Please be advised that this lecture will include possibly upsetting themes, including early animal testing.

There will be visual representations of operations on both humans and animals.

Viewer discretion is advised

EST. 1597

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Christopher Wren's Medical Discoveries: the 'Architect of Human Anatomy'

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EST. 1597
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Lecture outline

- Five areas
- Anatomy
- Intravascular access
- Lung function & oxygen
- Cardio-pulmonary resuscitation (CPR)
- Other things...

Incredible topics!

- Astronomy
- Physics (optics)
- Mathematics
- Architecture
- Member of Parliament 1685-1702 (!)
- Founded Royal Society
- ...and worked in medical sciences (not a qualified physician)

Yet, lecture not really about ‘Wren’…Oxford group

- Robert Boyle 1627-1691
- Robert Hooke (1635-1703)
- Richard Lower (1631-1691)
- John Mayow (1641-1679)
- Thomas Willis (1621-1675)
- ..and others
- In the background was William Harvey (1578-1657)

Collaboration

- *“Wren's notes were few…he gladly allowed others to borrow his ideas without attribution…*
- *Wren's co* *is own right…[he saw the ne* *problems]…,*
- *and espec* *ies, or pieces of apparatus* *temporaries like Hooke and Boyle…*
- Humility in Windsor Guildhall story

First theme: brain anatomy – circle of Willis

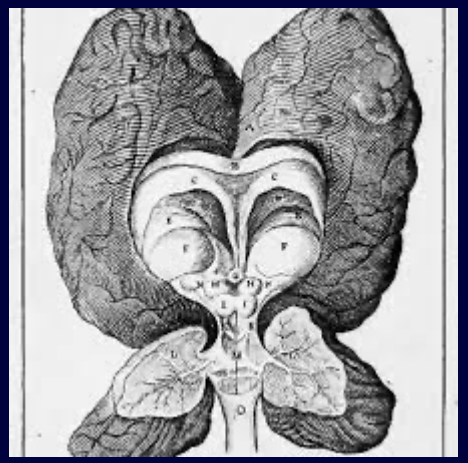
- Wren part of the research group
- Willis: relationship between soul and body
- understanding species differences:
- 3 forms of soul—vital, rational and immortal
- Named: *corpus striatum, internal capsule, cerebellar peduncles, anterior commissure, claustrum, inferior olives, pyramids, optic thalamus, spinal accessory nerve, stria terminalis, vagus nerve, intercostal nerve (sympathetic ganglionic chain), ophthalmic nerve*

doi:10.1093/brain/awab016 BRAIN 2021: 144; 1033–1037 | 1033

BRAIN
A JOURNAL OF NEUROLOGY

ESSAY

On the 400th anniversary of the birth of Thomas Willis



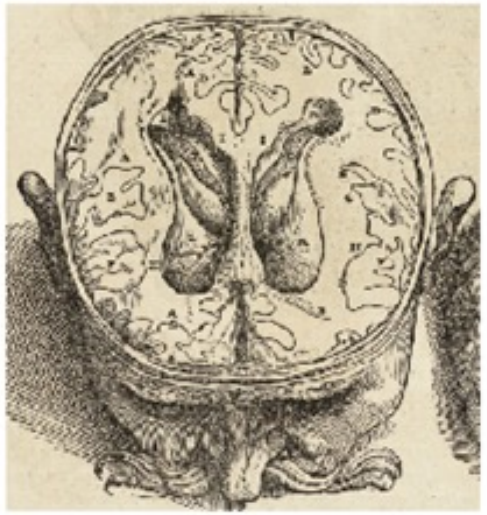
- Willis/Wren corrected previous anatomy
- ..but they did get things wrong
- Only 9 cranial nerves as lumped 2 (7^{th} & 8^{th}) together
- And also 9^{th}, 10^{th}, 11^{th} together

Different portrayals of the brain

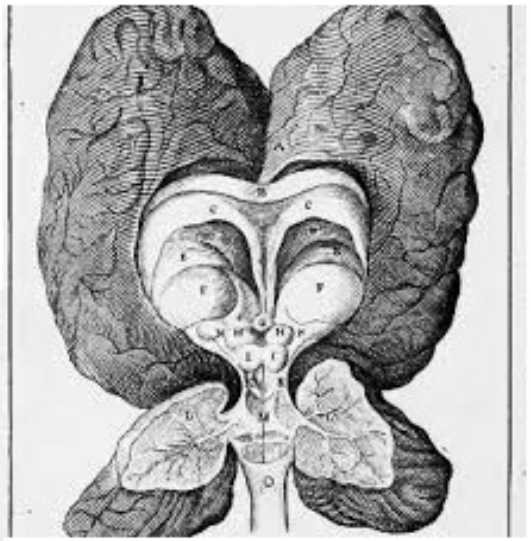
300 BC

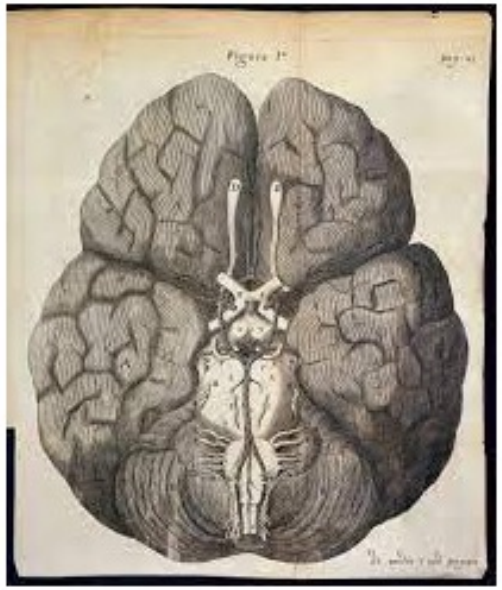
da Vinci 1508

Vesalius 1543

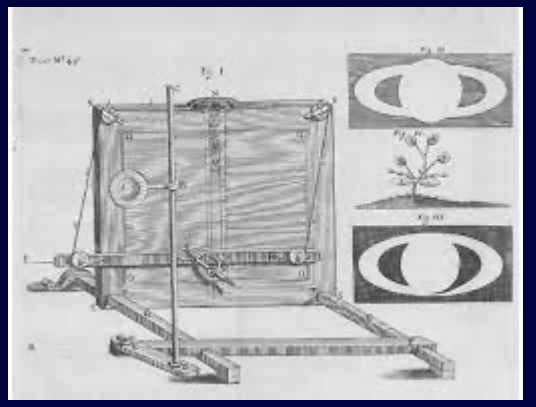


Willis/Wren 1664





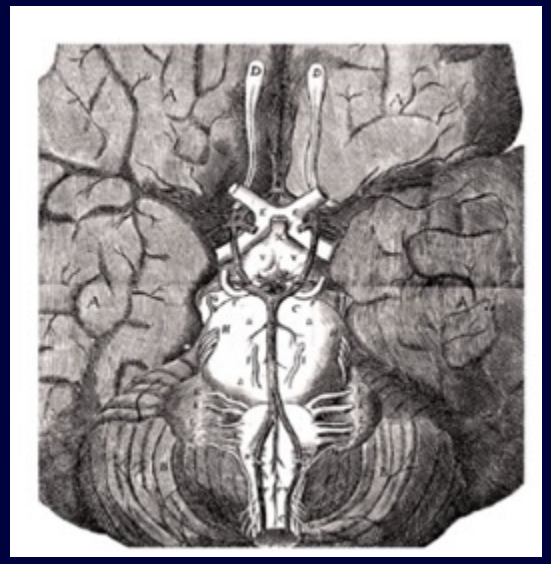
Methods

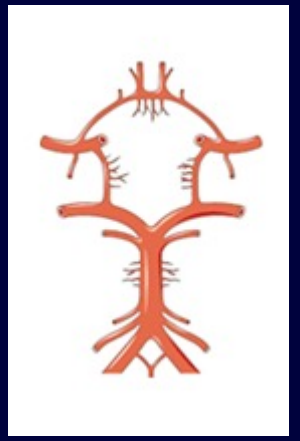


- Artistic developments
  - perspective (“perspectograph”)
  - artists tools
  - print

- Presenting pictures as ‘maps’ for function/application vs ‘what we see’
- Experimental science: inject vessels with dye to provide contrast
  - cerebral angiography
- ‘Luck’ with undamaged corpse
  - Samuel Mashbourne Wadham student

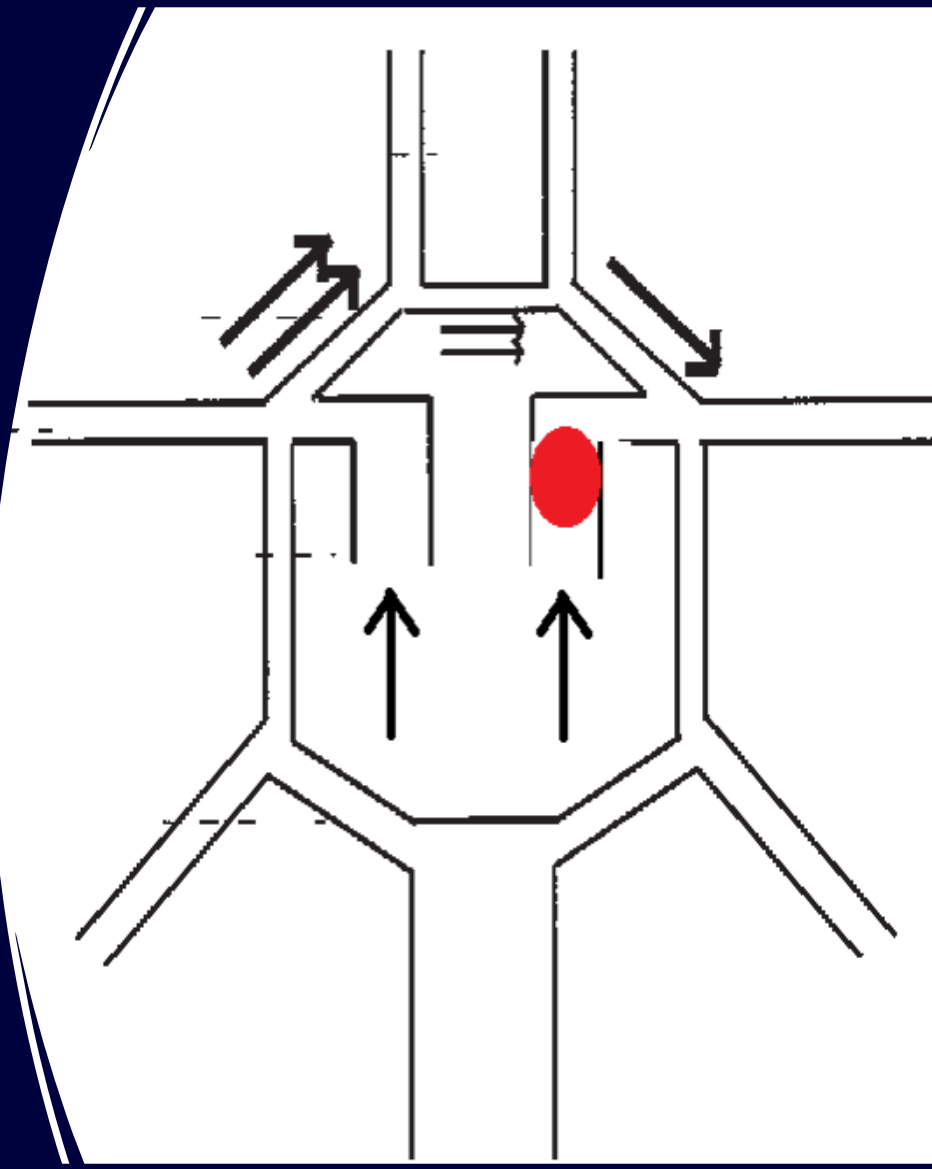
Circle of Willis





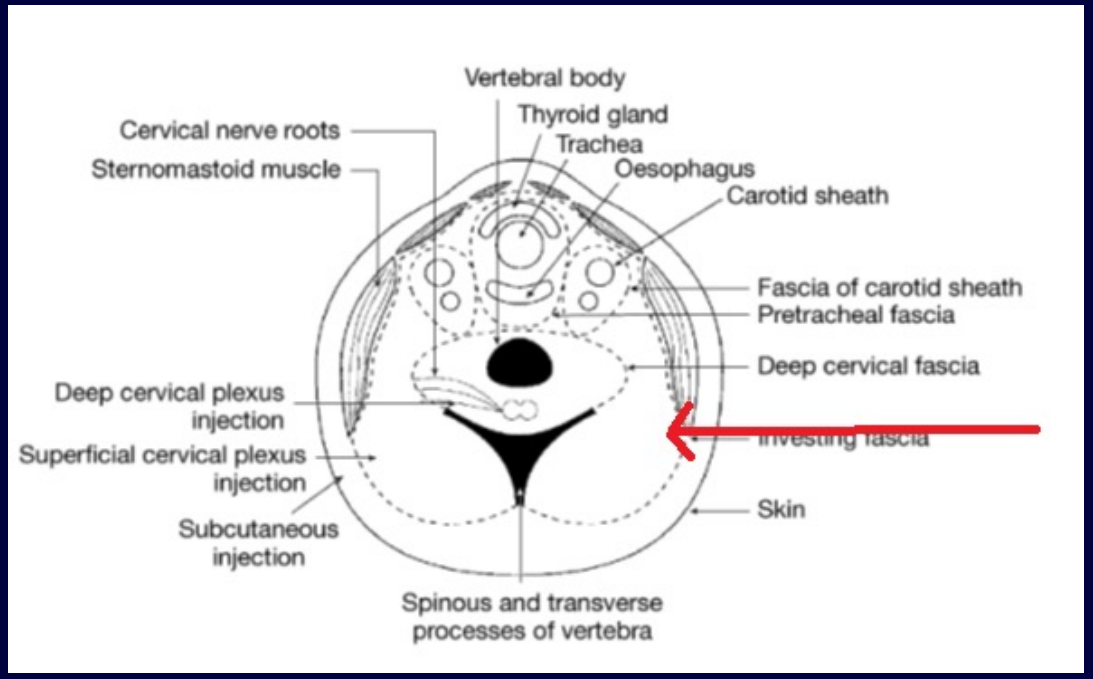
Function of circle of Willis

- If there was no circle then a blockage of an artery stops blood flow to that (large) part of the brain (stroke)
- Disease caused by atherosclerosis
- Carotid artery atherosclerosis can be treated surgically
- But to operate on the vessel it needs to be clamped…but that is causing a complete blockage
- How to know under anaesthesia that the Circle is patent and patient will not have a stroke?



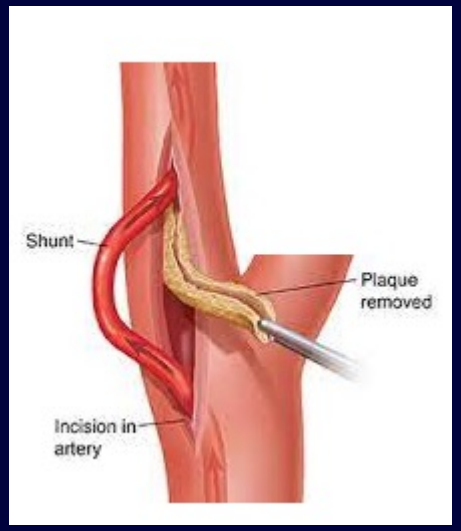
Awake carotid endarterectomy

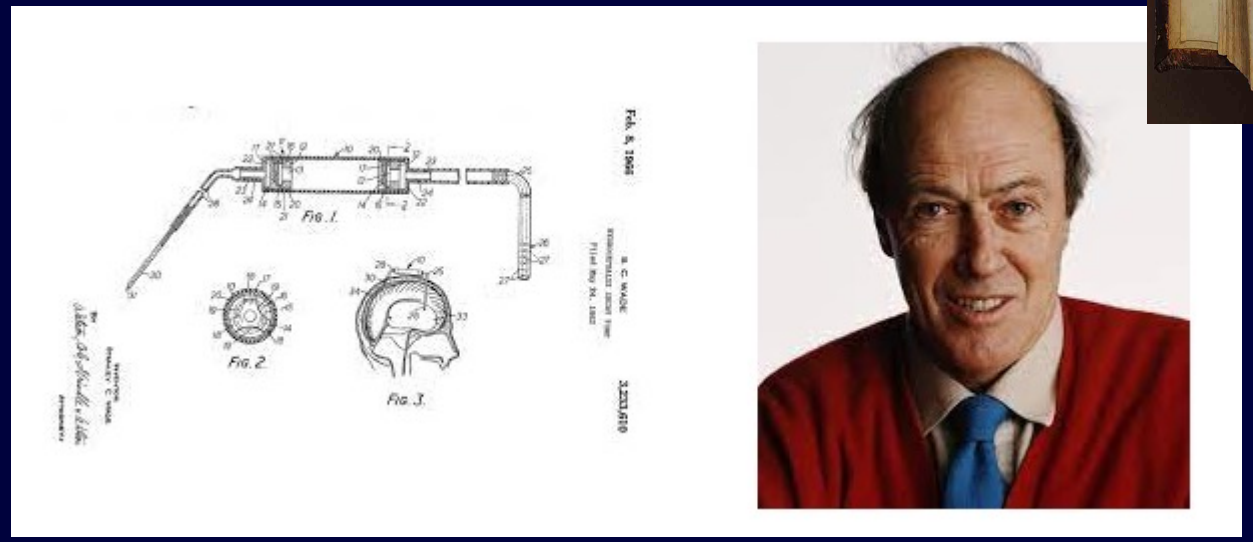
- Local anaesthesia injection into neck
- (one of my connections with Wren/Willis) -Pandit et al. (2000 & 2003)
- ...but what to do if patient does show symptoms with clamping?



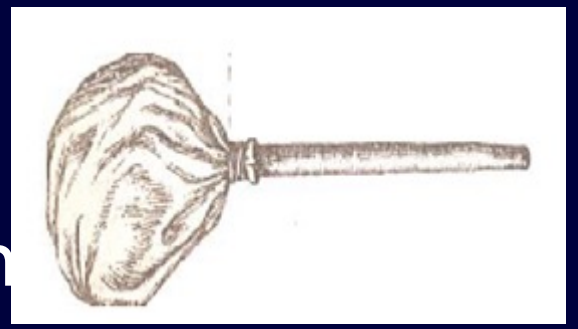
Shunt

- One invented by Roald Dahl (hydrocephalus)
- Willis in *De Anima Brutorum* described formation of CSF
- (Wren's drawings...again)





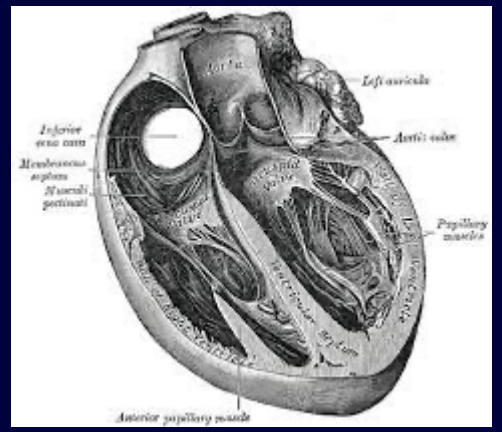
Second theme: intravascular access

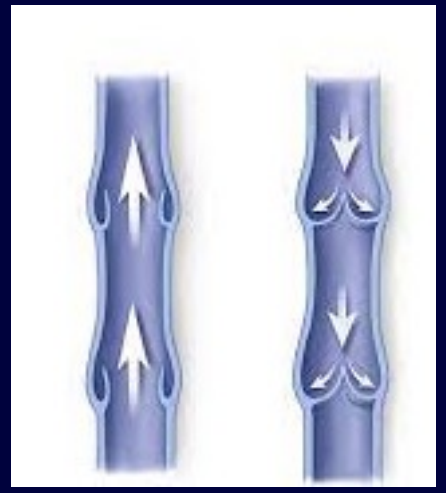


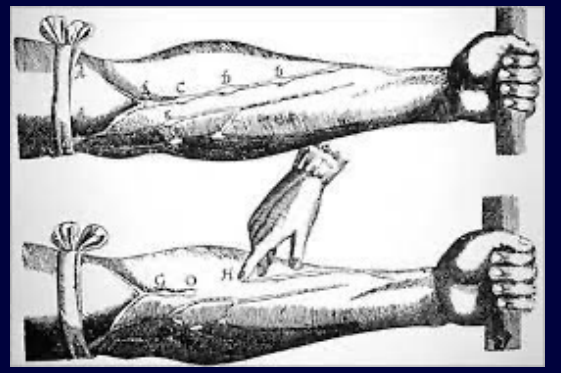
- Wren first cannulated a vein, designing equipmen
- Sharp, but wide – long enough to hold, but not too long
- Means of injection
- Wren used this to delineate vessels in circle of Willis…and more
- Harvey set the scene with circulation of blood
  - Question: *"purpose of blood?"*
- Boyle linked this to administering drugs by a new route

Evidence for circulation

- Older theory of ‘ebb and flow’: relies on blood mixing in heart
- Harvey showed this did not/could not happen
- Anatomical:
  - (a) septum in heart not porous
  - (b) valves in veins do not permit backflow
- Experimental







What did Wren & Boyle do?

- …the first anaesthetic! (dog)
- Paracelsus: *"what differentiates a poison from a drug is the dose"*
- Boyle: use poisons as medicine *(An Essay of Turning Poisons into Medicines)*

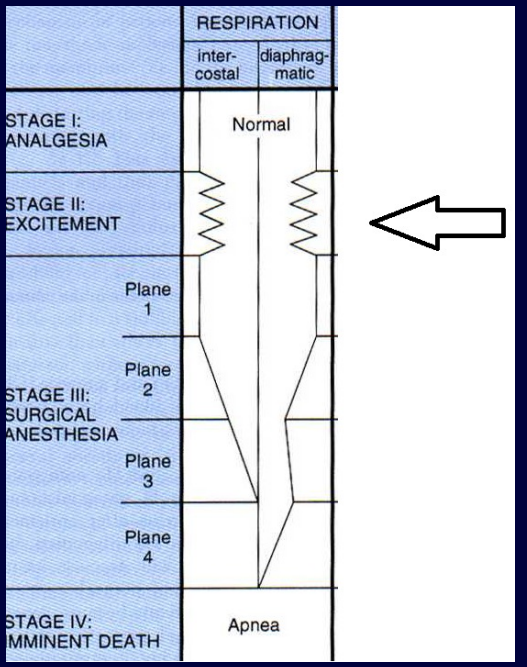
The 1st intravenous anaesthetic

- Boyle & Wren injected a dog with mix of opium & alcohol

- *"[the tincture] getting into the mass of Blood . . . was quickly, by the circular motion of That, carry'd to the Brain...before the Opium began to disclose its Narcotick Quality...and presently after [the dog] appear'd so stupifi'd..."*

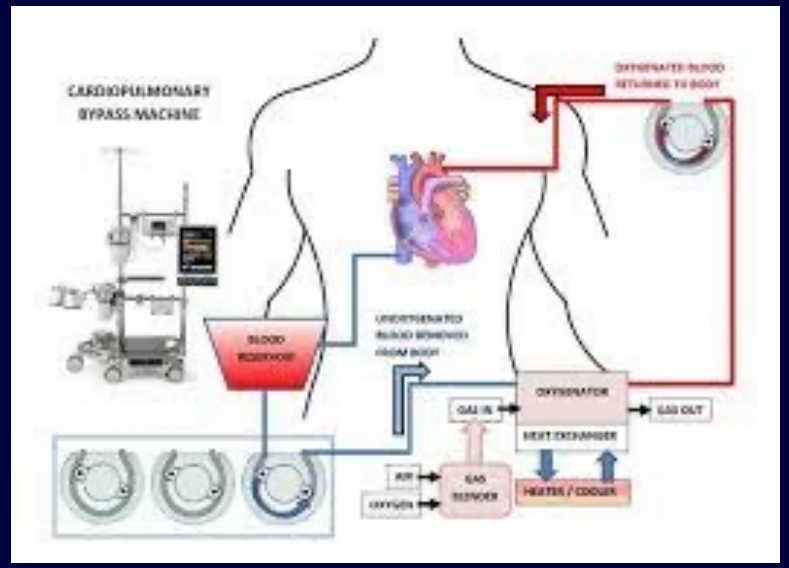
Benefits (and risks) of intravenous anaesthesia

- 1st true anaesthetics inhaled (ether; 1846)
- One danger (slow induction) is ‘stage 2’
- IV anaesthesia – being rapid – avoids stage 2
- But rapid action on brain = on other organs too
- More depression on heart & BP
- Pearl Harbor
  - Thiopentone
  - Need for prior resuscitation



Wren's anaesthetic mix used till 1970s!

- Dundee (1970) & Mannheimer (1971) used opiate-alcohol in cardiac bypass



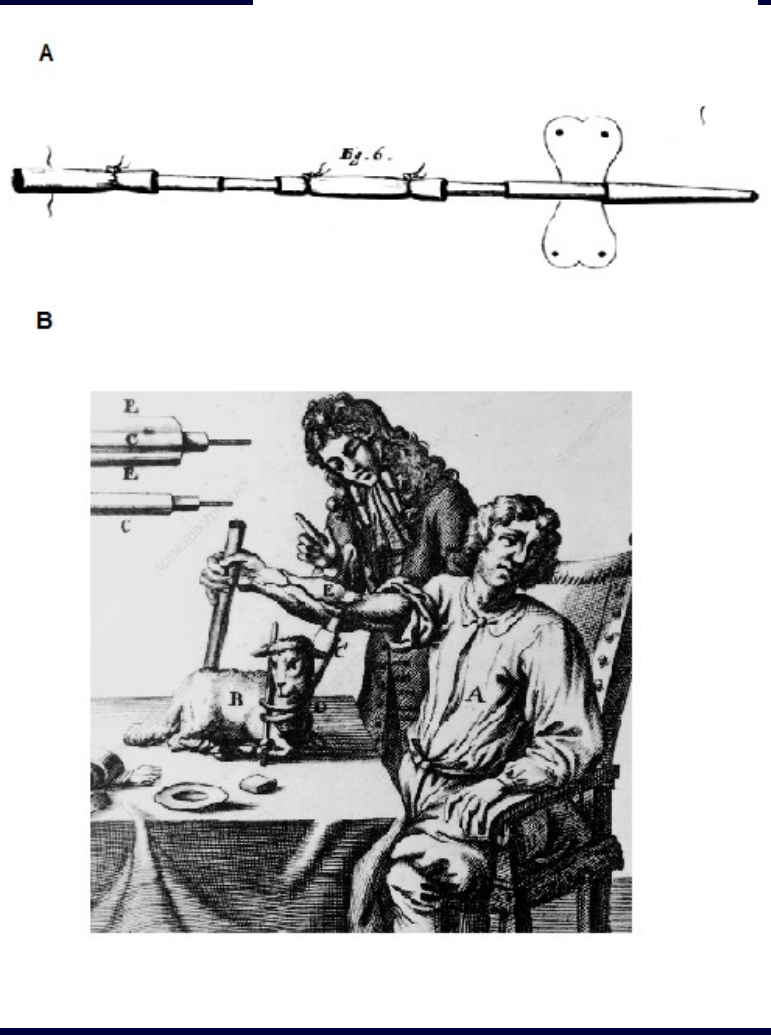
Blood transfusion

- Wren left Lower to use his IV access method to transfuse

- Animal to animal

- Beaten to animal to man by Denis (Paris)

- (But Denis also had first patient death)



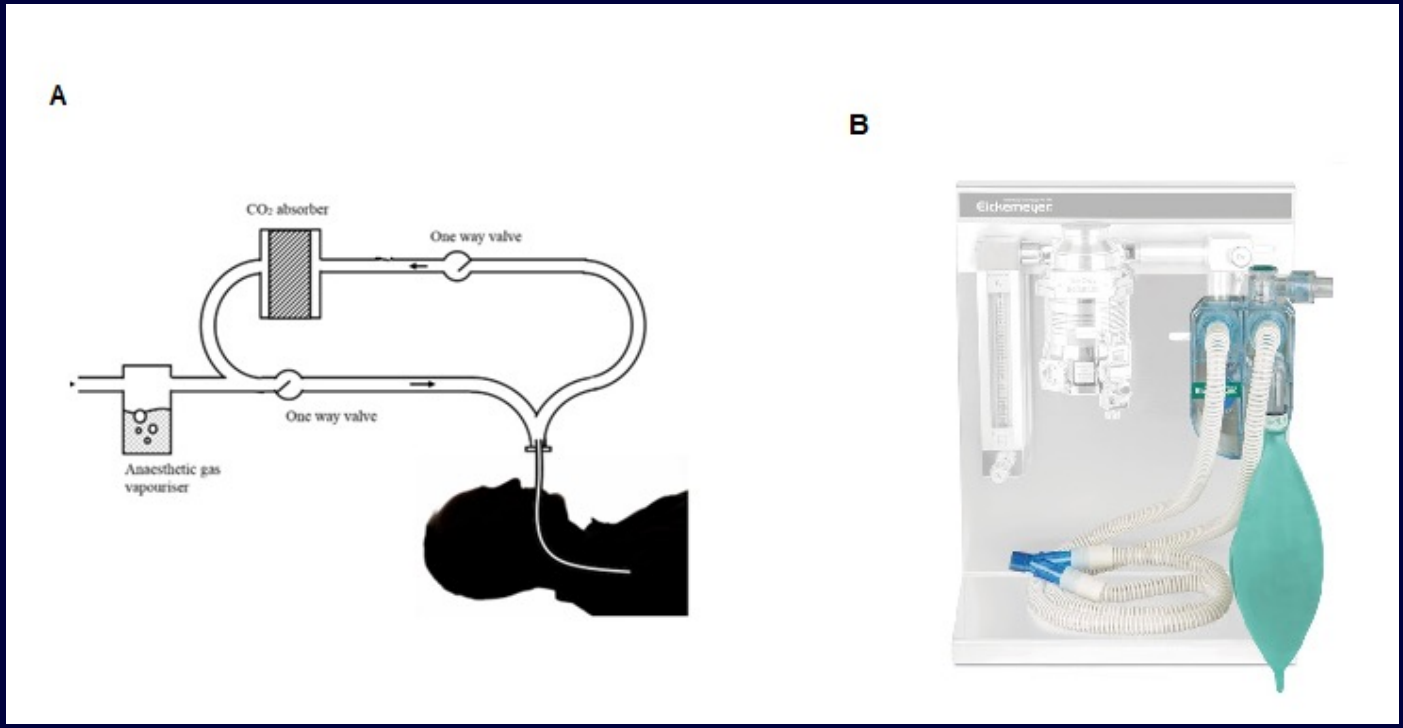
Third theme: lung function

- *"Dr. Wren made use of this experiment to explain the motion of the muscles by explosion"*
- Modern view:

- Wren: some link between 'air' & 'muscle explosion' and imagined
- *"An Instrument of Respiration, and for straining the breath from fuliginous vapours, to try whether the same breath so purify'd will serve again"*

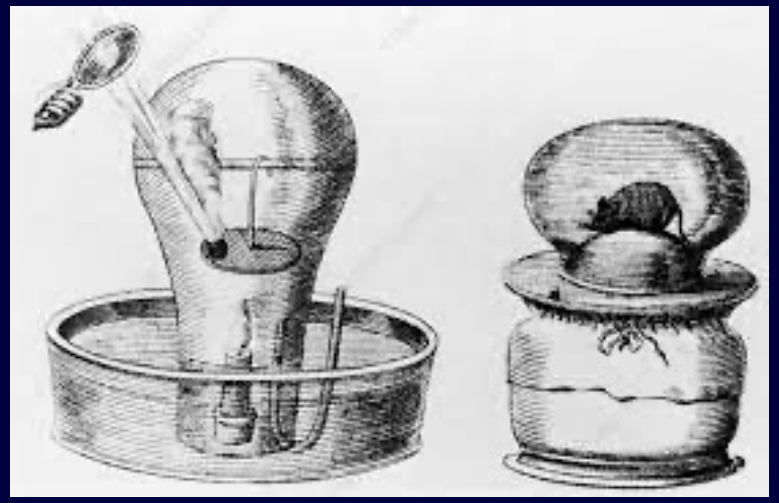
Wren's anaesthetic breathing circuit!

- Circle system – air re-breathed
- CO2 scrubbed by soda-lime
- Saves on oxygen and anaesthetic vapour

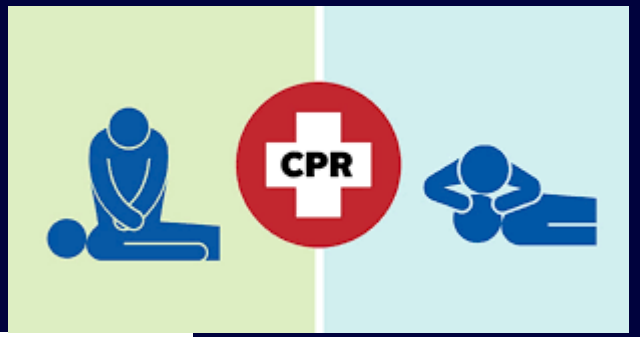


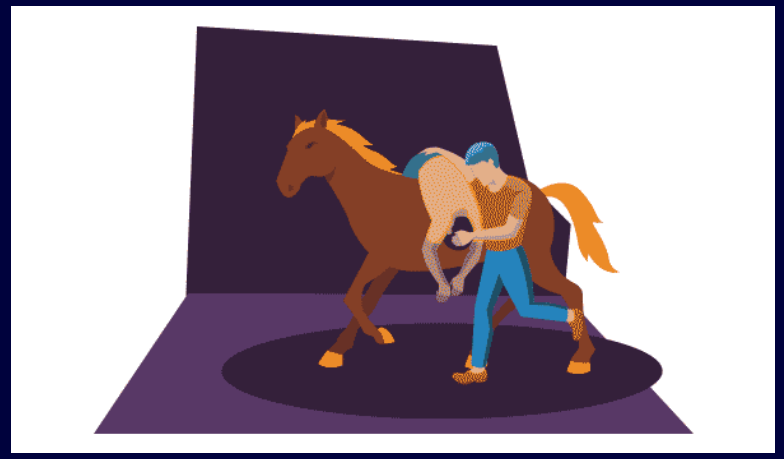
John Mayow nearly discovers oxygen

- Using an adaptation of Wren's imagined breathing device
  - Volumetric analysis
- Prevailing theory of 'phlogiston' as something given off by burning objects
- O2 discovered/named by Lavoisier 1790s noting burning metals gained weight (oxidised; ie, did not give off phlogiston)



Fourth theme: CPR



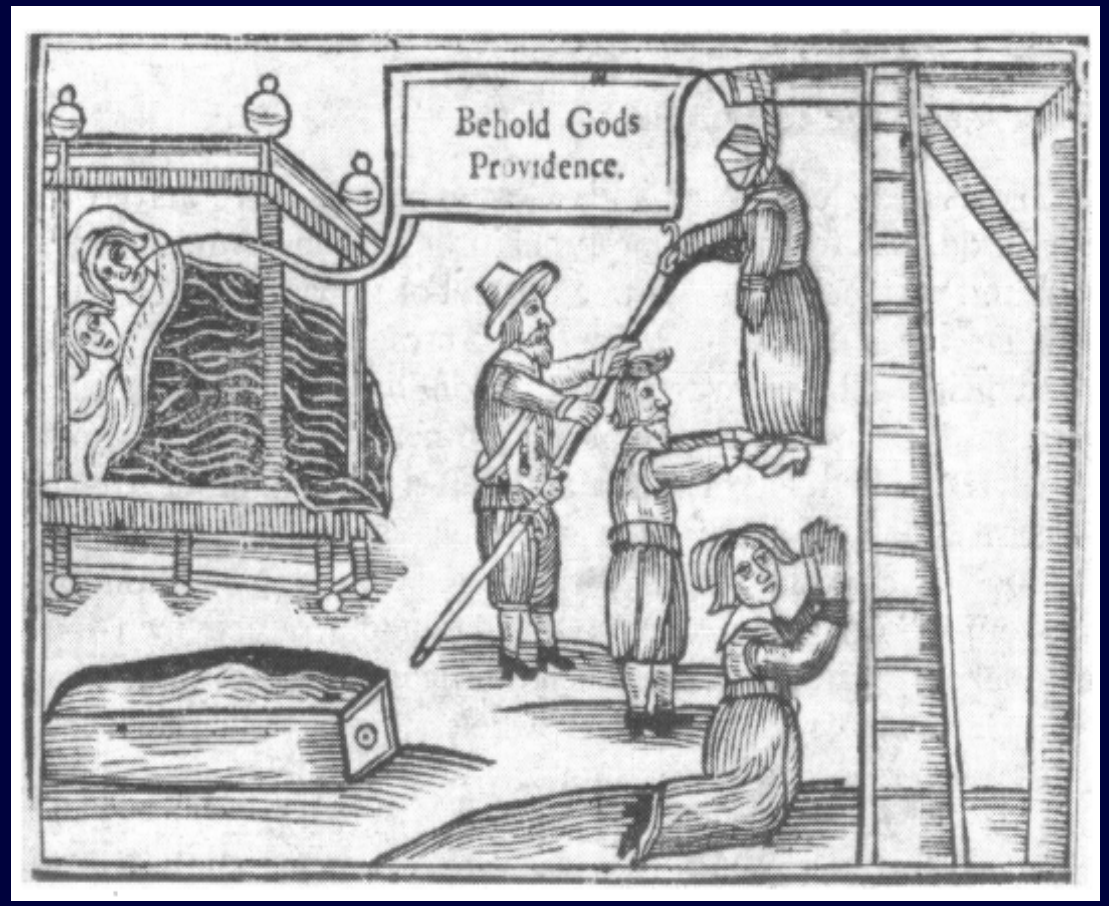


Oxford group ready

- Knowledge of circulation and heart as a pump (Harvey)
- Lower had used cardiac massage in an animal to pump blood out of artery to collect it (noted blood remained red)
- Wren had developed IV injection of drugs
- Mayow had (nearly) discovered oxygen
- ...ready to apply

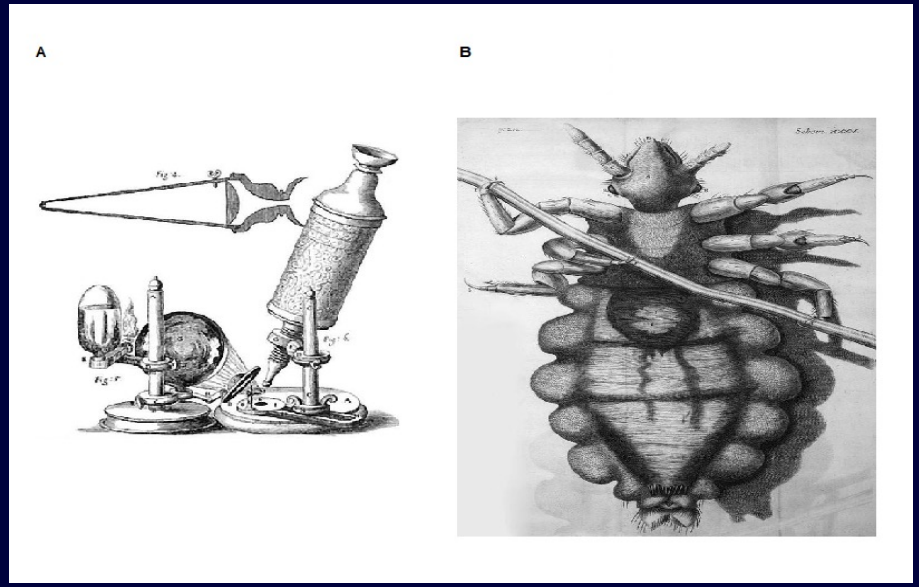
Resuscitation of Anne Green

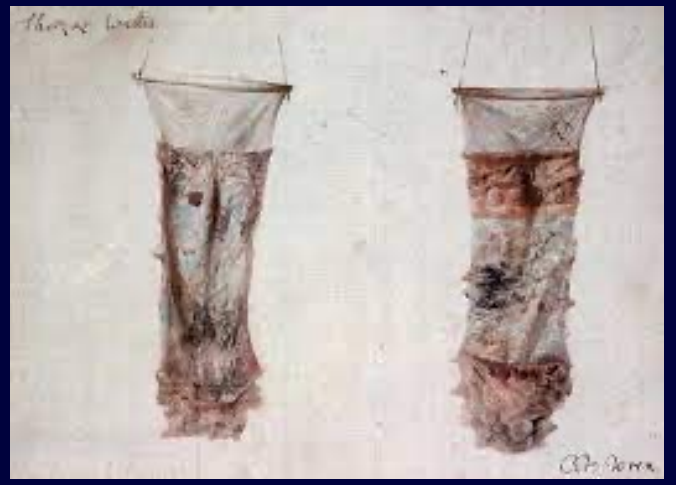
- Maid; stillbirth – tried and convicted of murder
- Hanged 14 Dec 1650 Carfax, Oxford
- Willis & Petty (Reader in Anatomy) claimed the corpse, dragged it to Beam Hall
- Willis and others (?Wren) decided to apply their discoveries to resuscitate
- Successful: “miraculous” – conviction quashed, Anne lived for 15 years and bore 3 children



Finally: other contributions

- Microscopy (helped Hooke on Micrographia)
- Operative surgery (splenectomy)
  - Care with ligature to prevent blood loss
  - Careful suturing of skin
  - Attention to detail for good outcome
  - Post-operative care
- Specimens (biopsy)





Hospital design

- Royal Hospital, Chelsea;
- the King William, Queen Mary and Queen Anne Courts of Greenwich Hospital;
- the Royal Hospital Kilmainham in Ireland;
- the College of Physicians, Warwick Lane, London

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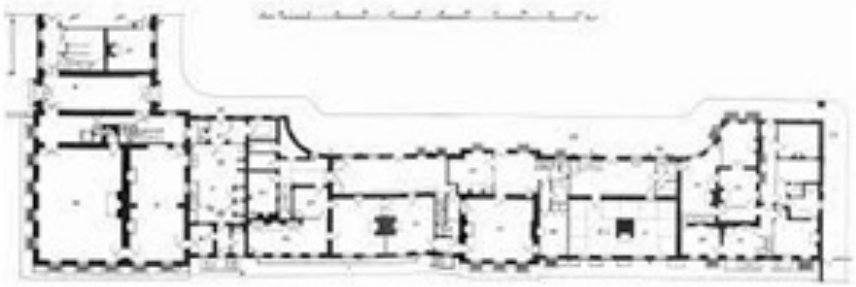

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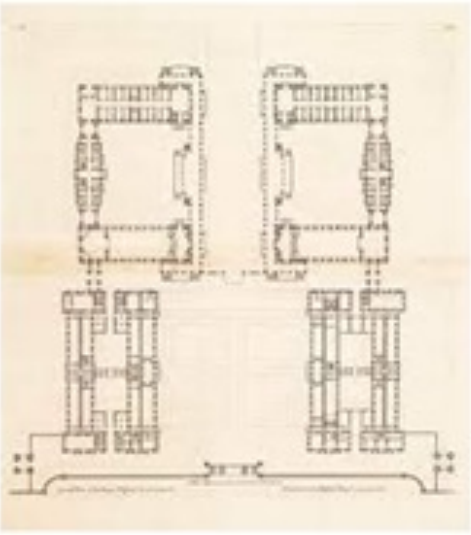

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D


The Royal College of Physicians London

Wren: Personal points of contact

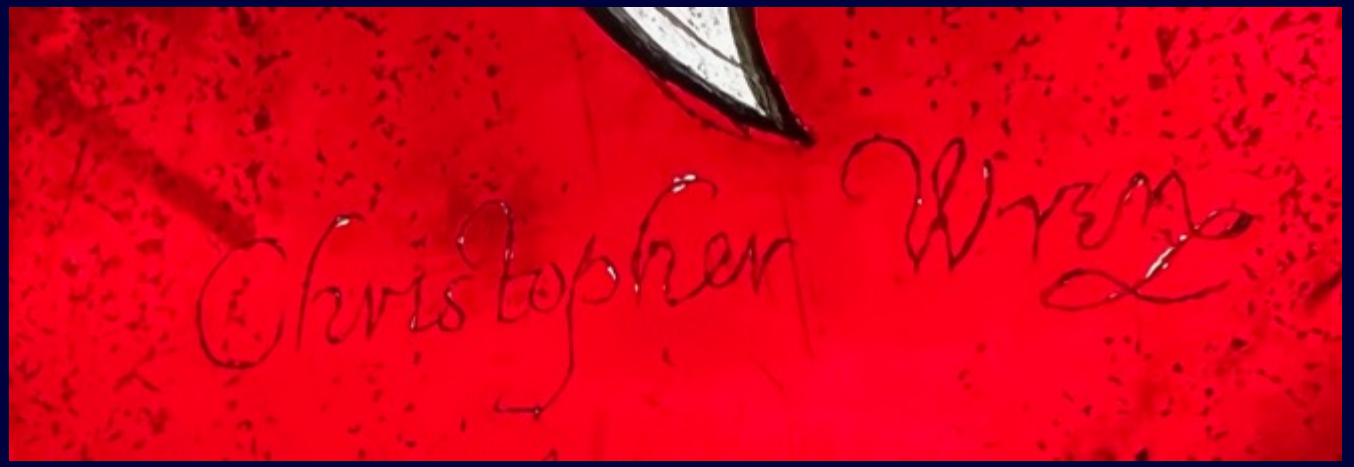
- (1) Awake carotid surgery and circle of Willis (discussed)
- (2) Oxygen consumption (Mayow) developed by CG Douglas, Tutor at St John's College, Oxford – Douglas bag c.1905 (volumetric gas analysis)

(3) Respiratory Physiology Fellows at St John's

- CG Douglas 1905-1963
- RW Torrance 1963-1999
- JJ Pandit 1999-now

(4) Another St John's connection...

- Christopher Wren (senior) etched his name on a glass panel in our Old Library (why?)



(5) And finally…many experiments in Beam Hall

- Which has had 2 important residents since 1187…

I have two questions to finish…

- What would Wren and Oxford group make of what we know now? Especi a – or oxygen?
- “kicking ourselves
- “we were right”

- What did Wren enjoy the most of all his pursuits?

- Thank you for listening!