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Abstracts

Results: The activity in the model is characterized by a decreasing frequency spectrum in the LFP, with peaks at the primary network oscillation frequency and harmonics. Varying the global spatial extent of connections by all cell classes quickly alters the dynamics of the model. The LFP derived strictly from synaptic currents or subsets of synaptic currents continue to demonstrate the higher frequency components in the time-frequency spectrum indicating their likely importance in microelectrode recording efforts. Spatially evolving spiral wave dynamics are readily and spontaneously produced by the model.
Conclusions: This multicompartment simulation of neocortex demonstrating epileptiform behavior has been created in the freeware parallel Genesis (pGenesis) environment and currently runs on 16 computational nodes. It allows the user to selectively record LFPs from various synaptic current sources, or LFPs from arrays of superficially simulated microelectrodes. The time-frequency behavior of the modeled seizures is presented, and demonstrations of spiral wave activity similar to experimental preparations are shown.
References: 1. Traub RD, et al. J Neurophys 2005;93:2194-2232. 2. Anderson WS, et al. Biol Cybern 2007;97:173-194. 3. Bower JM, Beeman D. The Book of GENESIS. Springer, NY, 1997. Support: Charles H. Hood Foundation (WSA), NIH-NINDS K08 (1K08NS066099-01A1) (WSA)

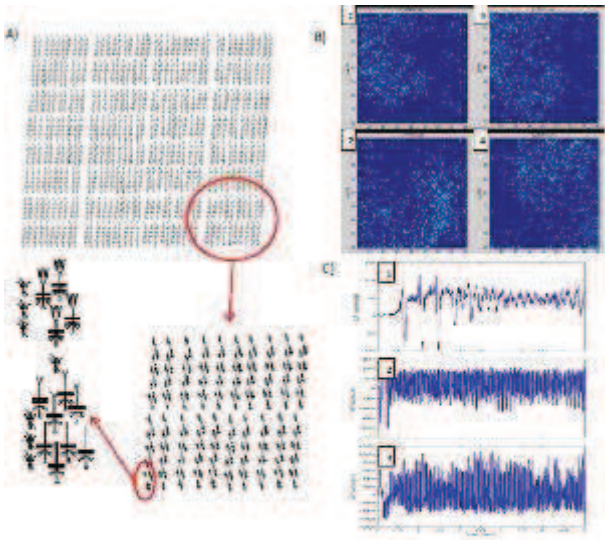

Figure 1. A) Schematic of the multicompartment neocortical model organized around a minicolumnar and laminar structure. Demonstrating the Layer II/III, Layer V, and Layer VI pyramidal cells, the obligate cell component, along with basket, non-basket, and low threshold spiking inhibitory cells. B) 3D movie time locked action potentials in the Layer II/III pyramidal cell component projected into 2-D. Spiral wave progression shown from panels 1-4. C) 1. LFP recordings from a simulated microwire positioned over 1 computational node (only sampling from 2,100 cells); 2. LFP recorded from superficial center of all 16 nodes. 3. 2Hz high pass filter of LFP derived solely from synaptic currents in the model.

2.042
A PERSONALIZED STEREOTACTIC FIXTURE FOR IMPLANTATION OF DEPTH ELECTRODES IN STEREOENCEPHALOGRAPHY (SEEG)
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Rationale: The SEEG implantation procedures still represent a challenge due to the intrinsic complexity of the method and the number of the depth electrodes required.
Methods: We have designed a custom stereotactic fixture based on the STarFix technology (FHC Inc, ME) that allows implantation of depth electrodes used in presurgical evaluation of patients with focal pharmacoresistant epilepsy. We used the traditional orthogonal approach, but oblique trajectories are supported as well.
The fixture is built using 3D laser sintering technology based on a computer-generated model to fit each patient's anatomy. Fiducial markers that also serve as anchors for the fixture are implanted into patient's skull prior to the surgery. The 3D fixture model is designed to align with the patient's anatomy (AC-PC and mid-plane points), such that the frame coordinates are identical to the anatomical coordinates, making targeting of individual structures more intuitive and consistent across patients. A rectangular grid of guides orthogonal to the sagittal plane and centered on the mid-commissural point (MCP) can be accommodated in the platform design, allowing an arbitrary selection of orthogonal trajectories.
The frame has no adjustable parts, reducing the risk of inaccurate coordinate settings. Due to this feature, the procedure time is significantly reduced.
Results: We have used the fixture for the implantation of depth electrodes for presurgical evaluation of a patient with temporal lobe epilepsy, with an overall two-fold reduction of the time required for planning and implantation.
Conclusions: The custom stereotactic fixture design greatly simplifies the planning procedure, significantly reduces the OR time while maintaining a high accuracy.

2.043
BURSTS OF HIGH FREQUENCY REPETITIVE TRANSCRANIAL MAGNETIC STIMULATION SUPPRESS SEIZURES IN A RAT KAINATE STATUS EPILEPTICUS MODEL
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Rationale: Status epilepticus (SE) is characterized by frequent or prolong seizures, and pharmacologic treatment is not always effective. SE does not always respond to first or second line of anticonvulsants, and may require sedating anticonvulsants and need for intubation and intensive care support. Thus there is still a need for novel approaches to terminate the prolonged seizures of SE. Repetitive transcranial magnetic stimulation (rTMS) is a method for focal brain stimulation where small intracranial electrical currents are induced by a powerful fluctuating extracranial magnetic field. rTMS, especially when applied at low frequencies to reduce cortical excitability, is emerging as a therapeutic option in epilepsy. Yet the rTMS capacity to terminate ongoing seizures of SE, particularly with bursts of high frequency stimulation which may interrupt sustained cortical activity, has not been tested.
Methods: Nonconvulsive seizures were triggered by kainic acid (KA; 15 mg/kg ip) injection in adult Sprague Dawley rats previously anesthetized with urethane (1.2 mg/kg ip). The urethane anesthesia enabled continuous EEG seizure monitoring and rTMS in immobilized subjects. Rats were divided into three groups to receive (1) KA and verum rTMS (ten 3-sec 20 Hz trains, 30 sec intertrain interval, 80% machine output intensity; n=7 rats), (2) KA and sham rTMS (8% machine output intensity and otherwise identical to the verum rTMS group; n=7 rats), or (3) no KA and sham rTMS identical to group 2 (n=6 rats).
Results: Nonconvulsive seizures were reliably triggered in all KA injected rats. In the verum rTMS group spike frequency was significantly reduced during (46% sham; p=0.037) and after (68% sham; p=0.045) treatment in comparison to sham rTMS, while rats receiving no KA and sham rTMS had no EEG spikes at any stage. In addition, Fast Fourier Transformation analysis of EEG, revealed a significant reduction in the 1.6 to 3.2 Hz activity band in the verum rTMS group after treatment (p=0.048).
Conclusions: Our data suggest that high-frequency burst rTMS, a protocol which may be applied more rapidly, particularly in the