Is a Brain-Dead Body an Organism?

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Definition of Death

“The permanent cessation of functioning of the organism as a whole.”


Irreversible unconsciousness is not death.
### Categories of Integration

#### Levels of Integration

- **Structural-functional**
  - Organism
  - Organ, tissue
  - Cell

- **Ontological-hierarchical**
  - Intellectual-volitional
  - Sensorimotor
  - Vegetative

#### Types of Integration

- **Life-constituting**
  - makes the entity to be a living whole
  - “Bubble of anti-entropy”

- **Life-sustaining**
  - helps the entity to stay a living whole
    - Internally directed: **Health-maintaining**
    - Externally directed: **Survival-promoting**
Correlates of Types of Integration

**Life-Sustaining**

**Substitutability**
- Relative
- Examples
  - Thyroid function
  - Hearing

**Life- Constituting**

**Non-substitutability**
- Absolute
- Examples
  - Resistance to entropy
  - Consciousness
Defenders of BD maintain that:

- not only is brain-based integration *necessary* for an organism’s constitutive integration, but
- it *is* the constitutive integration;
- moreover, *any* residual brain function suffices for organism-level constitutive integration (an almost-but-not-quite BD person is *not* dead).
To the Contrary...

We shall see that:

- *All* brain-mediated *somatic* integration is either health-maintaining or survival-promoting.
- The body’s constitutive integration is *entirely* non-brain-mediated.
How Could Integration Take Place Throughout the Body Without Brain-Based Coordination or Brain-Regulated Endocrine Function?

- There is more to the nervous system than the brain.
- There is more to “the endocrine system” than the hypothalamic-pituitary axis.
- There is more to the circulatory system than a mere means by which endocrine information is transferred.
Non-Brain-Based Neural Integration

- Spinal cord
- Cardiac nervous system
- Enteric nervous system
Brain-Mediated Somatic Integration Is Non-Constitutive

“It is primarily the brain that is responsible for the functioning of the organism as a whole: the integration of organ and tissue subsystems by neural and neuroendocrine control of temperature, fluids and electrolytes, nutrition, breathing, circulation, appropriate responses to danger, among others.”


Health-maintaining
Survival-promoting
Brain-Mediated Somatic Integration Is Non-Constuitive

- Bulk of brain = cerebral hemispheres → survival-promoting integration

- Brain functions tested in clinical BD determinations are health-maintaining or survival-promoting
  - Coma
  - Brainstem reflexes
  - Apnea

- Brain-body disconnection: body remains a living whole
  - Severe Guillain-Barré
  - High spinal cord transection
The Requirement of Irreversibility – Trojan Horse for BD Theory

- General anesthetic suppressing all brain function
- Not clinically BD, because of reversible “confounder”
- But the body is nevertheless receiving no brain-based integration

Dilemma for BD defenders: 3 possible analyses
- Body must be dis-integrating
- Latency between loss of brain function and beginning of somatic dis-integration
- Concede that somatic integrative unity is not lost upon cessation of all brain functions

That reversible, loss of all brain function is recognized by all as not death implies that brain-based somatic integration is entirely of the non-constitutive type.
Acute Instabilities and Early Asystole in BD

- Spinal shock
- Direct multisystem damage from whatever caused the brain injury
- Multisystem hypoxic damage from apnea
- Multisystem damage due to process of brain herniation prior to BD
- Generalized inflammatory response

These dysfunctions:
- either result in early asystole or resolve
- are due to causes other than mere absence of brain-control
Brain-Based Somatic Integration in Clinical BD is Substitutable

“The main objectives [in the medical support of BD organ donors] remain the maintenance of oxygenation and circulation, control of polyuria, and control of hyperglycemia... The overriding principle is maintenance of normal or near-normal physiology. Therefore, several acute processes... can and should be reversed.”

The Endocrine System(s)
Brain-Regulated = Hypothalamic-Pituitary Axis

- Pituitary functions variably preserved in BD
- Posterior pituitary function present in ~1/3 of BD cases
- Only three pituitary hormones necessary for survival (i.e., target-organ function necessary for survival)
  - TSH
  - ACTH
  - ADH
- All are substitutable, health-maintaining
The Endocrine System(s) 
Non-Brain-Regulated

- **Digestion, metabolism**
  - insulin, somatostatin, secretin, cholecystokinin, insulin-like growth factor, glucagon, pancreatic polypeptide, ghrelin, vasoactive intestinal peptide ("neuroimmune axis"), leptin, adiponectin, resistin
  - gastrointestinal system, adipose tissue

- **Blood pressure, volume**
  - renin-angiotensin-aldosterone axis; atrial natriuretic peptide
  - kidneys, liver, lungs, adrenals, heart

- **Stress hormones**
  - epinephrine, norepinephrine
  - adrenal medulla

- **Blood cell formation**
  - thrombopoietin, erythropoietin
  - liver, kidneys, marrow

- **Calcium homeostasis**
  - parathyroid hormone, calcitonin, cholecalciferol
  - parathyroids, thyroid, skin, bone, liver, kidneys
The Circulatory System

- Reaches all parts of body (nervous system doesn’t)
- Means of intercellular biochemical communication
  - Homeostasis
  - Anti-entropy
- Circulation is not the integration; the homeostatic, anti-entropic mutual interactions among all parts of the body are the integration.
  - Life-constituting integration
  - Non-substitutable
Level of Integration in BD

“The cardiac arrest patient with whole brain destruction is simply a preparation of unintegrated individual subsystems, since the organism as a whole has ceased functioning.”


A BD body is nothing more than:

- “a ventilator [keeping] a heart beating in a corpse.”
  

- “a magnificent cell culture.”
  
Level of Integration in BD

- Continuum of degrees of integration
- Discontinuity of level at “whole” vs. “collection”
- No operational definition or method of measurement of degree or level of integration
- Need indirect criteria for which side of dividing line X lies
Criterion 1

Integrative unity is possessed by a putative organism if it possesses \textit{at least one emergent, holistic-level property}.

- \textbf{Emergent:} The property derives from the mutual interaction of the parts.
- \textbf{Holistic:} The property is not predicable of any part or subset of parts, but only of the entire composite.
Criterion 1
Holistic Properties in Chronic BD

- physiological and chemical homeostasis
- maintenance of fluid and electrolyte balance with min. adjustment of volume & composition
- assimilation of nutrients
- elimination, detoxification, recycling of cellular wastes
- energy balance
- maintenance of temperature
Criterion 1
Holistic Properties in Chronic BD (cont.)

- teleological wound healing
- fighting of infections and foreign bodies
- cardiovascular and hormonal stress responses
- proportional growth of BD children
- sexual maturation of BD children
- successful gestation of a fetus in BD women
Criterion 1
Holistic Properties in Chronic BD (cont.)

- resuscitatability & stabilizability after cardiac arrest
- ability to recover from hypotension, aspiration, etc.
- spontaneous improvement in general health
- overall ability to survive with little medical intervention, in a nursing facility or even at home
Criterion 1
Holistic Properties in Chronic BD (cont.)

“If being alive as a biological organism requires being a whole that is more than the mere sum of its parts, then it would be difficult to deny that the body of a patient with total brain failure can still be alive, at least in some cases.”

Criterion 2

Any body requiring less technological assistance to maintain its vital functions than some other similar body that is nevertheless a living whole must possess at least as much integration and hence also be a living whole.

<table>
<thead>
<tr>
<th>A  &gt; B</th>
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<tbody>
<tr>
<td>ALIVE</td>
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<tr>
<td>healthy organism</td>
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If A has more integration than reference entity B, and B is on the “whole” side of the dividing line, then A is necessarily also on the “whole” side of the dividing line.
**Criterion 2**

**A – Chronic BD**
- at home
- stable
- no pressors
- viscera functioning normally
- enteral tube feedings
- few medications
- simple management

**B – end-stage cancer, septic shock, comatose on ventilator but not BD**
- in ICU
- unstable, deteriorating
- pressor-dependent
- kidney & liver failure, DIC
- ileus, intravenous fluids
- multiple medications
- complex management

A > A' > B

**ALIVE**
- healthy organism
- integrated organism as a whole

**DEAD**
- dis-integrated collection of organs
- decomposing corpse
Conclusions

- The brain is not the body’s thermodynamically “critical” organ; the body has no such “critical” organ.

- All brain-based somatic integration is either of the health-maintaining or survival-promoting type.

- The body’s *life-constituting* integration is the anti-entropic mutual interactions among all its parts, mediated by circulation.

- BD patients are severely disabled, totally dependent, tenuously alive *organisms as a whole.*