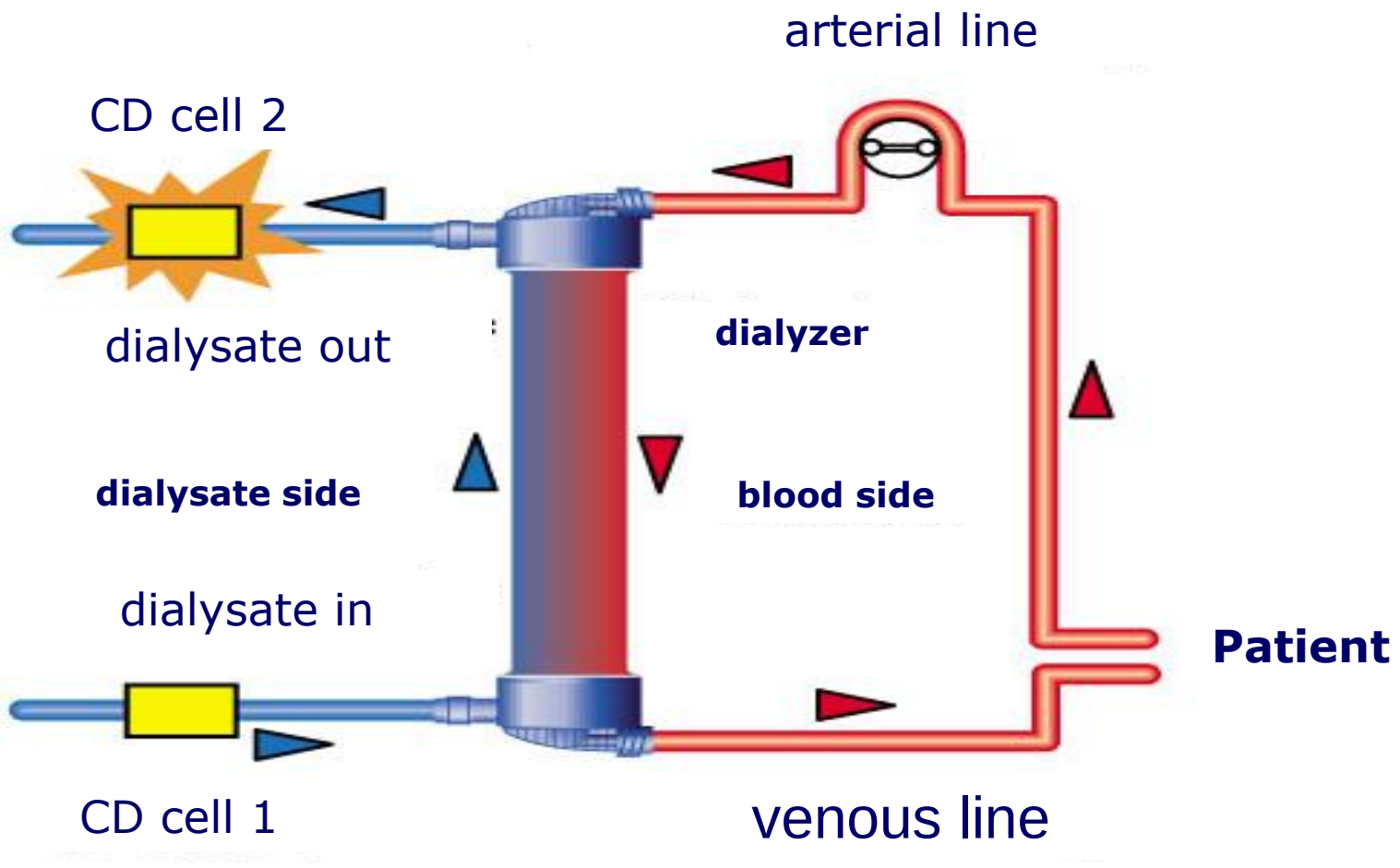


Babb AL, Maurer CJ, Fry DL, Popovich RP, McKee RE :

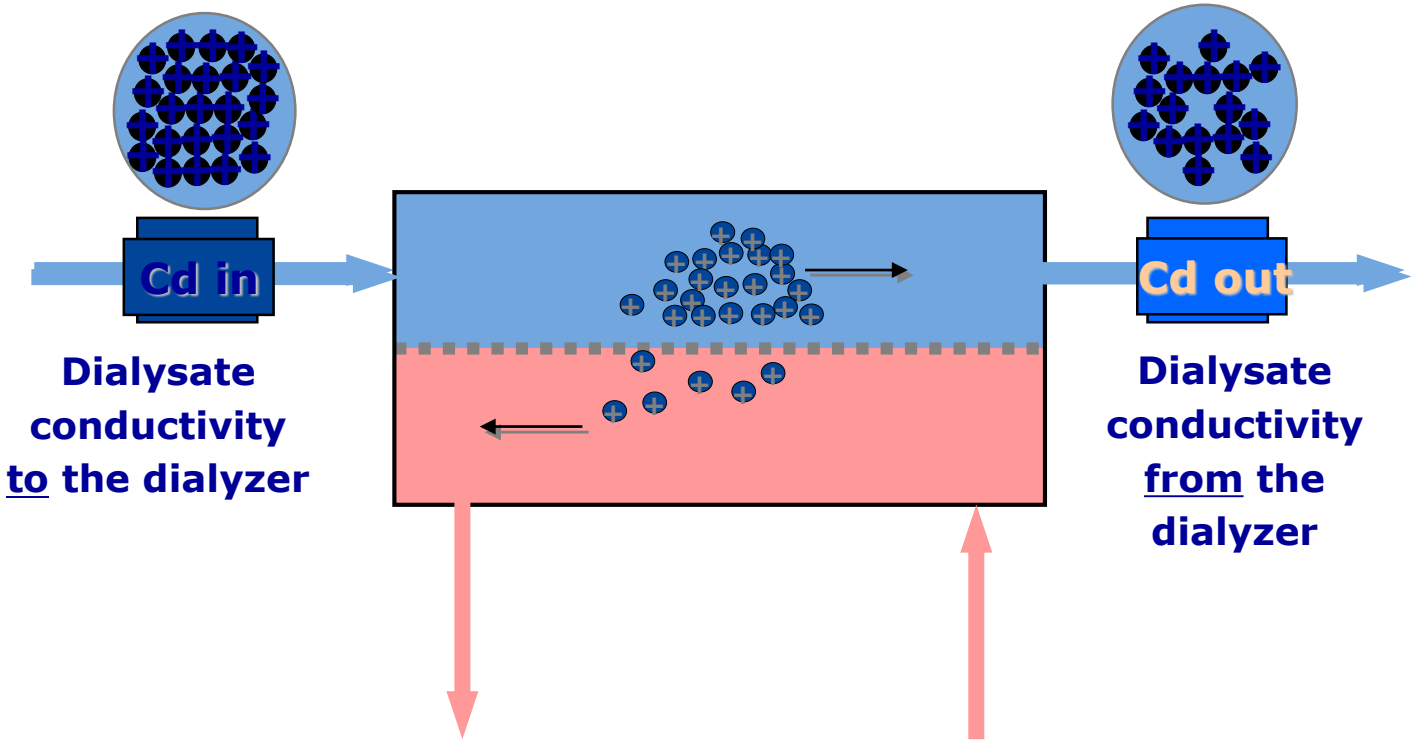
The determination of membrane permeabilities and solute diffusivities with applications to hemodialysis

Chem. Eng. Progr. Symp. Ser. 84,64 (1968) 59-68

OCM – technical principle



OCM – technical principle



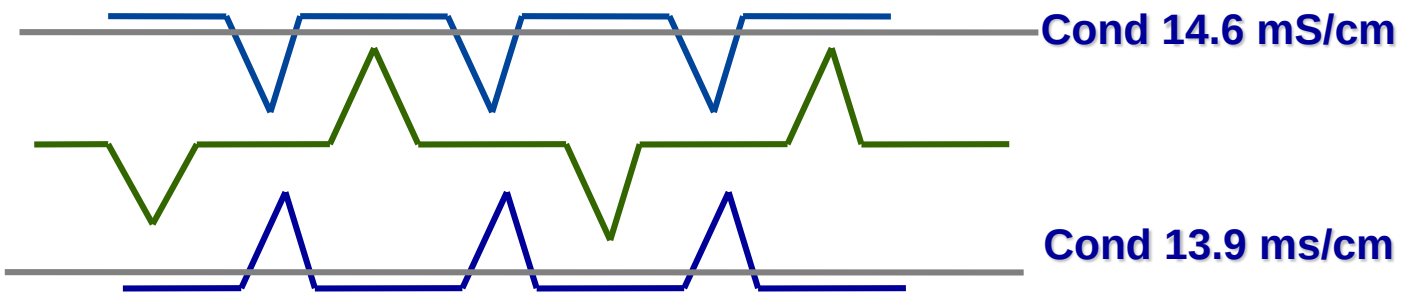
Dynamic CD pulse and measurement of the change in CD from before and after the dialyzer. The ionic dialysance is converted into the effective urea clearance.

OCM – measurement cycle

Measurement pulses are visible in the conductivity window:

- spreading of the CD window for approx. 3.5 min
- change in CD inside the spread window
- clearance and plasma sodium shown by the status indicator for 1 min

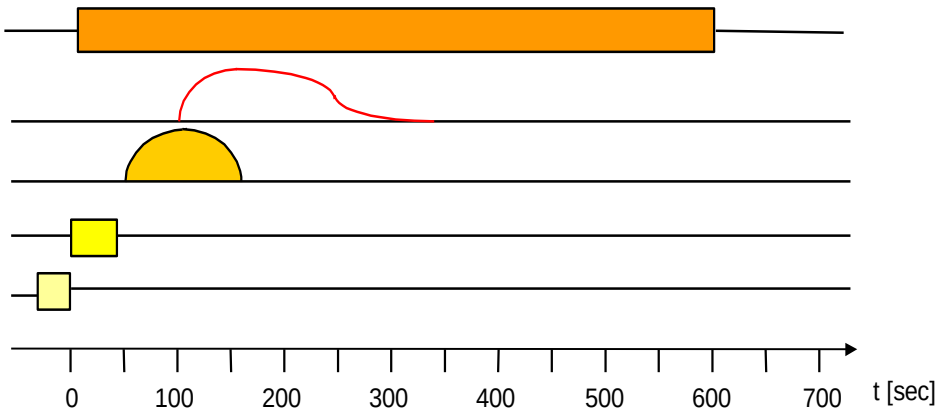
Direction of measurement pulses:



OCM – measurement cycle

Chronological measurement sequence:

- Total measurement time 10 min
- Change in CD 60 sec
- Waiting for stable CD 60 sec
- 1st cyclic PHT



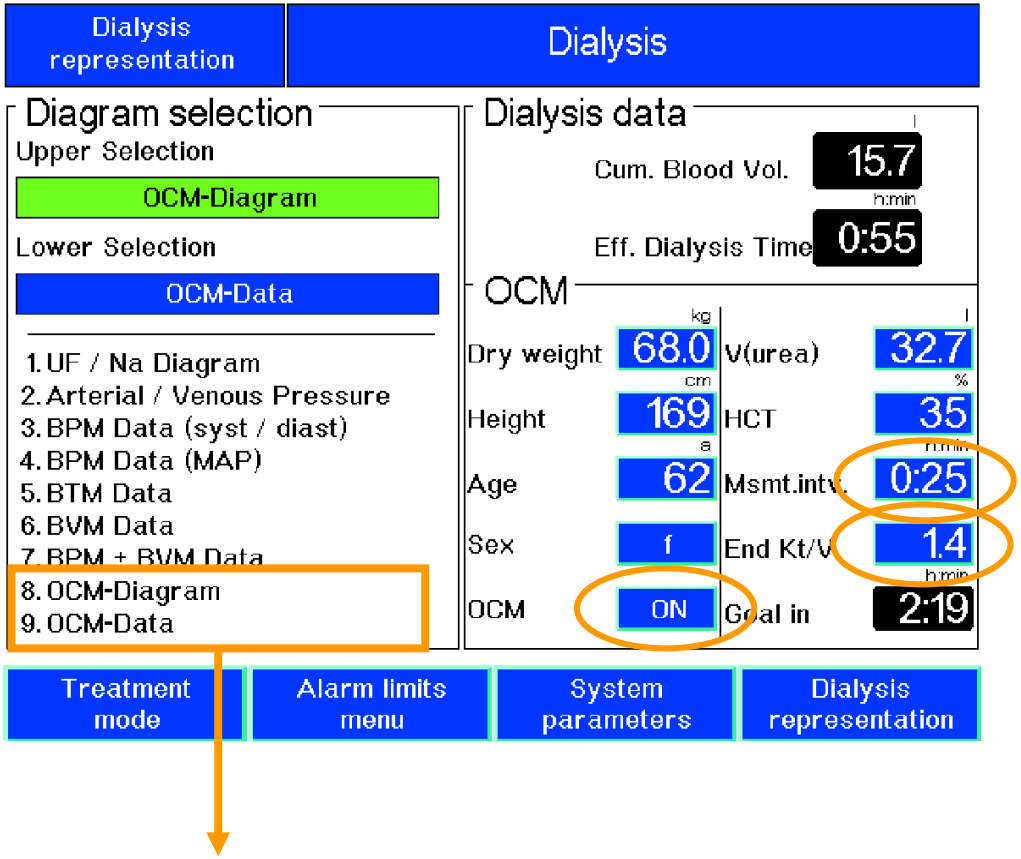
The first measurement result is available after approx. 25 minutes.

OCM measurement will be prematurely terminated in cases of:

- **blood or water alarms**
- **changes in blood flow,**
- **changes in dialysate flow and related Na^+ (repeated after 12.5 minutes)**

OCM - parameter input

- Measurement interval
- Goal Kt/V
- The measurement can be started either automatically or manually.



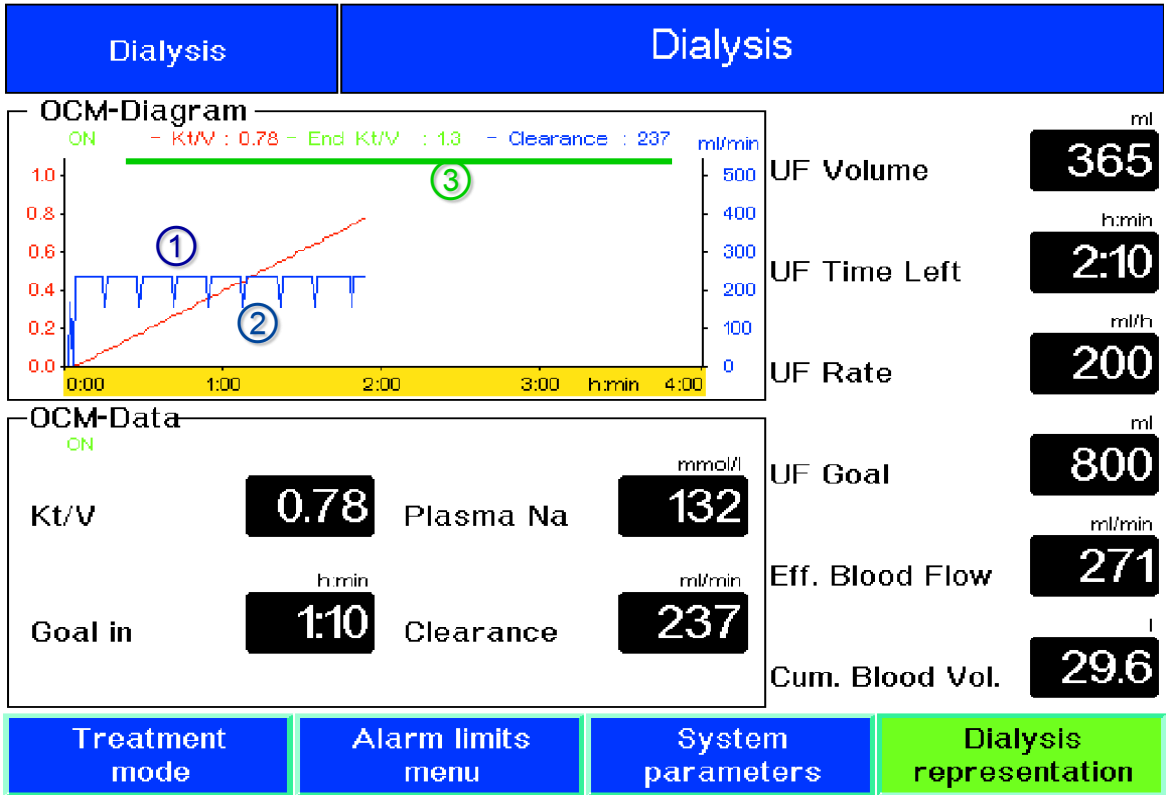
Select the desired representation

OCM - graphical display

① Clearance curve

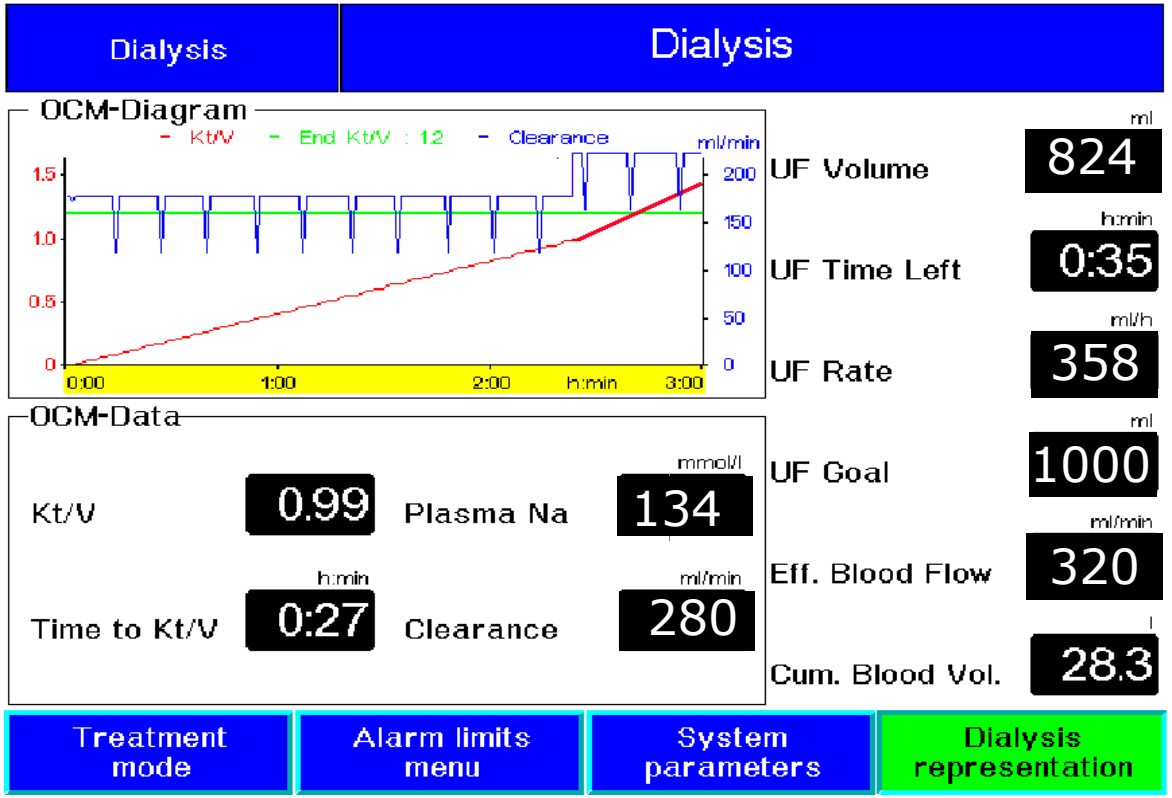
② Kt/V curve

③ Goal Kt/V

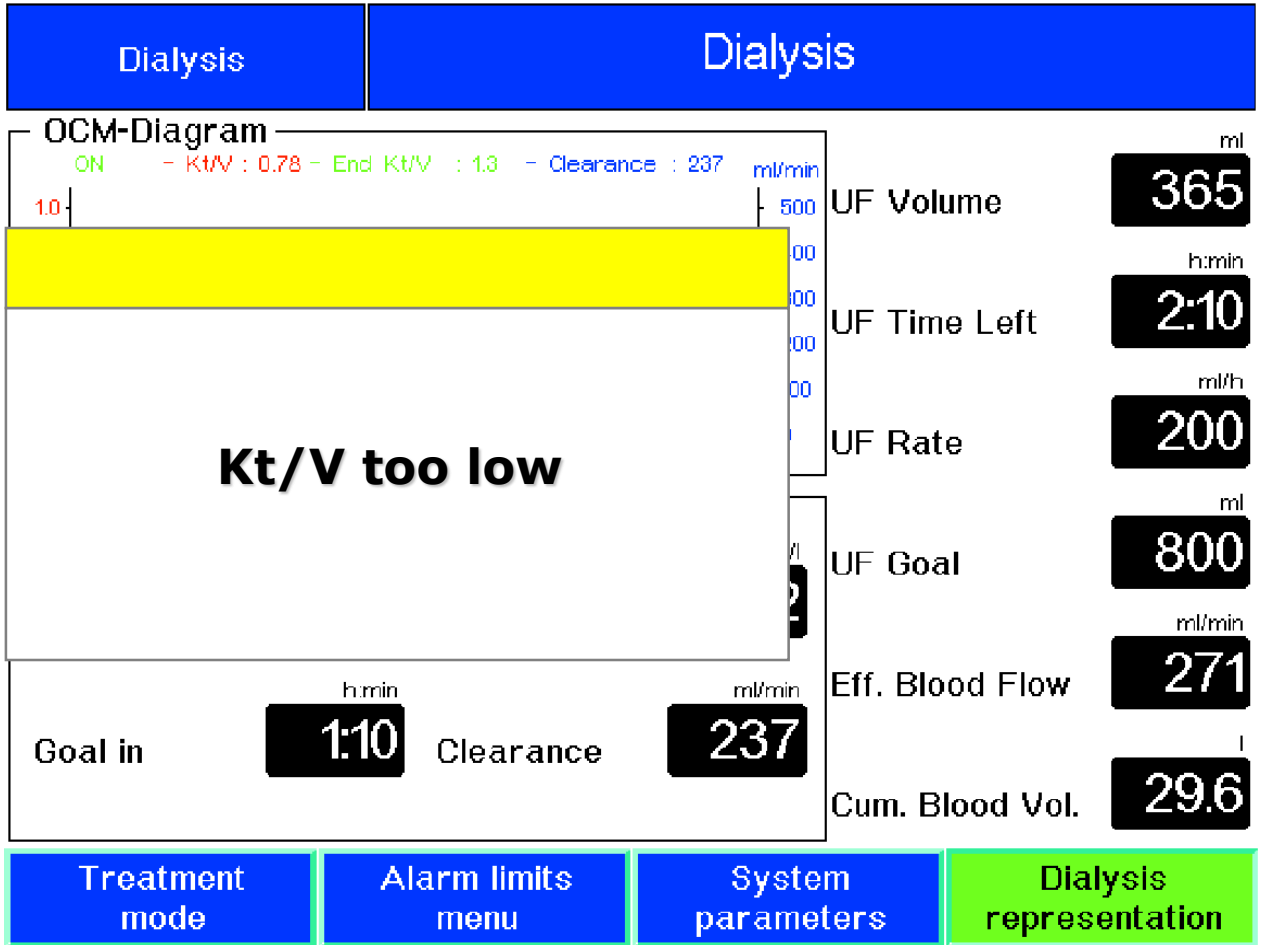


OCM - graphical display

Increase in clearance through an increase in blood flow



OCM - warnings / messages



OCM - restrictions

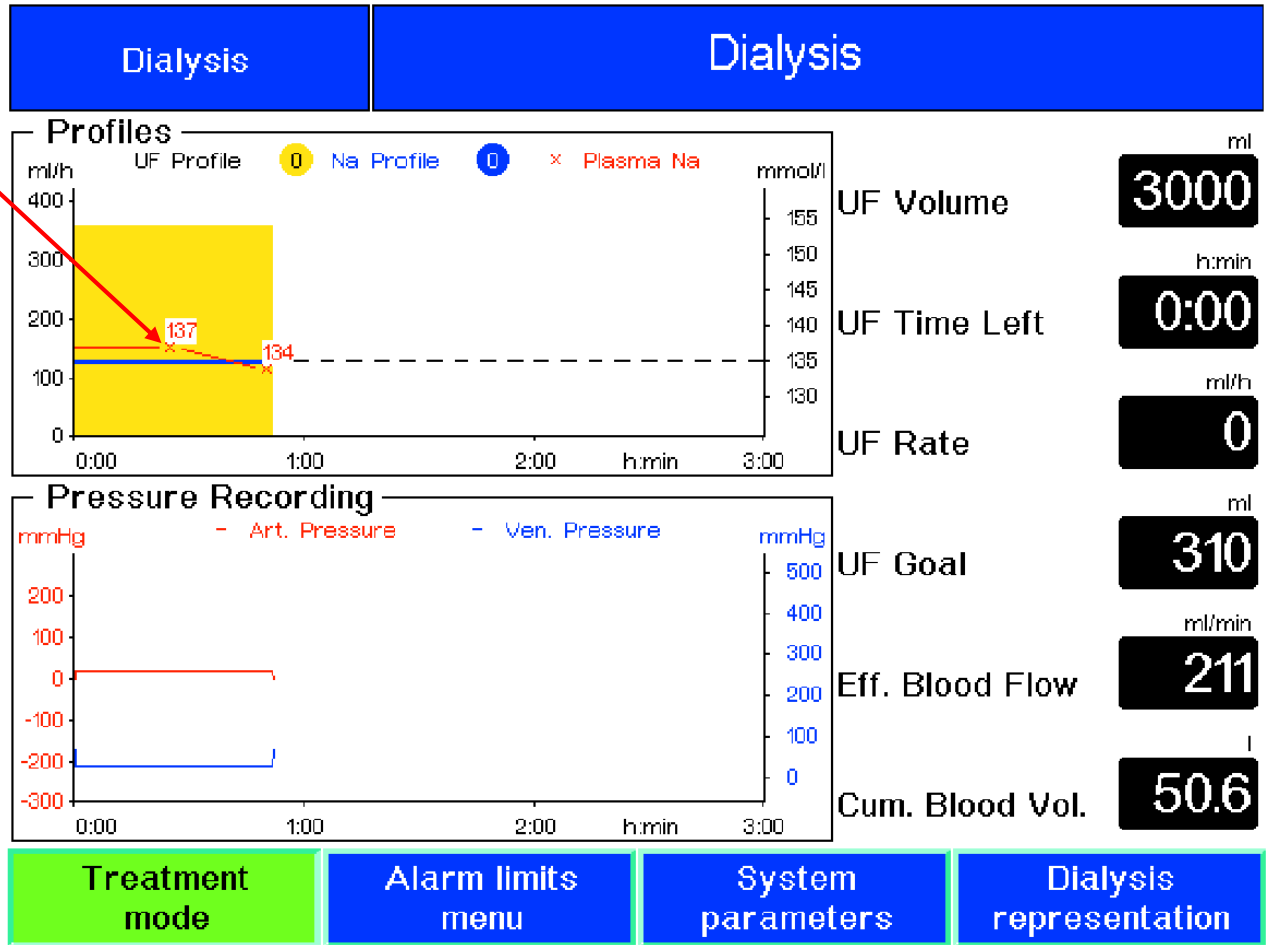
Procedures which cannot be combined with OCM:

- Single-Needle click-clack
- Single-Needle
- Standard HDF
- ONLINE$_{plus}$ (HF)
- UF time for UF and sodium profiles 1/5/6 must be at least 3 h

Graphical display of plasma Na^+

Plasma sodium

Plotted against the concentrate sodium

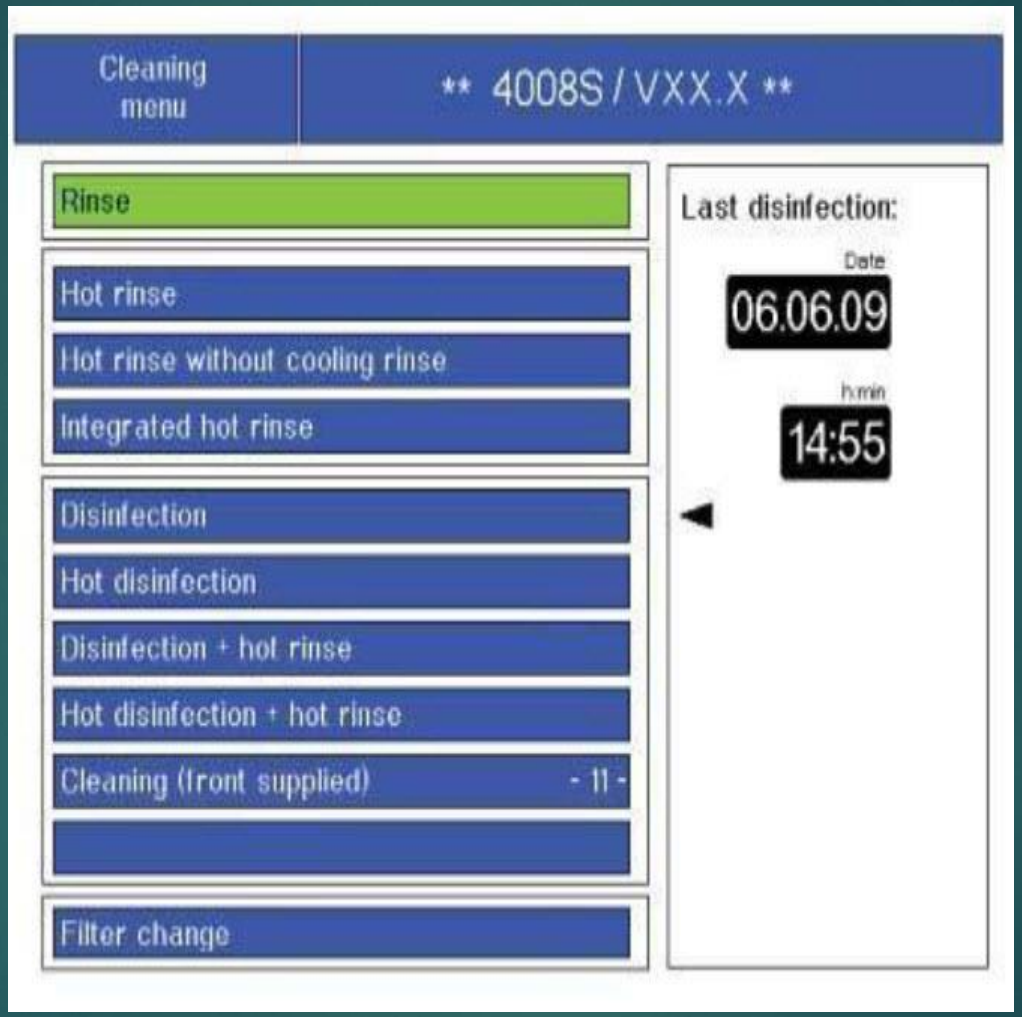


Give your patients and yourself the confidence of having a good dialysis

Impulses to improve quality of life!

Disinfections

Home



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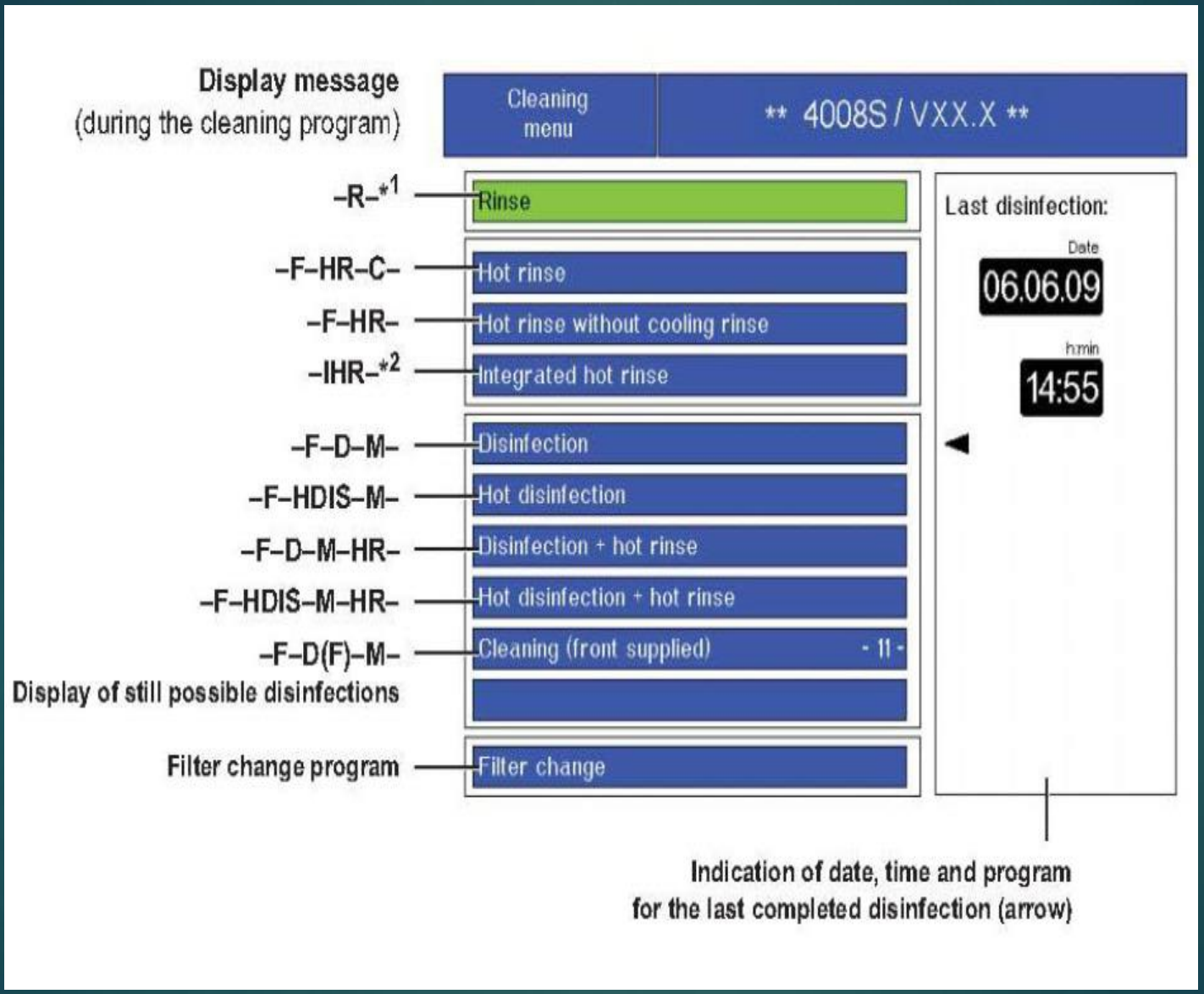

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Hygiene in dialysis machines: Disinfection

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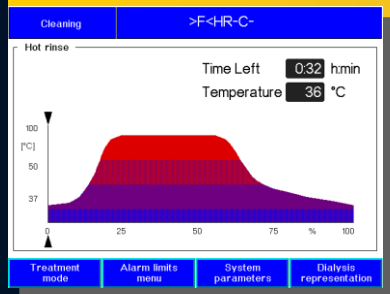
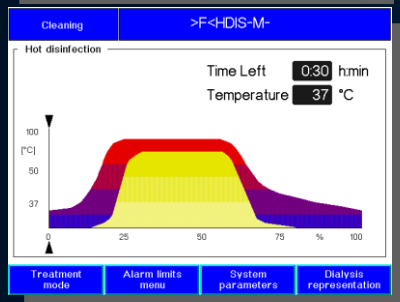
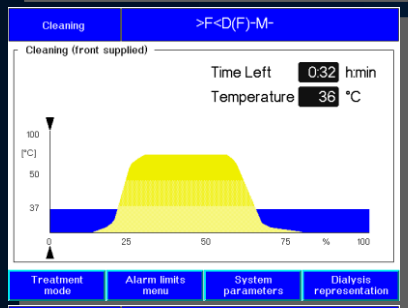
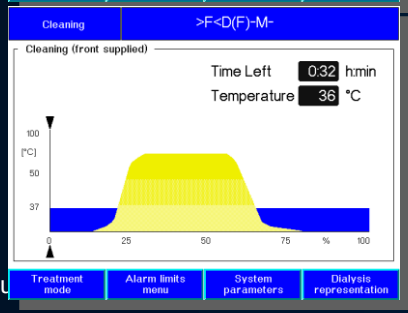








Hot rinse (recirculation): 85°C

- No agent required
- Between treatments when decalcification is not required

Heat Disinfection (recirculation): 85°C

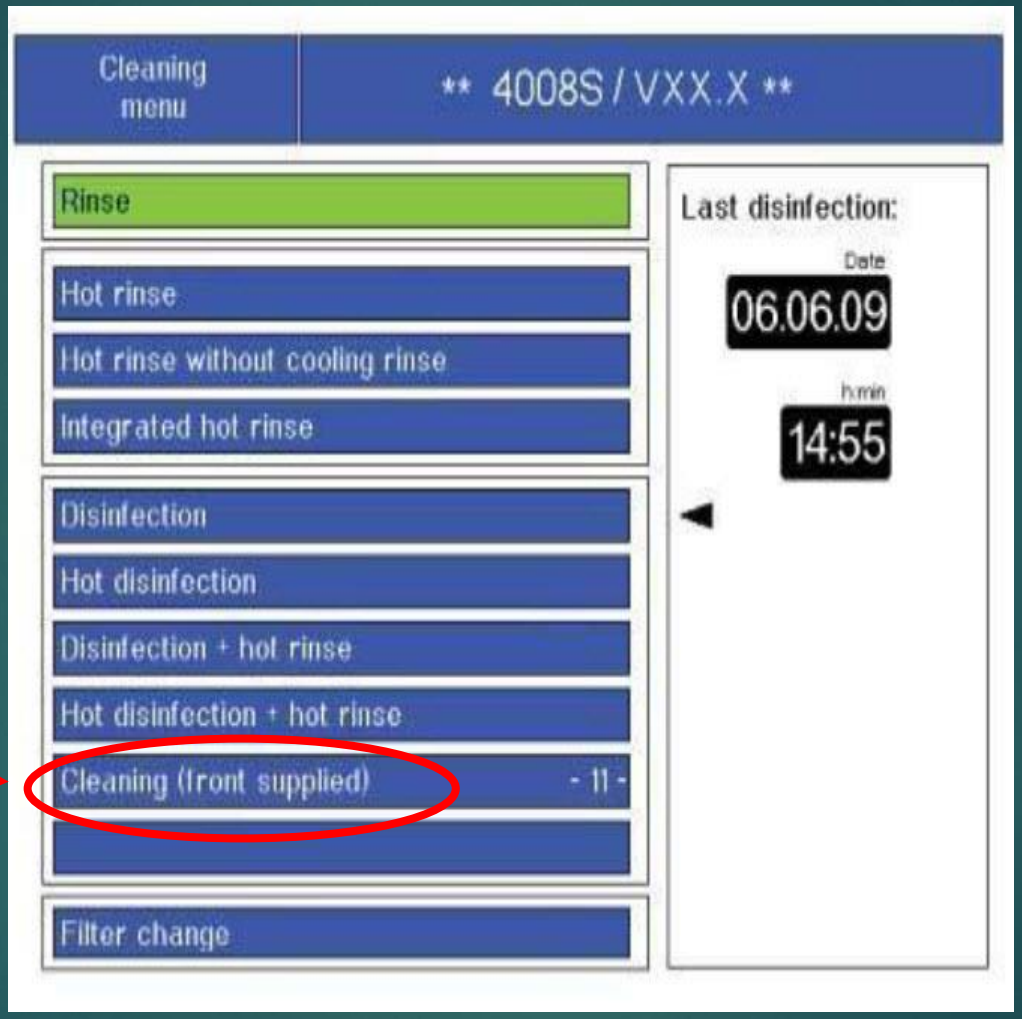
- Diasteril®
- Excellent for disinfecting,decalcifying and deliming(cleaning) between treatments.

Cleaning Sporotal® (recirculation): 37°C

- Sporotal® (Sodium hypochlorite)
- Good for disinfecting and degreasing (once a week) or after blood leakage. Not for decalcifying

Disinfection (recirculation): 37°C

- Puristeril®340
- Good for disinfecting and decalcification between treatments



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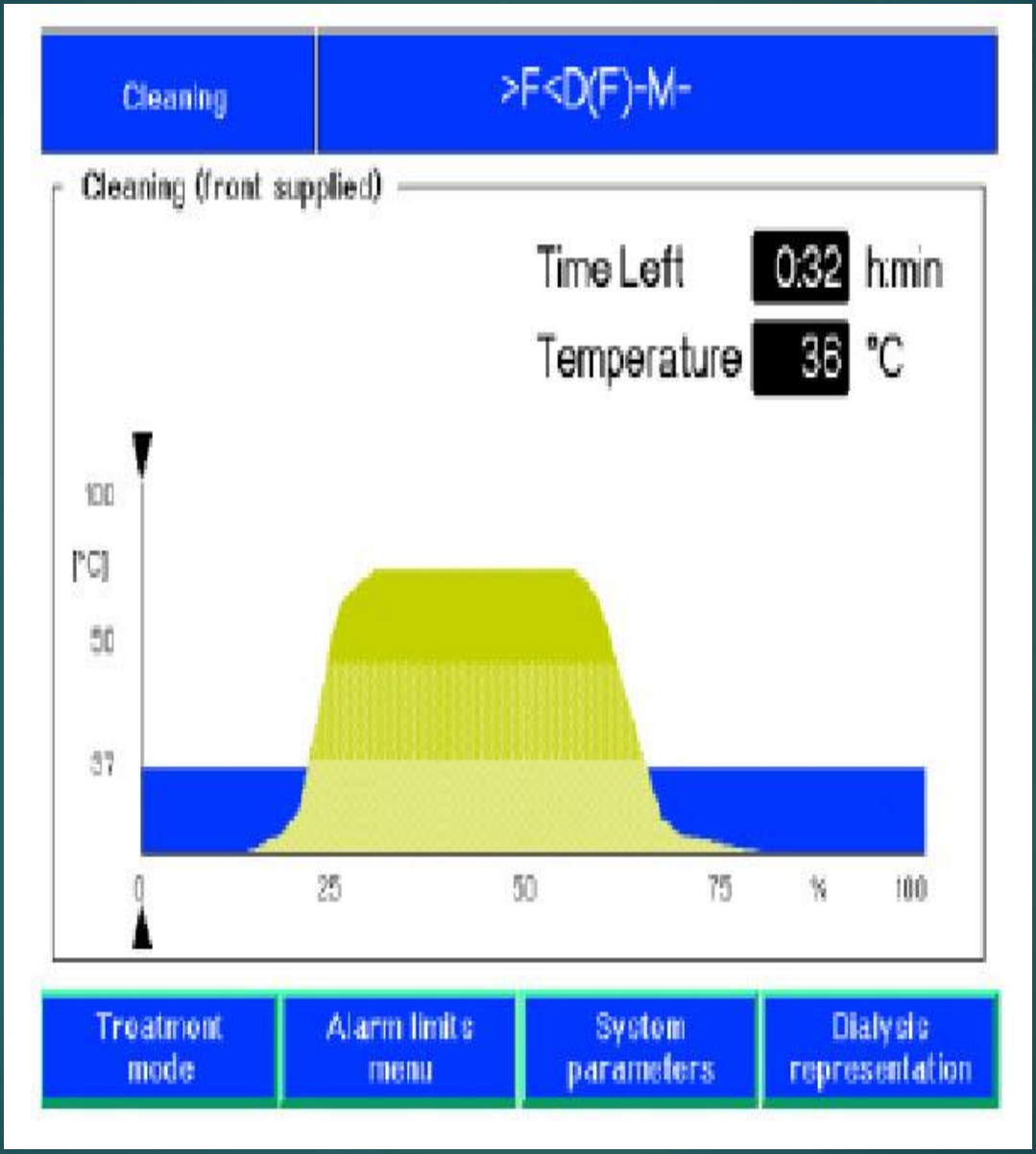

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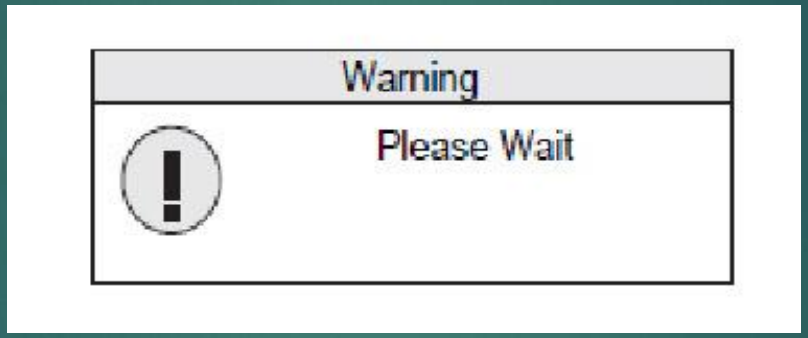

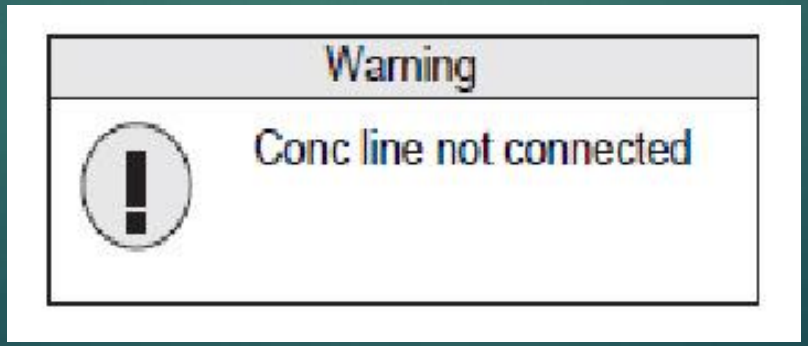

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Thank you for your attention

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