**The Human Burst Suppression Electroencephalogram of Deep Hypothermia**

1,2M. Brandon Westover, MD, PhD\*; 3Shinung Ching, PhD\*; 1Vishakhadatta M. Kumaraswamy, MD; 4Seun Oluwaseun Akeju, MD, MMSc; 4,5Eric Pierce, MD, PhD, 1,2Sydney S. Cash, MD, 6Ronan Kilbride, MD, PhD, 4,5,7Emery N. Brown, MD, PhD, 4,5,7Patrick L. Purdon, PhD

1Department of Neurology, Massachusetts General Hospital, Boston, MA

2Department of Neurology, Harvard Medical School, Boston, MA

3Electrical and Systems Engineering, Washington University in St. Louis, St. Louis MO 63130

4Department of Anesthesia, Critical Care and Pain Medicine, Massachusetts General Hospital, Boston, MA

5Department of Anesthesiology, Harvard Medical School, Boston, MA

6Department of Neurology, Beaumont Hospital, Dublin, Ireland.

7Department of Brain and Cognitive Science, Massachusetts Institute of Technology, Cambridge, MA

**\*** Equal contribution.

**Corresponding Authors:**

M. Brandon Westover

MGH Department of Neurology

55 Fruit Street, WACC 735

Boston, MA 02113, USA

Phone: 617-726-3311

E-mail: mwestover@mgh.harvard.edu

Patrick L. Purdon

MGH Department of Anesthesia, Critical Care and Pain Medicine

149 13th Street, Room 4005

Charlestown, MA 02129

Phone: 617-726-5864

E-mail: patrickp@nmr.mgh.harvard.edu

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**Summary Statement:** We analyzed the effects of decreasing the temperature of the brain on the human scalp EEG in patients undergoing deep hypothermia during cardiac surgery.

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### ABSTRACT

**Objective:** Deep hypothermia induces ‘burst suppression’ (BS), an electroencephalogram pattern with low-voltage ‘suppressions’ alternating with high-voltage ‘bursts’. Current understanding of BS comes mainly from anesthesia studies, while hypothermia-induced BS has received little study. We set out to investigate the electroencephalogram changes induced by cooling the human brain through increasing depths of BS through isoelectricity.

**Methods:** We recorded scalp electroencephalograms from eleven patients undergoing deep hypothermia during cardiac surgery with complete circulatory arrest, and analyzed these using methods of spectral analysis.

**Results:** Within patients, the depth of BS systematically depends on the depth of hypothermia, though responses vary between patients except at temperature extremes. With decreasing temperature, burst lengths increase, and burst amplitudes and lengths decrease, while the spectral content of bursts remains constant.

**Conclusions:** These findings support an existing theoretical model in which the common mechanism of burst suppression across diverse etiologies is the cyclical diffuse depletion of metabolic resources, and suggest the new hypothesis of local micro-network dropout to explain decreasing burst amplitudes at lower temperatures.

**Significance:** These results pave the way for accurate noninvasive tracking of brain metabolic state during surgical procedures under deep hypothermia, and suggest new testable predictions about the network mechanisms underlying burst suppression.