Neurological Determination of Death International (and personal..) Perspectives

1st National Organ Donation Congress
NHS Blood and Transplant
London March 8th 2012

Sam D. Shemie MD
Division of Critical Care, Montreal Children's Hospital
Medical Director, Extracorporeal Life Support Program

McGill University Health Centre
Montreal Children's Hospital/MUHC Research Institute

Professor of Pediatrics, McGill University

The Bertram Loeb Chair in Organ and Tissue Donation
Faculty of Arts, University of Ottawa

Medical Director, Donation, Canadian Blood Services

Canadian Blood Services
Société canadienne du sang

uOttawa

Summary

1. **Brain death was discovered, not invented**

2. **Globally, brain-based determinations of death are fundamentally similar and based on the absence of consciousness, motor responses, brainstem reflexes and capacity to breathe**

3. **With advances of technology, brain-based determinations of death have become more relevant**

4. **Death after cardiac arrest is a neurological determination based on the absence of brain blood flow.**

Canadian Blood Services www.blood.ca

National Health Policy for ICU Organ Donation

1. **Severe Brain Injury to Neurological Determination of Death (Brain Death)**

   April 2003 Shemie (FRG) et al, CMAJ, 2006

2. **NDD to Organ Procurement: (Donor Management)**

   Feb 2004 Shemie (FRG) et al, CMAJ, 2006

3. **Donation after Cardiocirculatory Death (DCD/NHBD)**

   Feb 2005 Shemie (FRG) et al, CMAJ, 2006

4. **Brain Blood Flow (Brain Death)**

   Nov 2006 Shemie (FRG) et al, CJNS, 2008

5. **Donation Physician Specialists in a National System**

   Feb 2011

References of Further Information

1. **Severe Brain Injury to Neurological Determination of Death**
   Shemie et al, CMAJ, 2006

2. **Brain Death in Adults, American Academy of Neurology**
   Wijdicks et al, Neurology 2010

3. **A Code of Practice for the Diagnosis and Confirmation of Death**
   Academy of Medical Royal Colleges (UK) 2008

Brain Death Instructional Video
open access

http://video.bloodservices.ca/Streaming/nddvideo/

Canadian Blood Services
Société canadienne du sang

www.blood.ca

British Journal of Anaesthesia 108 (S1): i14–i28 (2012)
doi:10.1093/bja/aer397

BJA

REVIEW ARTICLES

International perspective on the diagnosis of death

D. Gardiner[1*], S. Shemie[2], A. Manara[3] and H. Opdam[4]

[1] Adult Intensive Care, Nottingham University Hospitals NHS Trust, Derby Road, Nottingham NG7 2UH, UK
[2] Division of Critical Care, Montreal Children's Hospital, McGill University Health Centre, 2300 Tupper Street, Montreal, QC, Canada H3H 1P3
[3] Anaesthesia and Intensive Care Medicine, Frenchay Hospital, North Bristol NHS Trust, Bristol BS16 1LE, UK
[4] Department of Intensive Care, Austin Hospital, 145 Studley Road, Heidelberg, VIC 3084, Australia

* Corresponding author. E-mail: dalegardiner@doctors.net.uk

Death Determined 3 Ways

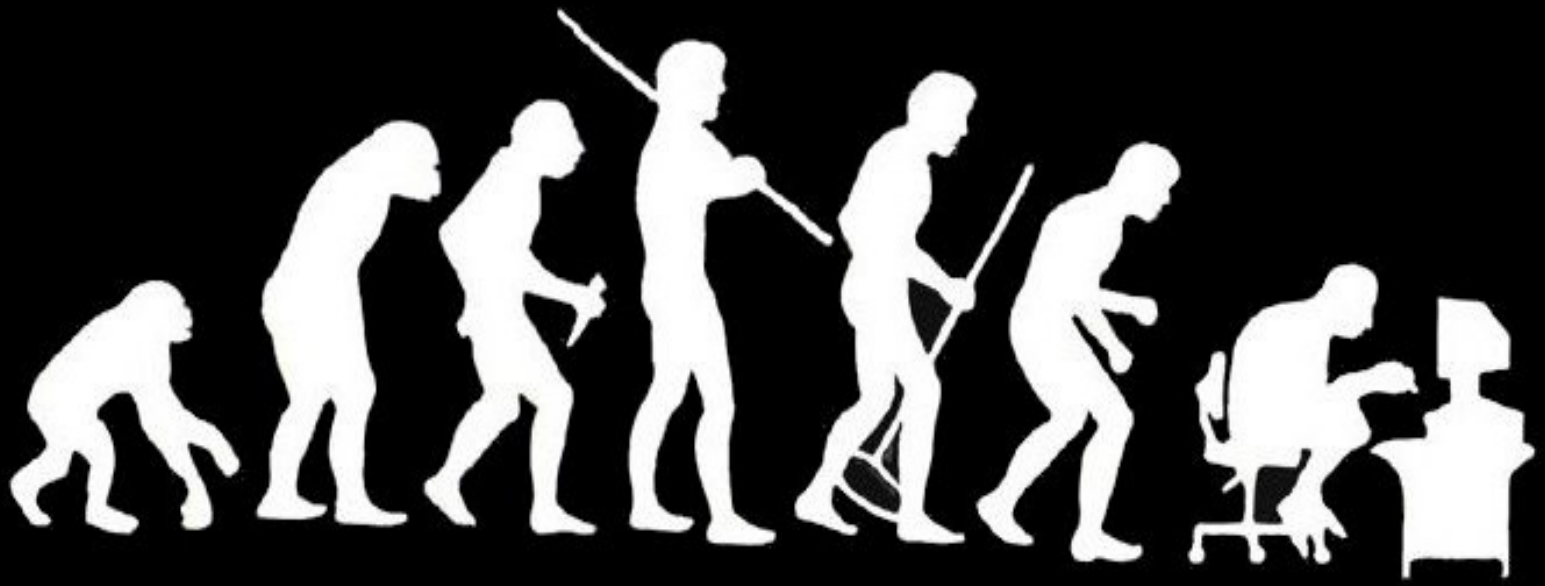
1.Somatic

2.Neurological

3.Circulatory

Somatic Death

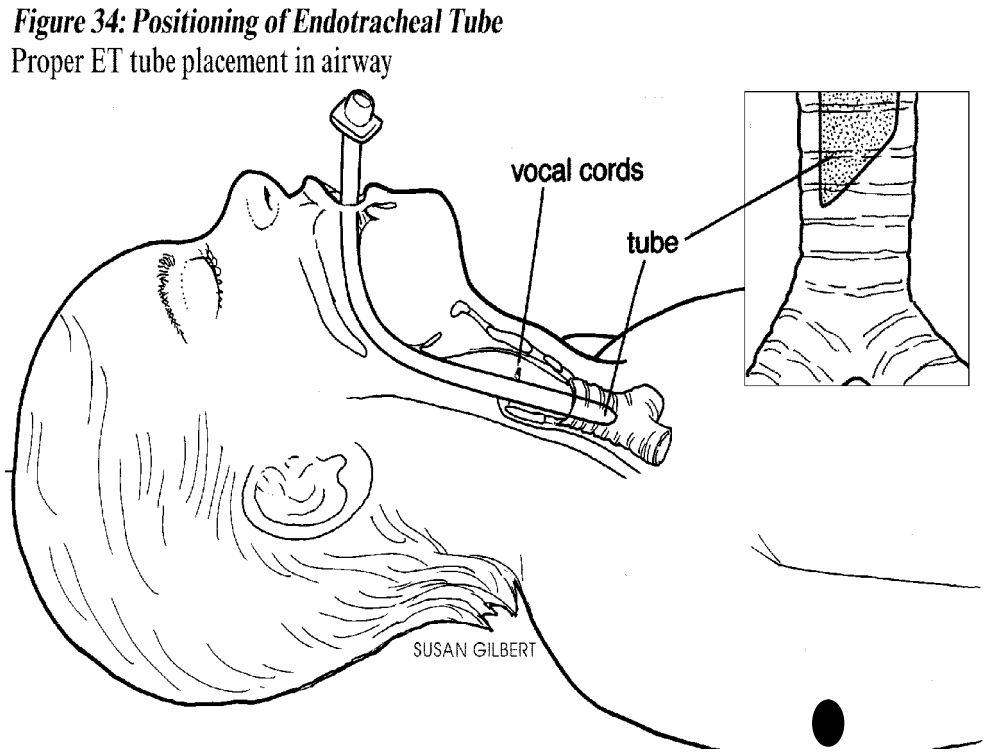
Complete & irreversible loss of all biological functions of all cells & organs that constitute a living organism.



Evolution of Our Understanding

- Cardiopulmonary physiology and resuscitation
- Cardiac surgery and cardiopulmonary bypass
- ICU life support
- Extracorporeal life support and ECMO
- Cell biology
- Organ donation, preservation, transplantation

Airways and Mechanical Ventilation



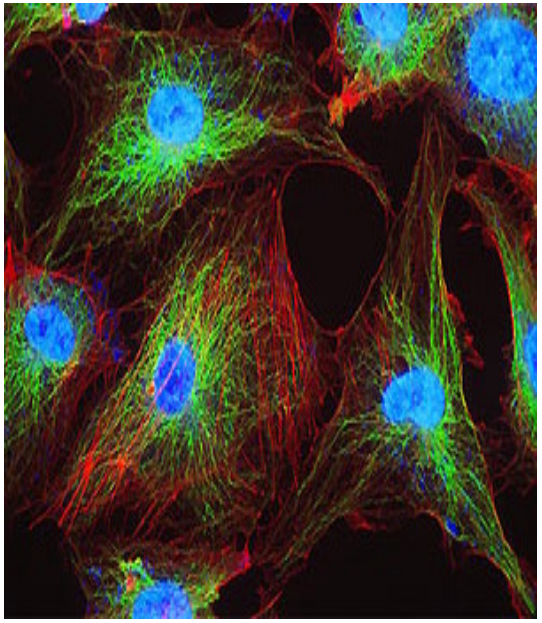
1. Mollaret and Goullon, Coma Depasse, 1958
2. Havard ad hoc Committee in 1968

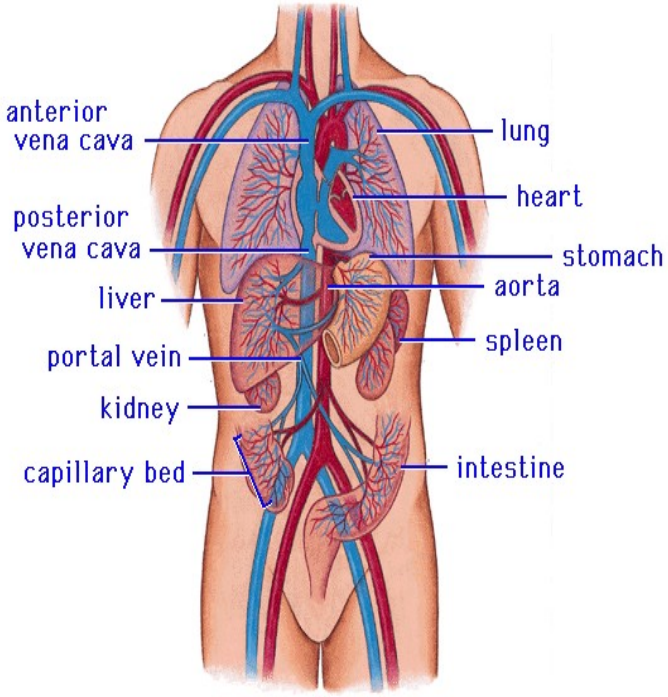
To promote donation,
organs are animated with a life force that can be gifted,
allowing the person to 'live on' in the bodies of recipients.

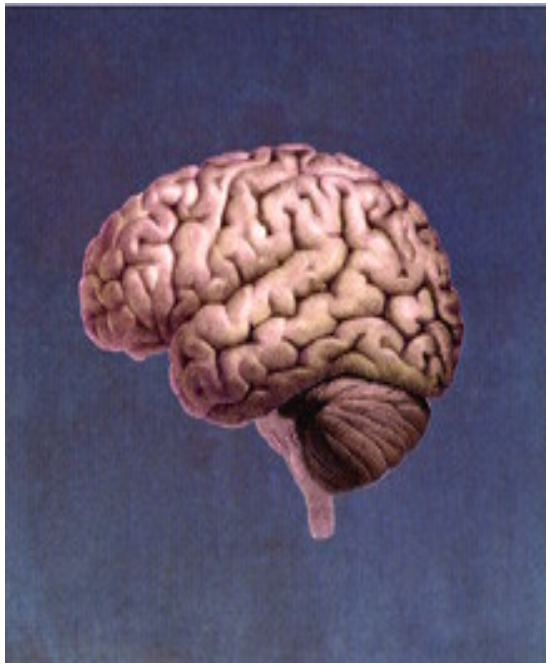
However, the language of medicine insists
that human body parts are material entities,
entirely devoid of identity….

Margaret Lock, Twice Dead: Organ Transplant and the Reinvention of Death, 2001

Biology of Life







Organs as Mechanical Parts

Lungs load oxygen

Heart is the pump

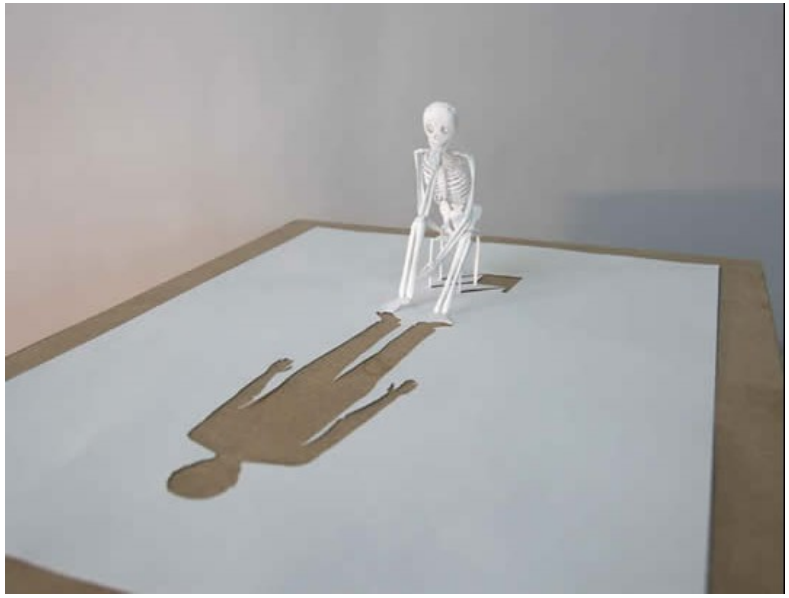
Blood vessels are conduit pipes

Liver metabolizes

Kidney filters

Technology, Organ Donation & Transplantation

- **Forces reflection on:**
  - **What it means to be alive, or dead**
  - **Where our personal identity resides**
    - **Body, heart, brain or soul?**

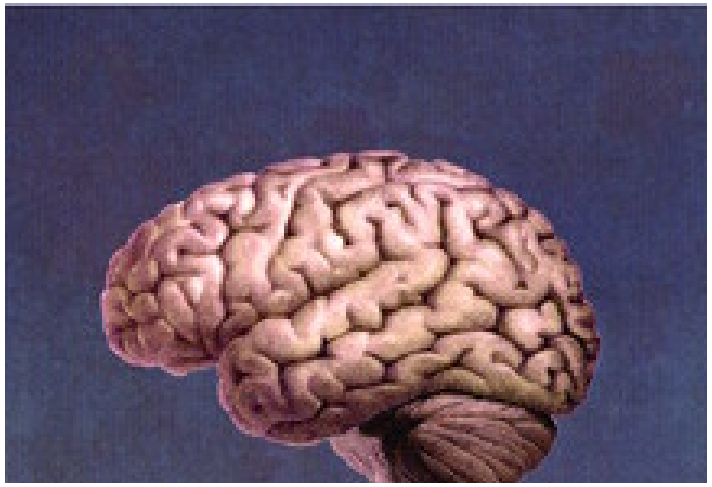


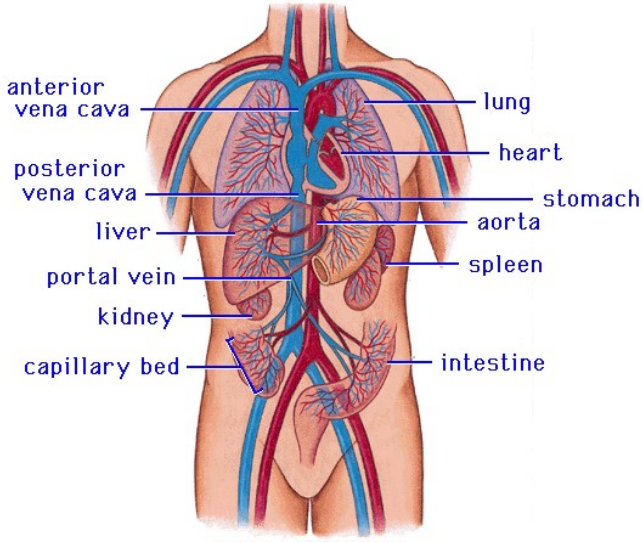
All vital organs:

Heart, Lung, Liver and Kidney,

can be supported by technology or replaced by transplantation.

Except the Brain





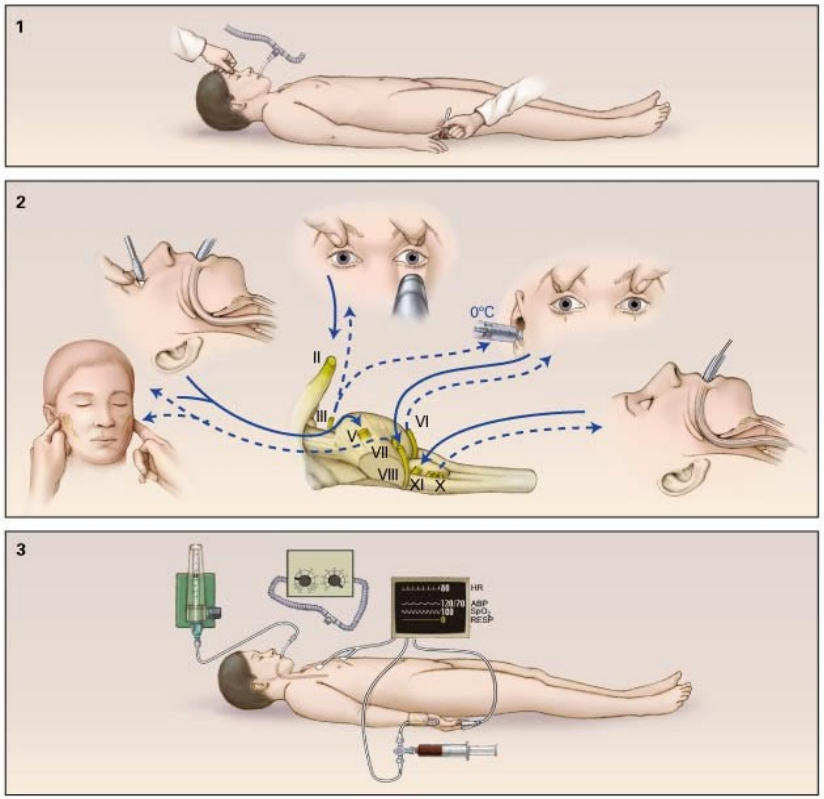
Is the only organ that <u>cannot</u> be functionally supported or replaced.

Brain-based determination of death is more relevant today.

Brain Function in Critical Illness

1. Consciousness
   - -cognition
   - -awareness/ receptivity
   - -interaction
2. Motor function/response
3. Sensory function/response
4. Autonomic function
5. Respiratory drive
6. Brainstem reflexes including airway control

Neurological Determination of Death/Brain Death



1. **Unresponsive coma with a <u>known proximate cause</u> and <u>absence of reversible</u> conditions**
2. **Absence of centrally-mediated motor responses**
3. **Absent brainstem reflexes & the <u>capacity to breathe</u>**

Wijdicks EFM. The diagnosis of brain death. N Engl J Med 2001;344:1215-1221

Brain Death Determination
Variable and Inconsistent?

Variability in brain death determination practices in children.

Mejia and Pollack JAMA 1995

Brain death worldwide. Accepted fact but no global consensus in diagnostic criteria. **Wijdicks, Neurology, 2002**

Variability among hospital policies for determining brain death in adults. **Powner et al, CCM, 2004**

Variability of hospital based brain death guidelines in Canada.

Hornby et al, Can J Anes, 2006

Brain Death Worldwide
Brain Death Guidelines in Canada 2003

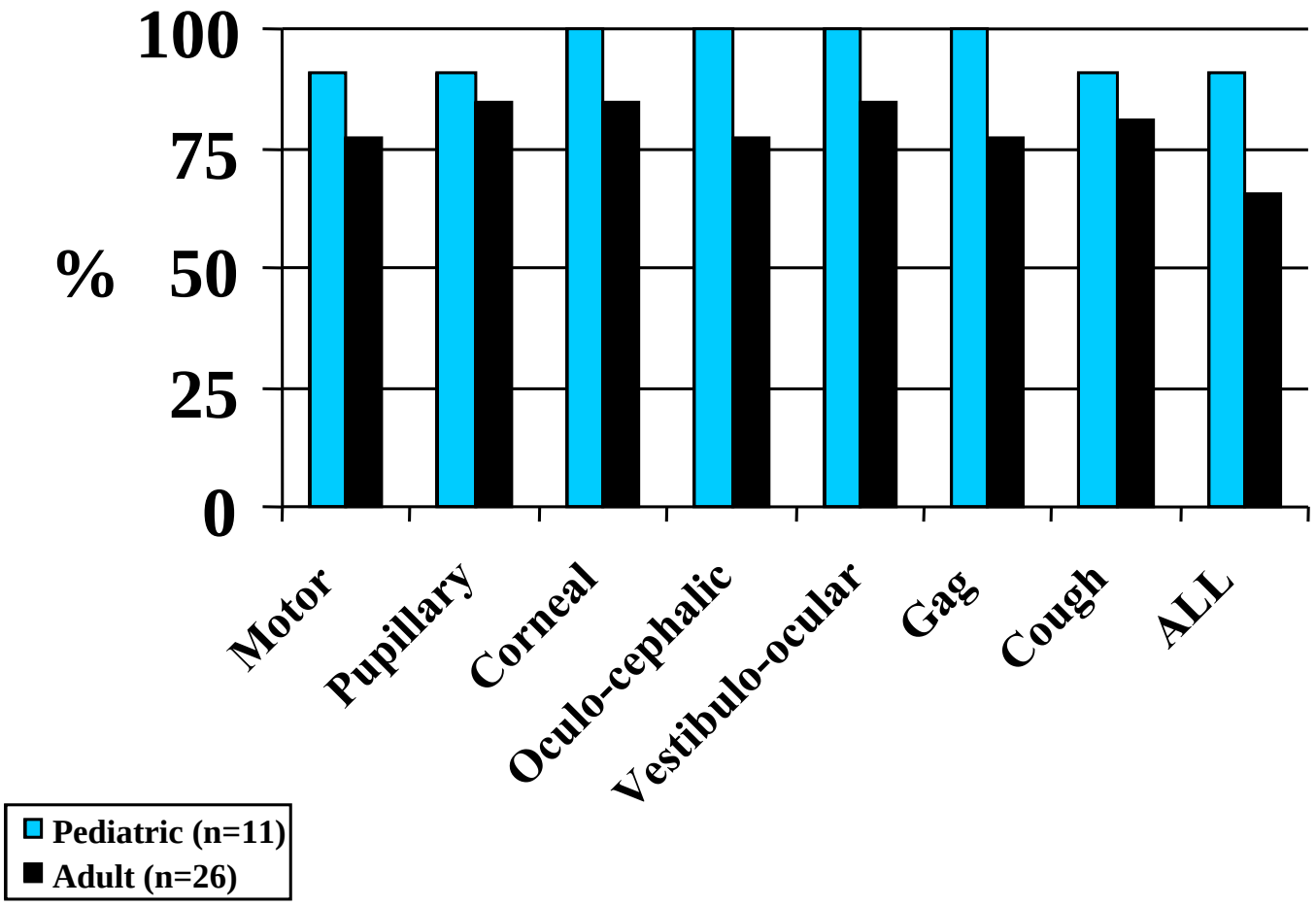
Major differences in procedures for diagnosis of brain death in adults and children:

- **apnea testing**
- **observation time**
- **age related criteria**
- **required expertise of physicians**
- **provisions for anoxic BD**
- **confirmatory lab tests**
- **legal standards**

Hornby, Shemie et al, Can J Anes, 2006
Wijdicks, NEUROLOGY 2002;58:20–25

2003 Canadian Hospital-based Brain Death Document Survey

Brainstem Reflexes



Hornby et al, Can J Anes, 2006

Trauma
Cerebrovascular Accident
Cardiac Arrest

↓

Severe Brain Injury

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Mechanical Ventilation and
ICU based Life Support

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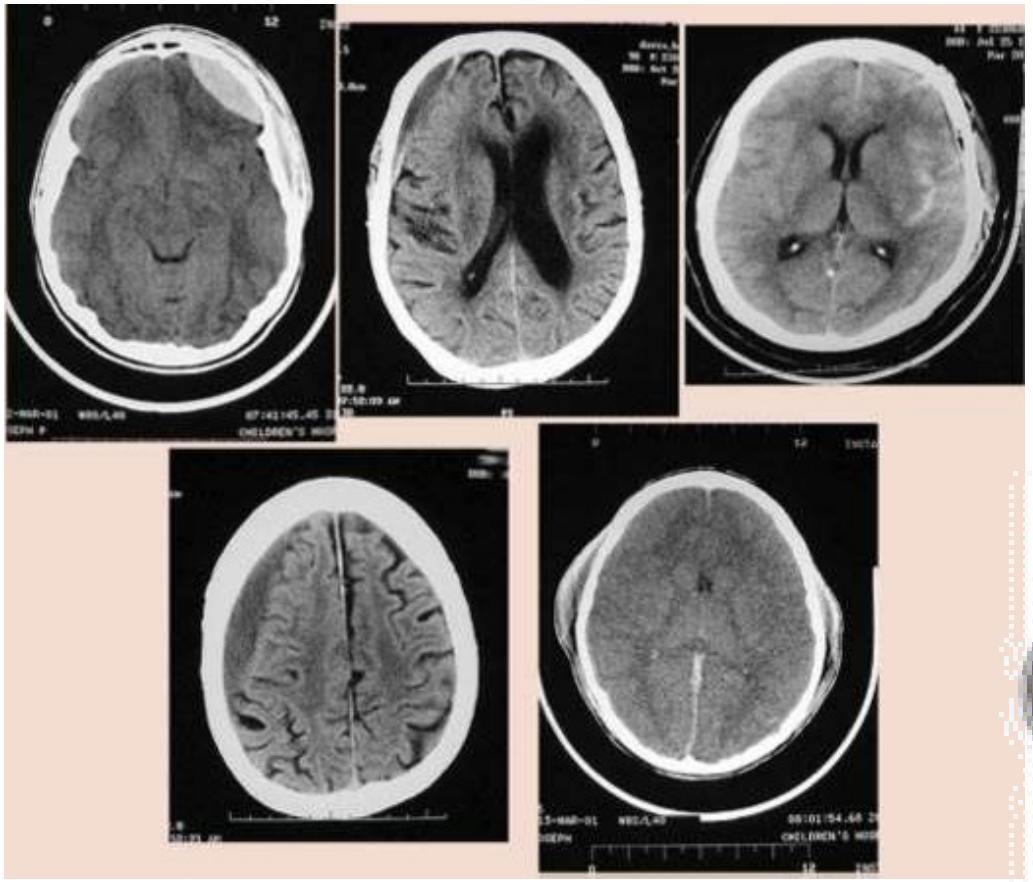
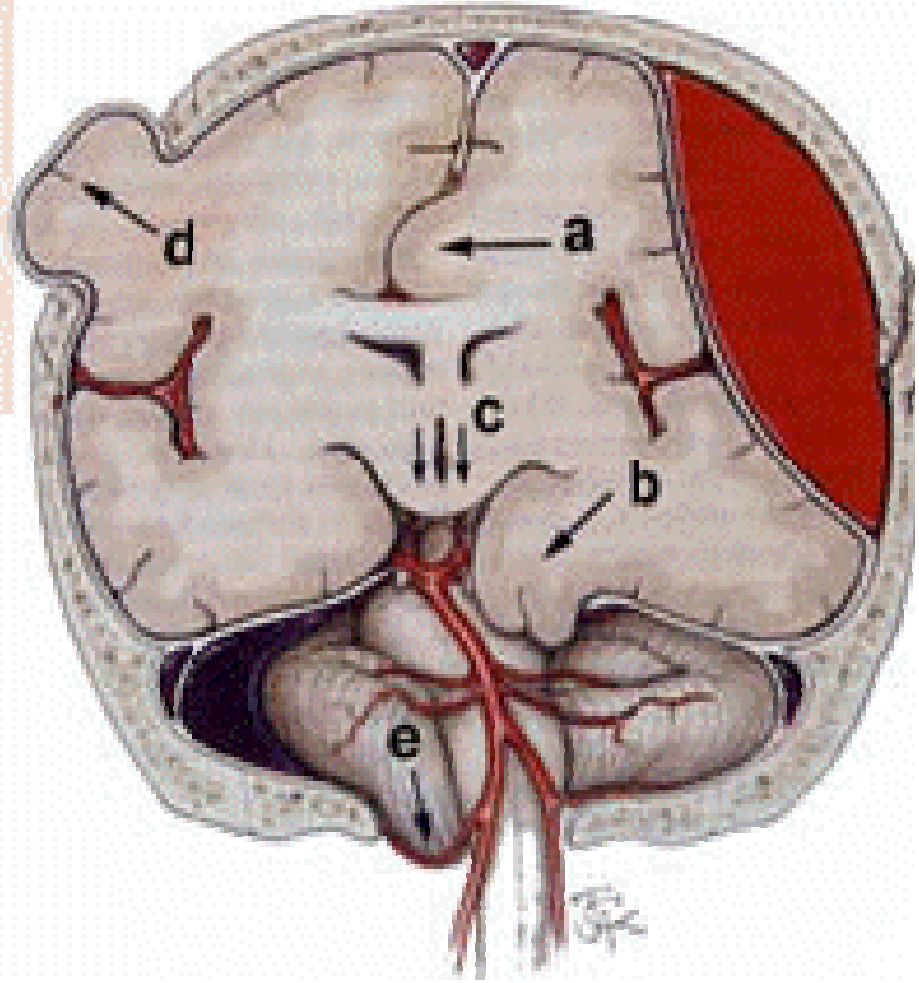
Brain Protective Therapies

↓

Brain Death

- **Recognition**
- **Diagnosis**

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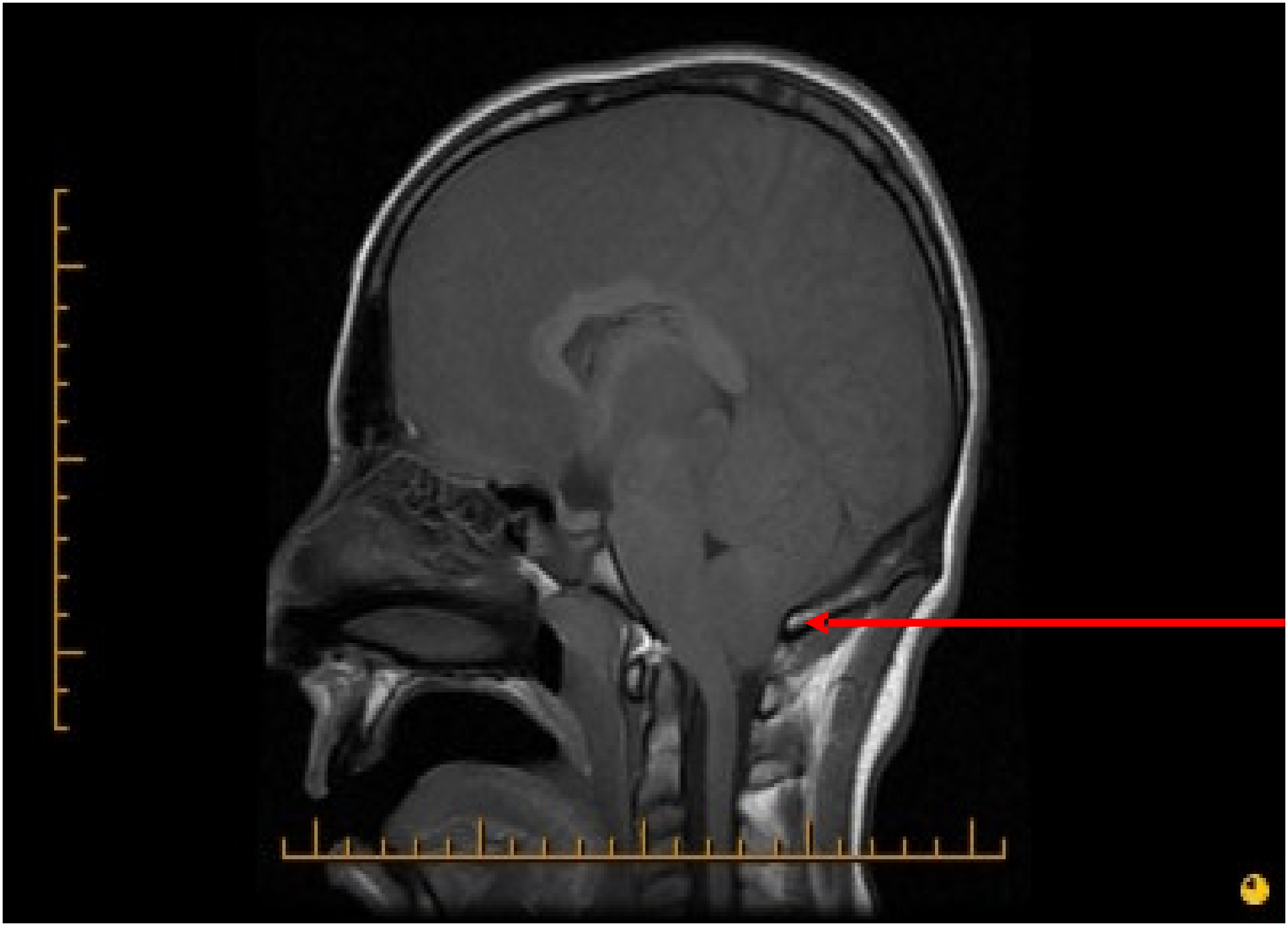
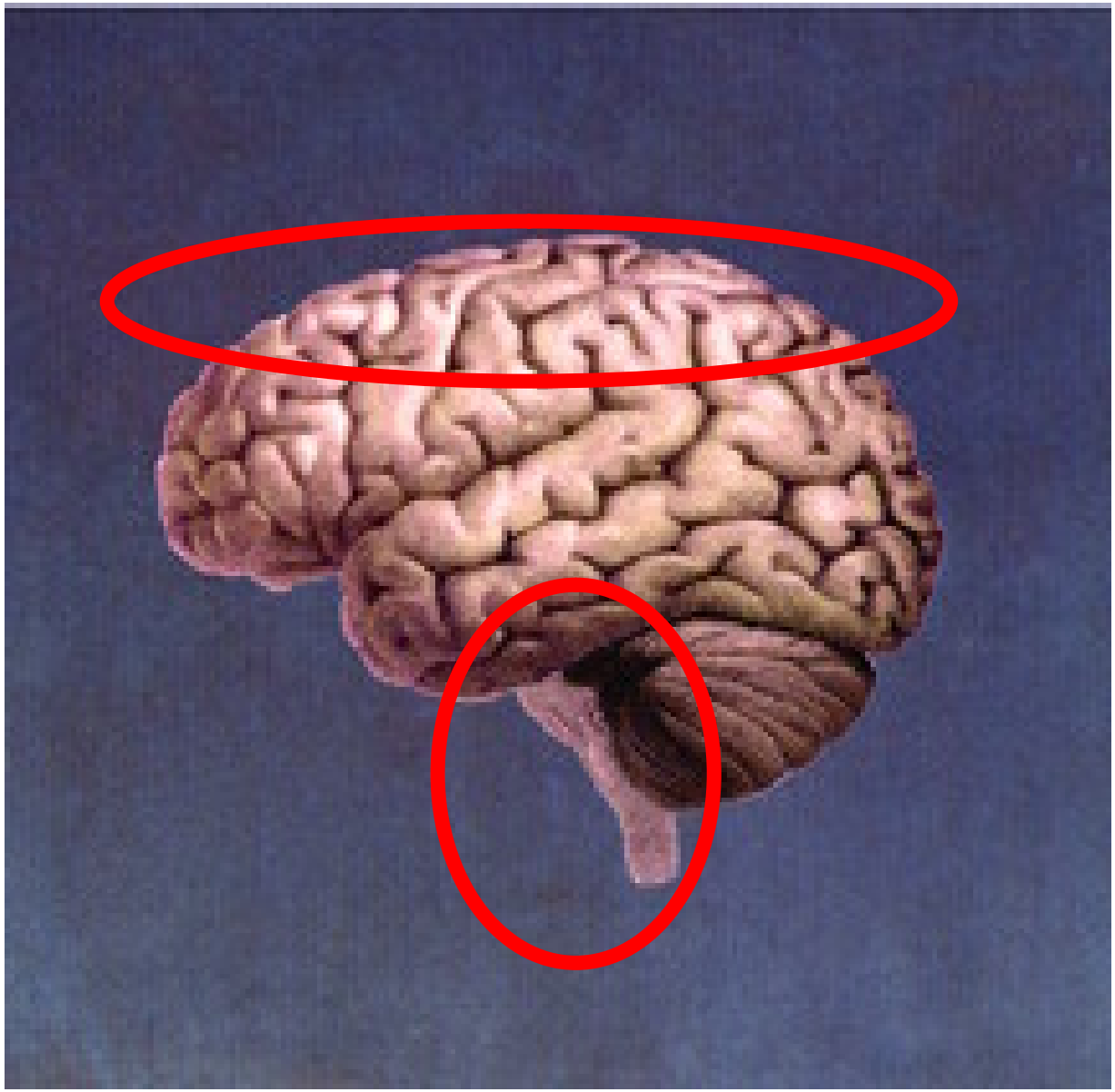
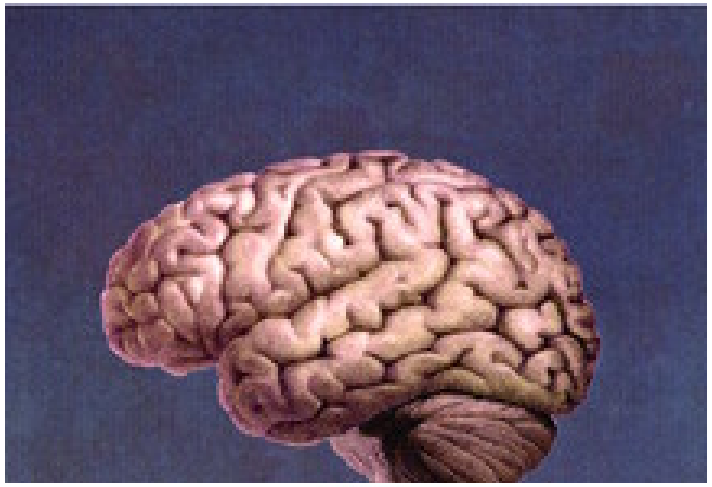
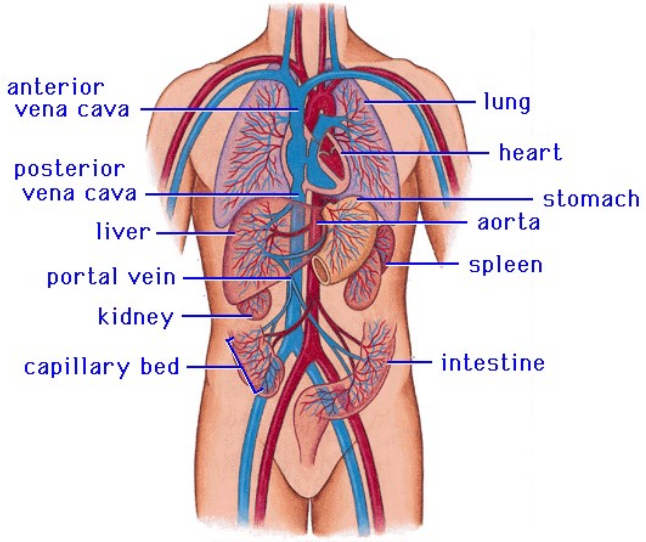




CORTEX
-EEG-

BRAINSTEM
-clinical criteria-





<u>Complete</u> and <u>irreversible</u> loss of <u>all clinical functions</u> of the brain.

= BRAIN ARREST

Is the loss of function based on clinical evaluation and/or functional assessment/imaging?

USA

= Whole Brain Death

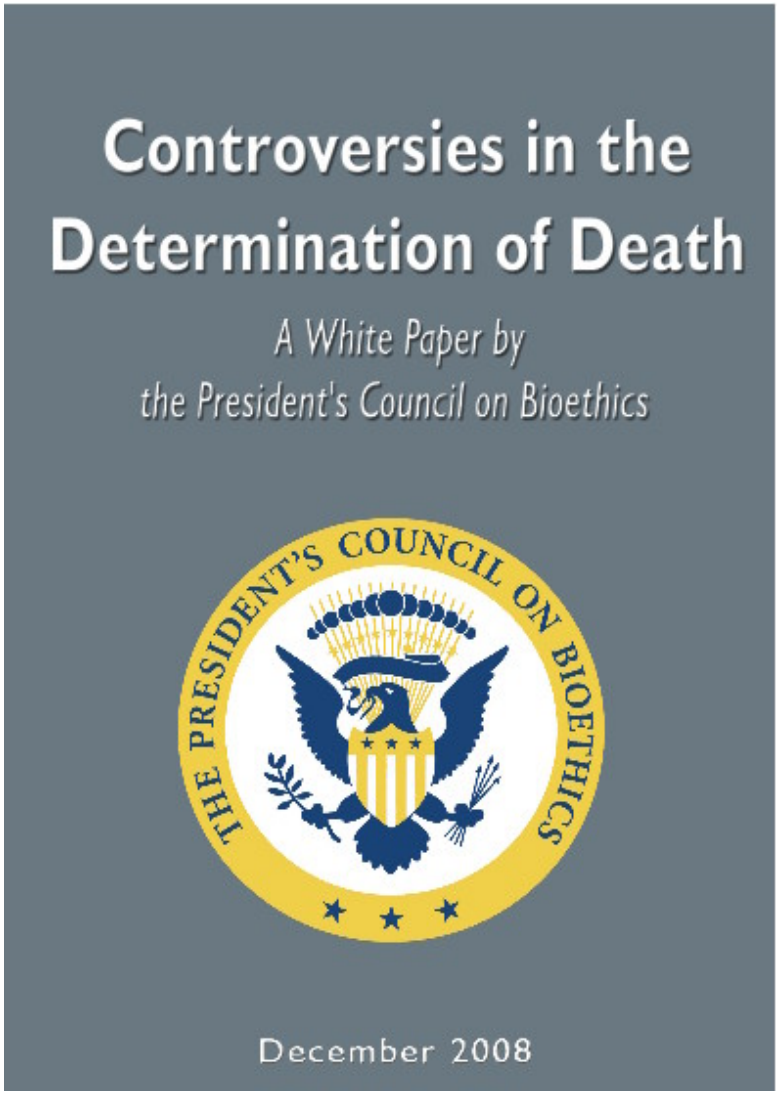
United Kingdom

= Brain Stem Death

Canada

= Both

There is no test that can evaluate & isolate brainstem integrity



The work of the organism,
is expressed in it's commerce with the surrounding world:

1. **Receptivity to stimuli & signals**
2. **Drive to act**
3. **Ability to act**

www.bioethics.gov

Death is a biological phenomenon:

Must distinguish:

The profound, religious, social & psychological customs around death,

From the biology of being dead or alive.

Brain Death is a social construct created for utilitarian purposes, primarily to permit organ transplantation.

Taylor, Semin Neurol, 1997

Brain Death is driven not by a clear understanding of death, but by a need for organs.

Alan Shewmon MD
Pediatric Neurologist UCLA
Maclean's Jan 28, 2002.

The Neurological Determination of Death: What Does it Really Mean?

Ari Robin Joffe, M.D., FRCP(C)*

Issues Law Med. 2007 Fall;23(2):119-40.

Scaring Us To Death?
Alarming Language & the
Need for Responsible Scholarship

Naffine et al, J Law Med, 2009

- **Fear of death**
- **Fear of mistaken diagnosis of death**
- **Fear of premature declaration of death**

Academia and Media

‘truly dead?”
“almost dead?”
“as good as dead?”
“nearly but not quite dead?”
“not completely dead but dead enough?”
“legal fiction”

Words Matter & Punctuation Saves Lives

Words Matter

1. ‘Complete’
2. ‘Irreversible’
3. ‘Permanent’
4. “Whole’
5. ‘Unity’ ‘Integration’
6. ‘Vital’ functions
7. ‘Clinical’ functions
8. Ancillary, confirmatory, supplemental
9. ‘Death’
    - Concept
    - Definition
    - Determination
    - Declaration
    - Criteria and tests

Evolving Brain Protective Therapies

Direct ventricular drainage

(Brain Trauma Foundation J Neurotrauma, 2000)

Hypothermia

Head Injury **(Hutchison et al)**

Cardiac Arrest **(Bernard et al NEJM, 2002)**

(HCASG et al NEJM, 2002)

Decompression Craniectomy

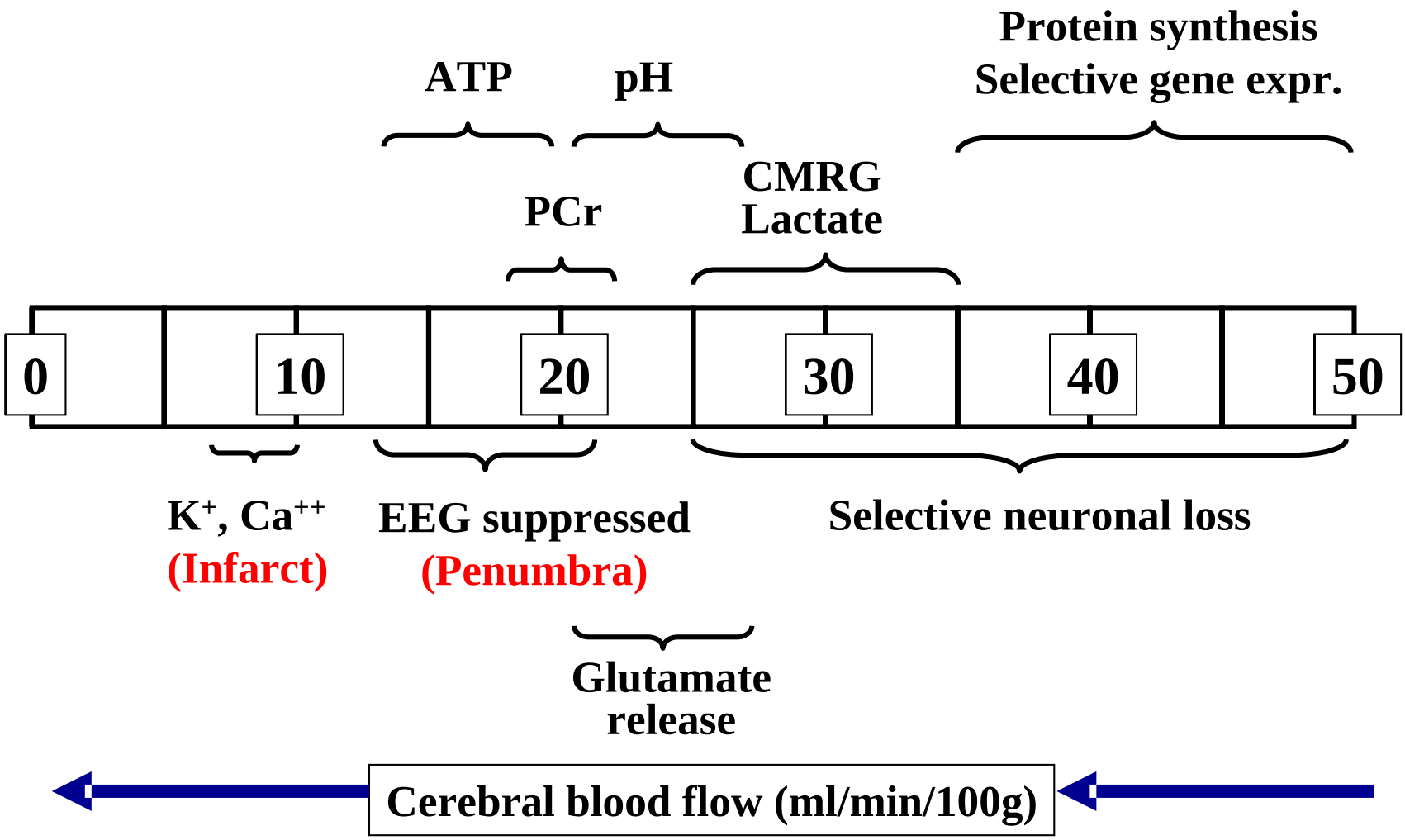
(Schneider et al Acta Neurochir Suppl 2002)

Decompressive Craniectomy

rescueICP.com

Effects of Cerebral Ischemia

Nominal Cerebral blood flow = 100 ml/min/100g



K-A Hossmann, Ann Neur 1994

Time from Circulatory Arrest to Isoelectric (Flat) EEG

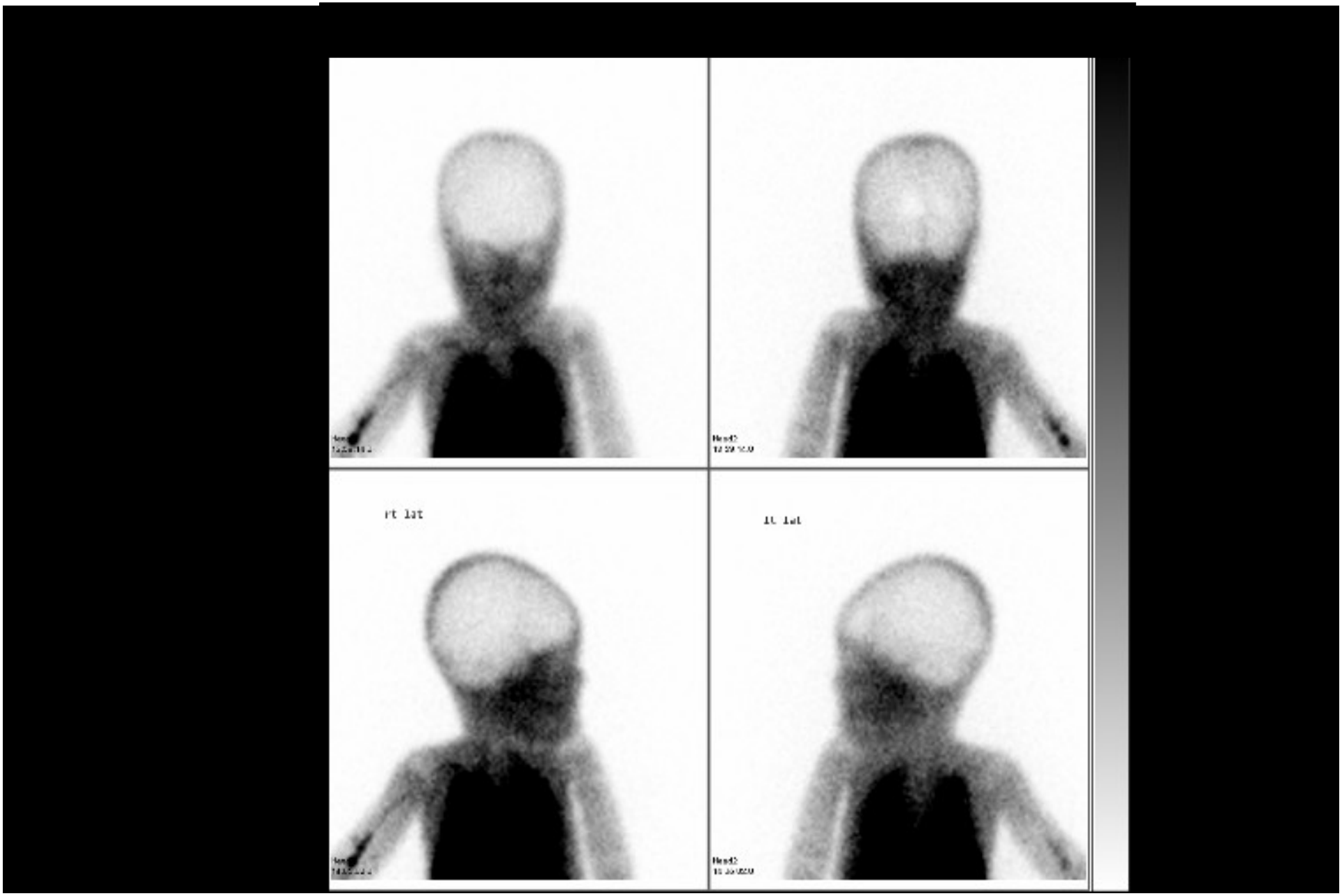
Less than 20 seconds

1. **Arrest of cerebral blood flow in mammals**
   = 10-15 seconds (Hossmann and Kleihues, Arch Neurol 1973)

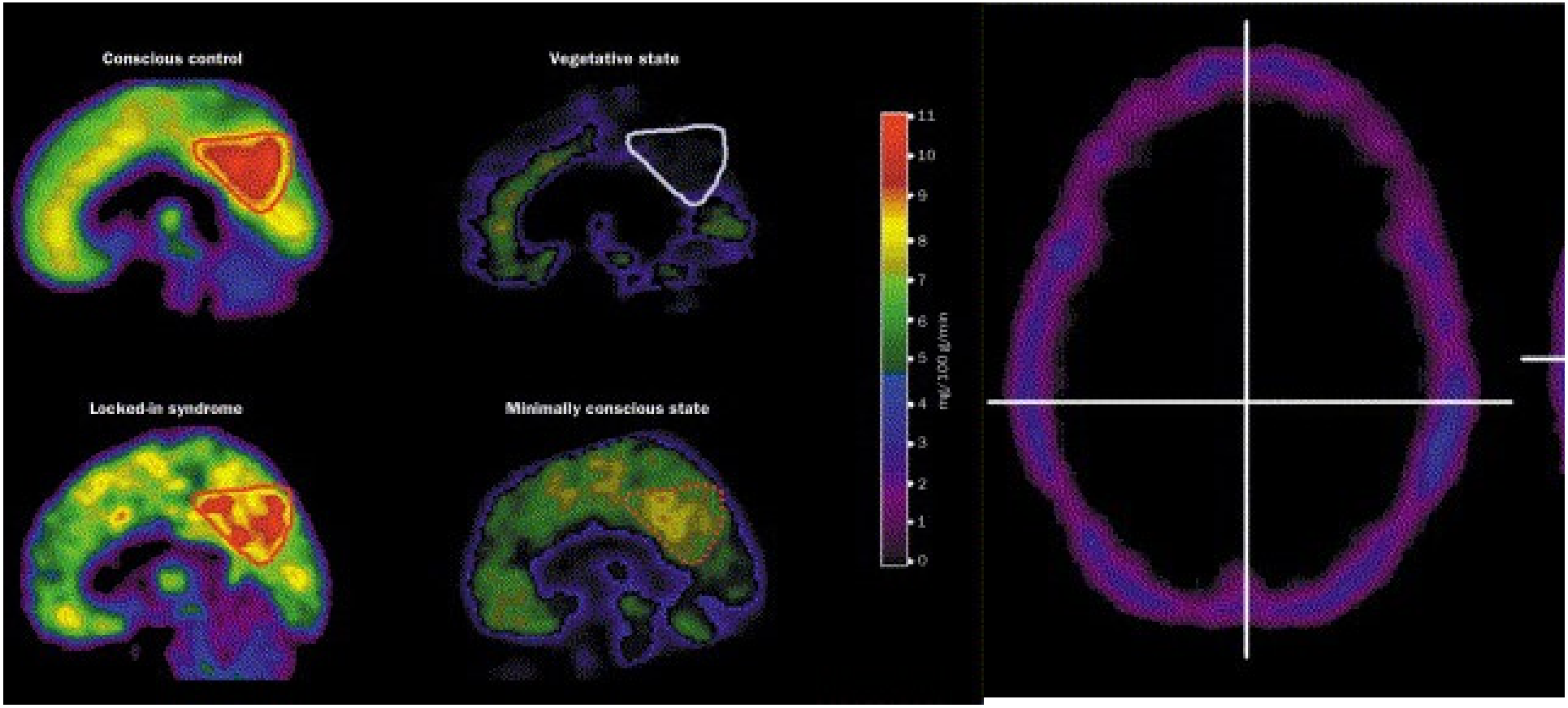
2. **Arrest of cerebral blood flow in primates**
   = 10-15 seconds (Steen et al, Anesthesiology, 1985)

3. **Brief cardiac arrest in humans**
   10 seconds (Clute and Levy, Anesthesiology, 1990)
   12 seconds (Lasasso et al, Anesth Analg 1992)
   12 seconds (Moss and Rockoff, JAMA 1980)

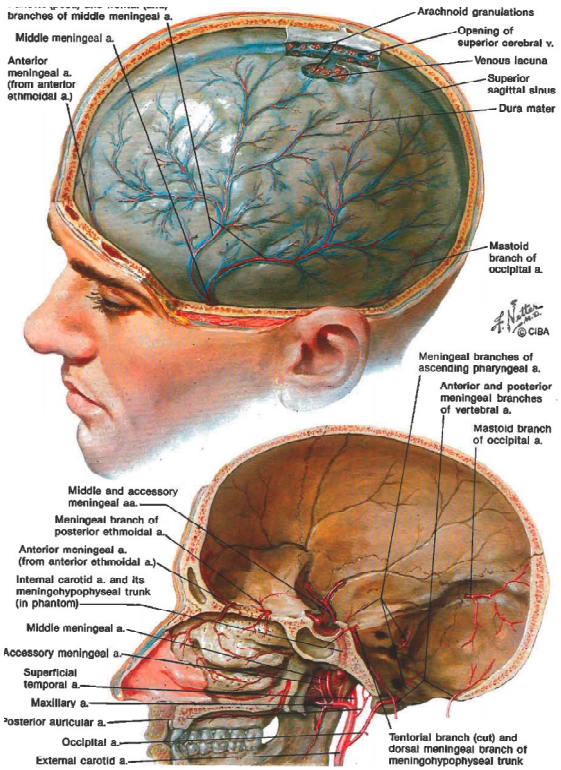
Brain Blood Flow as the Basis of Life?

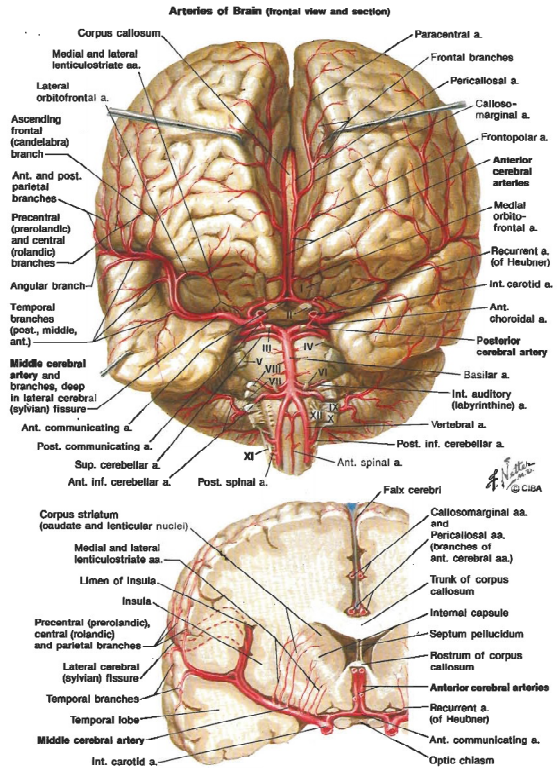


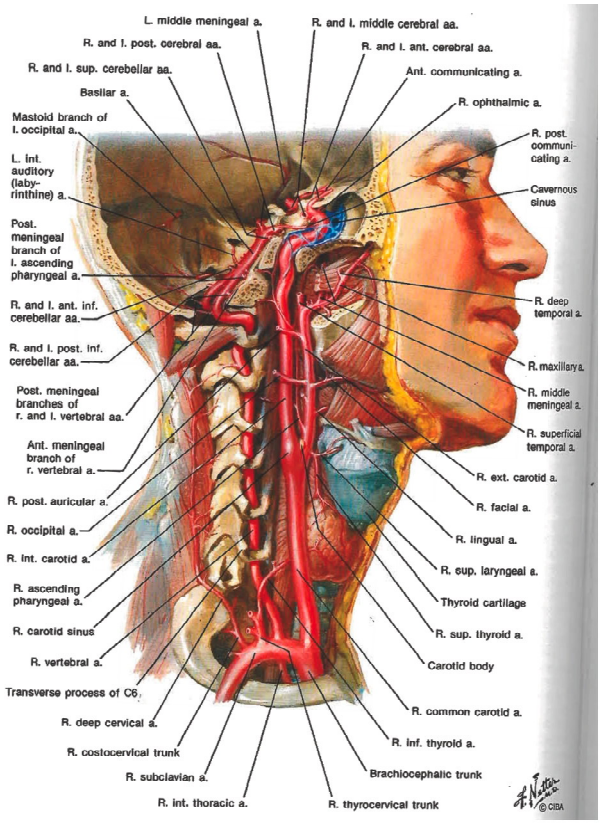
Cerebral Metabolism and States of Consciousness
Positron Emission Tomography (PET)

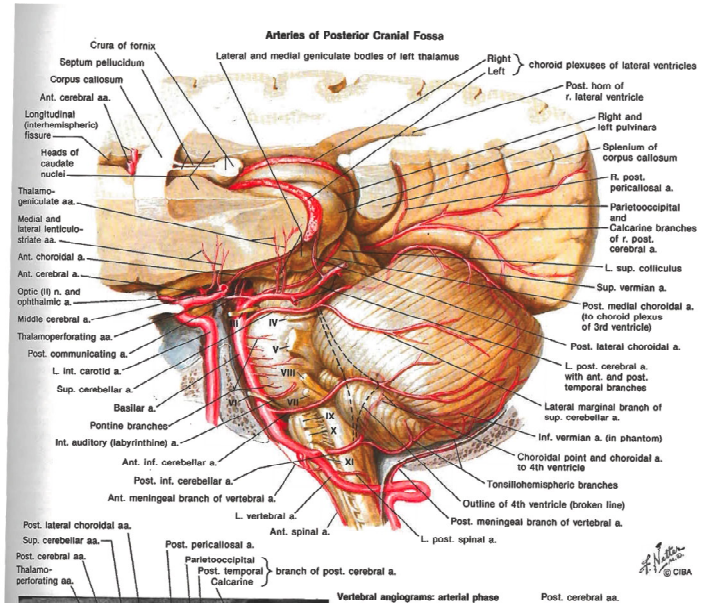


Laureys, Lancet Neurol, 2004









Vertebral angiograms: arterial phase

Post. cerebral aa.

Complete and Irreversible Brain Arrest

1. **Associated with absence of brain blood flow**

1. **Presence of some residual brain blood flow of unclear significance**

Absent Brain Blood Flow?

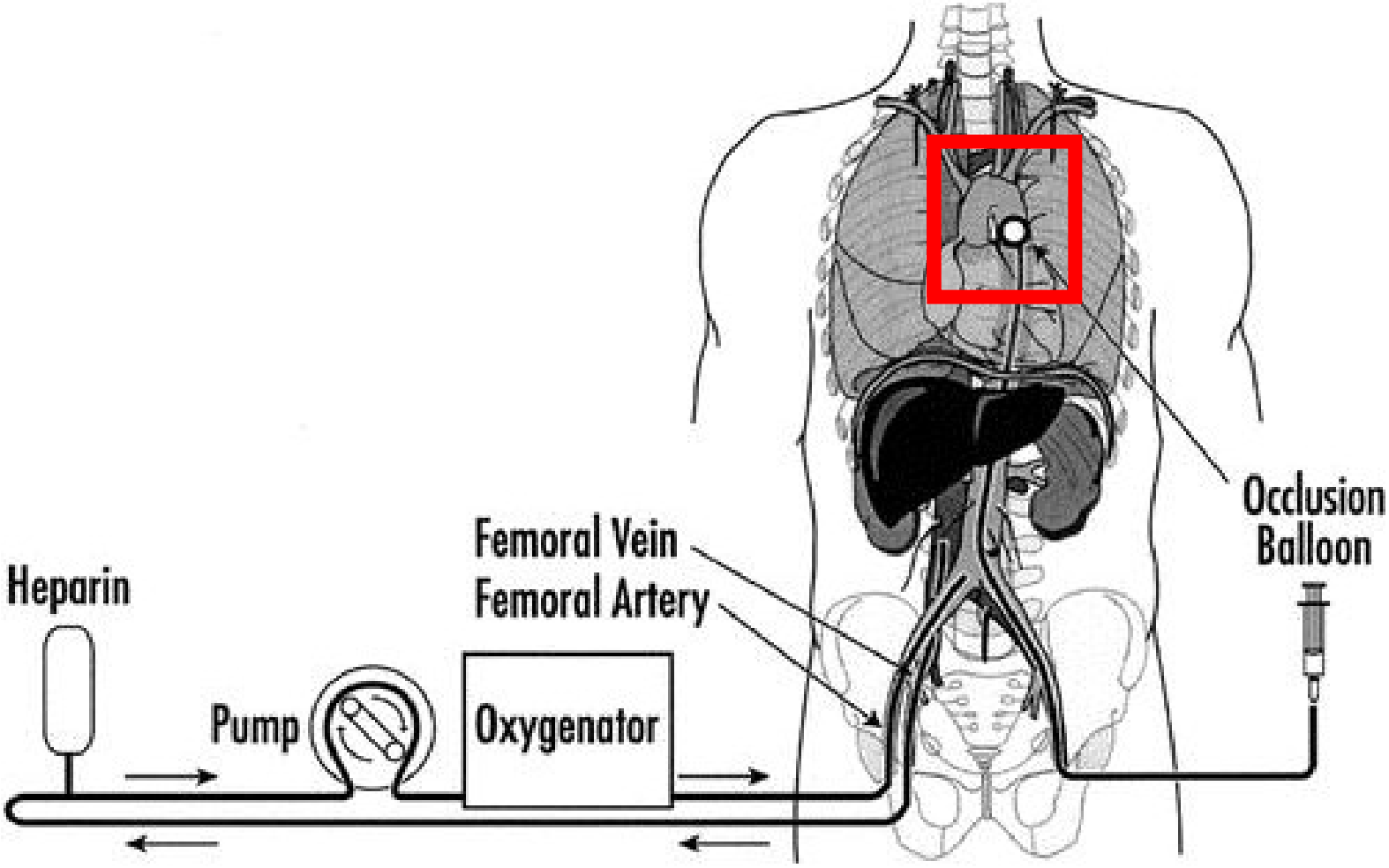
1. Radionuclide angiography
2. CT angiography
3. Traditional 4 vessel cerebral angiogram
4. MR angiography
5. Transcranial doppler
6. CT or MR perfusion

The most reliable confirmation of the absence of brain blood flow is a cardiocirculatory arrest

It no longer matters
whether the heart is beating
inside the body or outside the body.

It only matter if that beating heart generates
circulation to the brain.

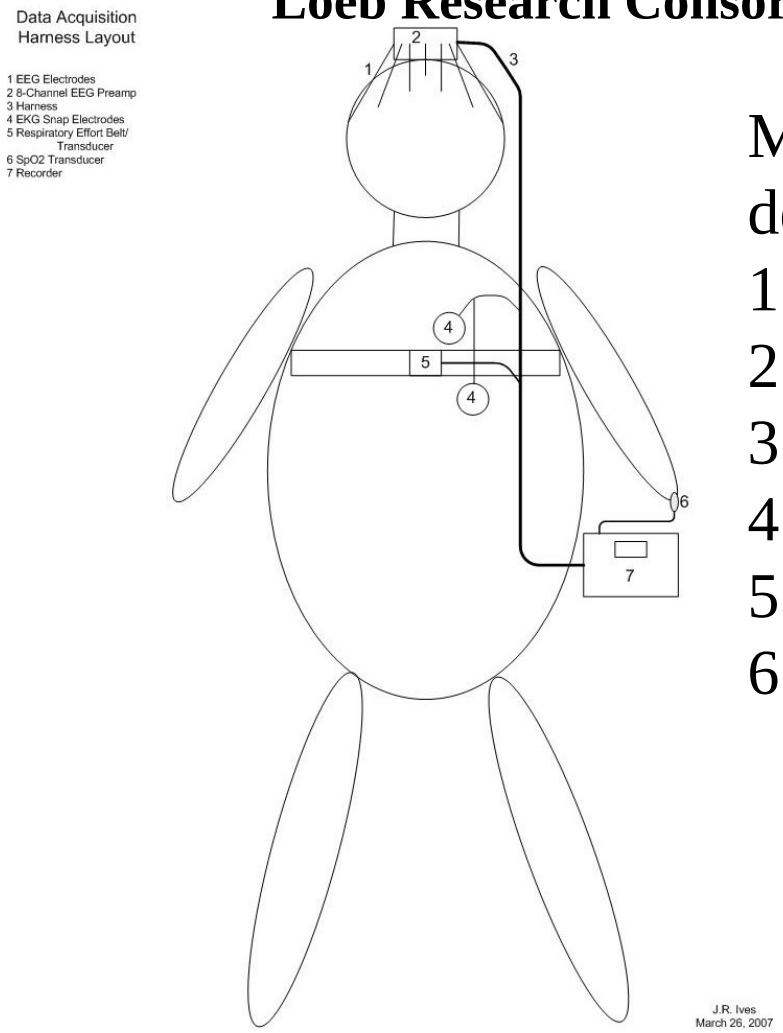
Extracorporeal Support for Organ Donation after Cardiac Death



Magliocca et al, J Trauma, 2005

DDePICt www.ddepict.com
Death Determination Practices in Intensive Care

Sonny Dhanani, Laura Hornby, Roxanne Ward, Sam Shemie
Loeb Research Consortium & Can Crit Care Trials Group



Monitoring cardiocirculatory & neuro determinants after cardiac arrest:

1. ECG
2. Arterial pressure
3. Cerebral oximetry
4. Respiratory effort
5. EEG
6. Evoked potentials

Funding PSI, CHEO, CIHR

Ongoing Concerns

- **Incidence of brain death is unknown**
- **Professional and public confusion/controversy**
- **Inconsistency of criteria/ancillary testing**
- **Effect of CNS depressing medications**
- **Impact of therapeutic hypothermia**
- **Pediatric and neonatal age adjustments**
- **Credibility**
  - **Sporadic case reports of ‘reversibility’**

Words do Matter
Dying, Death, Determination & Declaration

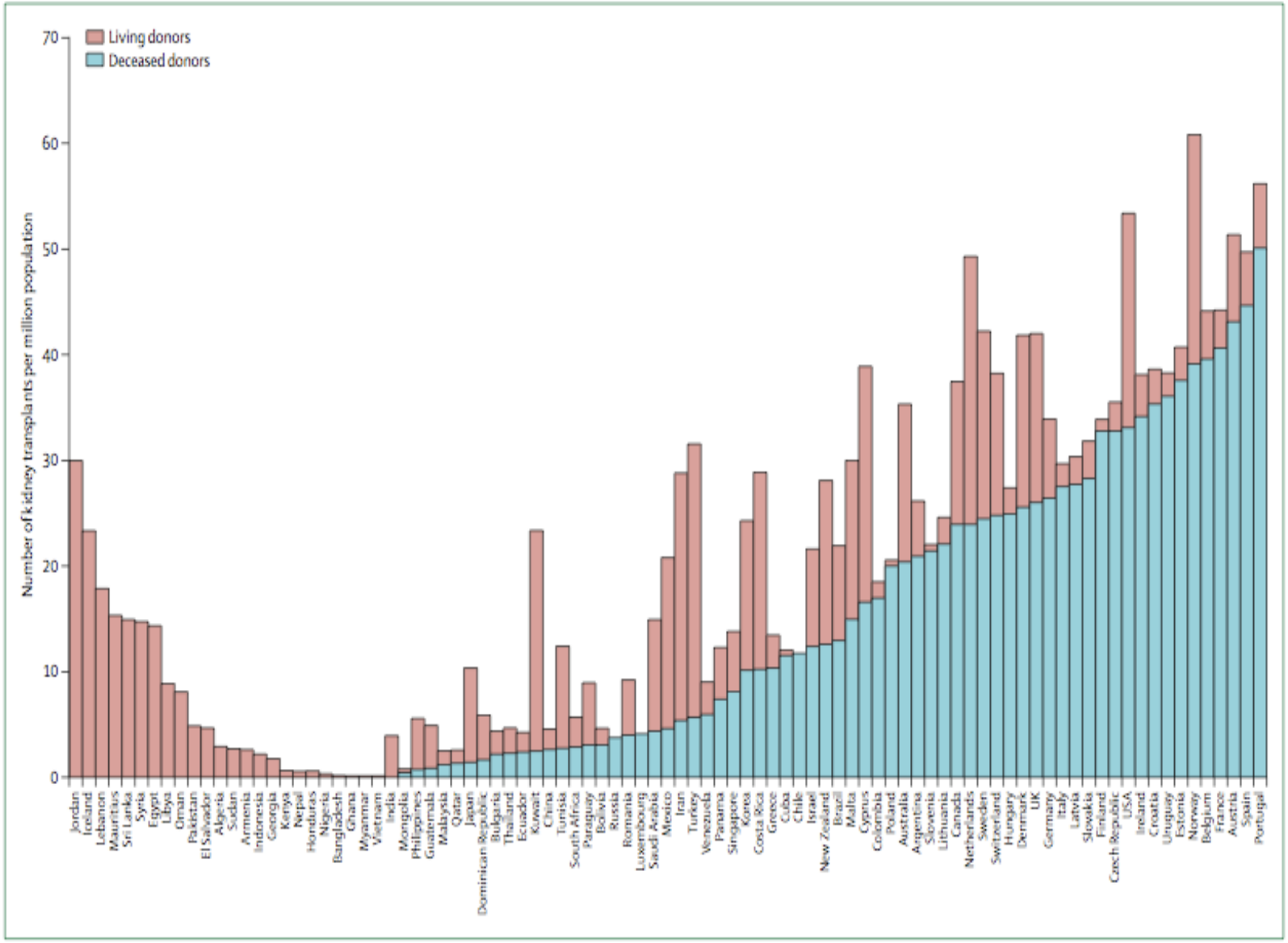
Death of the person versus death of the organism and its parts

- **Dying is a process**
- **Procedures to determine death are a process**
- **The *declaration* of death is a moment in time**

The Declaration of Death is the point in time after which:

1. No requirement to continue/provide resuscitation
2. Loss of personhood and most individual rights
3. Autopsy
4. Organ and/or tissue procurement for donation/transplantation
5. Burial/cremation proceedings
6. Execution of legal estate and life insurance
7. Loss of a loved one and family grieving

2009 Global Deceased & Living Donation Rates



Global Observatory on Donation and Transplantation, WHO, 2009

American Journal of Transplantation 2008; 8: 925–929
Blackwell Munksgaard

doi: 10.1111/j.1600-6143.2008.02200.x

Ethics Corner

Organ Trafficking and Transplant Tourism: A Commentary on the Global Realities

D. A. Budiani-Saberi [a,*] and F. L. Delmonico[b]

deterioration in the health condition of commercial living "donors"

long-term **financial disadvantage** following nephrectomy

(compromised ability to work)

social rejection and regret about donation

British Journal of Anaesthesia **108** (S1): i6–i9 (2012)
doi:10.1093/bja/aer355

EDITORIAL III

Brain death: time for an international consensus

M. Smith

Department of Neurocritical Care, The National Hospital for Neurology and Neurosurgery, University College London Hospitals, Queen Square, London WC1N 3BG, UK

E-mail: martin.smith@uclh.nhs.uk

Why Canada?
We are Peaceful, Cooperative and Collaborative

The Only Place We Conflict is Playing Hockey

Global Consensus on Death Determination
Canadian Blood Services in collaboration with WHO
Montreal May 2012

How to mitigate illegal organ trade and victimization of the poor?
Countries must become 'self sufficient'

= Improvements in deceased donation

Predicated on:
Understanding, acceptance and implementation of death determination practices

Canadian Blood Services
Société canadienne du sang

International Forum on Death Determination
Canadian Blood Services in collaboration with WHO
Montreal May 2012

Canadian Blood Services
Société canadienne du sang

Even a Bunch of Asses Can Work Together

Human Caterpillar

Summary

1. **Brain death was discovered, not invented**

2. **Globally, brain-based determinations of death are fundamentally similar and based on the absence of consciousness, motor responses, brainstem reflexes and capacity to breathe**

3. **With advances of technology, brain-based determinations of death have become more relevant**

4. **Death after cardiac arrest is a neurological determination based on the absence of brain blood flow.**

END