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Organ perfusion prior to transplantation

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Introduction

- Organ perfusion with blood products prior to transplantation is an emerging technology
- Poses new questions:
  - Compatibility
  - Traceability and fating
  - Multiple 'recipients' of blood products
  - Regulatory requirements

Outline

- Demand for novel perfusion technology
- Novel technologies in organ perfusion
- Usage by organ
- Implications of using blood products
- Approach at Guy's Hospital

Novel perfusion technology

- Static cold storage has been the mainstay of organ preservation for 60 years
- Cheap, easy to deliver and effective
- Novel preservation techniques now being implemented
  - What are they?
  - What is the demand for these?

Organ preservation / perfusion

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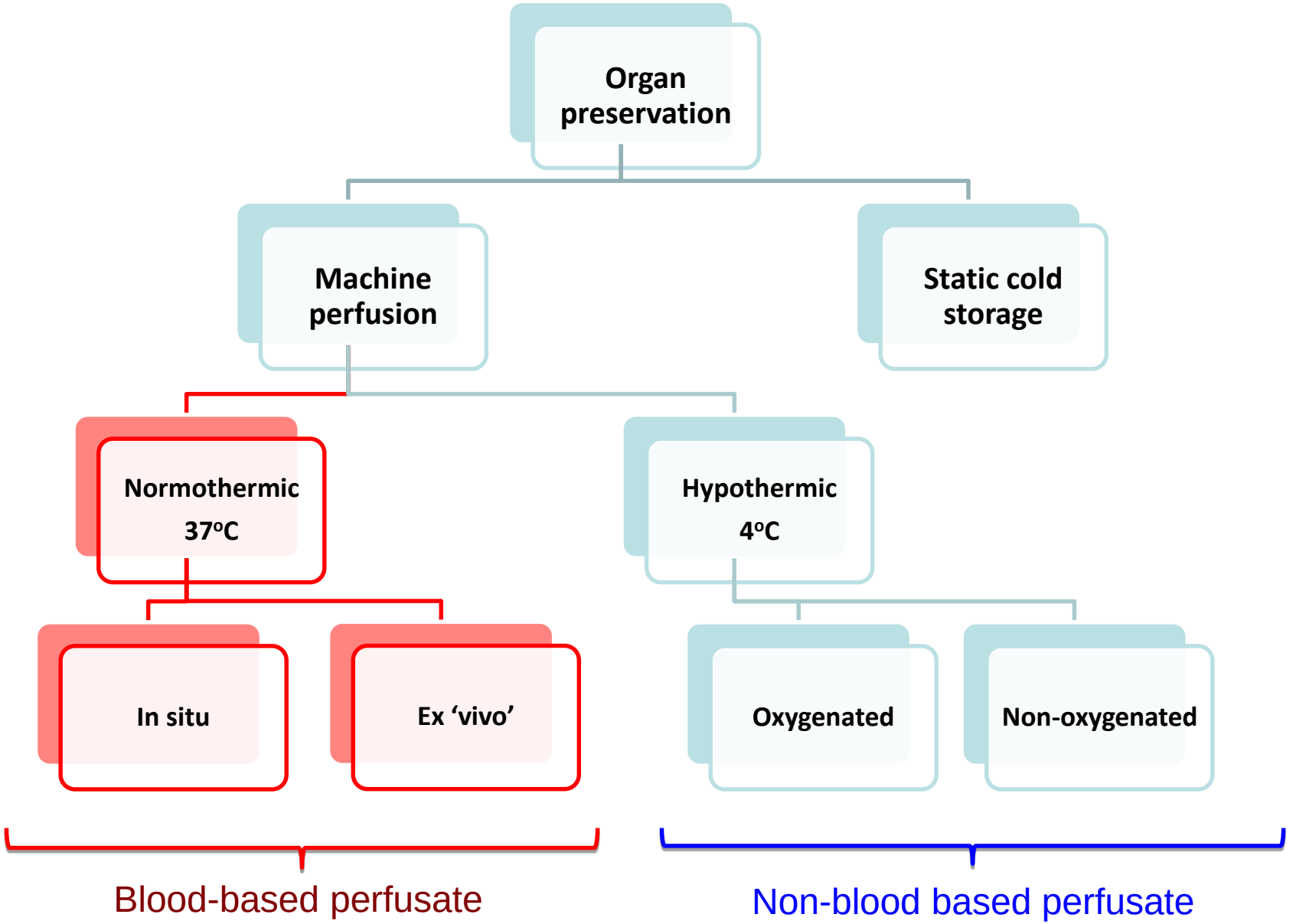

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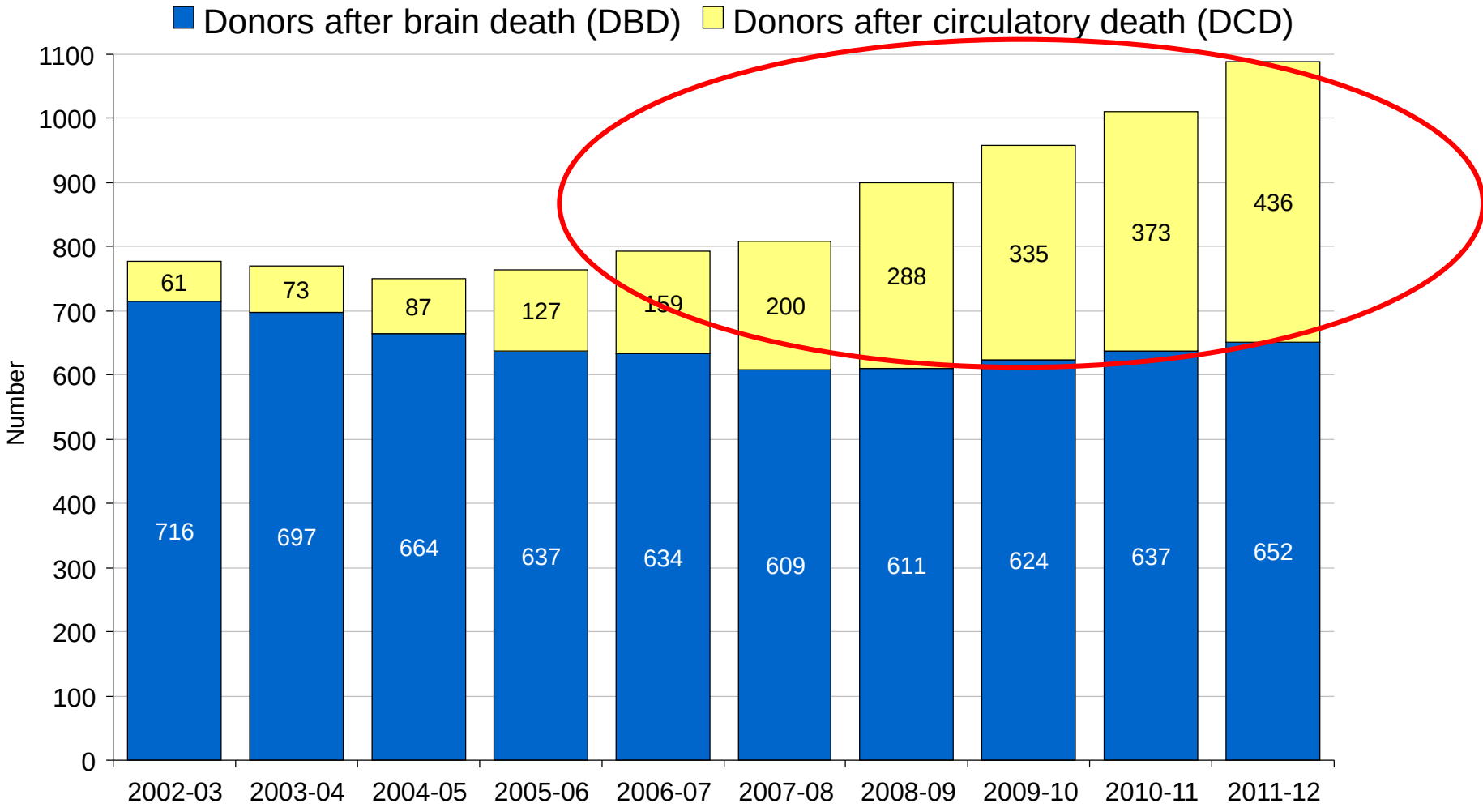
Why the need?
Deceased donor type over time



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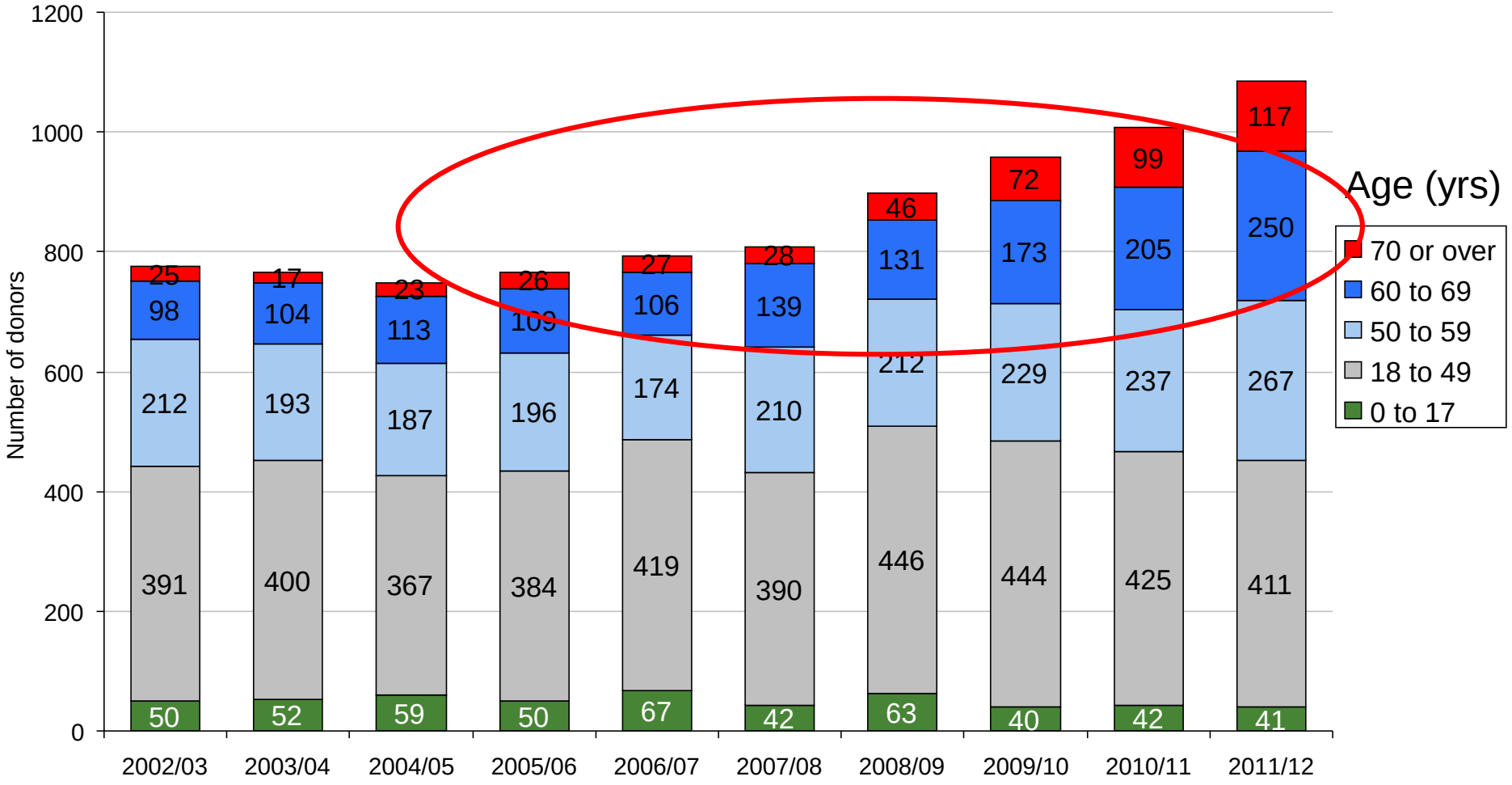
Deceased donor age over type



Demand for novel organ preservation techniques

- Increasing demand for organs
- Increasing DCD donors
  - Pre-existing ischaemic damage
- Donor quality:
  - Rising age
  - Co-morbidities
- Emerging evidence of organ intolerance to prolonged static cold storage

Organ preservation / perfusion

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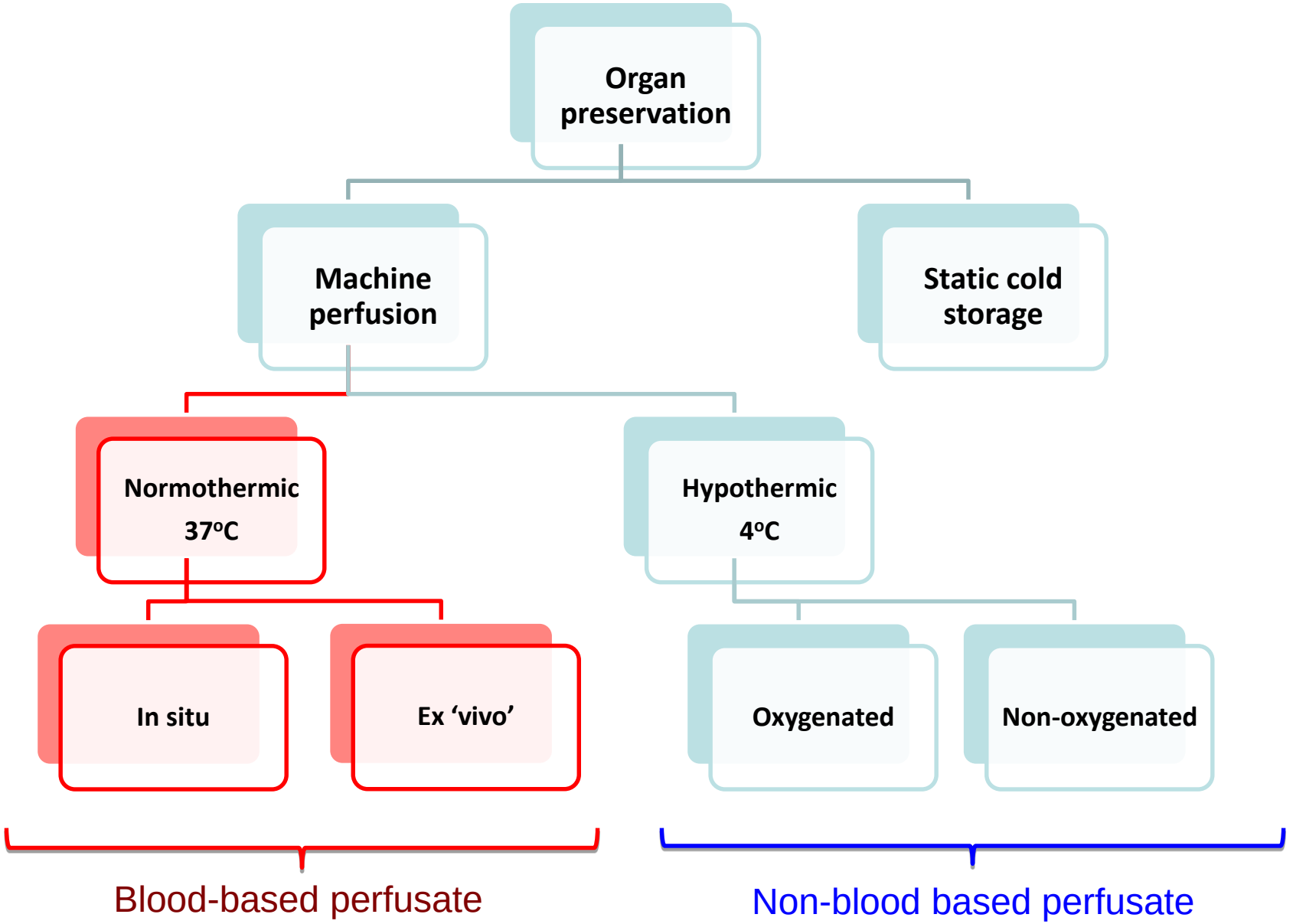
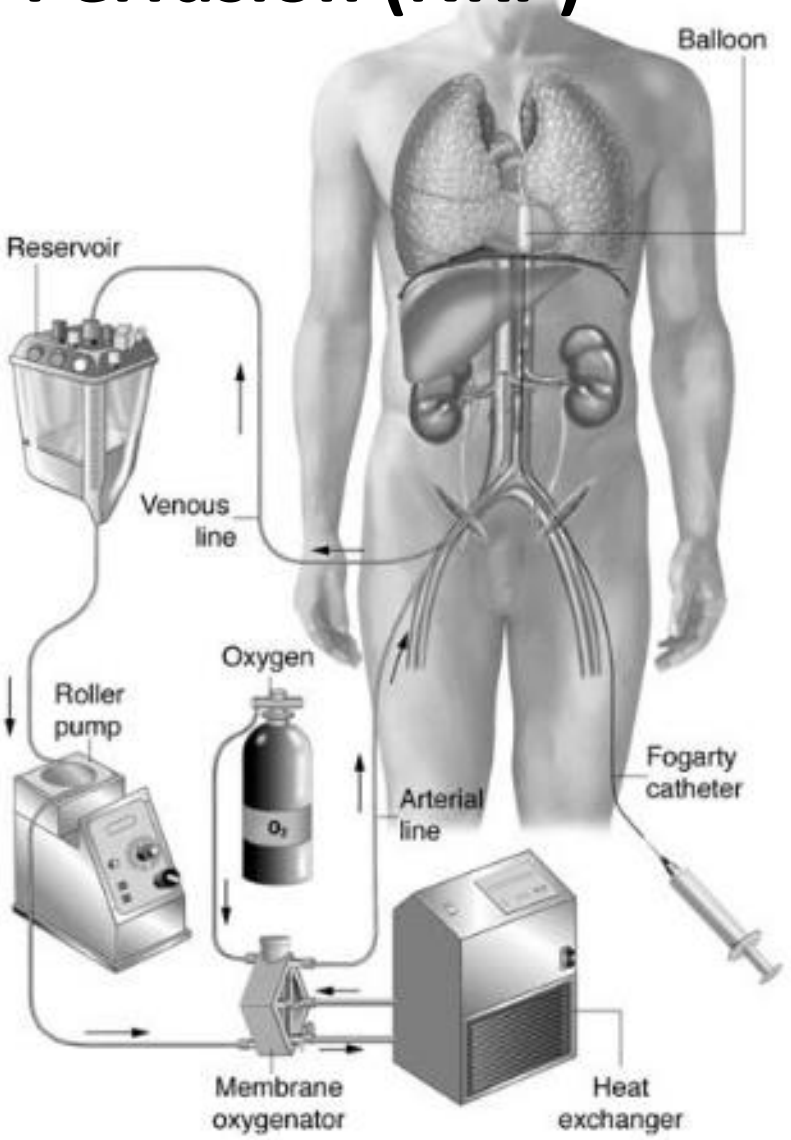


Normothermic Regional Perfusion (NRP)

- Restorage of regional circulation of oxygenated blood in the donor after death
- Major artery and vein cannulated
- Ballon or cross-clamp to thoracic aorta
- Closed circuit of circulating warm oxygenated DONOR blood



Normothermic Regional Perfusion (NRP)

- May improves organ quality (especially liver)
- May expand DCD donor pool
- Organ viability assessment (liver?)
- If allogeneic blood needed: donor-typed
  - Exposure to multiple recipients
- Tracing - captured on HTA-A form under DIN

Organ preservation / perfusion

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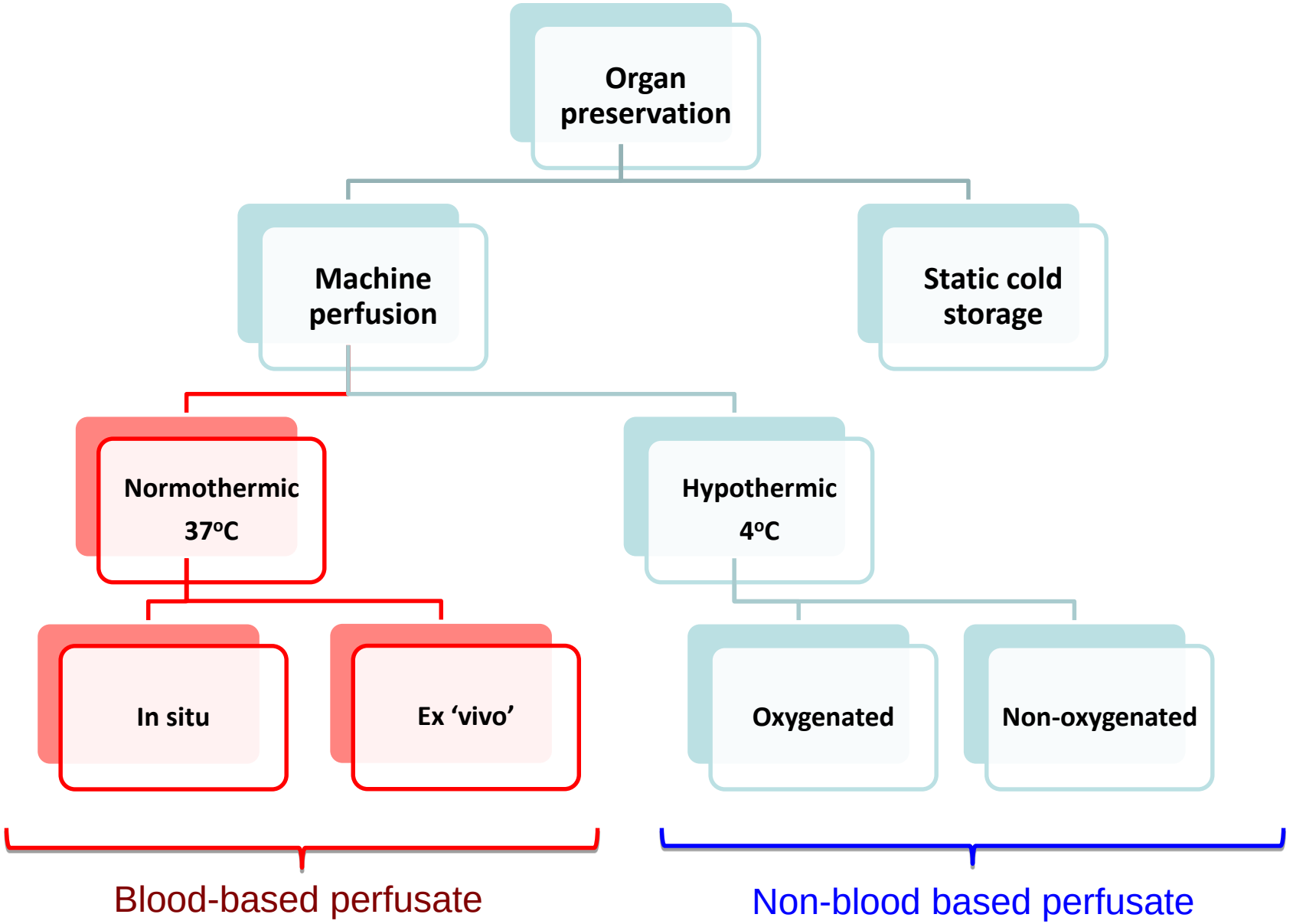


Ex-situ organ perfusion

- Clinical uses:
  - Heart
  - Lung
  - Liver
  - Kidney
- Allows better organ viability assessment
- May resuscitate organ and improve quality

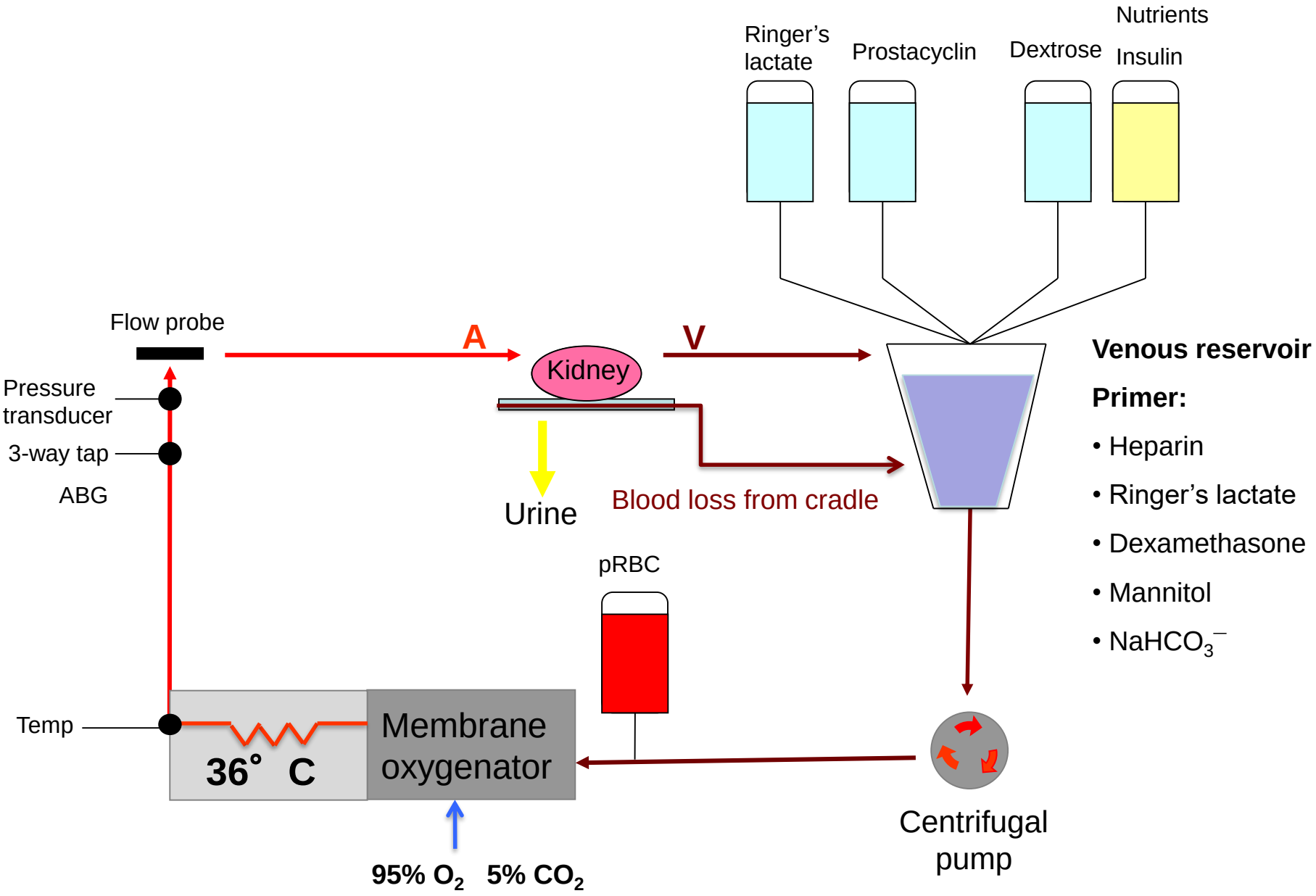
Ex-situ organ perfusion

- This may occur at (any combination of):
  - Donor hospital
  - During transportation
  - Recipient hospital

Kidney EVNP

- Led by Chris Callaghan at Guy's
- Ex 'vivo' normothermic perfusion (EVNP) uses clinical CPB technology to perfuse a kidney with oxygenated pRBCs at body temperature
- Pioneered by the Leicester / Cambridge group
- Possible indications for EVNP:
  - Attempt to reduce rates of DGF
  - Viability testing pre-transplant

Kidney EVNP at Guy's



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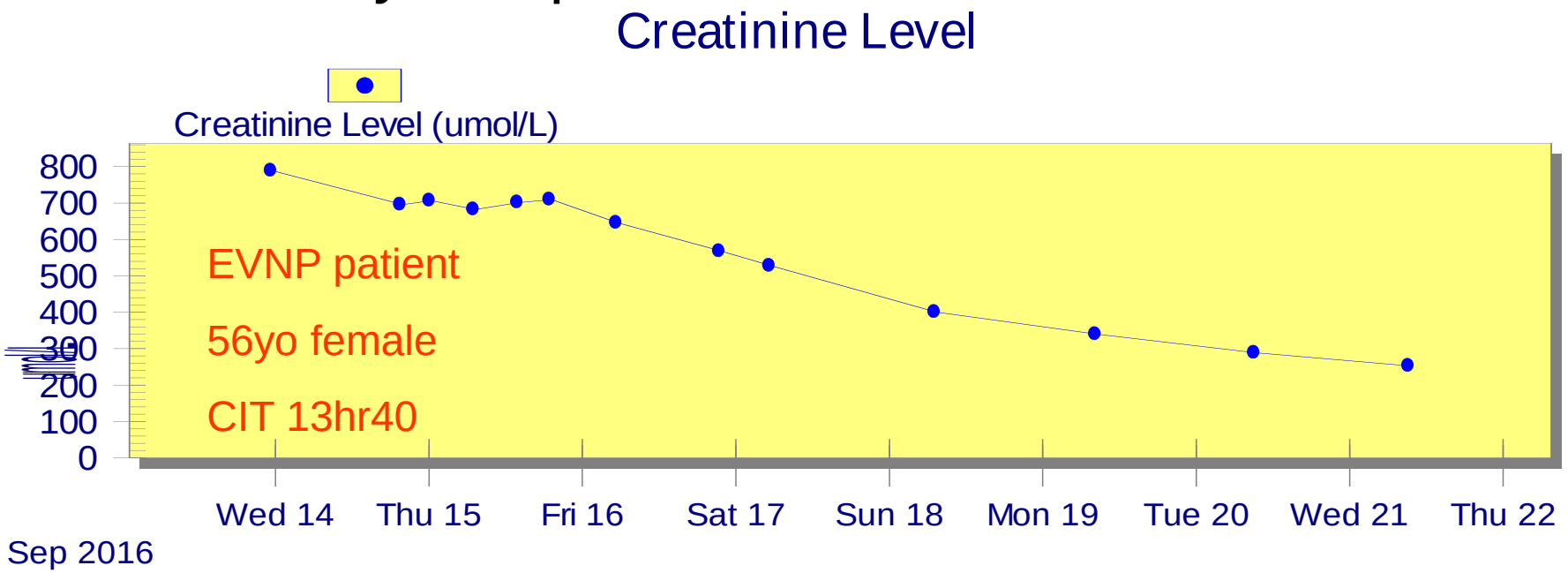
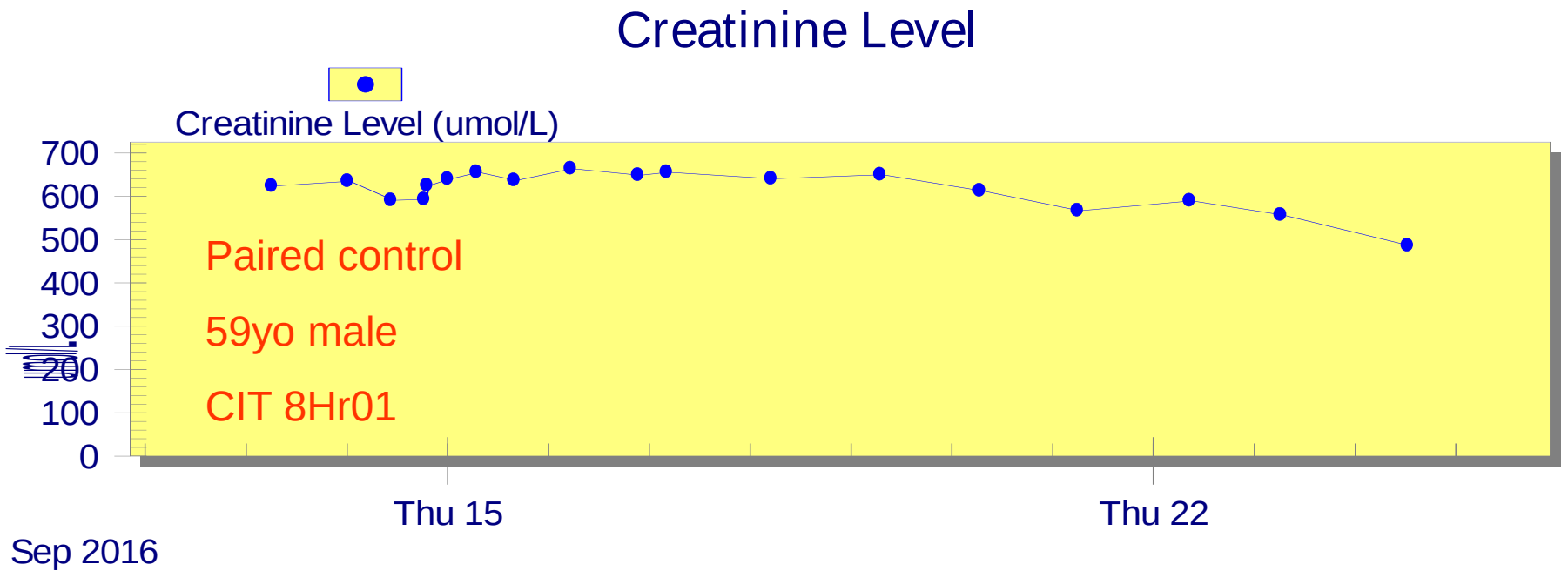
Paired kidney comparison

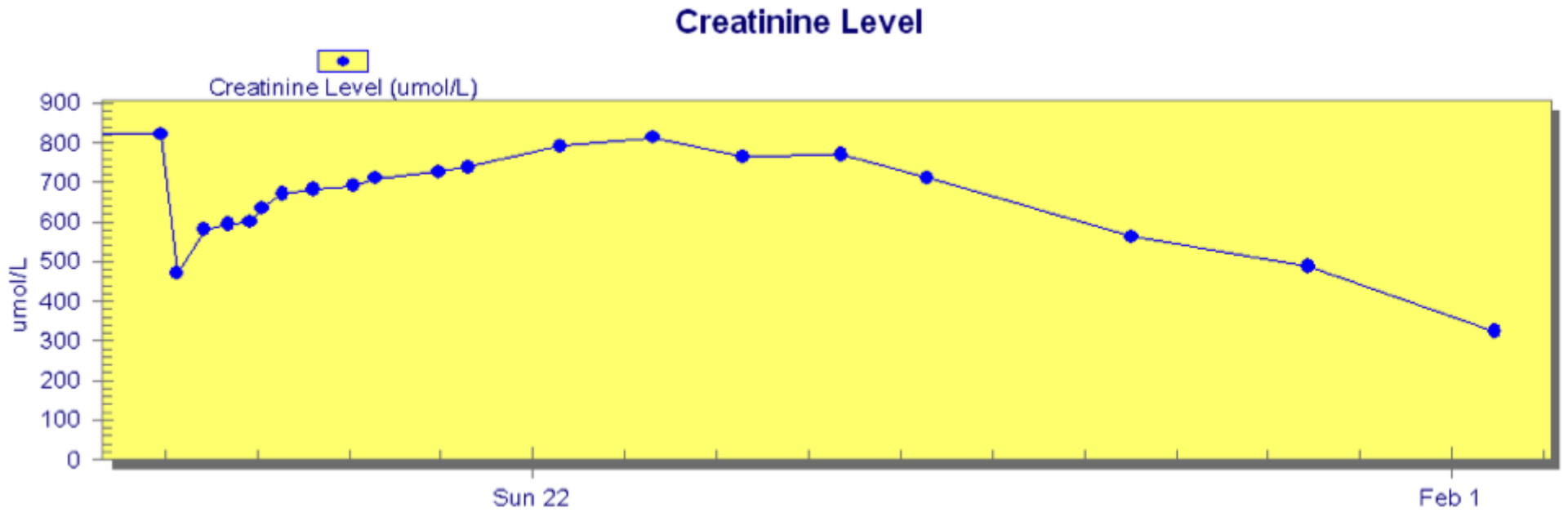




Donor with AKI

Donor: 17 yo male DBD with severe AKI
creatinine 250 umol/L

Recipient: 28yo male failing allograft on HD (1 session)



Considerations of using pRBCs on EVNP

- Residual transfused erythrocytes, leukocytes and plasma remain within the organ –
  compatibility issues?
- Risk of transfusion
  reaction or transfusion-transmitted infection
- Traceability
  - Law demands evidence of final fate (retained for 30 years)
  - Small (<1/100) chance of changing recipient after EVNP performed
  - EVNP prior to planned recipient arrival in hospital?
- <u>Cross-match to donor, planned recipient, or…?</u>

Approach at Guy's

- Multiple, complex discussions between EVNP and Transfusion teams
  - Understanding of technology and novel issues
  - No written guidance available elsewhere
  - Evolving clinical use of EVNP has changed the ways that pRBCs were used, requiring revised guidance
- Potential risks balanced against known benefits of transplant and possible benefits of EVNP
- Existing practice with residual donor blood in organ (and transfusions pre-mortem)

Approach at Guy's

- Consent issues
  - Risks discussed, leaflet given
  - Need for irradiated blood identified
- Additional patient ID band generated and checked
- Band on EVNP machine
- Usual prescription chart with planned recipient addressograph

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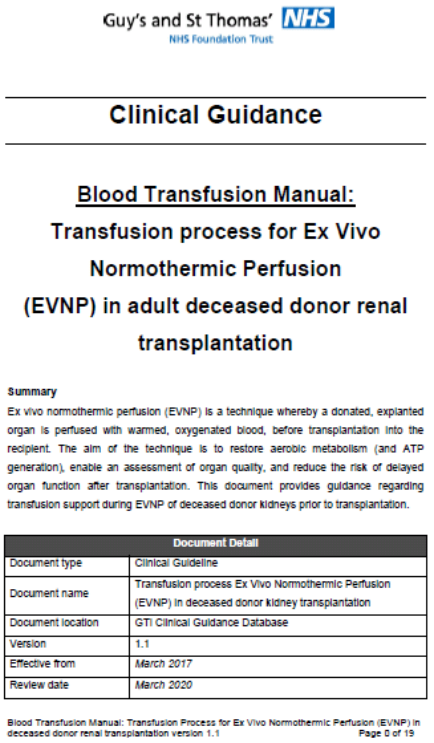
Approach at Guy's

- O Rh neg pRBCs from theatre fridge
  - Residual pRBCs
    - Compatible with potential donors / recipients
  - Plasma in pRBCs
    - Too low to cause rejection of kidney
    - Too low to cause haemolysis in recipient
  - Rh
    - Avoid sensitisation if females
- 'Bedside' check before giving pRBCs on EVNP



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Clinical Guidance

Blood Transfusion Manual:
Transfusion process for Ex Vivo Normothermic Perfusion (EVNP) in adult deceased donor renal transplantation

Summary

Ex vivo normothermic perfusion (EVNP) is a technique whereby a donated, explanted organ is perfused with warmed, oxygenated blood, before transplantation into the recipient. The aim of the technique is to restore aerobic metabolism (and ATP generation), enable an assessment of organ quality, and reduce the risk of delayed organ function after transplantation. This document provides guidance regarding transfusion support during EVNP of deceased donor kidneys prior to transplantation.

Document Detail	
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Document location	GTI Clinical Guidance Database
Version	1.1
Effective from	*March 2017*
Review date	*March 2020*

Blood Transfusion Manual: Transfusion Process for Ex Vivo Normothermic Perfusion (EVNP) in deceased donor renal transplantation version 1.1 Page 0 of 19

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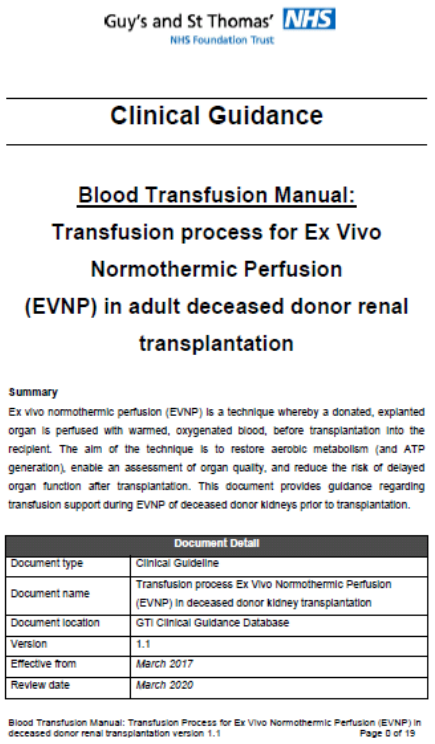
Approach at Guy's

- Blood bank informed at time of use
- ID band and prescription chart scanned to EPR, and left in paper notes
- 'EVNP' in traceability book
- Traceability tag returned to Lab with recipient's details
- EVNP team trained by Transfusion practitioners



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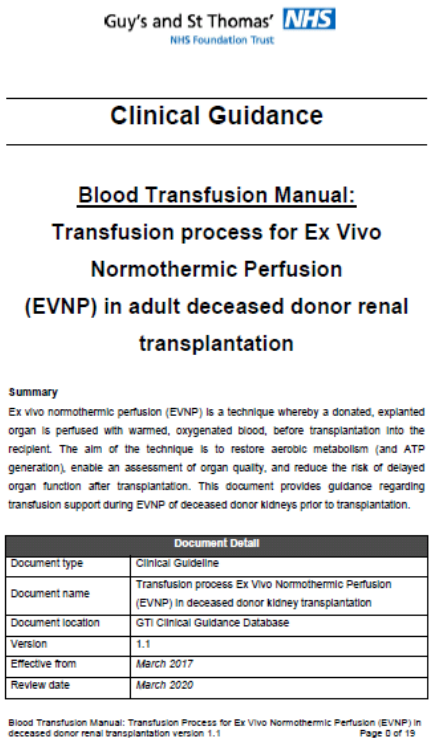
Approach at Guy's

- Defined pathways for organ re-allocation
  - Recipient at Guy's
  - Recipient elsewhere
  - Organ discarded
  - Organ sent for research and discarded



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Summary

- Emergence of perfusion technologies prior to transplantation
- Pose questions regarding compatibility, unit traceability and fating
- Detailed protocol for use of blood products
- Collaborative effort between transplantation and haematology
- Approaches needed at a local and national level
  - Will vary depending on perfusion technology and local issues

Acknowledgements

Chris Callaghan, Transplant Surgeon

- EVNP lead at Guy's

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- Sue Robinson
- Vanessa Fulkes and team
- Tim Maggs and team

Blood and organ donors, and their families