

*If the patient is severely
hyponatraemic or
hypernatraemic,*

*you can be sure there is a doctor
involved.*

MANTRAS

MANTRAS

Na content \neq [Na]

MANTRAS

Na content \neq [Na]

Na content \rightarrow ECF size

MANTRAS

Na content \neq [Na]

Na content \rightarrow ECF size

Water content \rightarrow ICF size

MANTRAS

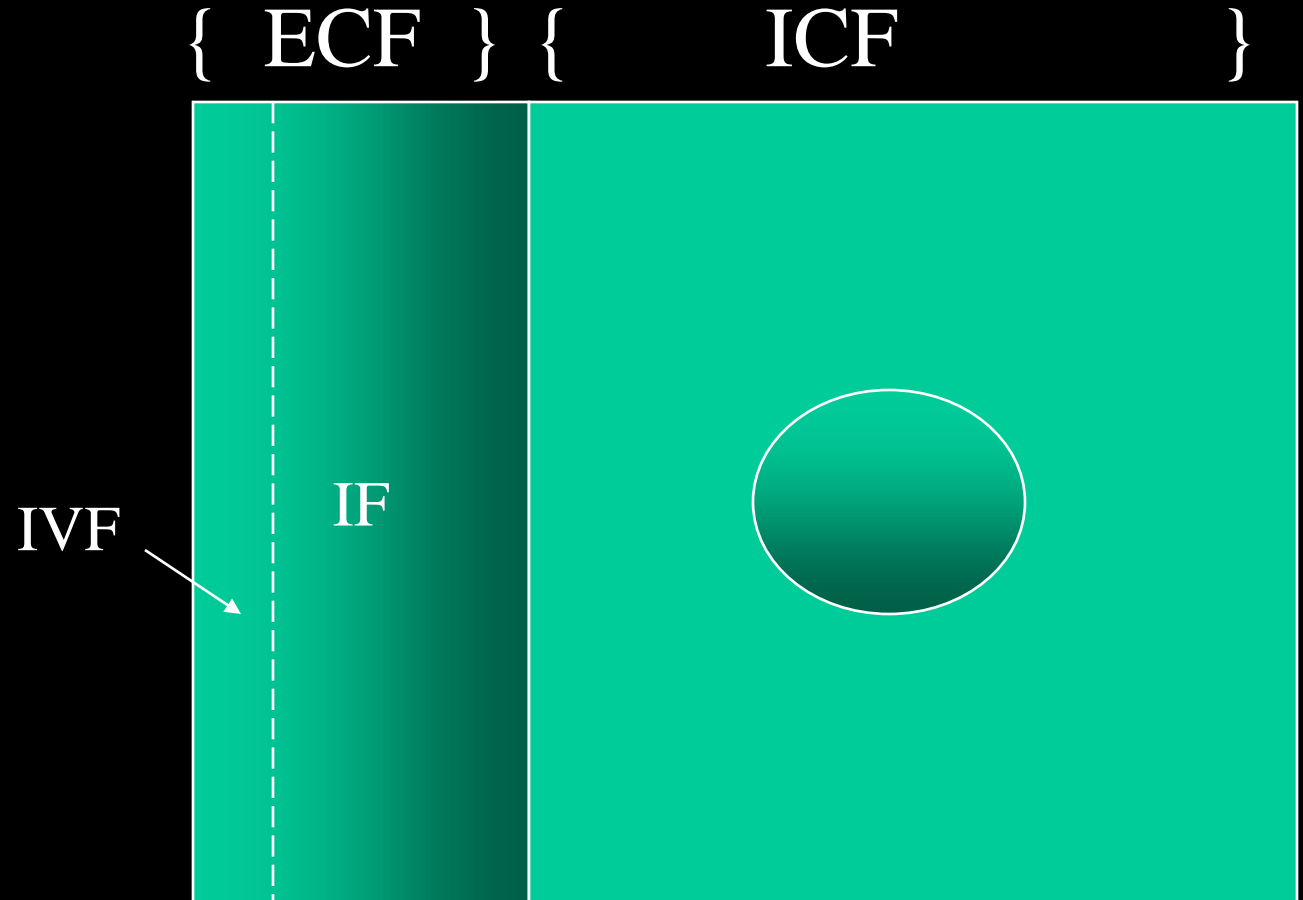
Na content \neq [Na]

Na content \rightarrow ECF size

Water content \rightarrow ICF size

Water content \propto $1/[Na]$

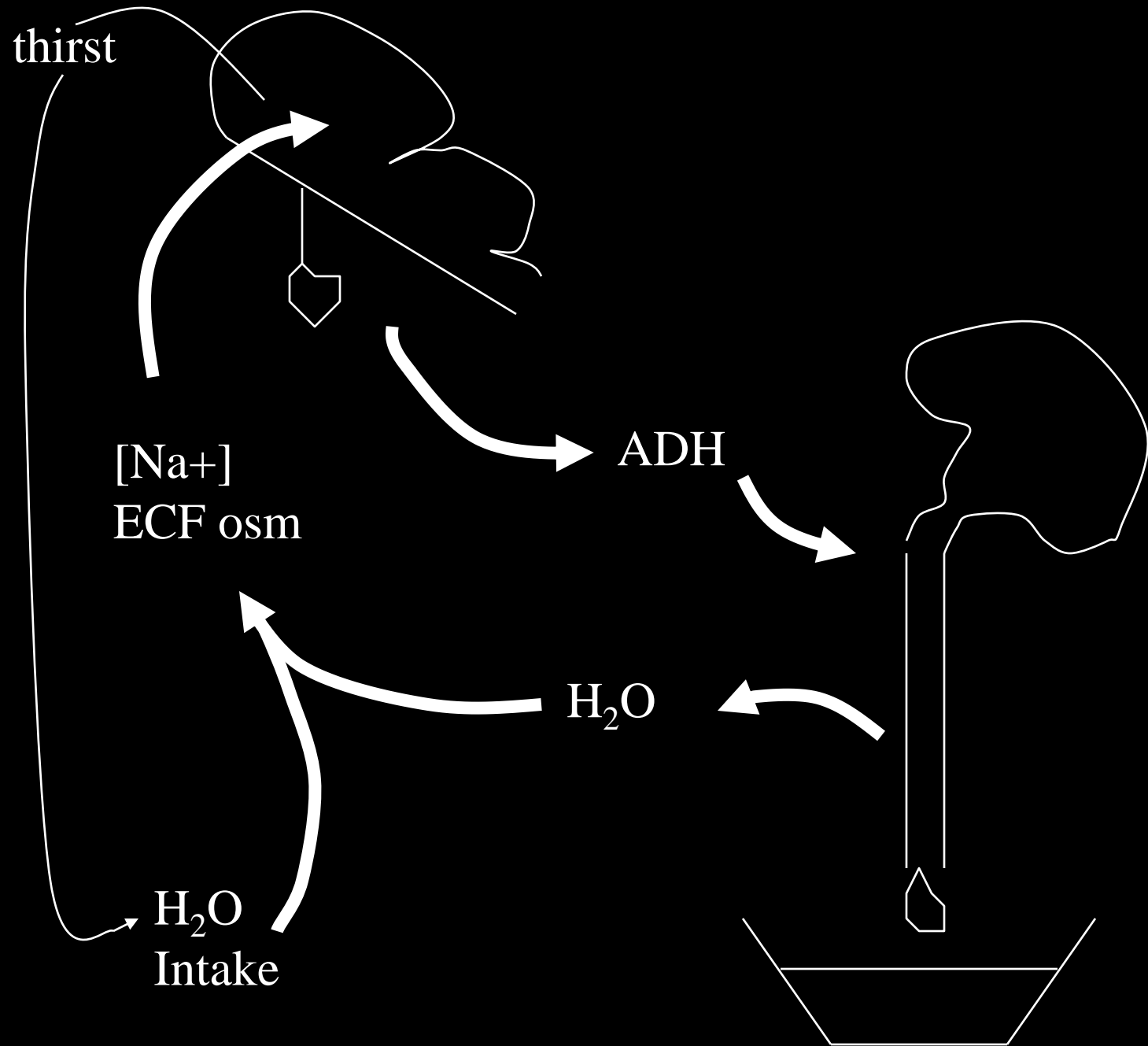
Normal



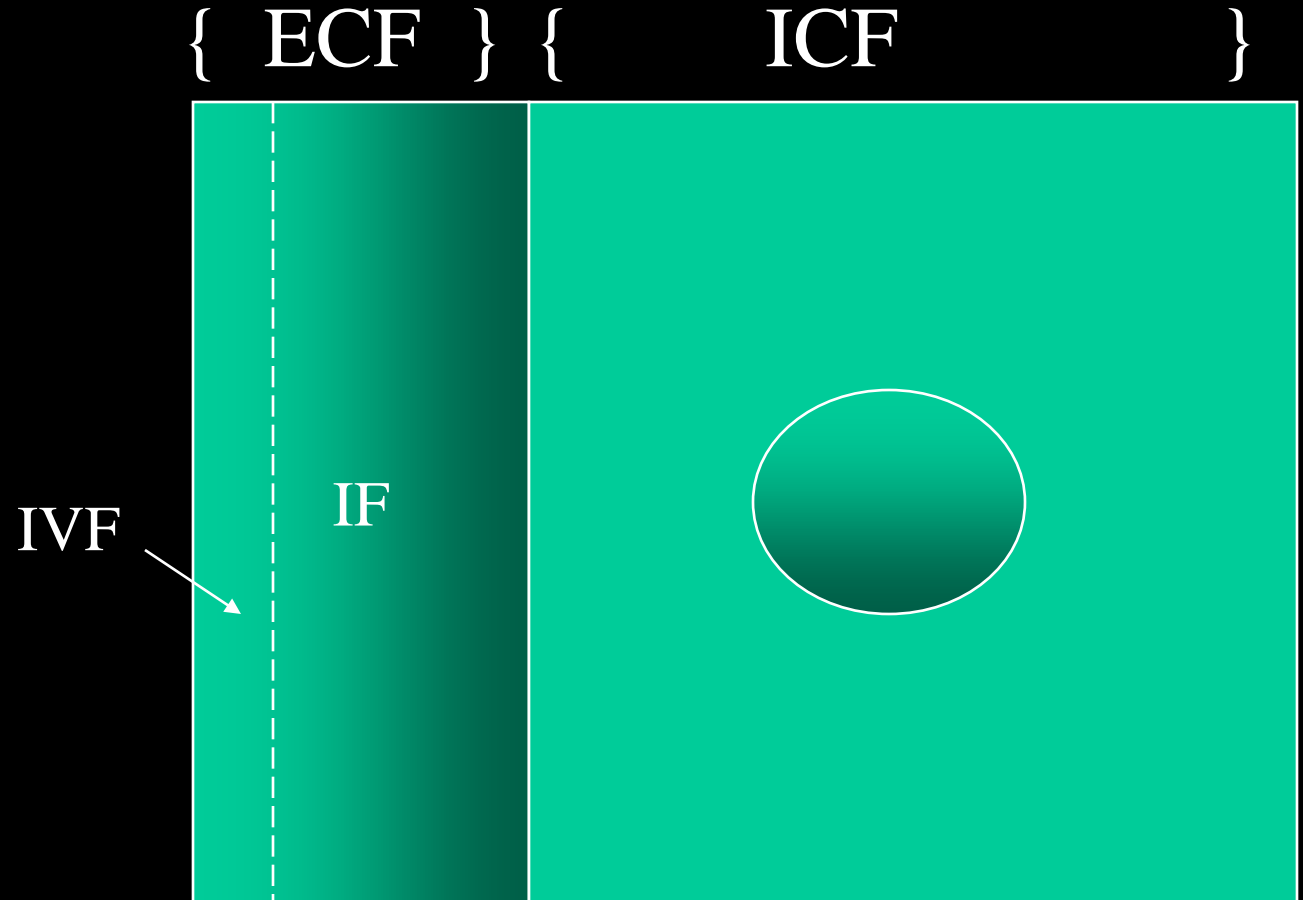
WATER PROBLEMS

WATER PROBLEMS

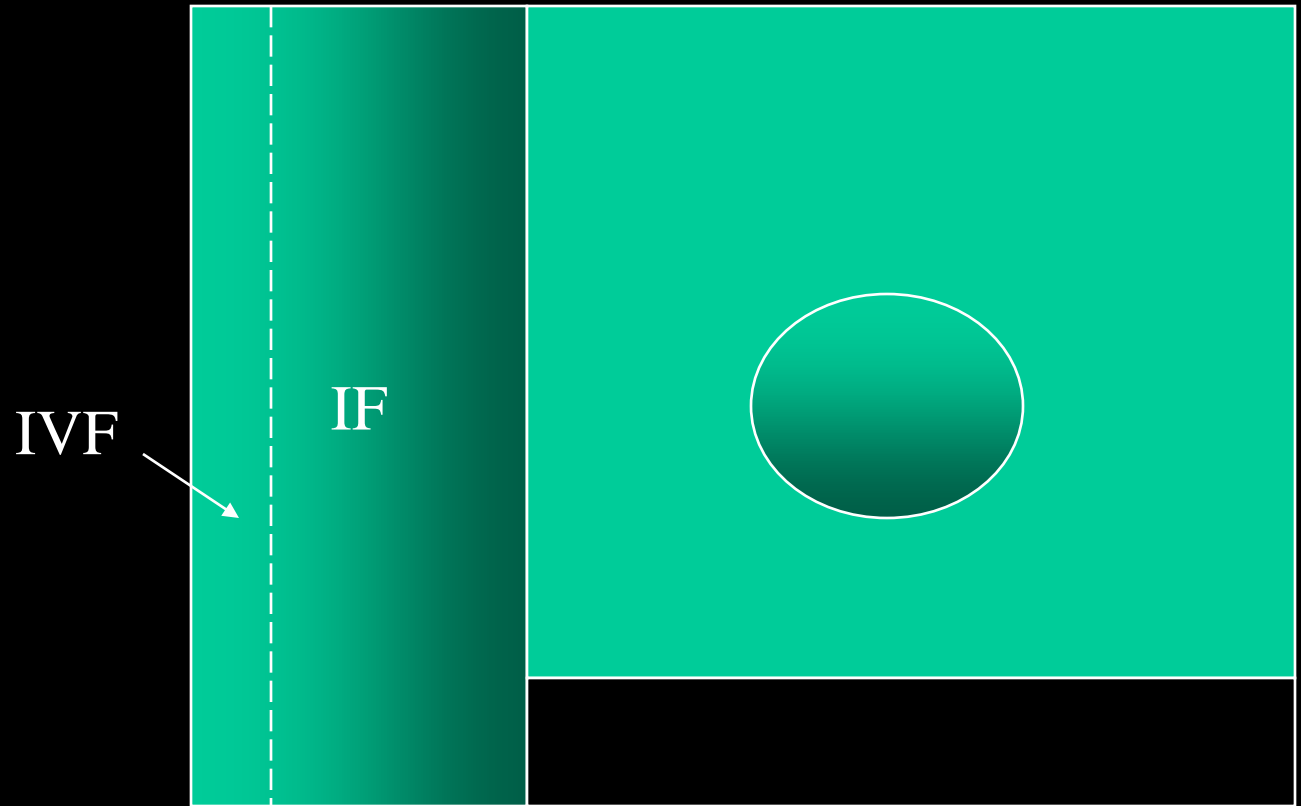
- Water deficit



Normal



{ ECF } { ICF }



How to recognize?

How to recognize?

- Hyponatraemia

How to recognize?

- Hypernatraemia
- (thirst)

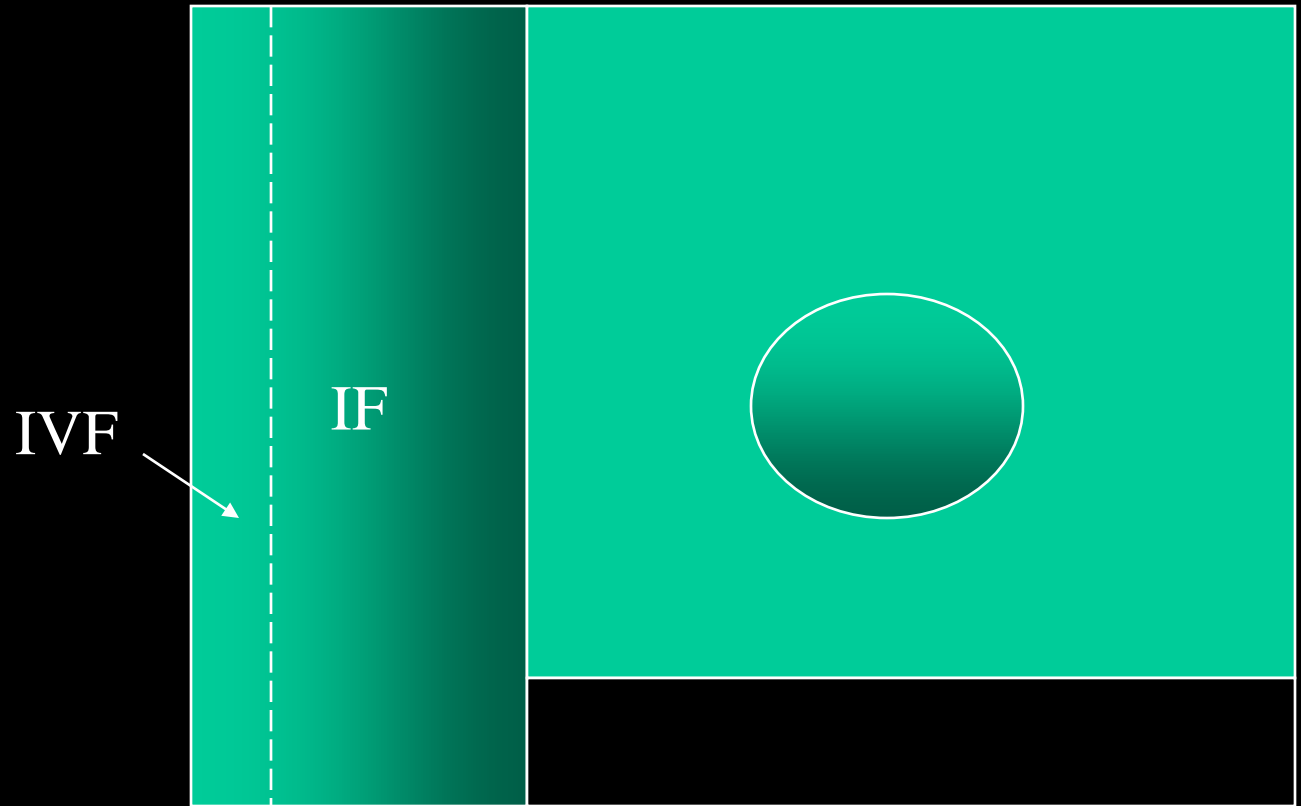
How to recognize?

- Hypernatraemia
- (thirst)
- Shock?

How to recognize?

- Hyponatraemia
- (thirst)
- Shock? *No*

{ ECF } { ICF }



How to treat?

How to treat?

- Give water

How to treat?

- Give water
 - NG

How to treat?

- Give water
 - NG
 - IV

How to treat?

- Give water
 - NG
 - IV Glucose 5%

How to treat?

- Give water
 - NG
 - IV Glucose 5%

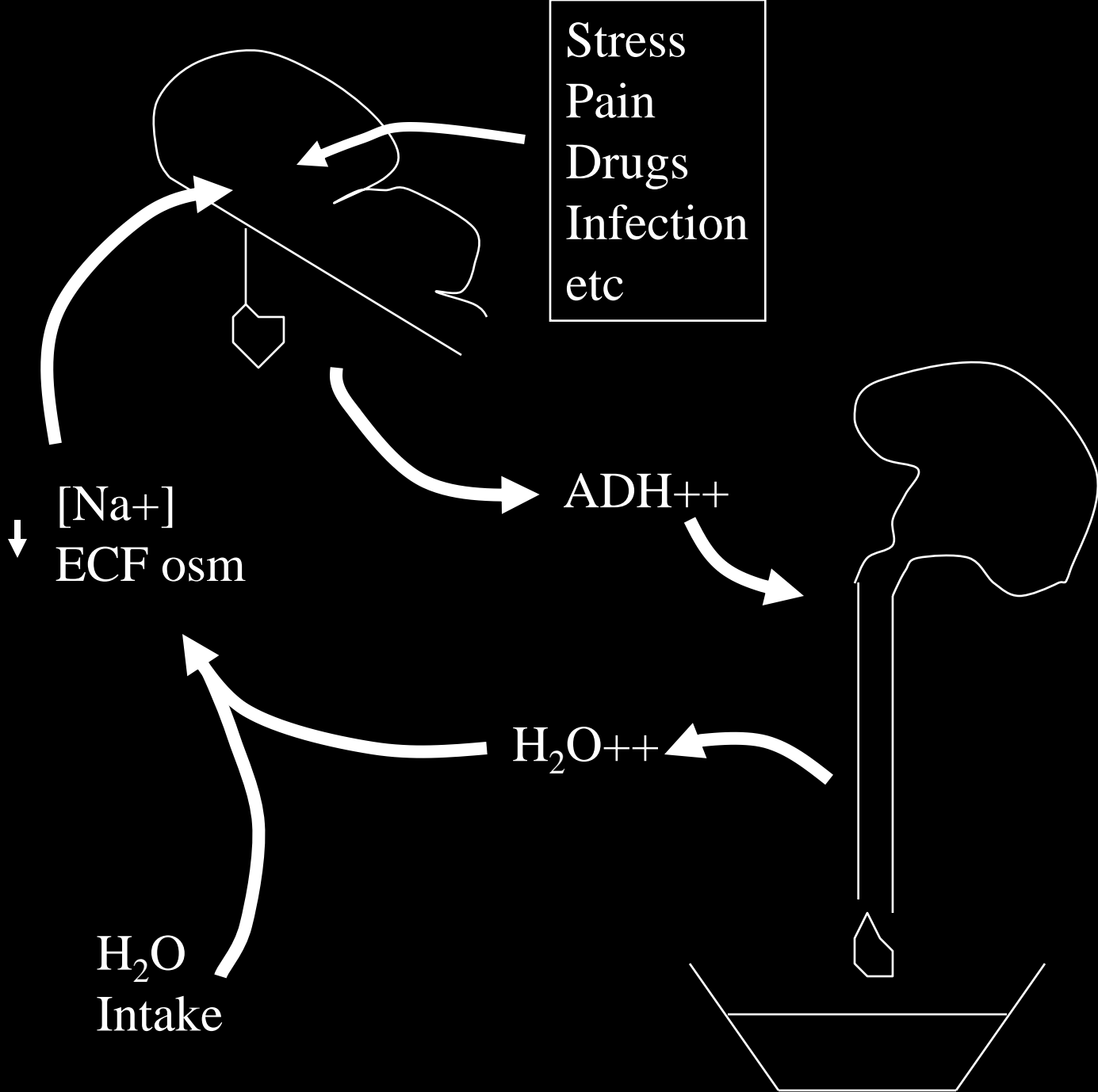
- Give Na?

How to treat?

- Give water
 - NG
 - IV Glucose 5%

- Give Na? *No*

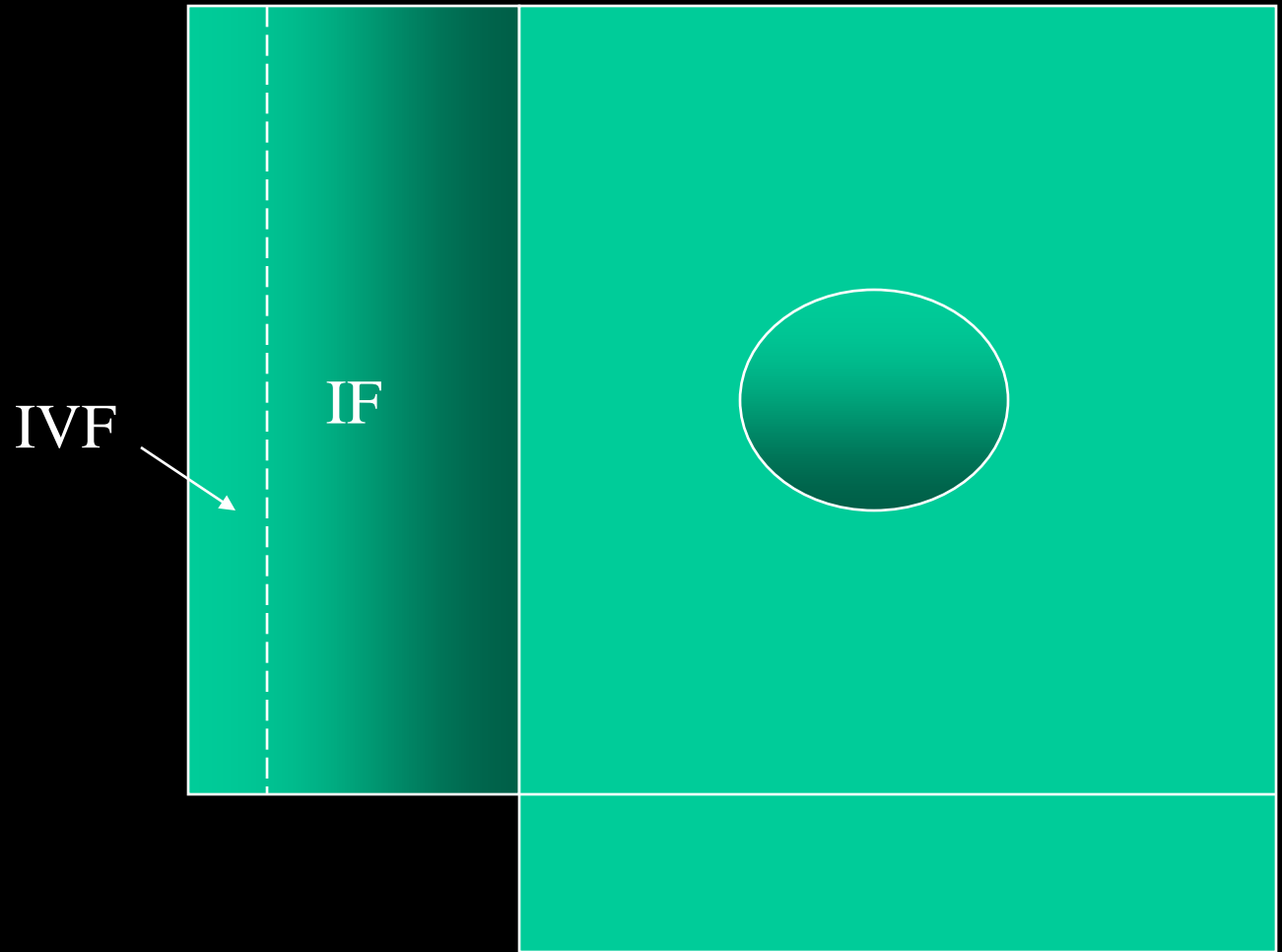
- Water excess



- Na 134 mmol/L

- Na 134 mmol/L (135-145)

{ ECF } { ICF }



How to recognize?

How to recognize?

- Hyponatraemia

How to recognize?

- Hyponatraemia
- Clinical upset?

How to recognize?

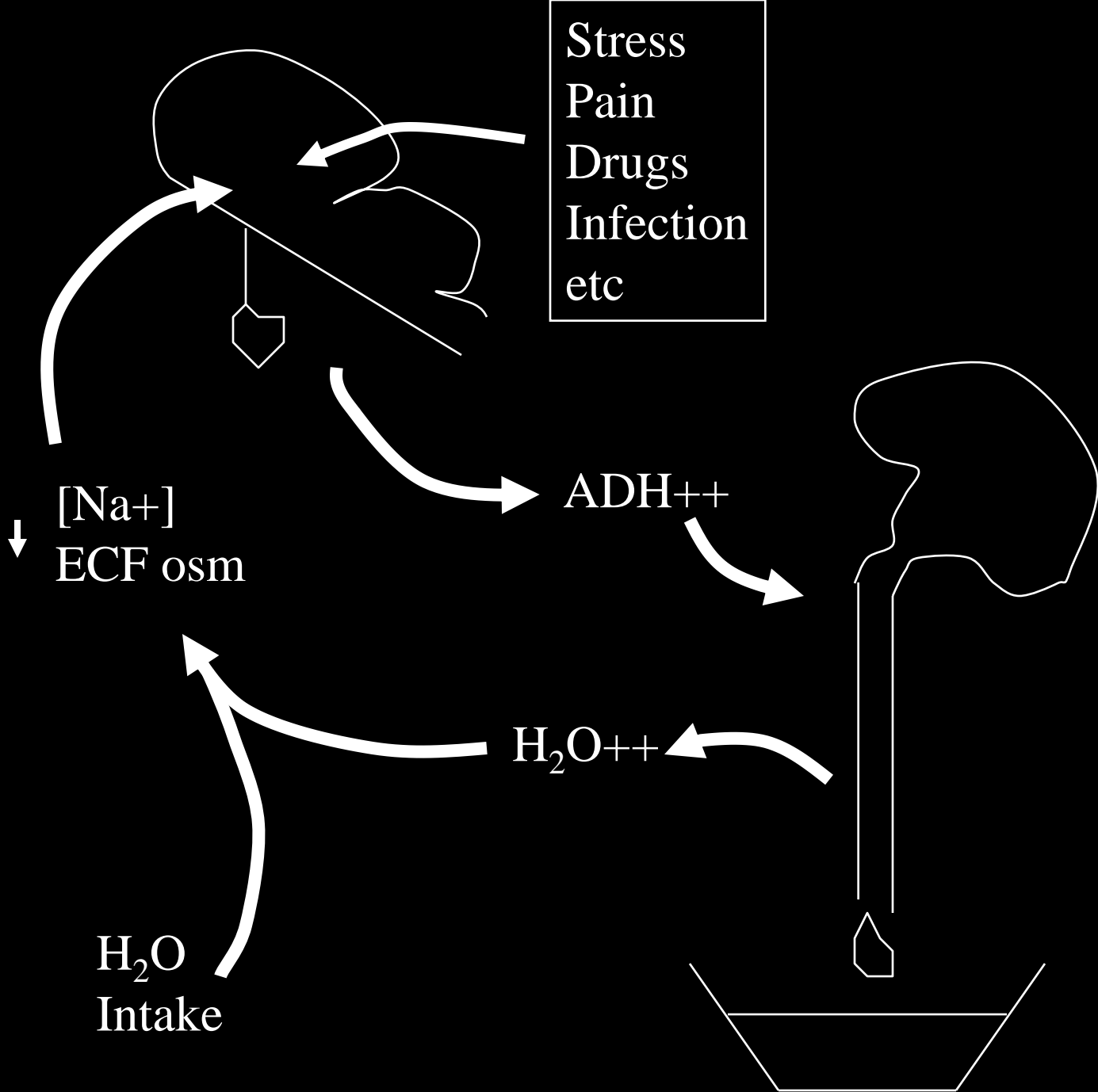
- Hyponatraemia
- Clinical upset? CNS

How to recognize?

- Hyponatraemia
- Clinical upset? CNS
- Urine output?

How to recognize?

- Hyponatraemia
- Clinical upset? CNS
- Urine output? lowish



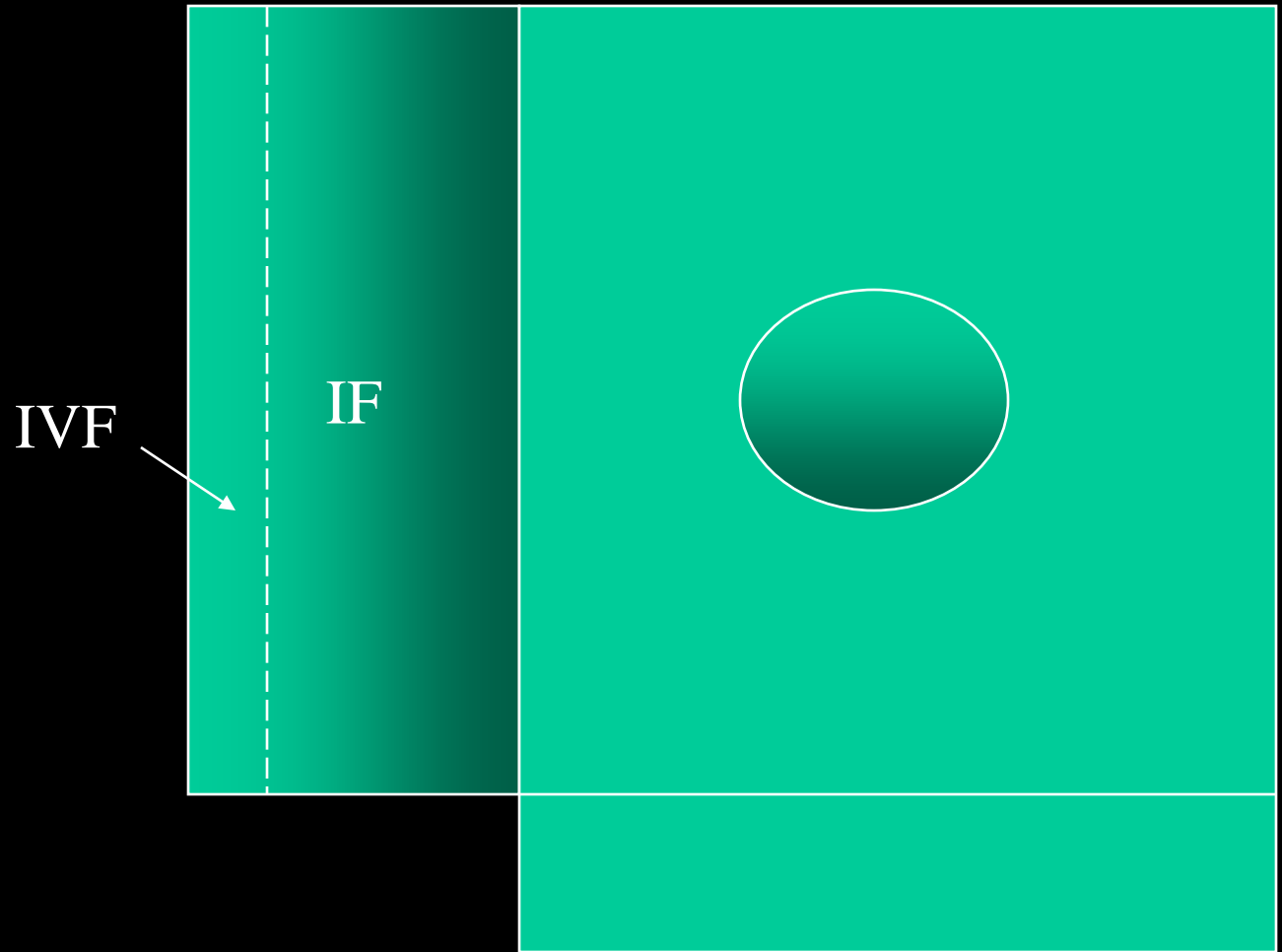
How to recognize?

- Hyponatraemia
- Clinical upset? CNS
- Urine output? lowish
- Oedema?

How to recognize?

- Hyponatraemia
- Clinical upset? CNS
- Urine output? lowish
- Oedema? *No*

{ ECF } { ICF }



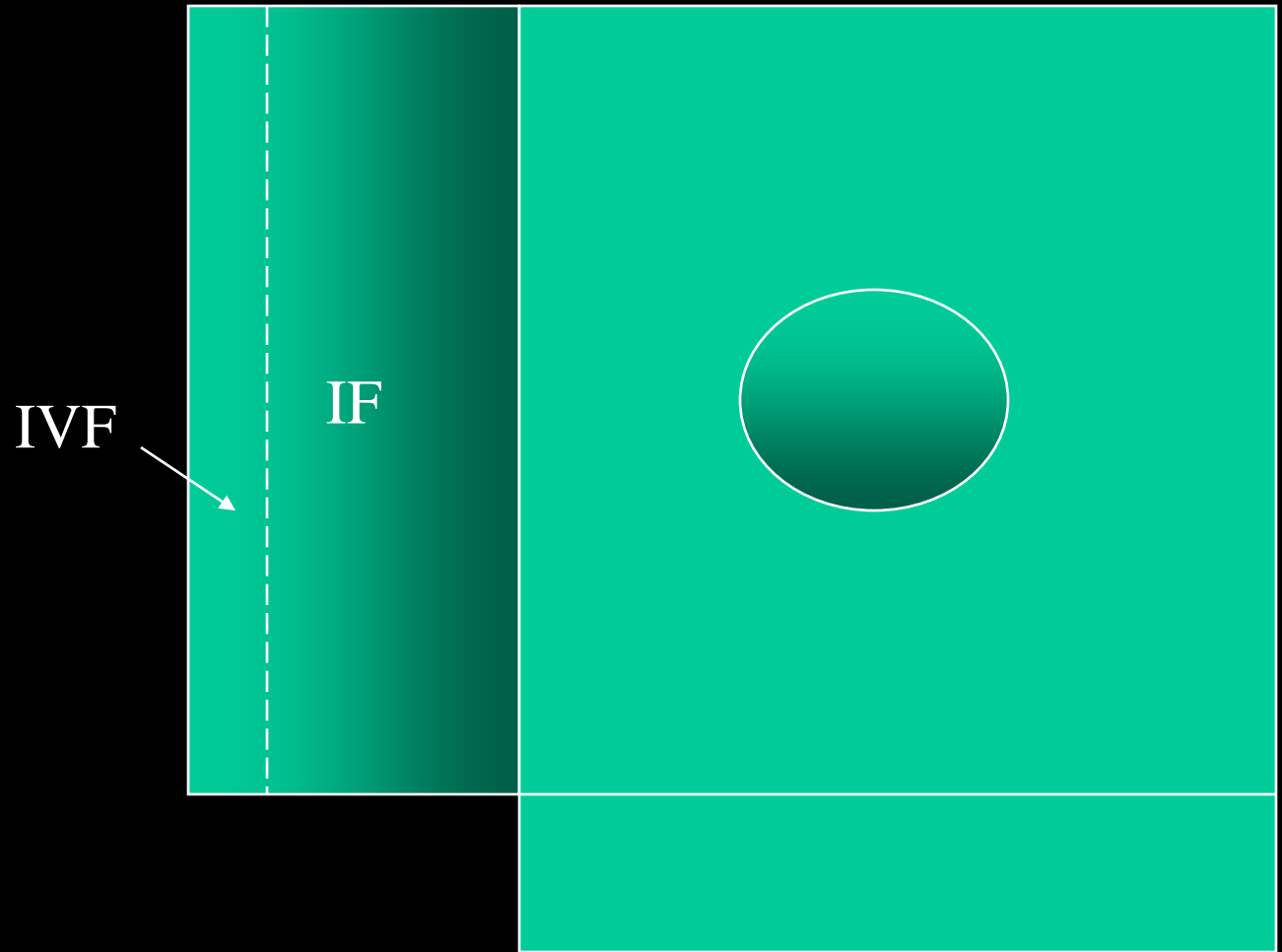
How to recognize?

- Hyponatraemia
- Clinical upset? CNS
- Urine output? lowish
- Oedema? *No*
- Shock?

How to recognize?

- Hyponatraemia
- Clinical upset? CNS
- Urine output? lowish
- Oedema? *No*
- Shock? *No*

{ ECF } { ICF }



How to recognize?

- Hyponatraemia
- Clinical upset? CNS
- Urine output? lowish
- Oedema? *No*
- Shock? *No*
- Renal function?

How to recognize?

- Hyponatraemia
- Clinical upset? CNS
- Urine output? lowish
- Oedema? *No*
- Shock? *No*
- Renal function? normal

How to treat?

How to treat?

- *When in a hole....*

How to treat?

- *When in a hole....stop digging*

How to treat?

- Stop giving water

How to treat?

- *...behaving as if in the desert...*

How to treat?

- *....behaving as if in the desert....*
- *.....put him in the desert!*

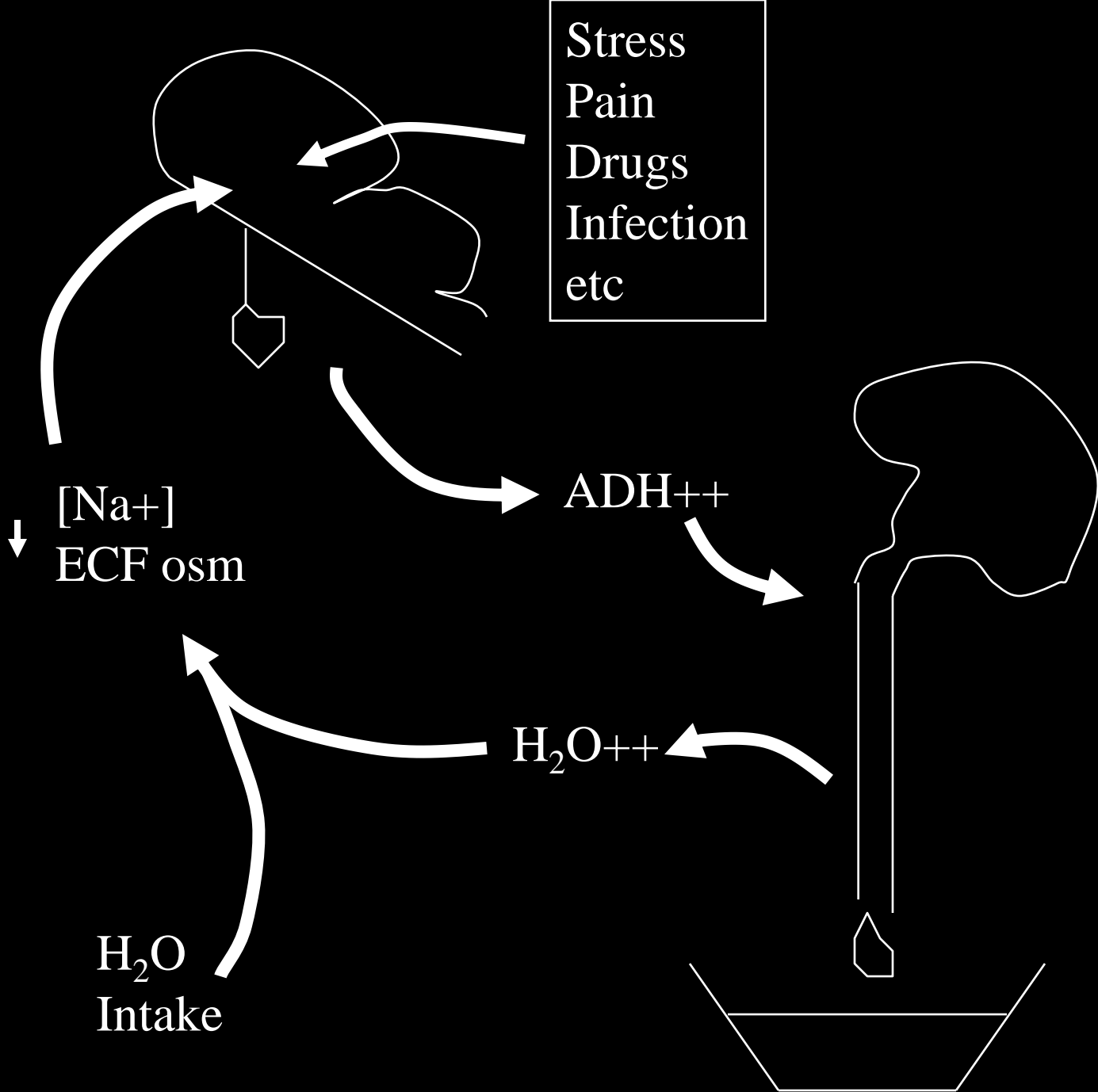
- “*maintenance*”

How to treat?

- Stop giving water

How to treat?

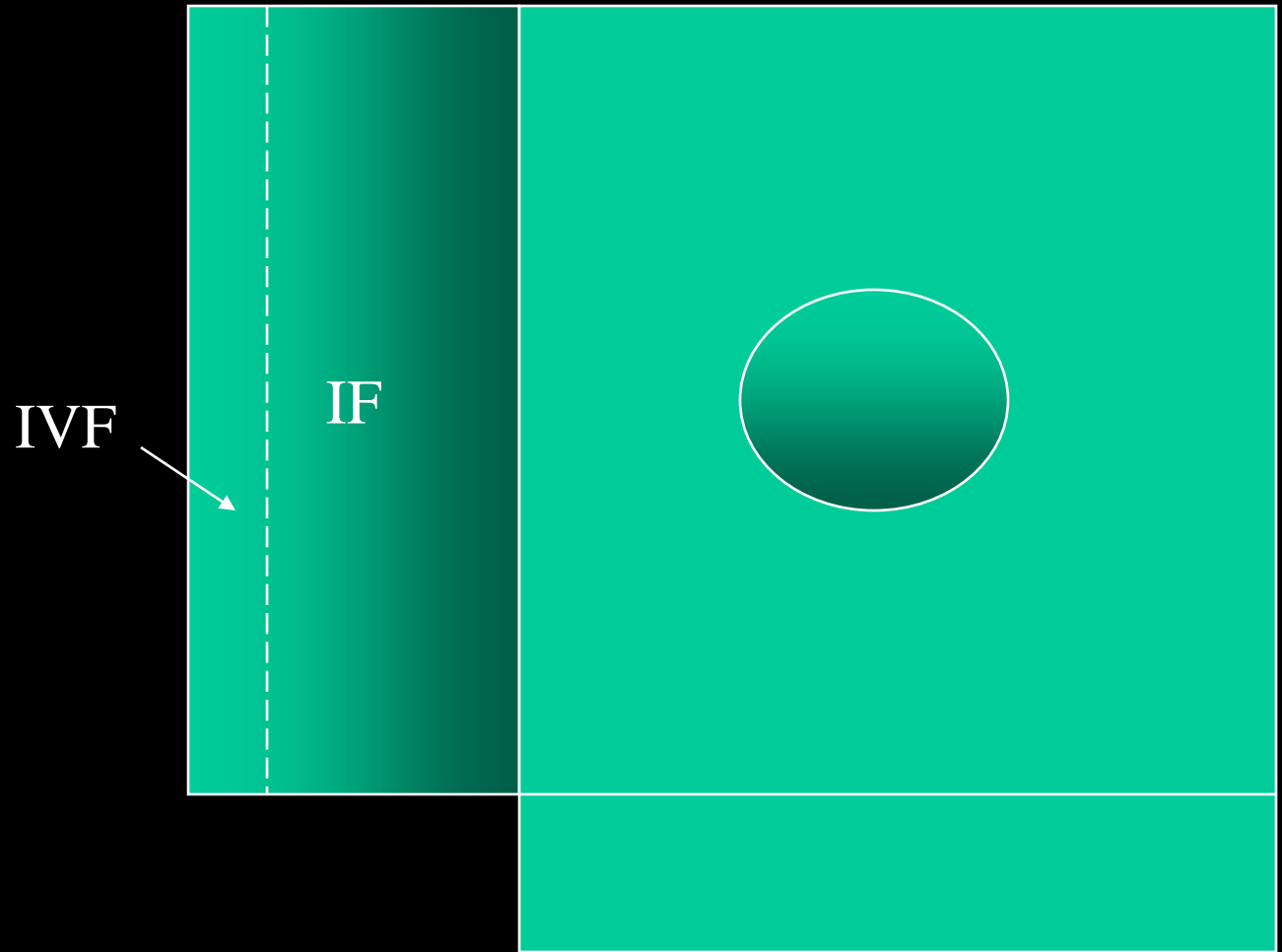
- Stop giving water
- Cruel to patient? *No*



Water excess

- Serious?

{ ECF } { ICF }



Water excess

- Serious?
 - Brain swelling





Water excess

- Serious?
 - Brain swelling
 - Central pontine myelinolysis CPM

How to treat?

- Stop giving water
- Cruel to patient? *No*
- Give Na?

How to treat?

- Stop giving water
- Cruel to patient? *No*
- Give Na? *No*

Why not give Na?

Why not give Na?

- No Na deficit

Why not give Na?

- No Na deficit *wrong treatment*

Why not give Na?

- No Na deficit *wrong treatment*
- Quickly

Why not give Na?

- No Na deficit *wrong treatment*
- Quickly *rapid rise in [Na]*
- Perpetuate problem

Why not give Na?

- No Na deficit *wrong treatment*
- Quickly *rapid rise in [Na]*
- Perpetuate problem *giving water*

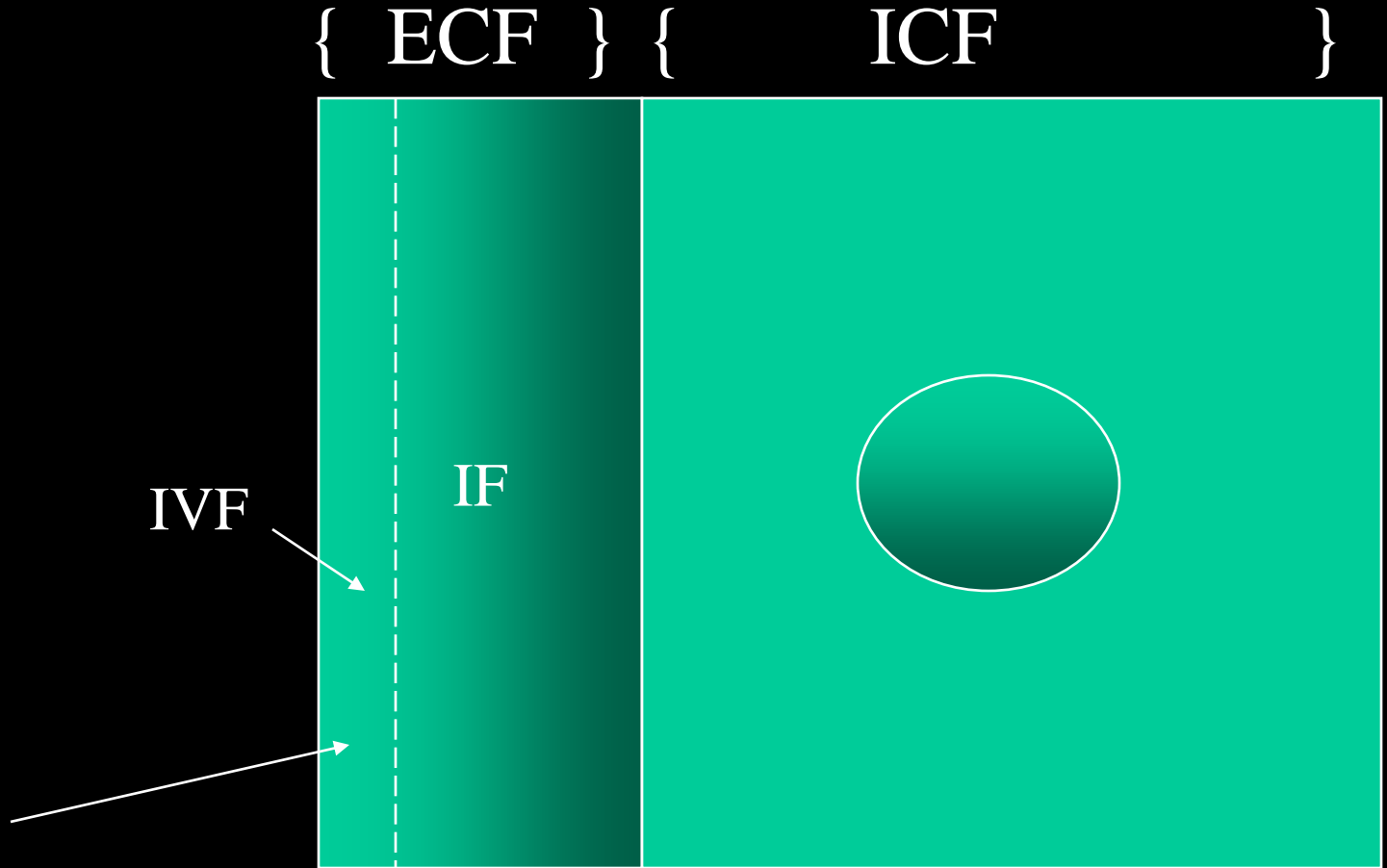
Why not give Na?

- No Na deficit *wrong treatment*
- Quickly *rapid rise in [Na]*
- Perpetuate problem *giving water*
- Cause oedema

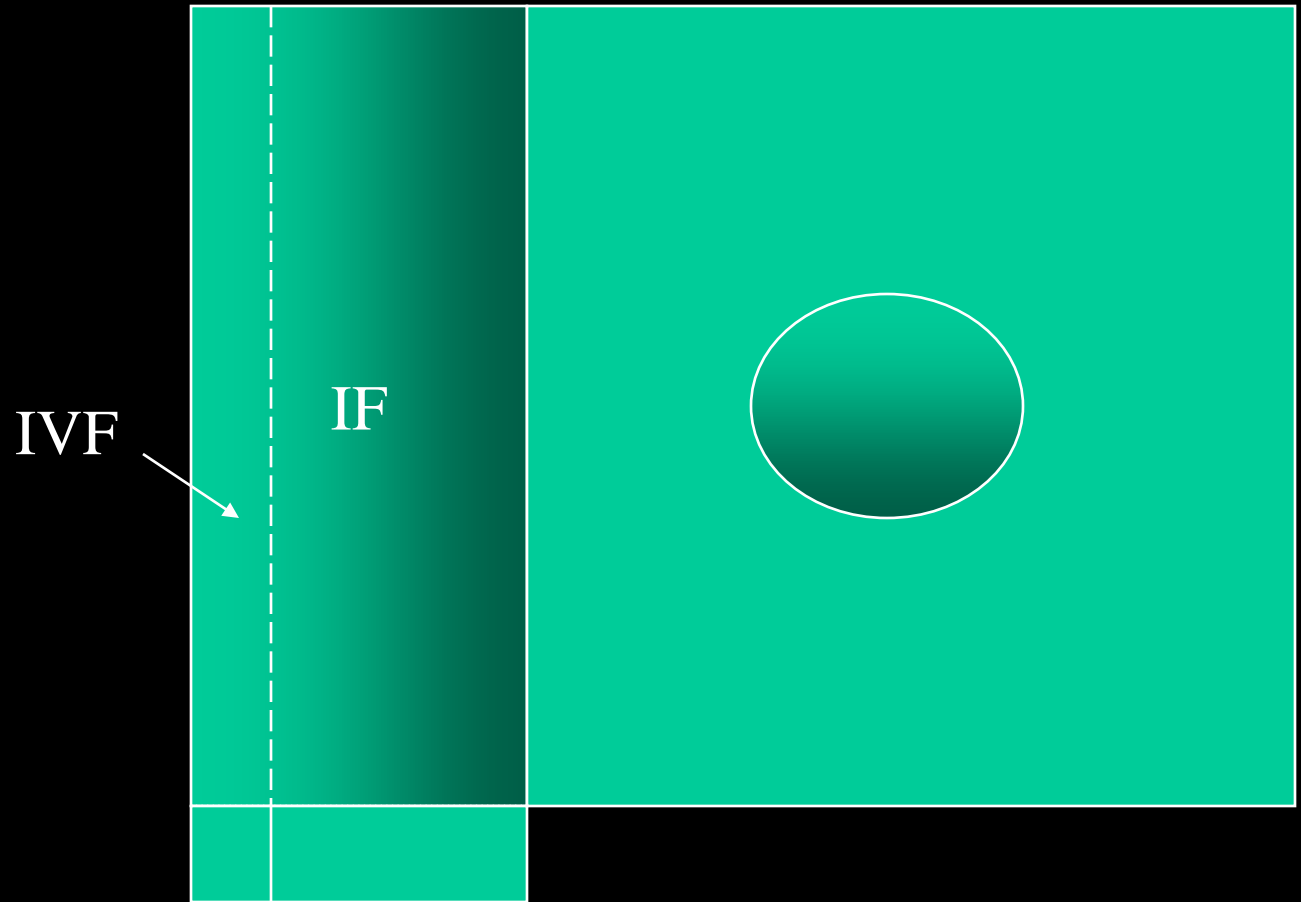
Water content \propto ICF size \propto $1/[\text{Na}^+]$

Na⁺ Excess

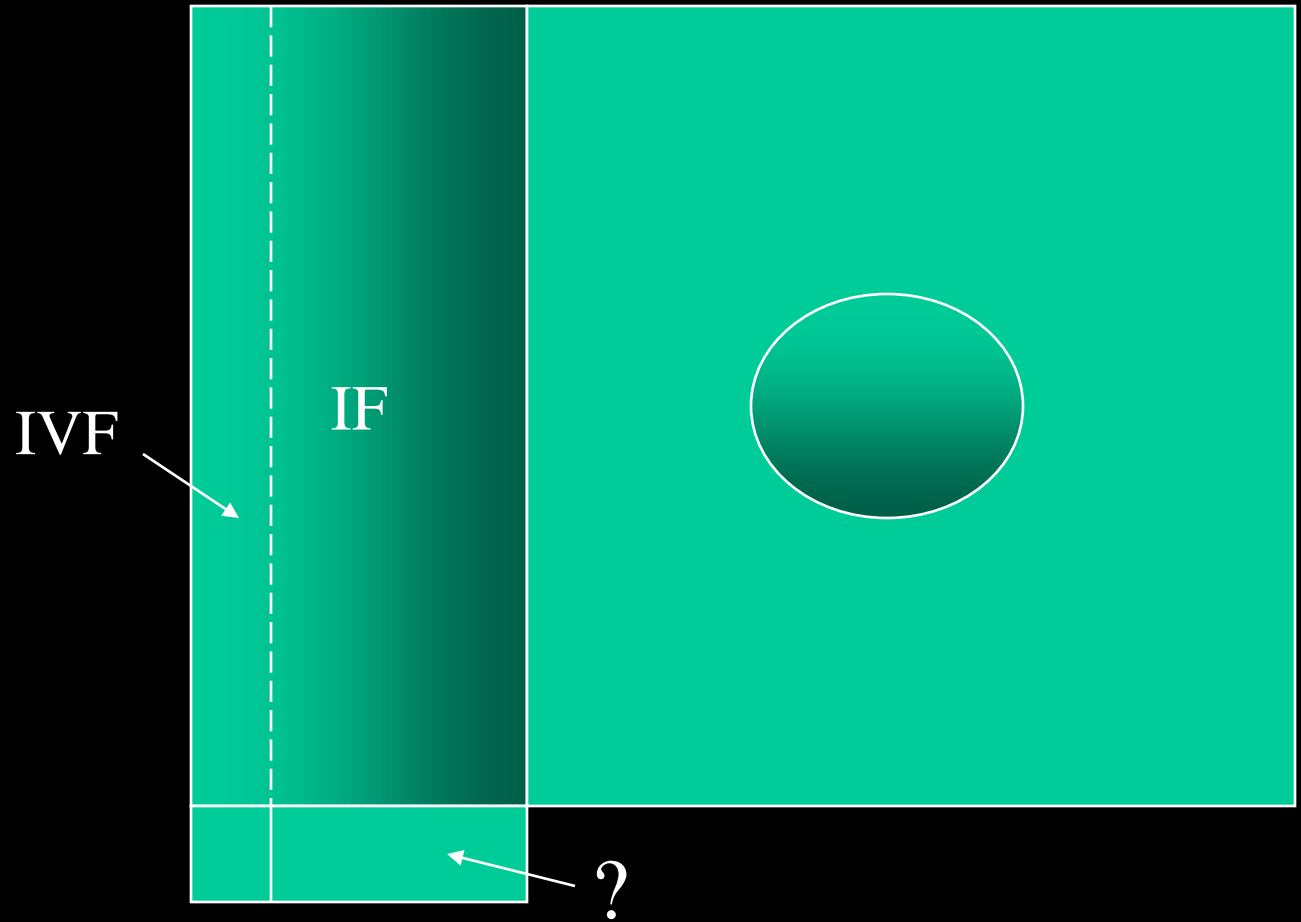
Normal

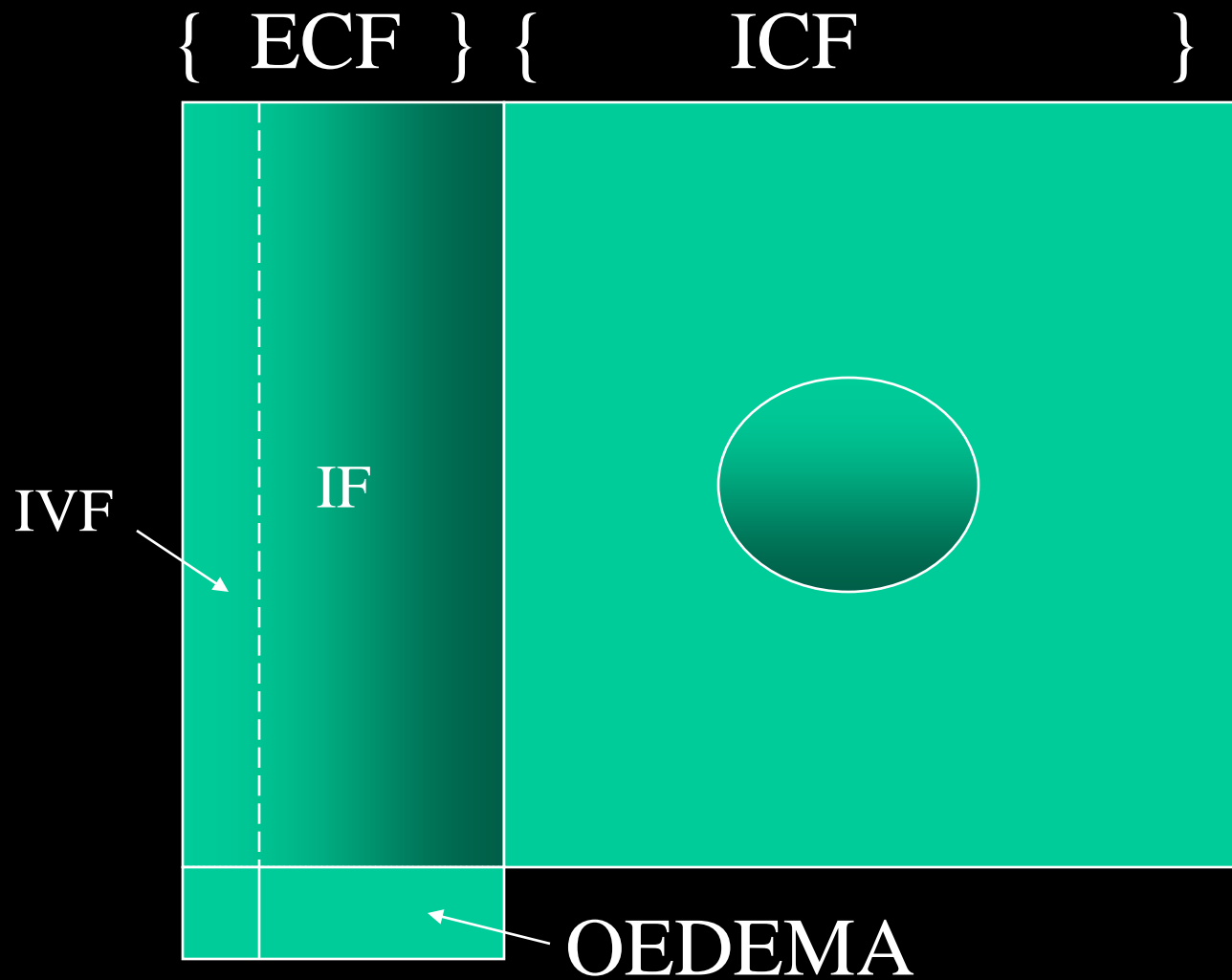


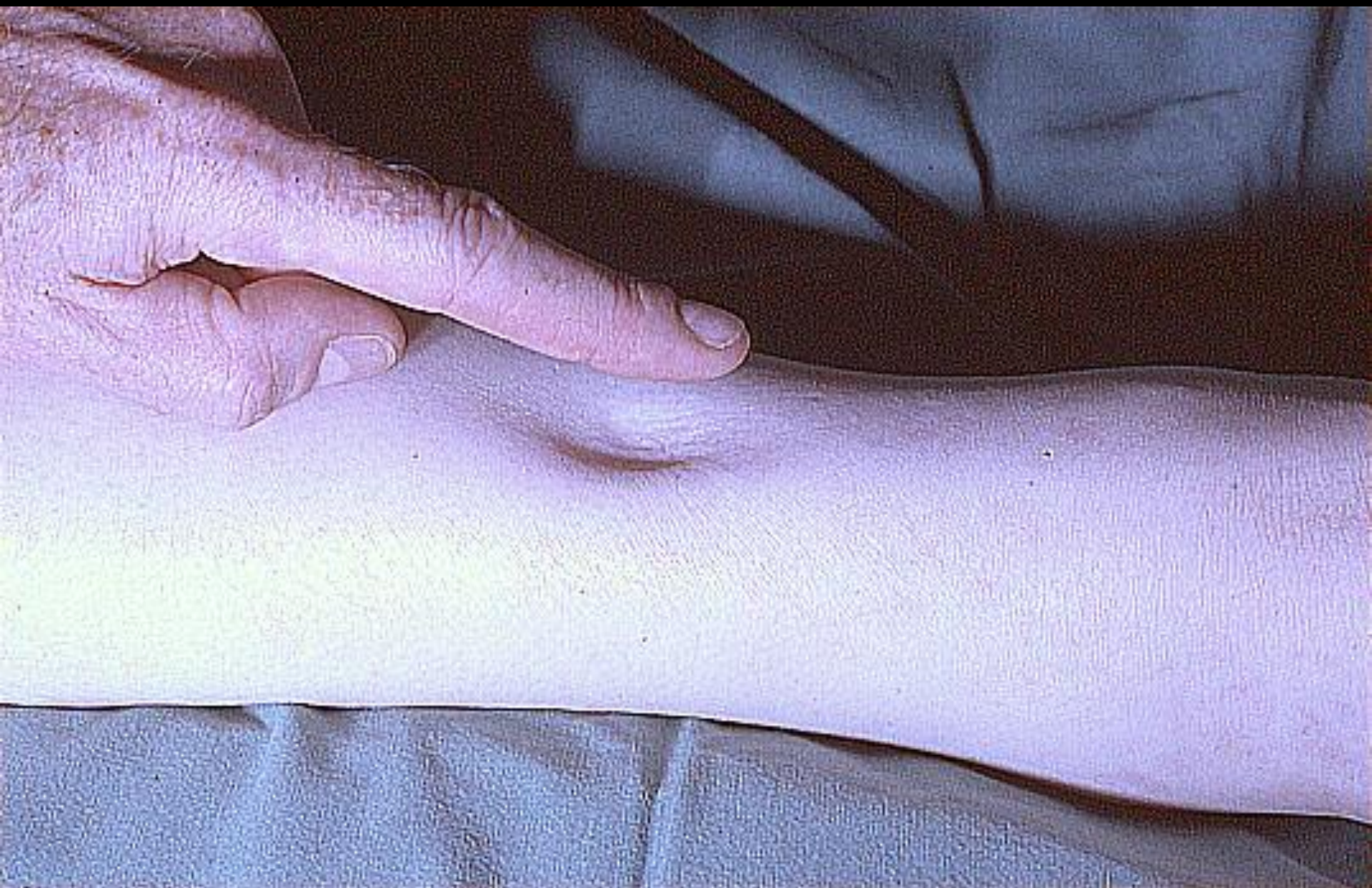
{ ECF } { ICF }

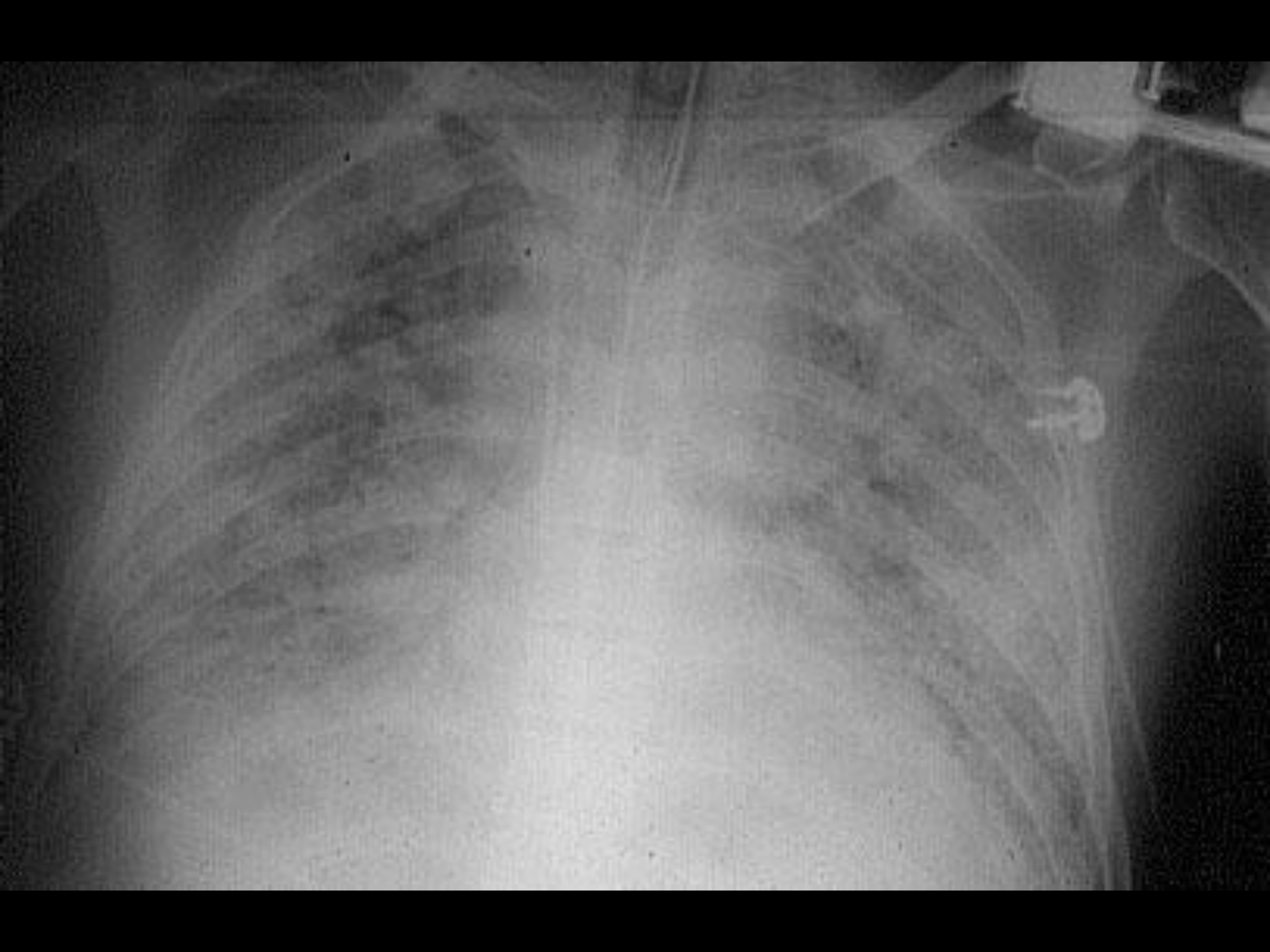


{ ECF } { ICF }









How Na excess?

How Na excess?

- Doctors

How Na excess?

- Doctors
 - Consciously

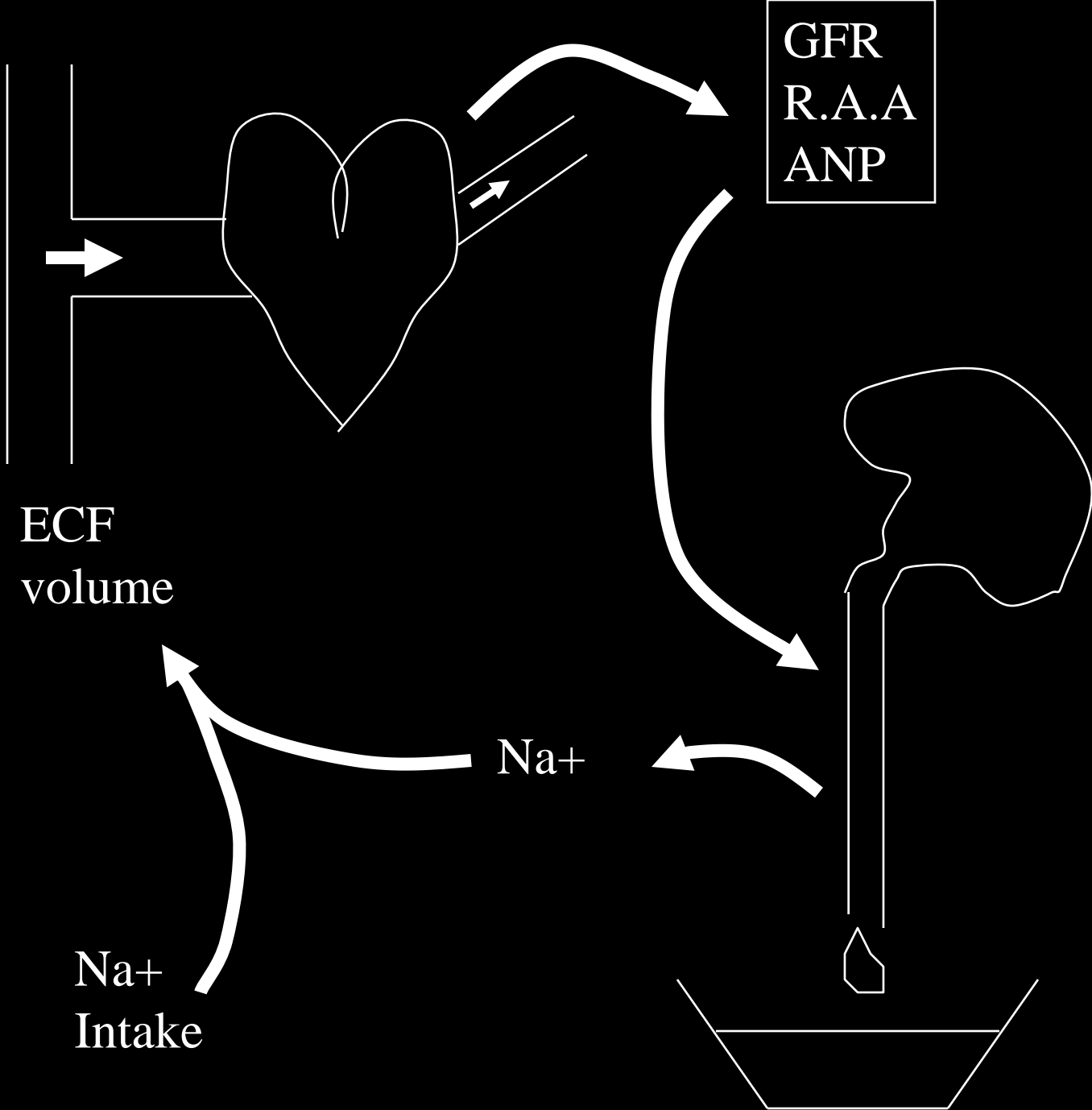
How Na excess?

- Doctors
 - Consciously
 - unconsciously



How Na excess?

- Doctors
 - Consciously
 - unconsciously
- Why not excrete excess Na?



How Na excess?

- Doctors
 - Consciously
 - unconsciously
- Why not excrete excess Na?
 - “stress”

How Na excess?

- Doctors
 - Consciously
 - unconsciously
- Why not excrete excess Na?
 - “stress” Na retention

How to recognize?

How to recognize?

- Oedema

How to recognize?

- Oedema
- Shock?

How to recognize?

- Oedema
- Shock?

No

How to recognize?

- Oedema
- Shock?
- [Na]?

No

How to recognize?

- Oedema
- Shock? *No*
- [Na]? *No change*

How to recognize?

- Oedema
- Shock? *No*
- [Na]? *No change*
- Renal function?

How to recognize?

- Oedema
- Shock? *No*
- [Na]? *No change*
- Renal function?
 - Dysfunction → Na excess

How to recognize?

- Oedema
- Shock? *No*
- [Na]? *No change*
- Renal function?
 - Dysfunction → Na excess
 - Na excess ↗ dysfunction

How to treat?

How to treat?

- Stop giving Na

How to treat?

- Stop giving Na
- Actively remove Na

- a Mannitol
- b Glucose
- c D-methyltetracycline
- d Urea
- e Frusemide
- f All of the above

“Diuretics”

Natriureticum

Saliuretique

- Water content

- Increased

- Normal

- Decreased

- Na content

- Increased

- Normal

- Decreased

Na deficit:

Na deficit:
arising how ?

Na deficit:
arising how ?

- Na loss

Na deficit: *arising how ?*

- Na loss
 - GI

Na deficit: *arising how ?*

- Na loss
 - GI
 - Renal

Na deficit: *arising how ?*

- Na loss
 - GI
 - Renal
 - Drain, wound

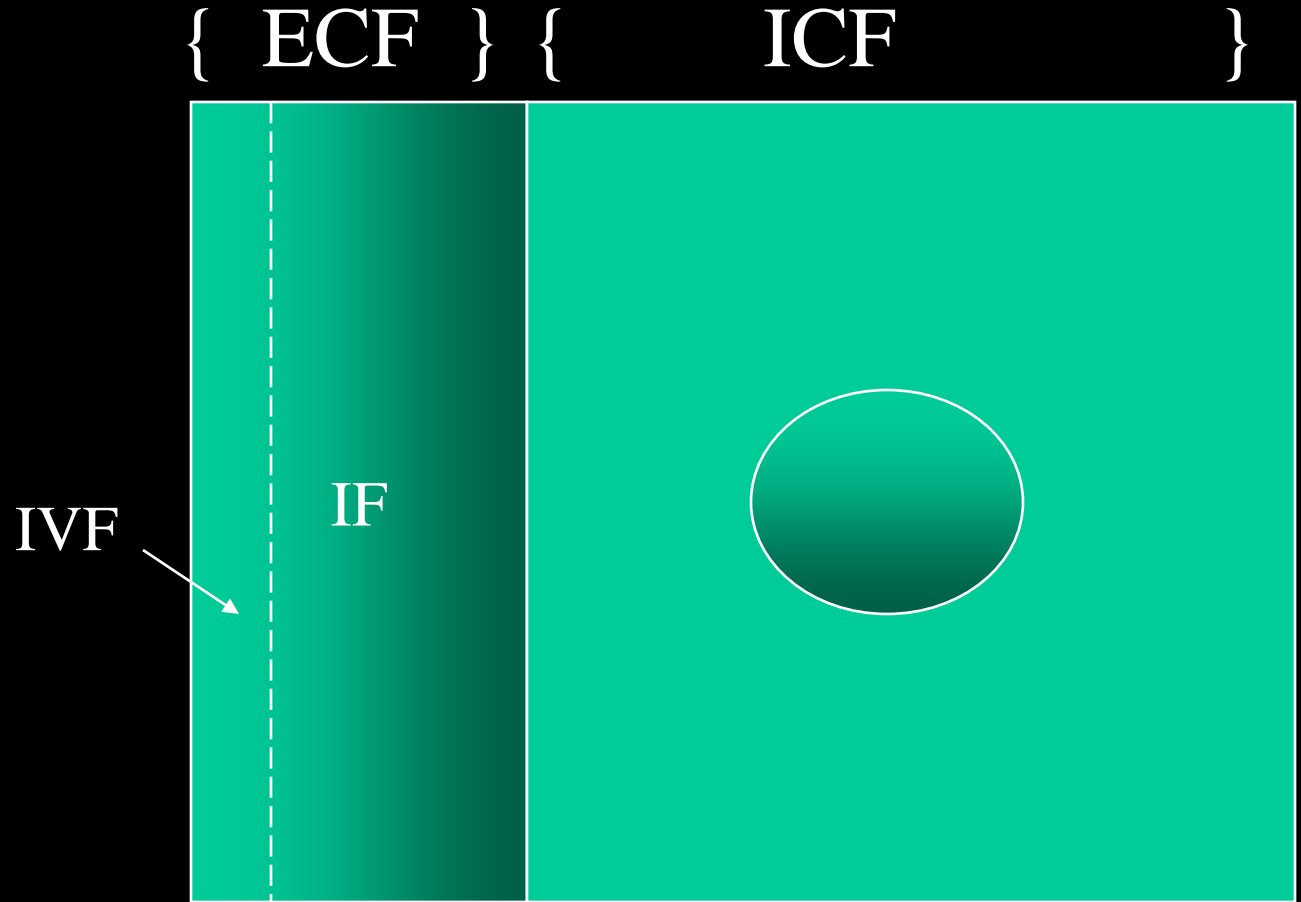
Na deficit: *arising how ?*

- Na loss
 - GI
 - Renal
 - Drain, wound
 - Internal

Na deficit: *arising how ?*

- Na loss
 - GI
 - Renal
 - Drain, wound
 - Internal *“third space”*

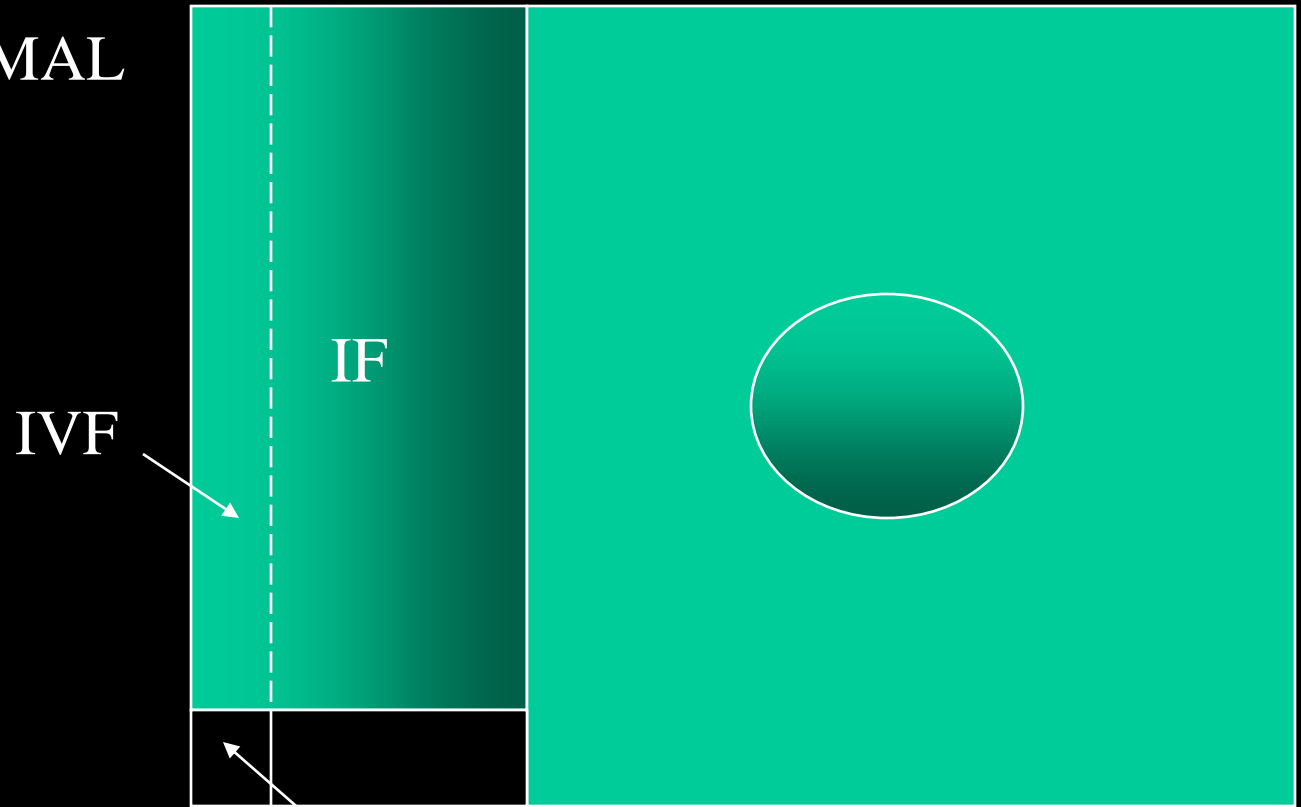
Normal



NaCl DEFICIT

{ ECF } { ICF }

[Na+] NORMAL



IVF

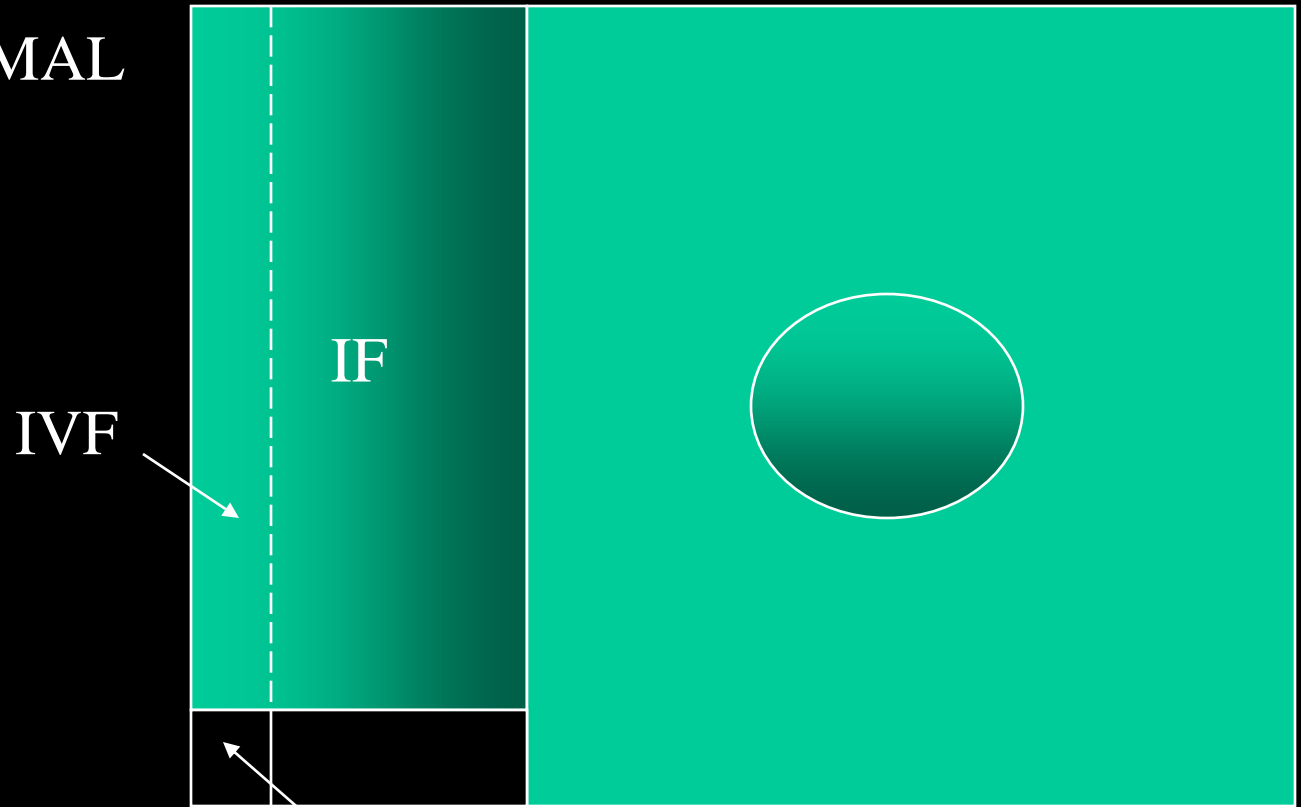
IF

?

NaCl DEFICIT

{ ECF } { ICF }

[Na+] NORMAL



IVF

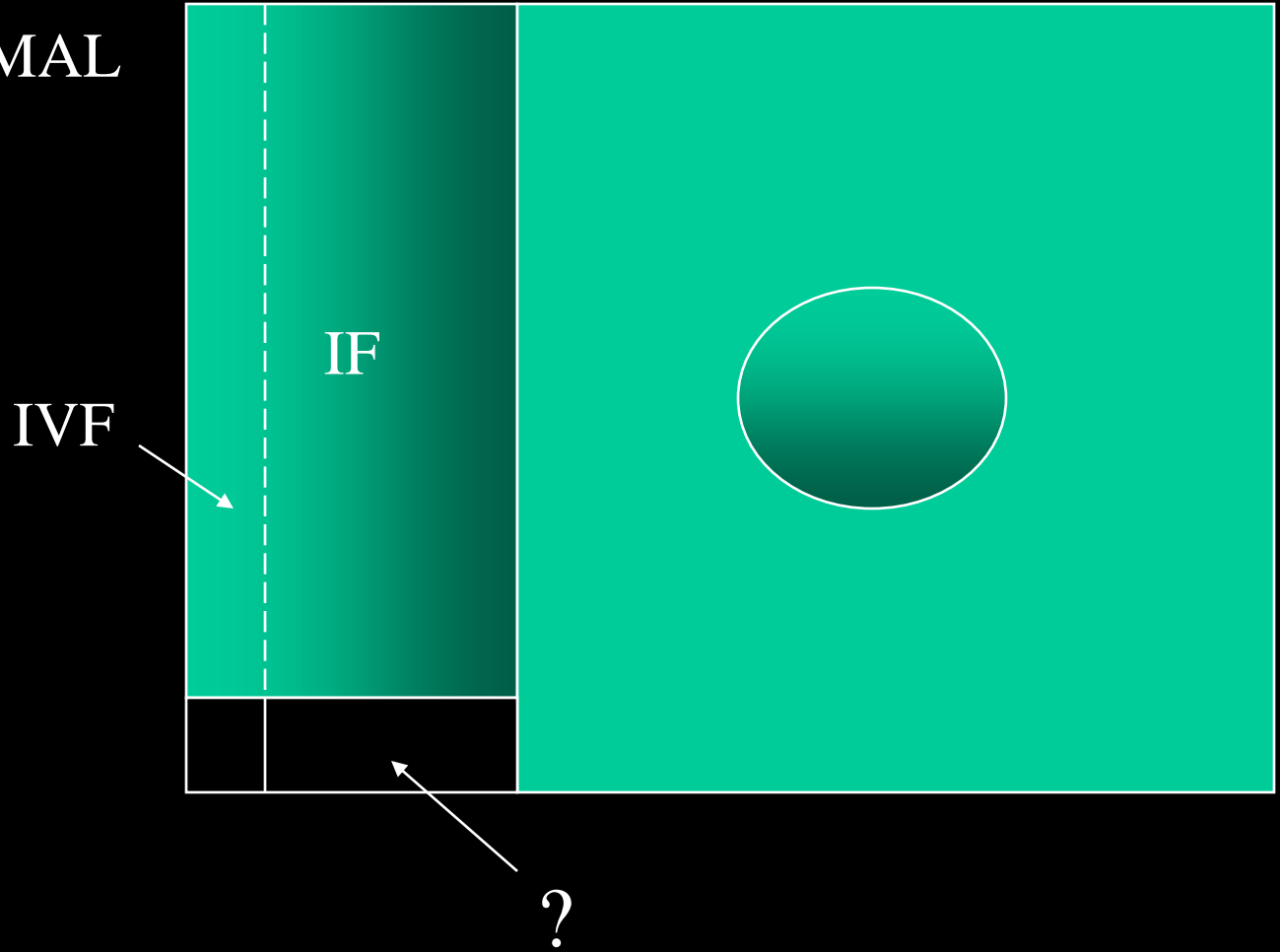
IF

HYPOVOLAMIA

NaCl DEFICIT

{ ECF } { ICF }

[Na+] NORMAL



Skin with decreased turgor remains elevated after being pulled up and released



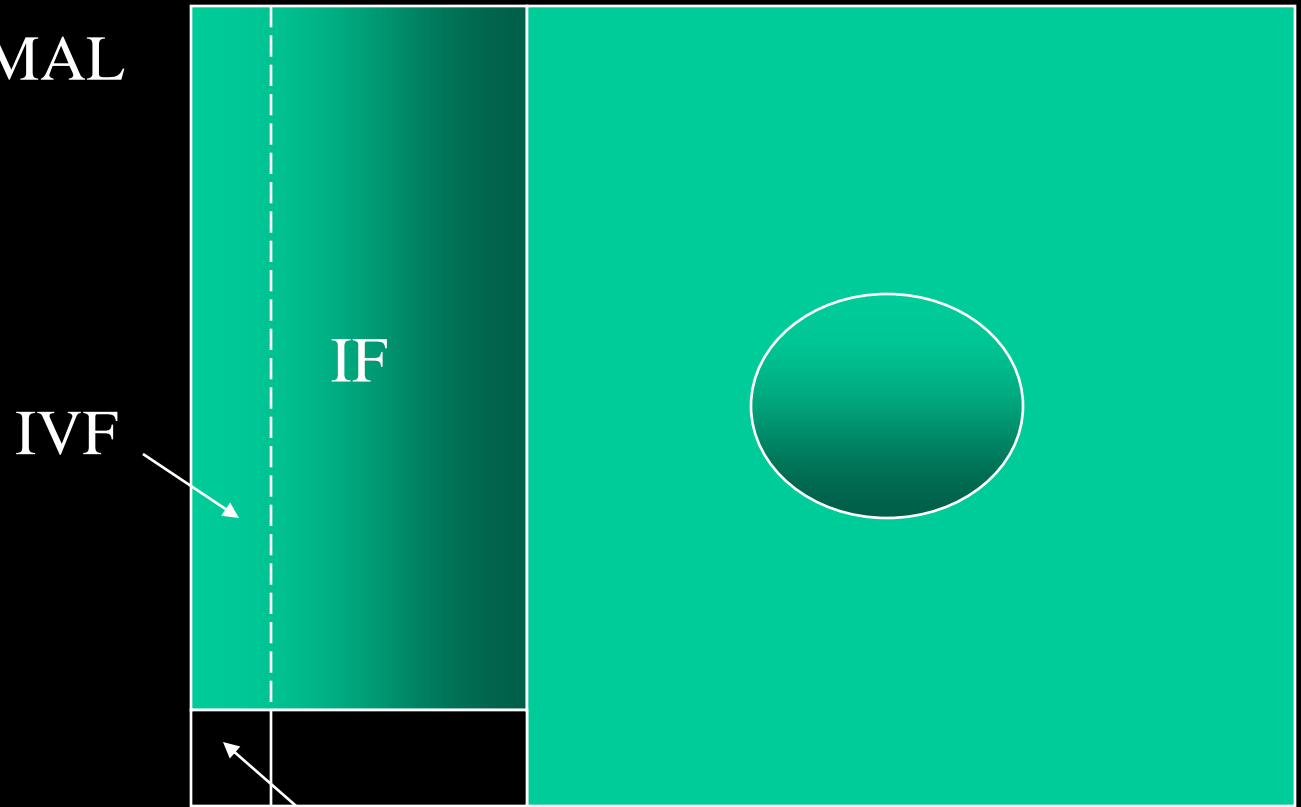




NaCl DEFICIT

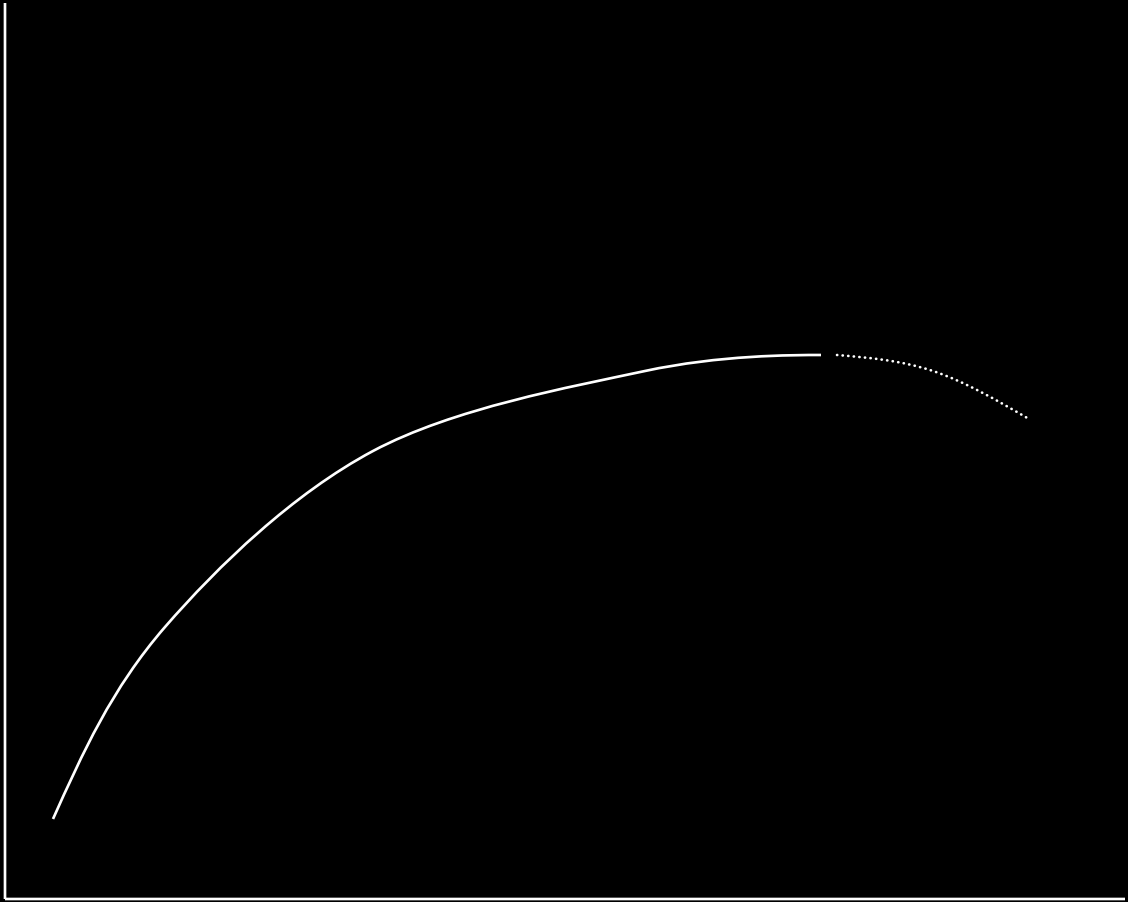
{ ECF } { ICF }

[Na+] NORMAL



?

CARDIAC
OUTPUT



VENOUS RETURN

Na⁺ content clinically

Na⁺ content clinically

ECF contraction

Na⁺ content clinically

ECF contraction

- Hypovolaemia
- Shock
- Skin turgor red.

Na⁺ content clinically

ECF contraction

• ECF expansion

- Hypovolaemia
- Shock
- Skin turgor red.

Na⁺ content clinically

ECF contraction

- Hypovolaemia
- Shock
- Skin turgor red.

• ECF expansion

- CVP/JVP
- Oedema

Na⁺ content clinically

ECF contraction

- Hypovolaemia
- Shock
- Skin turgor red.
- [Na]?

• ECF expansion

- CVP/JVP
- Oedema
- [Na]?

Na⁺ content clinically

ECF contraction

- Hypovolaemia
- Shock
- Skin turgor red.
- [Na]? *No*

• ECF expansion

- CVP/JVP
- Oedema
- [Na]? *No*

Na⁺ content clinically

ECF contraction

- Hypovolaemia
- Shock
- Skin turgor red.
- [Na]? *No*
- Renal dys.?

• ECF expansion

- CVP/JVP
- Oedema
- [Na]? *No*

Na⁺ content clinically

ECF contraction

- Hypovolaemia
- Shock
- Skin turgor red.
- [Na]? *No*
- Renal dys.? *Yes*

• ECF expansion

- Oedema
- CVP/JVP
- [Na]? *No*
- *(No)*

- Vomiting, diarrhoea
- Shocked

- Vomiting, diarrhoea
- Shocked

“dehydrated”

Treat with:

- a NaCl 0.9%
- b Glucose 5%
- c Hartmann's
- d Sterile water
- e Glucose 50%
- f All of the above

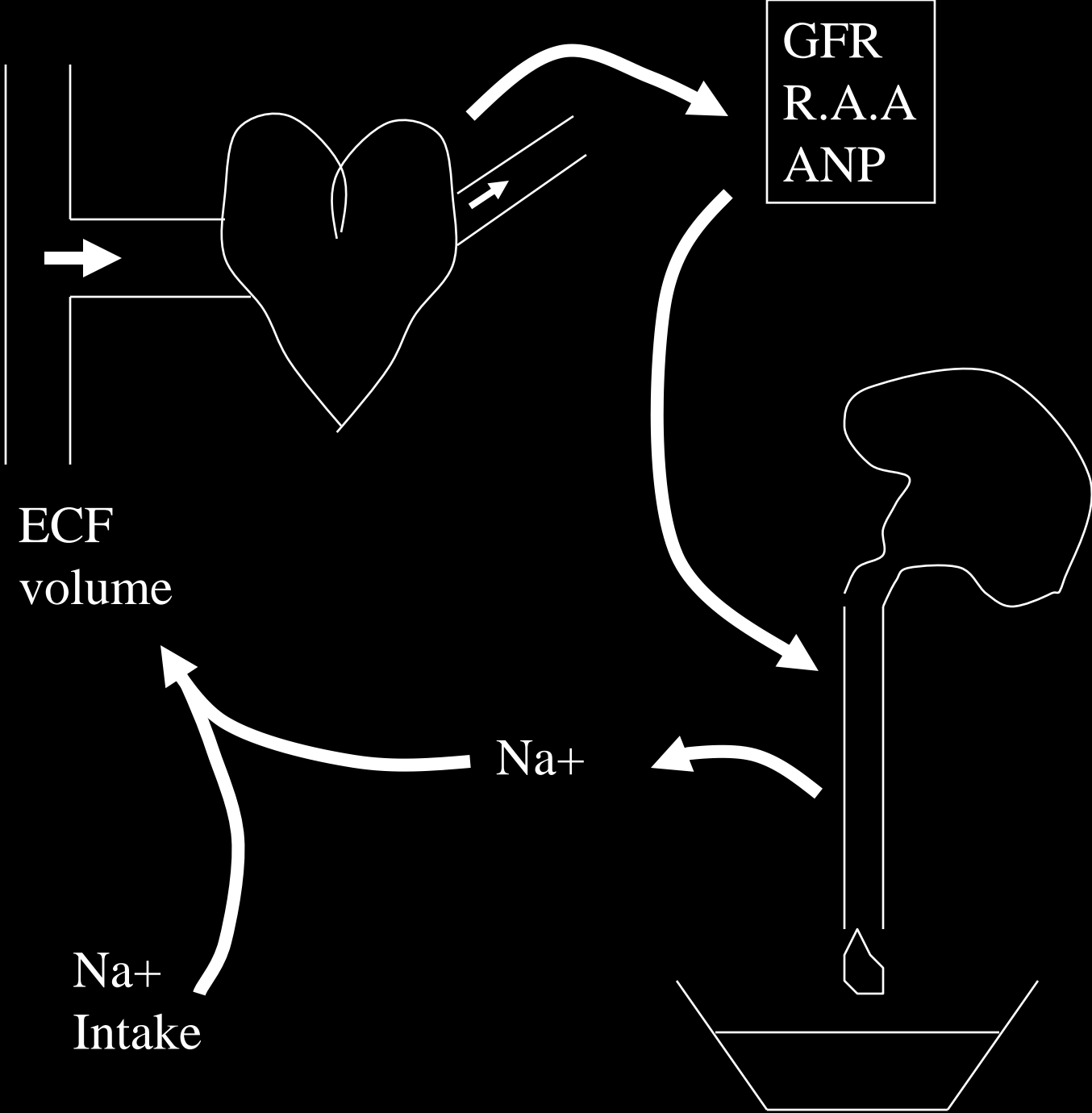
MANTRAS

Na content \neq [Na]

Na content \rightarrow **ECF size**

Water content \rightarrow ICF size

Water content \propto $1/[Na]$



Terminology

Terminology

- “fluid”

Terminology

- “fluid”
 - Na containing water

Terminology

- “fluid”
 - Na containing water
- “dehydrated”

Terminology

- “fluid”
 - Na containing water
- “dehydrated”
 - Water depleted? Na depleted?

Terminology

- “fluid”
 - Na containing water
- “dehydrated”
 - Water depleted? Na depleted?
- “diuretic”

Terminology

- “fluid”
 - Na containing water
- “dehydrated”
 - Water depleted? Na depleted?
- “diuretic”
 - Natriuretic? Water loss?

MANTRAS

Na content \neq [Na]

Na content \rightarrow ECF size

Water content \rightarrow ICF size

Water content \propto $1/[Na]$

*If the patient is severely
hyponatraemic or
hypernatraemic,*

*you can be sure there is a doctor
involved.*

"I know you believe you understand what I said, but I am not sure you realise that what you heard is not what I meant"

Alan Greenspan