

# WELKOM!!

Wetenschapsdag 2024



## Dialyse innovaties in Nederland – waar staan we nu?

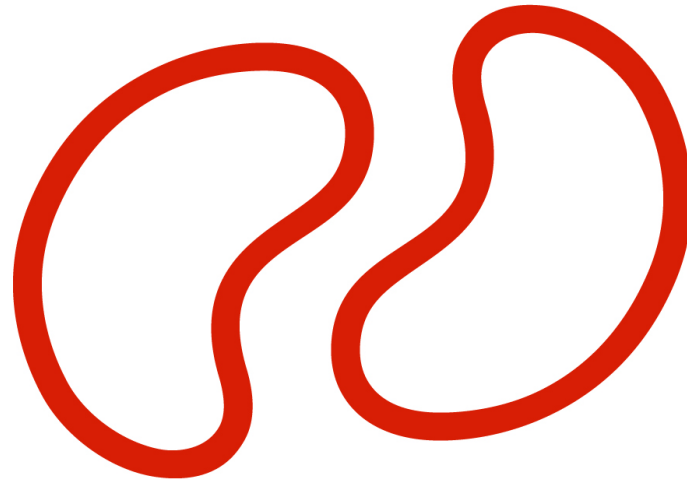
- Spreker : Jasper Boomker

**Aanvang: 10:30 uur**



CSL Vifor





**NIERSTICHTING**

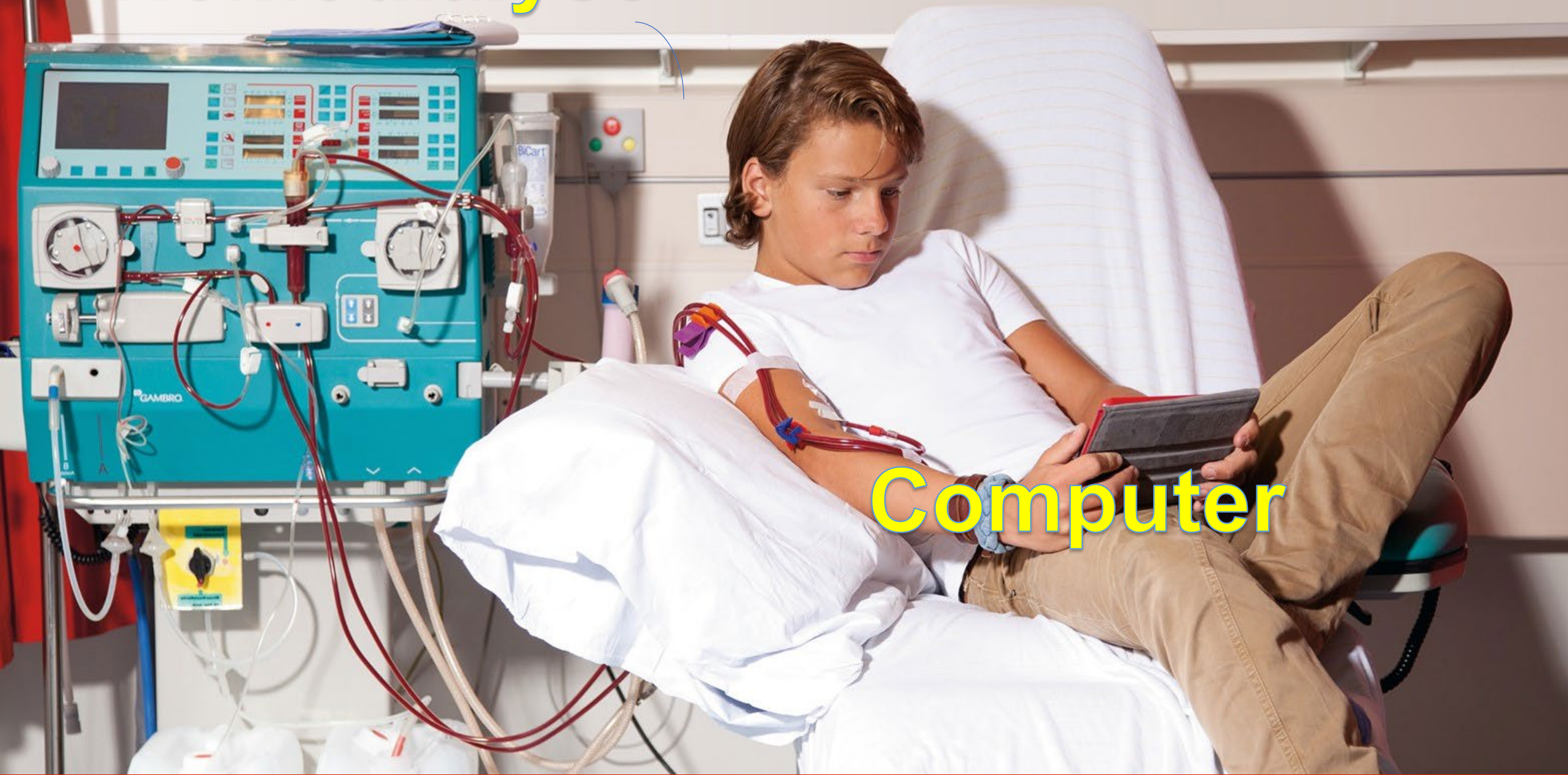
Je nieren zijn je leven.

# Update over dialyse innovatie: de draagbare kunstnier

**Jasper Boomker**

Programmamanager  
Nierfunctievervangende  
Technologie

# Hemodialyse



Computer

1943

Hemodialysis



# 1943

## Computer



# Korte geschiedenis van de hemodialyse

1950s

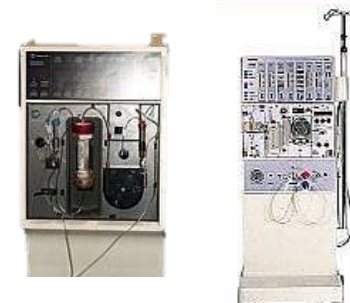
1960s-1970s

1964 Eerste  
dialysekliniek in NL  
Clara  
Ziekenhuis,

1980s e.v.

Vergoeding voor hemodialyse  
**Incrementele innovaties**

1968 Oprichting  
Nierstichting  
Eerste thuis HD in NL

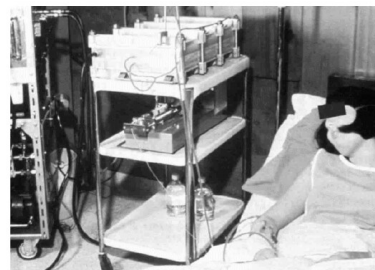
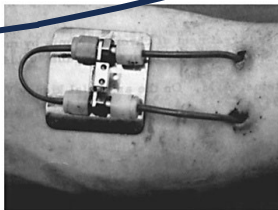


Innovations in dialysis: the user's  
perspective

Nieltje Gedney<sup>1</sup>, Wim Sipma<sup>2</sup> and Henning Søndergaard<sup>3</sup>

Gedney et al., Nat Rev Nephrol 16, 544–545 (2020).

“Necessary  
developments to  
facilitate improve-  
ment in health  
care ... have  
bypassed the  
world of kidney  
patients”



1945  
Dr. Kolff's  
hemodialyse

1960  
Scribner AV shunt

1961  
Eerste thuisHD  
Dr. Nosé

# Kenmerken van conventionele hemodialyse

- Verwijdering van afvalstoffen (oa. ureum), 10-15%
- Verwijderen van overtollig vocht (ultrafiltratie)
- Corrigeren zuur-base balans
- Corrigeren elektrolythoudding

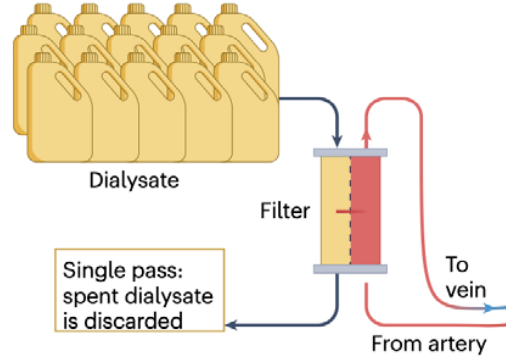
**‘Ziekenhuis verplaatste zorg’!**



- Niet continue
- Vaattoegang
- ~ 100 L dialysaat
- Buffers & concentraten
- Dialysefilter (kunstnier)
- Electrisch geïsoleerd
- Veel ruimte nodig
- Niet makkelijk te verplaatsen

## “transporteerbaar”

### a Haemodialysis



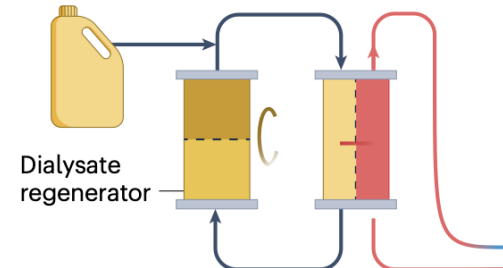
‘Single pass’  
Low flow dialyse

## “draagbaar”

### Sorbent dialyse

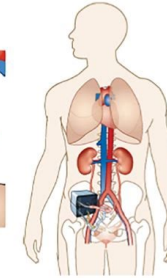
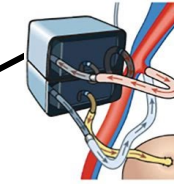


### b Portable and/or wearable haemodialysis

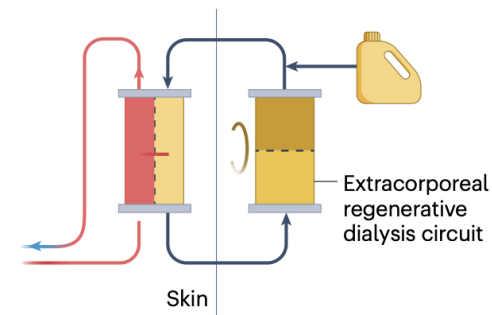


## “implanteerbaar”

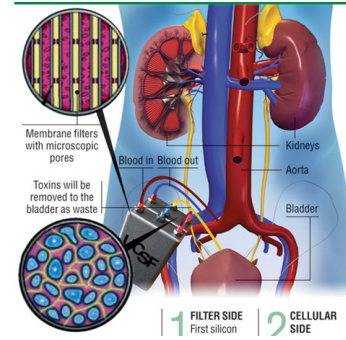
### Nanodialyse



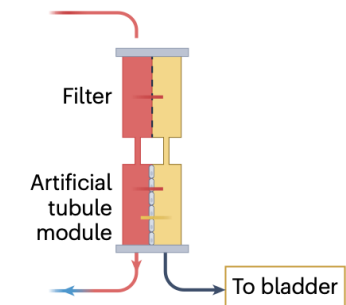
### c Implantable dialysis filter



## “biohybride”



### d Implantable artificial kidney



# Historie van de sorbent dialyse



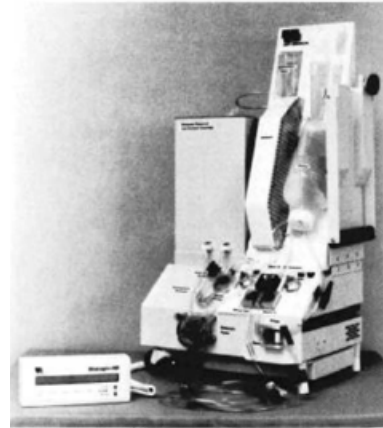
The REDY® URS System

REDY  
1973



The REDY® 2000 System

REDY 2000  
1983



Biologic-HD  
1987



Allient  
2005



2008 Sorbent System  
2010

# Sorbent dialyse ook in NL!



Drukker, W., Parsons, F.M., Gordon, A. Practical Application of Dialysis fluid Regeneration: The REDY System. Drukker W., Parsons, F.M., Maher, J.F. (eds): Replacement of Renal Function by Dialysis. Springer 1979, pp244-258.





*Dokter Willem Kolff toont zijn draagbare kunstnier op een congres van de Nierstichting (1977)*

Proc Eur Dial Transplant Assoc. 1976;12:511-8.

## Portable/ Wearable Artificial Kidney (WAK) — Initial Evaluation

R L STEPHENS, S C JACOBSEN, ELISABET ATKIN-THOR, W J KOLFF

Division of Artificial Organs, University of Utah, Salt Lake City, Utah, USA

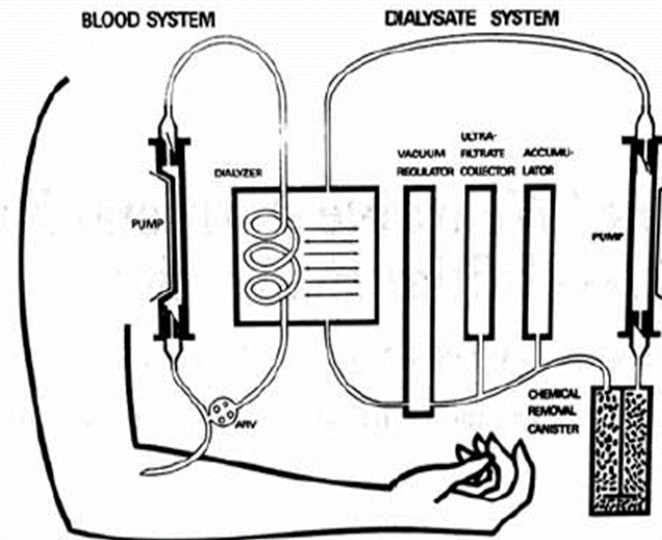


Figure 1. Concept of wearable kidney



**Five Suitcase Kidney machines were built in the mid 1970s and 25 of a smaller version, the Attache Case Kidney, were built in the early 1980s. Although the machines were well-received by patients, the cost to make them was high and the device wasn't put into mass production.**

# Er zijn 3 op het lichaam draagbare sorbentdialyse machines in ontwikkeling



## WAK- HD

- Draagbare HD
- Ca 5 kilo
- 2 klinische testen
- On hold?



## AWAK- PD

- Draagbare PD
- Ca 3 kilo?
- In klinische testfase

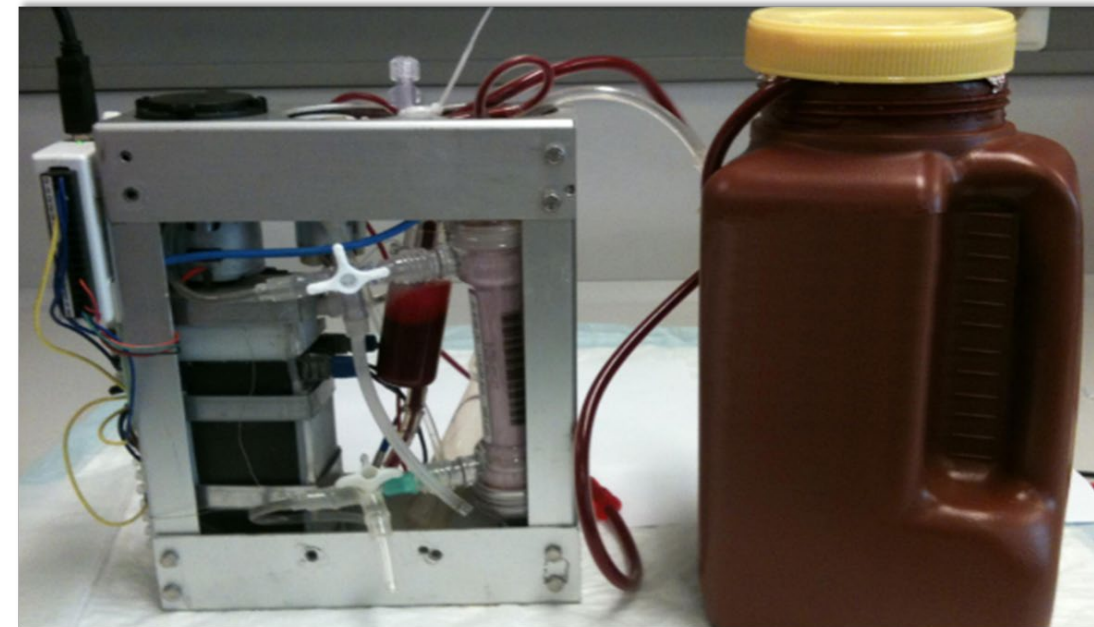
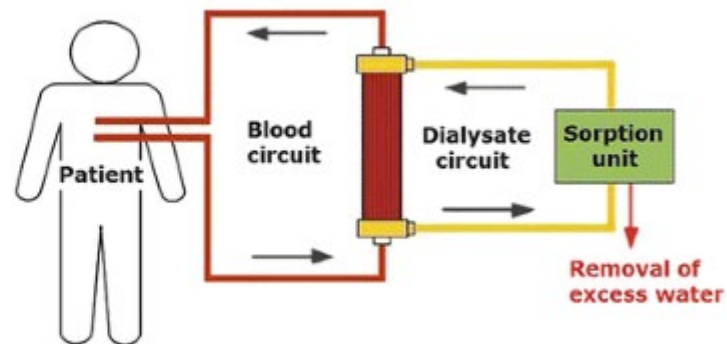
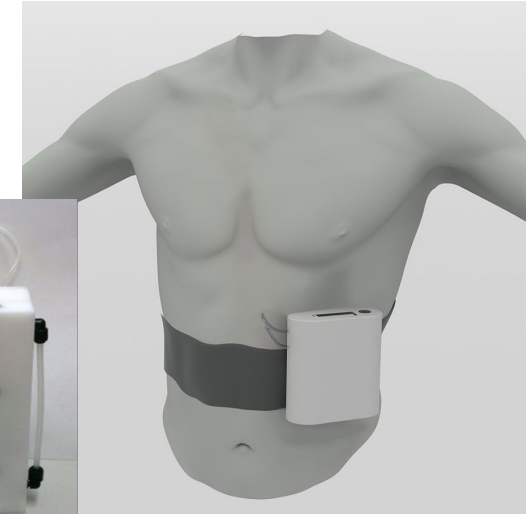
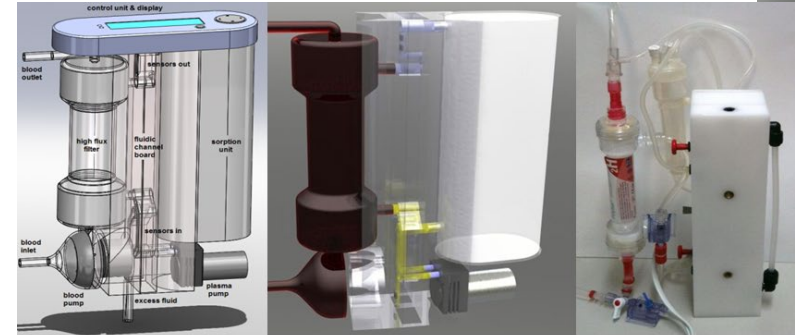


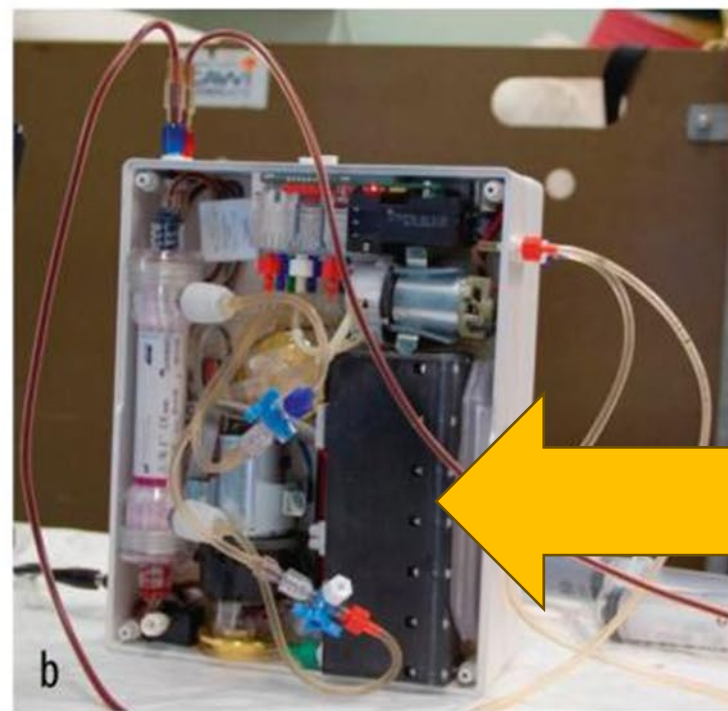
## MiniKID

- Draagbare CAPD / APD
- Ca 1,5 kilo
- In klinische testfase

2008-2014

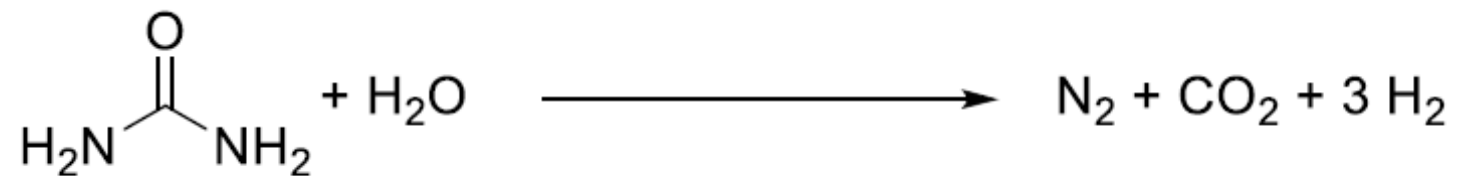
# Eerste concepten voor een draagbare HD kunstnier





Electro-oxidatie  
+ adsorptive  
module

**FIGUUR 1** (a,b) Prototype van een 'wearable artificial kidney' die ontwikkeld is binnen het Nephron+-samenwerkingsverband. Het apparaat is ongeveer 24 cm hoog. Foto's: Nanodialysis BV.





# Hoe het verder ging..

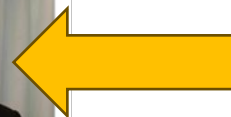
- Het NEPHRON+ prototype bleek **ongeschikt** voor dialyse, ivm onvoorspelbare vorming van toxische bijproducten in het dialysaat.  
(M Wester et al.)
- Er moet een **alternatieve methode** gevonden worden om ureum te verwijderen. Wat kunnen we leren van de historie?
- Daarnaast was er behoefte aan een **sneller innovatie traject** met uitzicht op een substantiele lange termijn financiering.
- Dit leidde tot de oprichting van NEOKIDNEY, een **maatschappelijke onderneming** op initiatief van de Nierstichting.

Tom Oostrom @TomOostrom · 4 juin

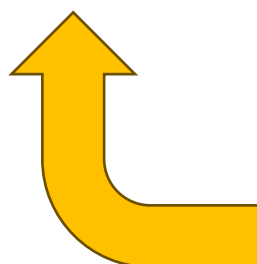
Yesterday Neokidney (Dutch Kidney Foundation) signed contract with Debiotech and AWAK for #portableartificialkidney!



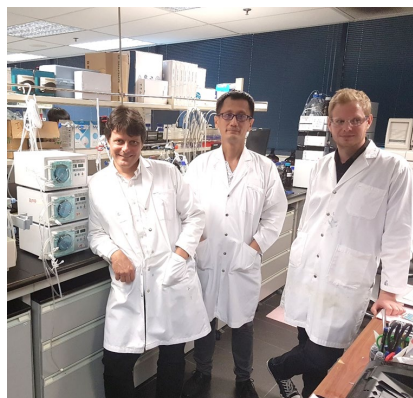
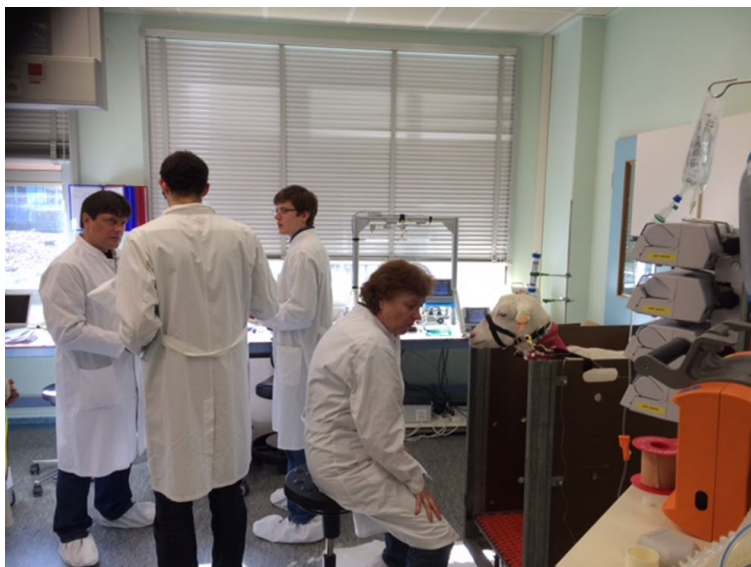
2014



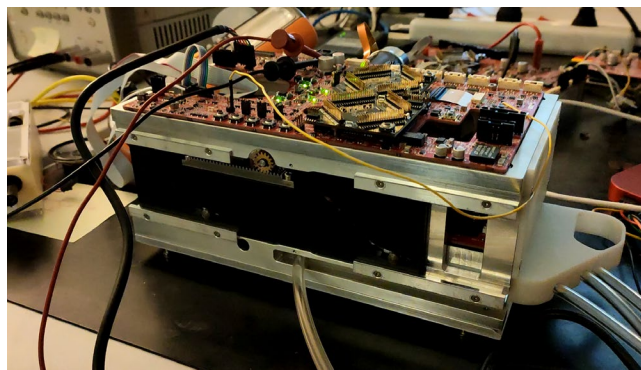
2016



# 2016



# 2017

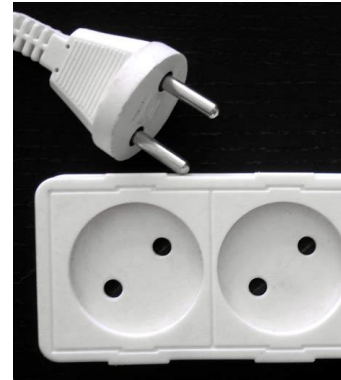


# 2021



# Wat is de Neokidney™?

- Draagbaar ontwerp
- Gewicht: 10kg zonder toebehoren
- Past als handbagage in vliegtuig (IATA)
- Dialysaat volume : 4-5 L
- Functioneert veilig met ongeaarde stroomaansluiting!
- “Cardiac floating (CF)”, en daarmee ook compatibel met centraal veneuze katheter



www.petequaifoundation.com - helping children on dialysis - donations gratefully accepted



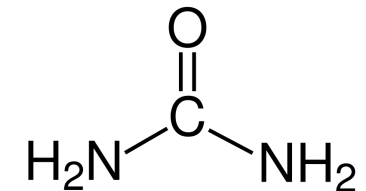
I do sympathize with you, sir, but I'm afraid it cannot be viewed as 'carry on' luggage.



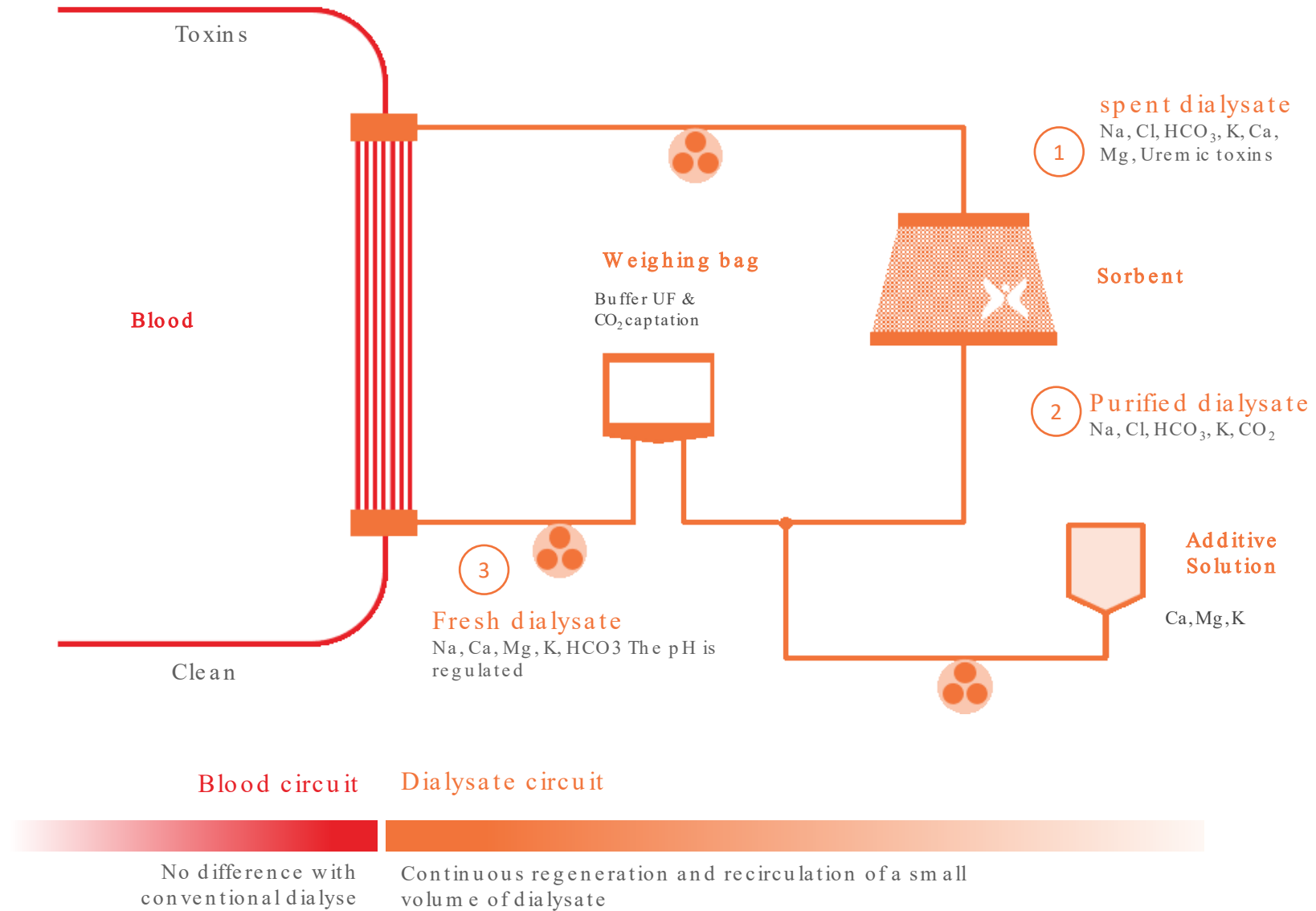
NeXtkidney


 Geregeneerd  
 Dialysaat

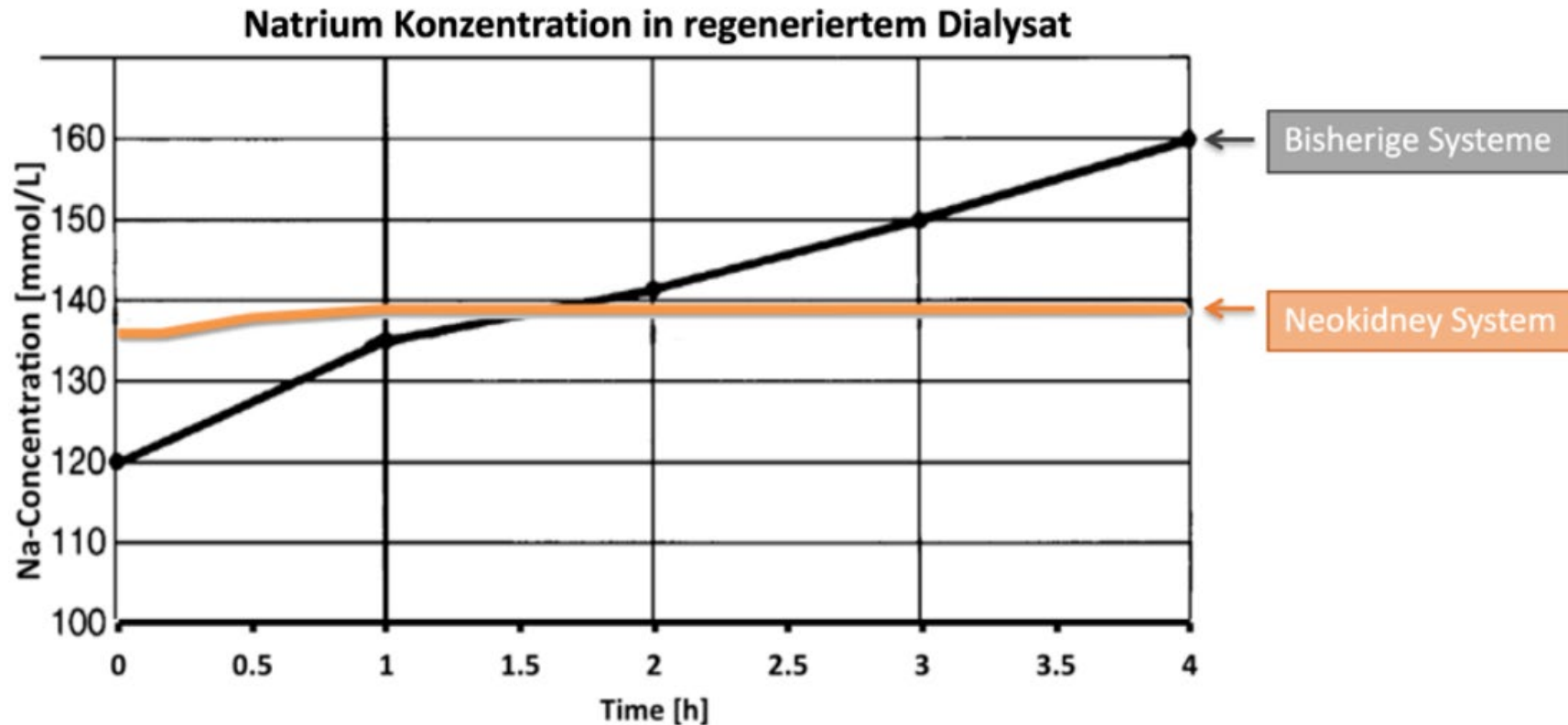
| Component                     | Functie                                                                                     |
|-------------------------------|---------------------------------------------------------------------------------------------|
| Activated Carbon (AC)         | Bind kleine organische afvalstoffen                                                         |
| Hydrous Zirconium Oxide (HZO) | Anionen wisselaar, bind fosfaat, fluoride etc.                                              |
| Zirconium Phosphate (ZP)      | Kation wisselaar, bind $\text{NH}_4^+$ , $\text{Ca}^{2+}$ , $\text{Mg}^{2+}$ , $\text{K}^+$ |
| Urease (IU)                   | Enzym dat ureum afbreekt tot ammoniak and bicarbonaat                                       |

 $\text{OH}^-$  $\text{H}^+$ ,  $\text{Na}^+$  $\text{NH}_4^+$ 
 Gebruikt  
 Dialysaat

**Klassieke sorbent dialyse systemen geven natrium af!**



# Sorbentdialyse met Neokidney™ is *isonatremisch*







“The world’s first and only truly portable hemodialysis device”

#### Fluid volume

- 4–5 Litre
- Easy handling with low volume fluid bags

#### Flow rates

- Blood 150–300 ml/min
- Dialysate 300 ml/min

#### Dialysate type

- Bicarbonate buffered

#### Accessories

- Dialyzer
- Blood leak detector
- Blood pressure monitor
- Wireless body weight scale
- Wireless blood pressure measurement

#### Duration

Daily 2 hours dialysis  
(5 to 6 times per week)

#### Dimensions (mm)

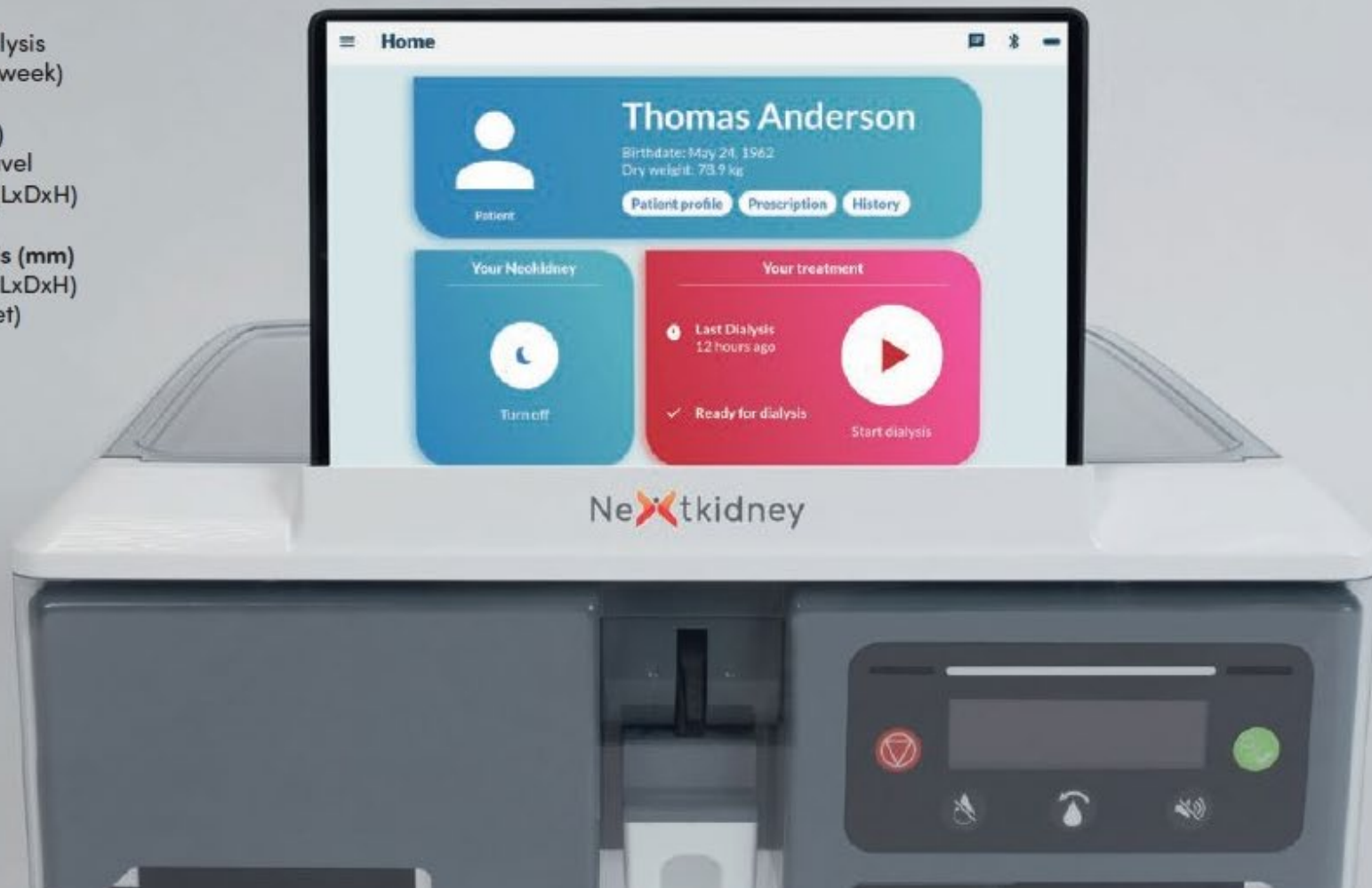
Collapsed for travel  
460 x 350 x 205 (LxDxH)

#### Set up for dialysis (mm)

460 x 350 x 320 (LxDxH)  
(+ 120 H for tablet)

#### Weight

~10kg





|                   |                                             |
|-------------------|---------------------------------------------|
| Company valuation | € 50.000.000<br>(*prior to your investment) |
| % shares offered  | 8,12%                                       |
| Price per share   | € 236,75                                    |

#### About Nextkidney

## An initiative of the Dutch Kidney Foundation

Chronic kidney disease affects approximately 700–850 million people worldwide. The mortality rate is estimated at 1.2 million, which puts kidney disease in the top 10 of most common causes of death.

In addition to transplantation, kidney failure is mainly treated with haemodialysis. This is an expensive procedure which severely restricts patients in leading a normal life, as kidney patients have to spend four hours on a dialysis machine for an average of three times a week.



oneplanetcrowd

# 2022

## CROWDFUNDING

€250 per certificaat  
1200 certificaathouders

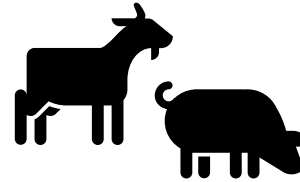
Opbrengst:  
**€4,1 miljoen**

# Testen met de draagbare kunstnier

- In het lab met gesimuleerde vloeistoffen
- In het lab met bloed



- In gezonde geiten en varkens
- In geiten en varkens zonder nieren



- In het ziekenhuis, enkele patiënten (veiligheid)
- In het ziekenhuis met 10-20 patiënten (effectiviteit)



- Buiten het ziekenhuis met 10-20 patiënten (effectiviteit en veiligheid)



Zorginstituut Nederland

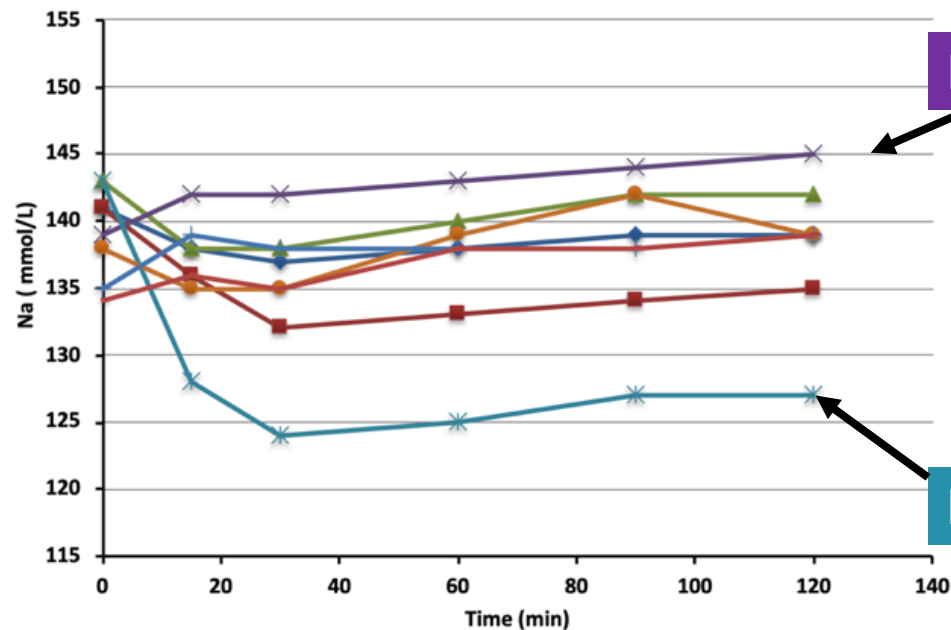




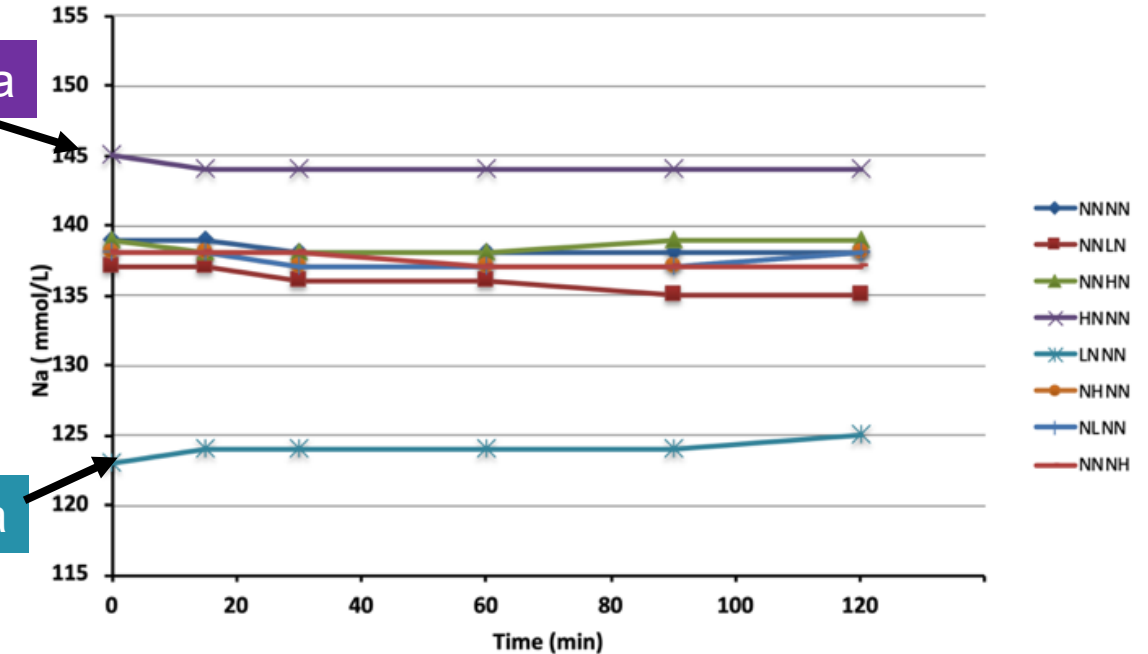
# In vitro testen met gesimuleerde vloeistoffen

$\text{Na}^+ - \text{HCO}_3^- - \text{ureum} - \text{K}^+$   
(hoog/laag/normaal)

Natrium in dialysaat



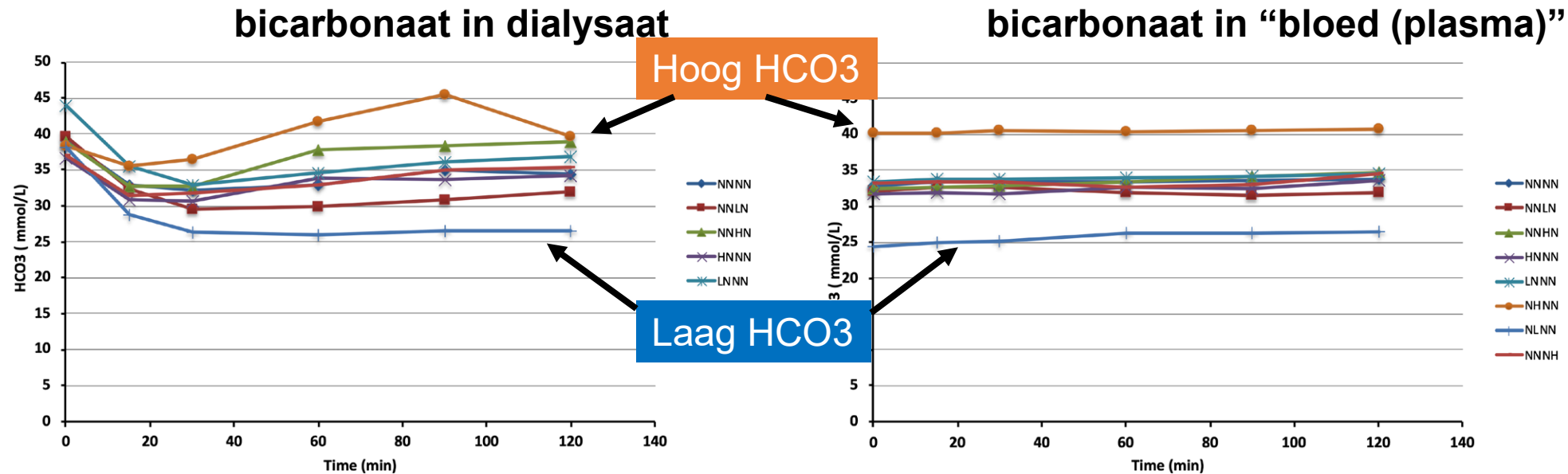
Natrium in "bloed (plasma)"





# In vitro testen met gesimuleerde vloeistoffen

$\text{Na}^+ - \text{HCO}_3^- - \text{ureum} - \text{K}^+$   
(hoog/laag/ normaal)

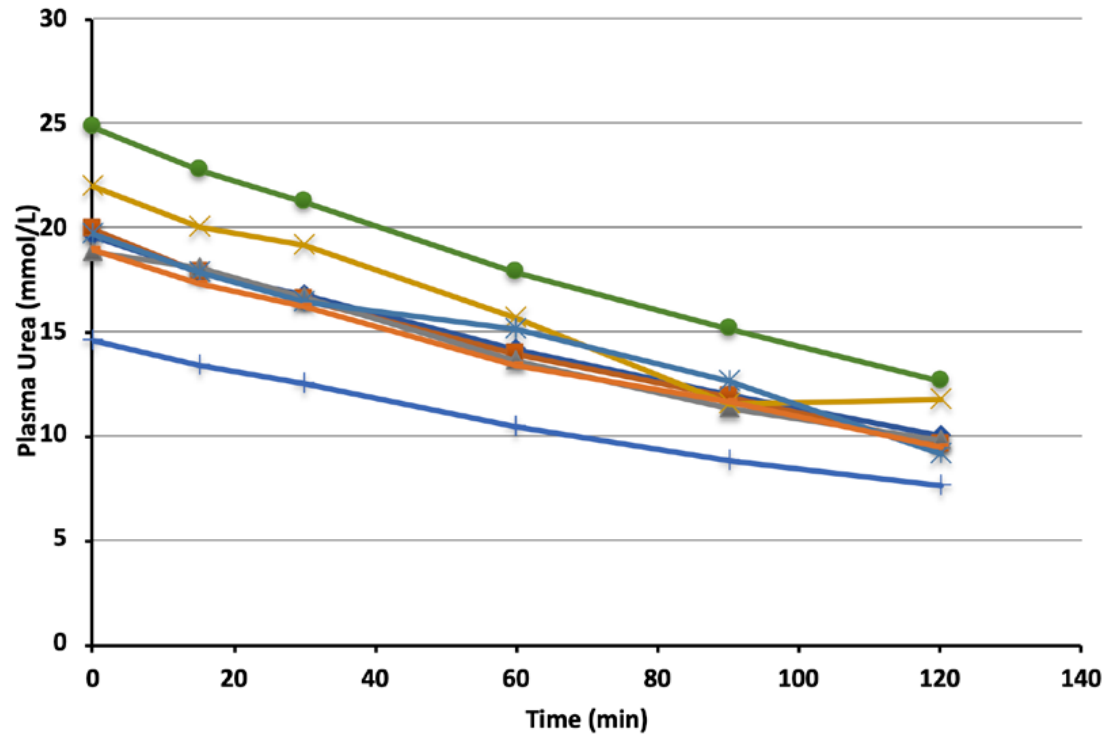




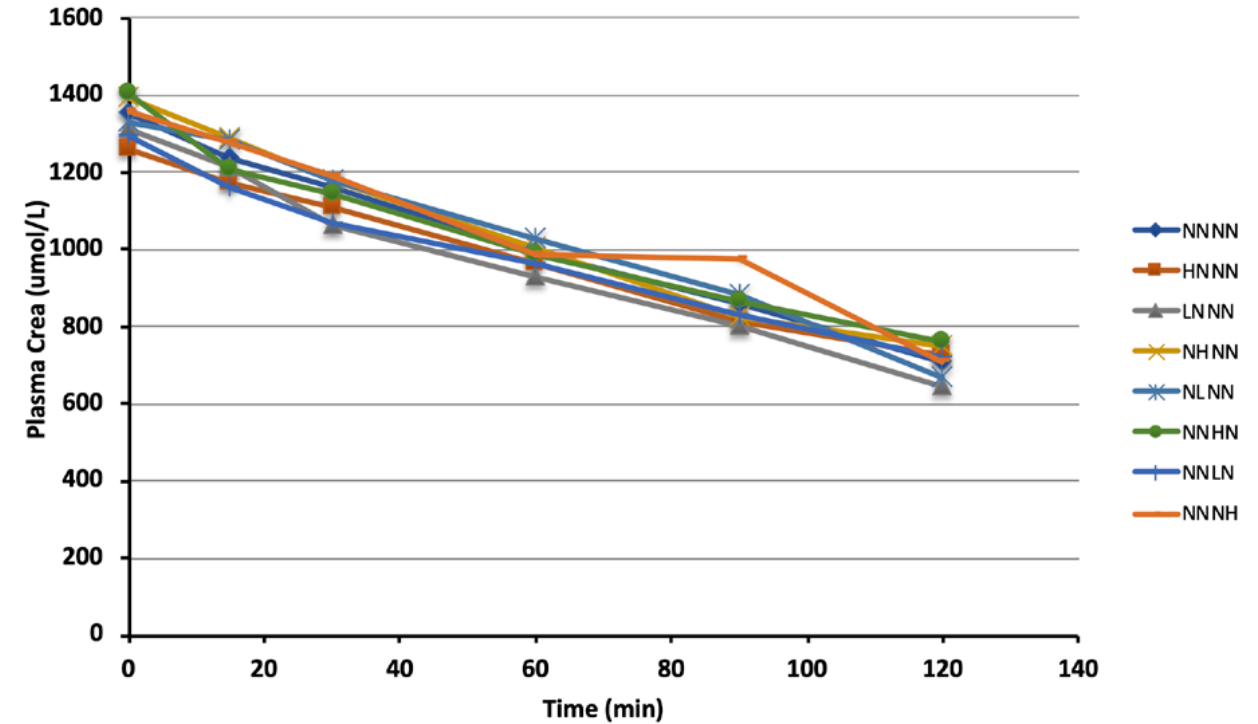
# In vitro testen met gesimuleerde vloeistoffen

$\text{Na}^+$  –  $\text{HCO}_3^-$  – ureum-  $\text{K}^+$   
(hoog/laag/ normaal)

Ureum in plasma (bloed)

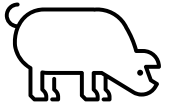


Creatinine in “bloed (plasma)”

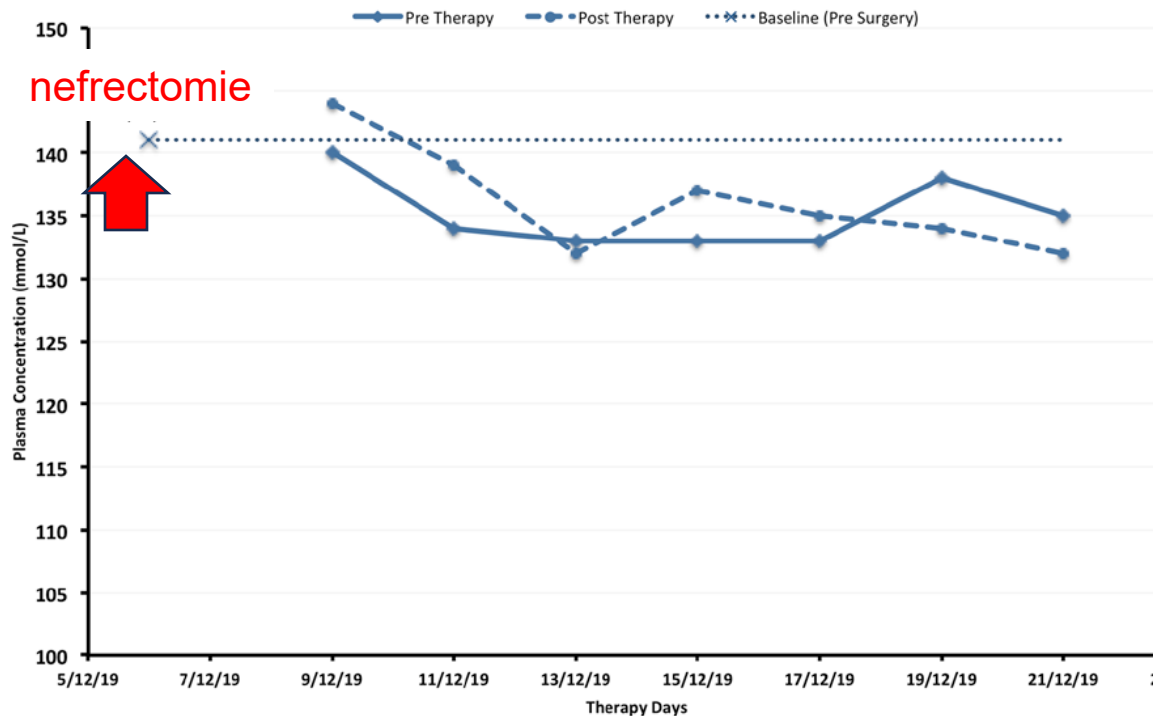


# In vivo testen in varkens

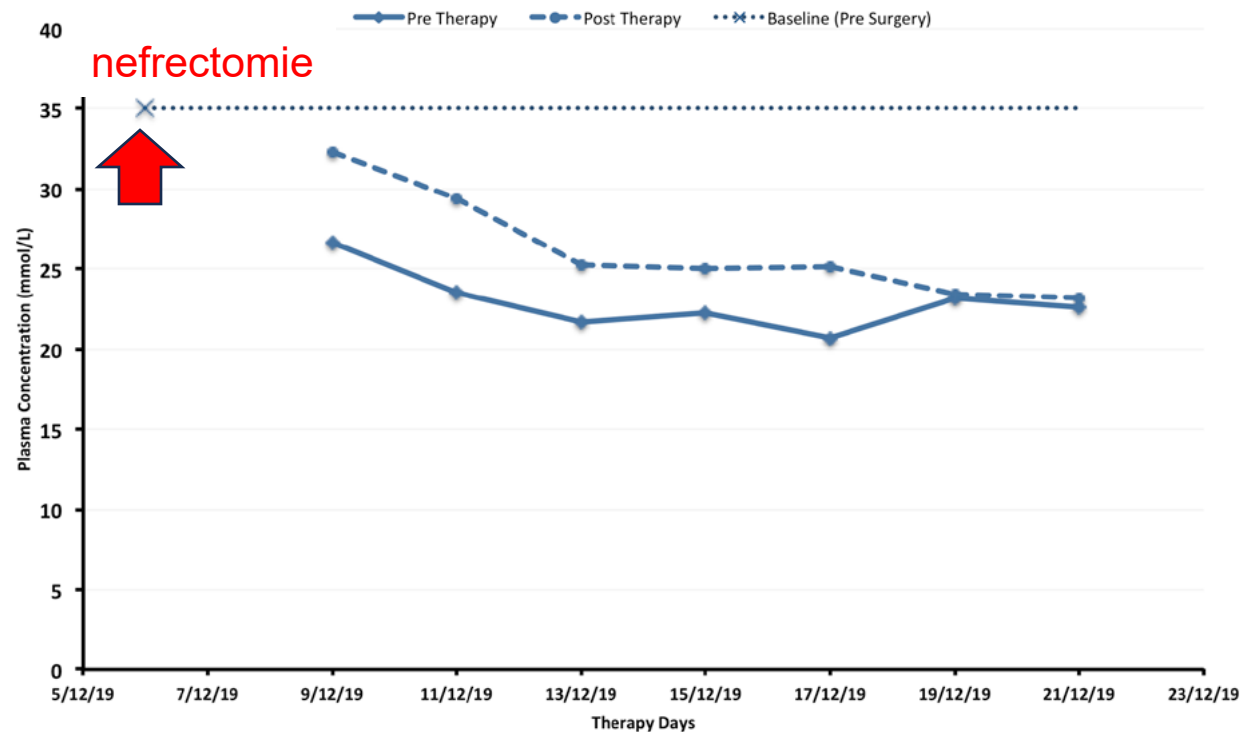
Hemodialyse om de dag



## Natrium in bloed (plasma)



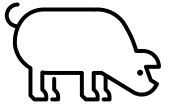
## Bicarbonaat in bloed (plasma)



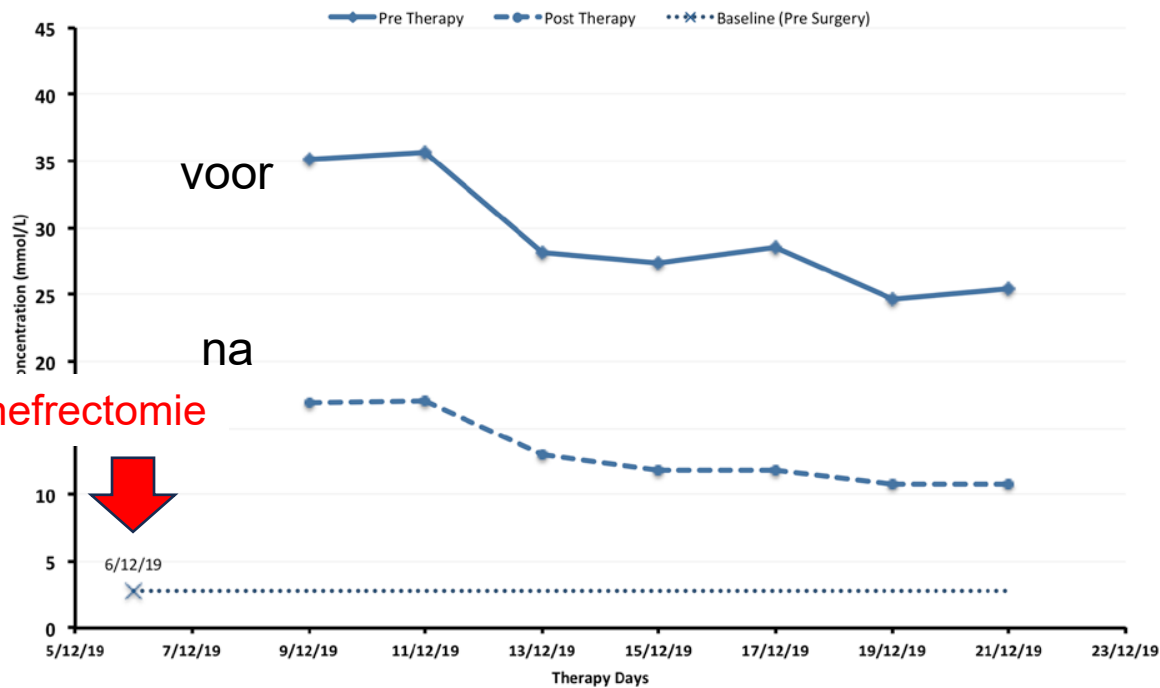
- Stabiele natrium spiegels
- Stabiele bicarbonaat spiegels

# In vivo testen in varkens

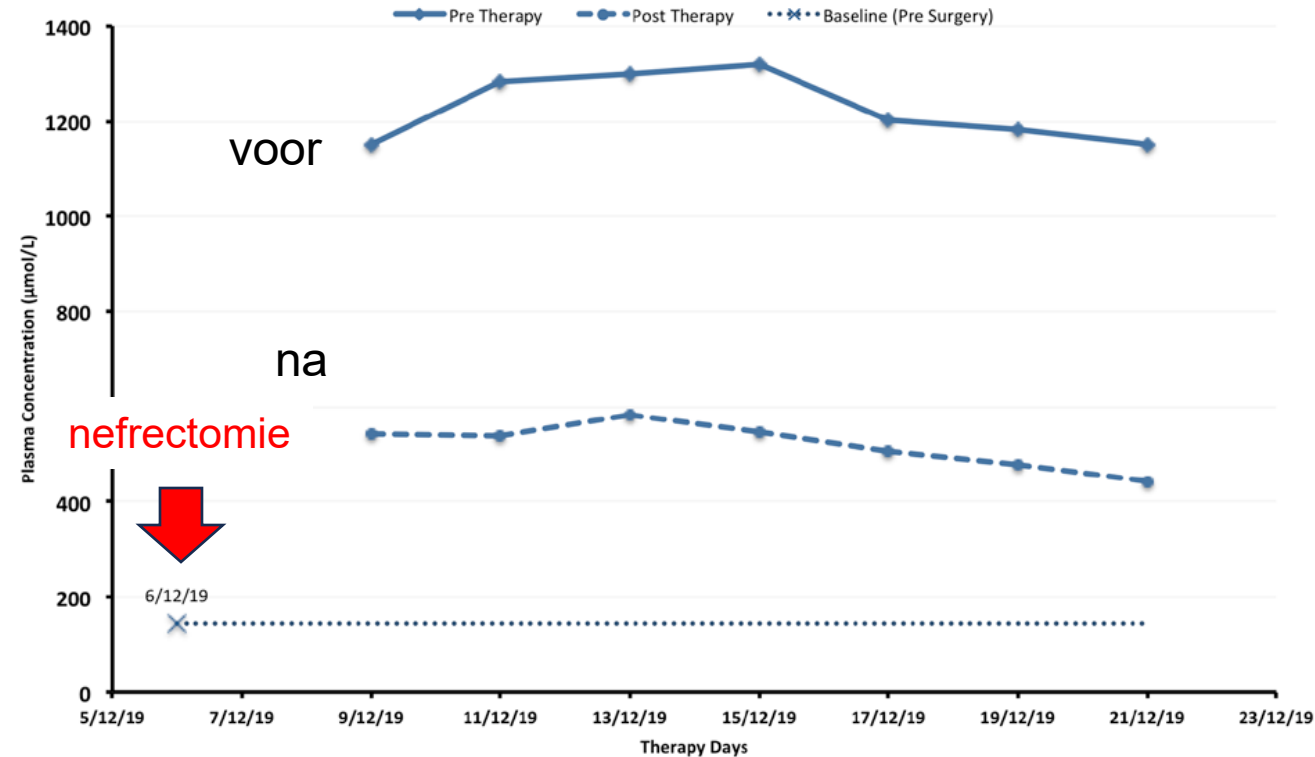
Hemodialyse om de dag



## Ureum in bloed (plasma)



## Creatinine in bloed (plasma)





# National University Hospital Singapore

Clinical investigators Sorbent Cartridges

← Dr. Titus Lau & Dr. Sabrina Haroon Wong Peixin →



# NUH Singapore

## Sorbent test with patients

- Blood circuit: normal HD machine
- Dialysate circuit: supplied with Sorbent Regenerated Dialysate



**2023**



# University Hospital Caen (France)

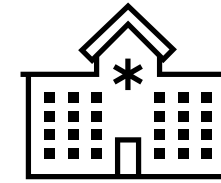
← Dr. Maxence Ficheux



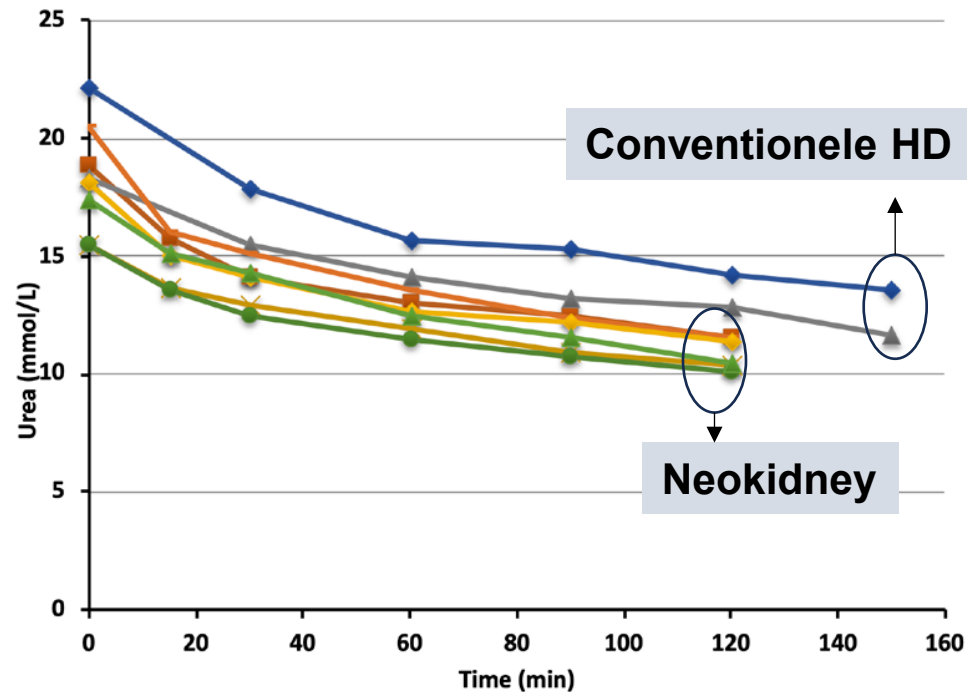
2024



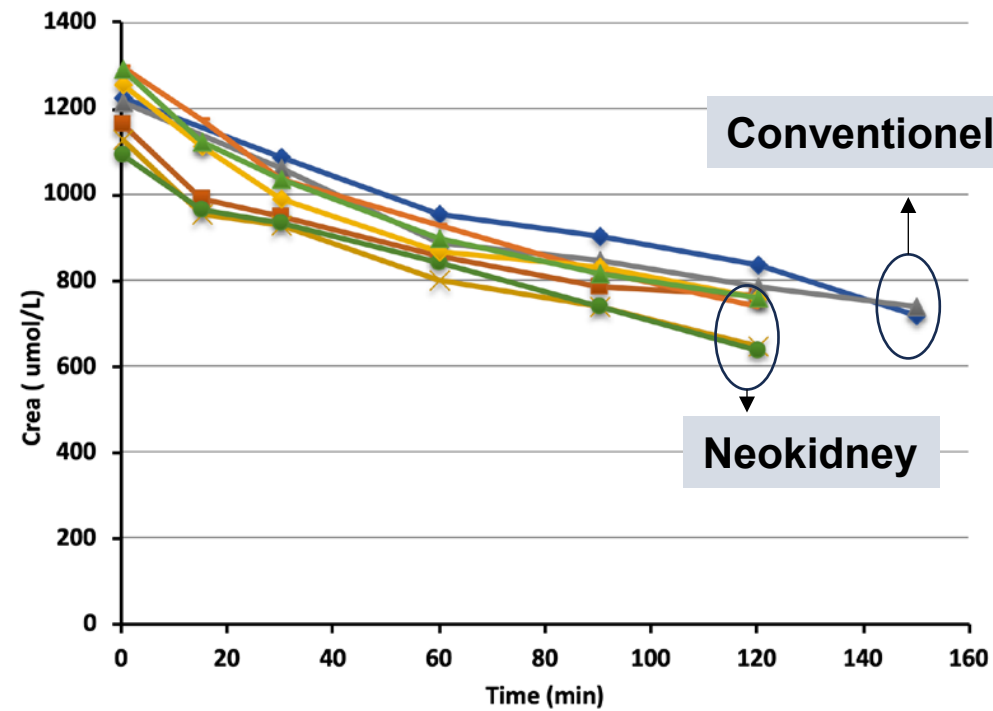
# Voorlopige resultaten First-in-Human trial



Ureum in bloed  
(plasma)



Creatinine in bloed  
(plasma)





# University Medical Centre Utrecht (Netherlands)

← Dr. Karin Gerritsen



**2025**

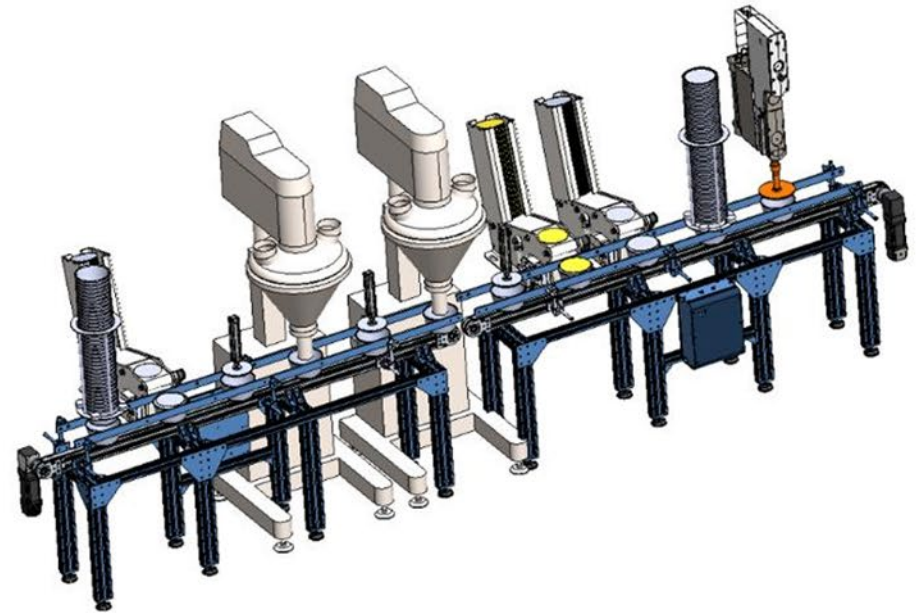
**Aanmelden niet mogelijk**



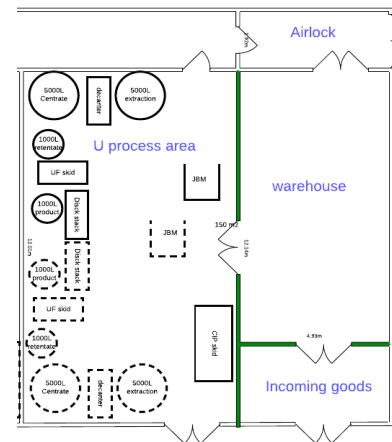
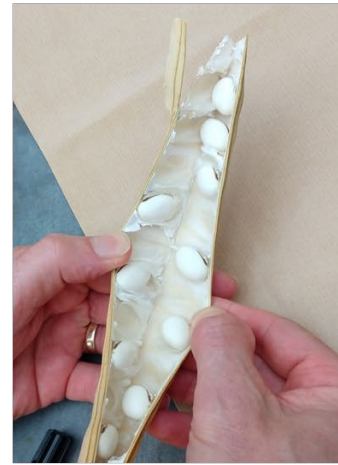
# Samenvatting Neokidney™

- Klinische testen in 2025-2026 in NL
  - Twee centra in Nederland en Frankrijk
  - Ca. 10-20 patienten, 3 maanden
  - Eerst ziekenhuis, daarna thuis
- 
- Verwachte markttoelating in Europa: 2026 (en later Noord-Amerika)
  - Geschikt voor ~80% van de patienten
  - 5-6x per week dialyse, 2-3 uur

# Ondertussen...productielijn voor sorbentcartridge



# Urease isolatie uit *Jack Beans*



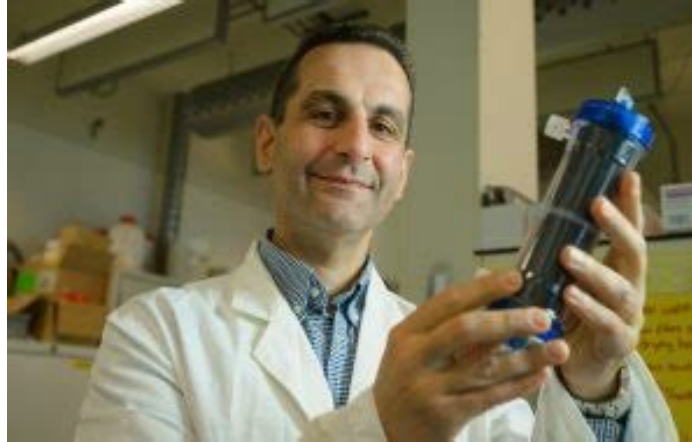
# Andere innovaties voor de dialyse in NL



**CORDIAL**

Sorbent dialyse voor  
continuous flow PD

<https://www.projectcordial.eu/>



**M3 Nephron**

Filtratie-adsorptie membrane  
voor thuisdialyse

**UNIVERSITY  
OF TWENTE.**



**KIDNEW**

Silicium filters voor implanteerbare  
kunstnier

<https://www.kidnew.eu/>



UMC Utrecht



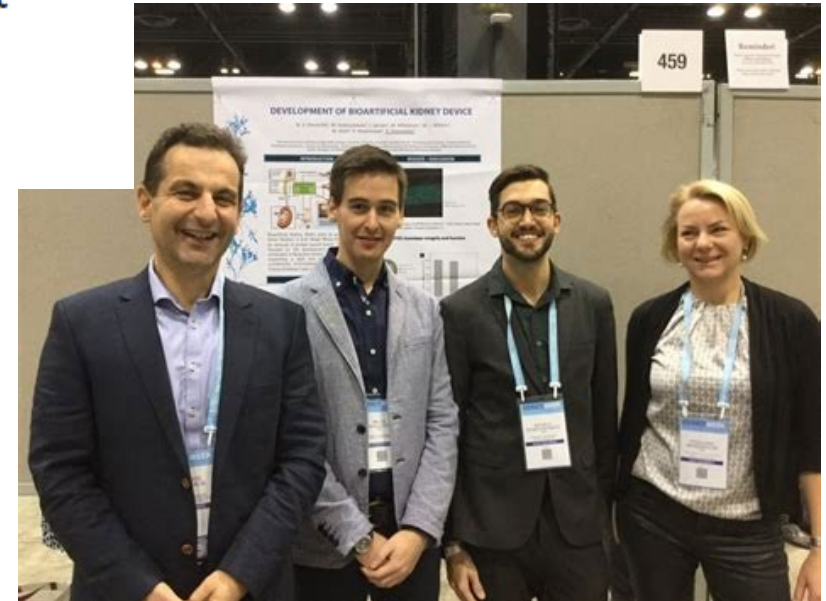
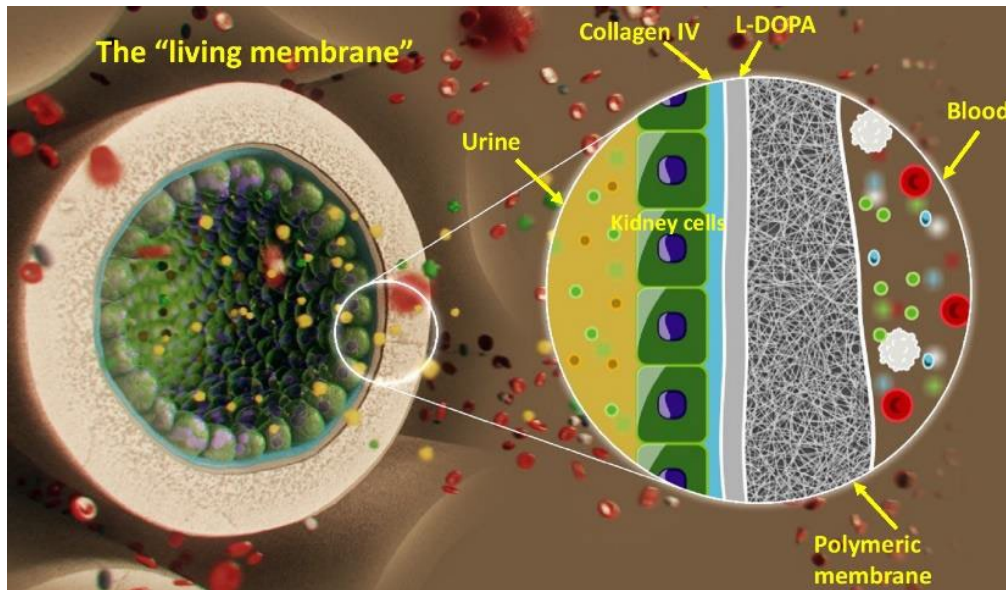
Universiteit Utrecht



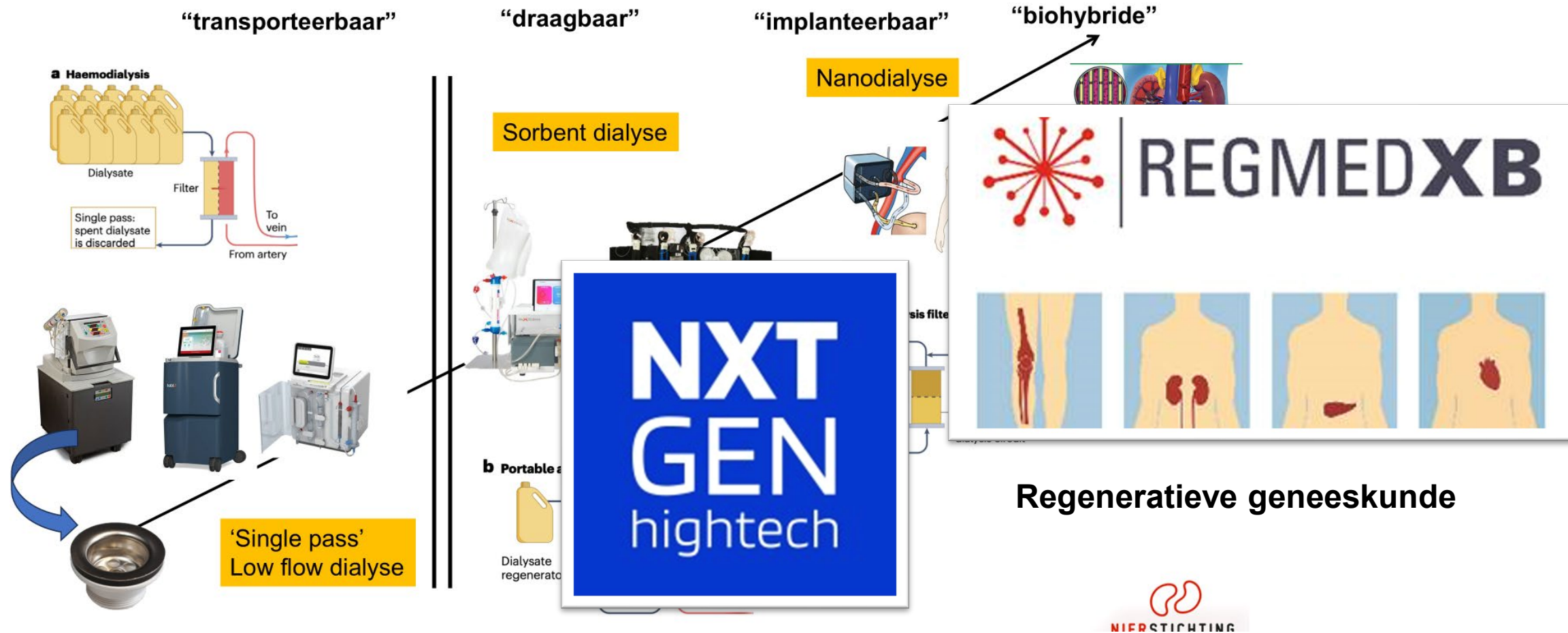
# Andere innovaties voor de dialyse in NL



BioArtificial Kidney device consisting of living membranes for improved kidney replacement therapy



# Innovatienetwerken



Biomedische productie technologie



European Parliament, Brussels, June 15<sup>th</sup>, 2022





UNIVERSITY  
OF TWENTE.

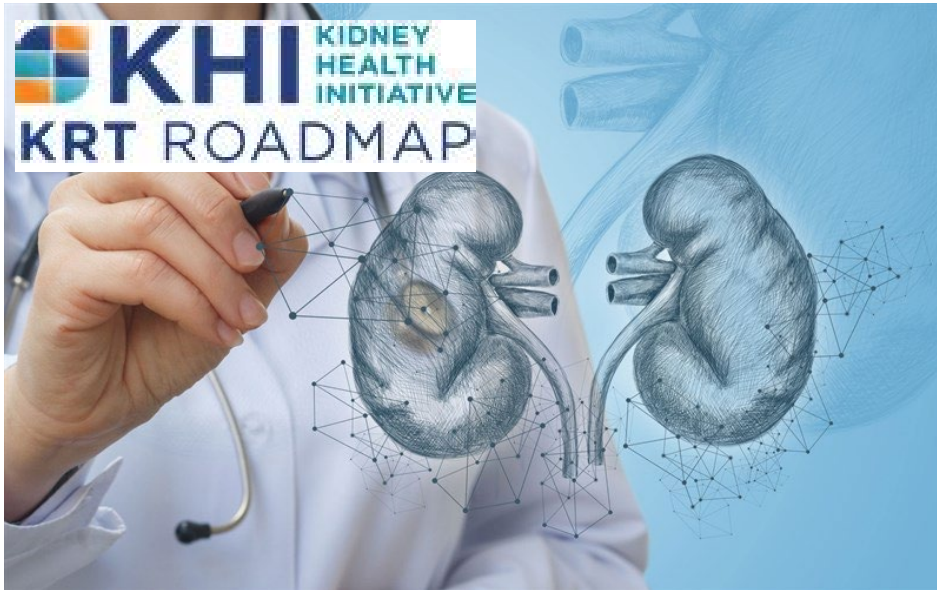


UMC Utrecht

umec



# Meer weten?

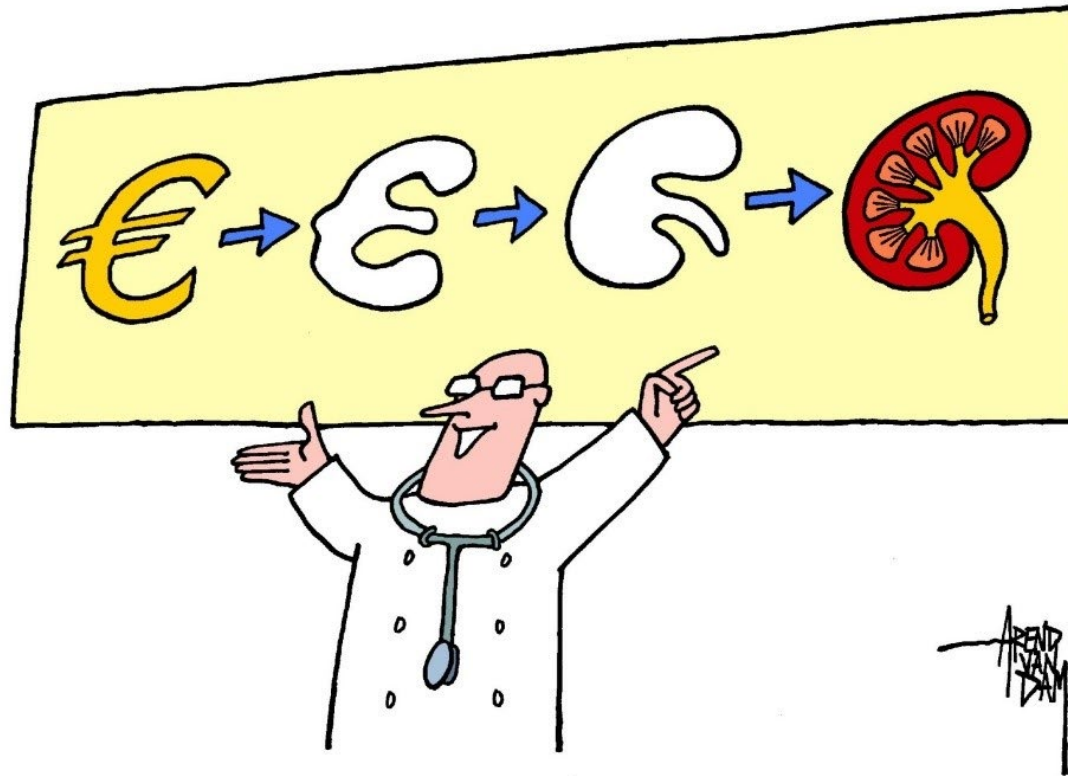


<https://khi.asn-online.org/roadmap/>

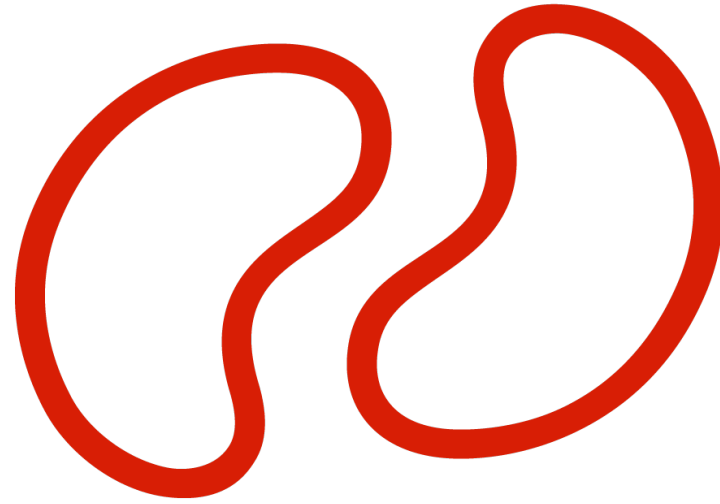


<https://www.youtube.com/@nierstichting>  
**TechNIERen**

**Dank voor uw aandacht!**



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# NIERSTICHTING

Je nieren zijn je leven.

# DANK!!

Wetenschapsdag 2024

  
**NIERSTICHTING**  
Je nieren zijn je leven.

  
**nvN** nierpatiënten  
vereniging  
nederland

 **nieren.nl**  
vergroef je kennis, deel je ervaring

Je hebt zojuist een presentatie van de Nierpatiënten Vereniging Nederland bekeken of bijgewoond.

Hiermee willen we niet alleen onze leden, maar alle nierpatiënten informeren over nierziekten en het leven ermee. Ben je geen lid, maar sta je achter het werk van de NVN? Steun ons dan met een gift. Zodat we mooie webinars/themadagen kunnen blijven maken. Wij zijn blij met elke bijdrage! Scan hiervoor deze QR-code.



AstraZeneca 

  
**HANSA**  
BIOPHARMA

**CSL Vifor**

 **Chiesi**

 **astellas**