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**EEG Artifact Unique to the NeuroPace® RNS® System**

Epilepsy Treatment: from blunt instrument to eloquent device

Mallory Schmidt R. EEG T.,BS  
Kaleigh Deglopper

August 2018



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## #NDTGoals

Become experts in our field

How do we accomplish this?

With curiosity and a desire for continuing education

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### Goals for today

- Evolution of Epilepsy Treatment
- NeuroPace® RNS® System 101
- RNS VNS DBS
- EEG Appearance
- Case studies

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### Blunt Treatment - Trepanation



1. <https://doi.org/10.1371/journal.pone.0105138.g004> 2014 Aug 12;12(2):526-32. doi: 10.1371/journal.pone.0105138. Epub 2014 May 23. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4078970/> Images from a search using results tagged with [Creative Commons License](https://creativecommons.org/licenses/by/4.0/)




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### Modern Day Devices

Implantable devices can be applied for:

- Pain
- Movement disorders (Parkinson's Disease, Essential Tremors)
- Spasticity
- Mood disorder
- Epilepsy

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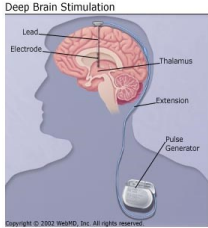
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### Deep brain stimulation (DBS)



Closed loop  
Constant Impulse

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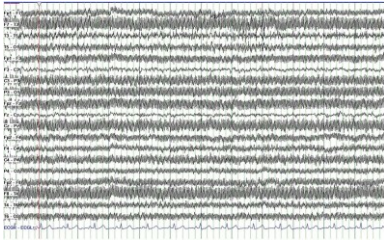
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7 **SPECTRUM HEALTH**

### DBS




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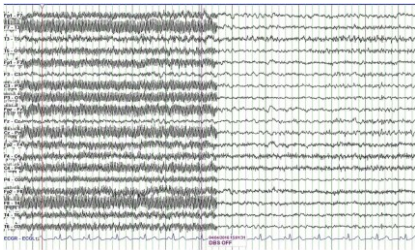
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8 **SPECTRUM HEALTH**

### DBS




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9 **SPECTRUM HEALTH**

### DBS



10 **SPECTRUM HEALTH**

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### Vagal Nerve Stimulator



- Multiple devices by multiple manufacturers
- Open loop/Closed loop
- No EEG Artifact

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11 **SPECTRUM HEALTH**

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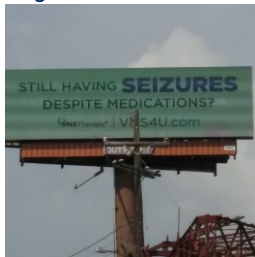
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### Vagal Nerve Stimulator



12 **SPECTRUM HEALTH**

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### Eloquent Treatment - **NeuroPace® RNS®** System



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**SPECTRUM HEALTH**

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### Eloquent Treatment - **NeuroPace® RNS®** System

- Up to four electrodes may be implanted (Cortical/Subdural)
- 2 leads may be accessed at a time for a total of 8 contact points
- Closed loop responsive neurostimulation system
- Device is always sensing/detecting abnormal activity and may deliver stimulation

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**SPECTRUM HEALTH**

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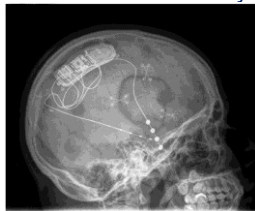
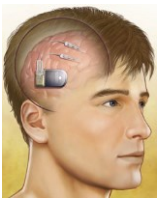
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### Eloquent Treatment - **NeuroPace® RNS®** System



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**SPECTRUM HEALTH**

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### Eloquent Treatment - **NeuroPace® RNS®** System

Detection vs. Prediction

Customizable Detection tools

- Line Length detector
- Bandpass detector
- Area detector

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### Eloquent Treatment - **NeuroPace® RNS®** System



Images from a presentation created based on [Medtronic Company Images](#)




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### Eloquent Treatment - **NeuroPace® RNS®** System

Device accessible by patient and doctor  
-Magnet activations

Stores 1.0MB (12min of ECOG)

Battery Life

Data rich device

RNS stores each time events occur  
-detections of parameters (ECOG)  
-administration of therapies  
-activations of magnets



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### Eloquent Treatment - **NeuroPace® RNS®** System

Stimulation can deliver 5 different programmed therapies

Therapy may be delivered in stepwise fashion or burst

Biphasic, rectangular pulses

Frequency: 1-333Hz  
Burst duration: 10msec – 5 sec  
Max current: 9.6 mA



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### Case Studies

38 year old female

Epilepsy diagnosed later adolescence

Seizures not well controlled

VNS

Disabled due to epilepsy

Ictal & interictal spect  
-broad, bihemispheric epileptogenic network

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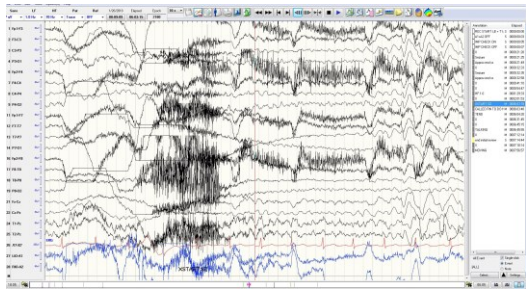
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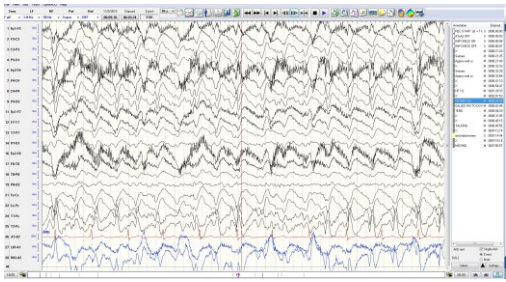
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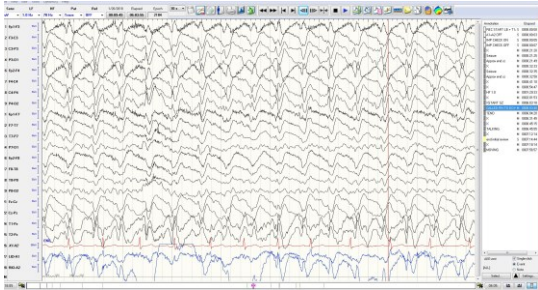
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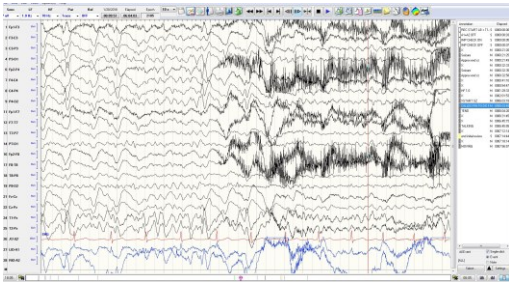
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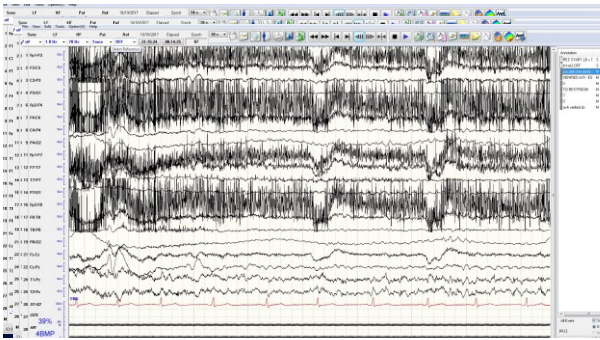
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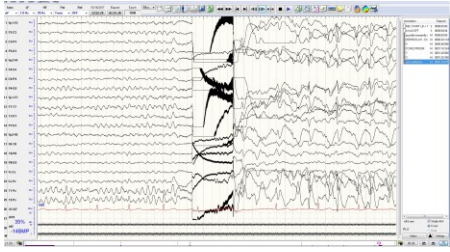
SPECTRUM HEALTH



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SPECTRUM HEALTH





28 **SPECTRUM HEALTH**

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29 **SPECTRUM HEALTH**

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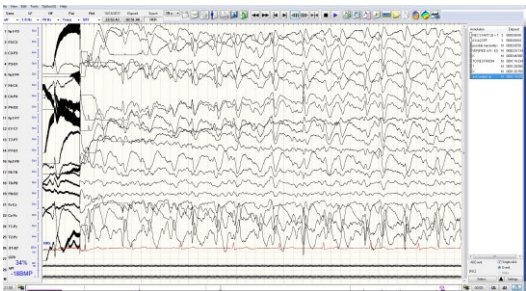
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30 **SPECTRUM HEALTH**

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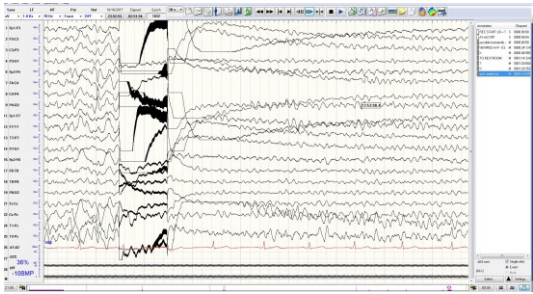
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31 **SPECTRUM HEALTH**

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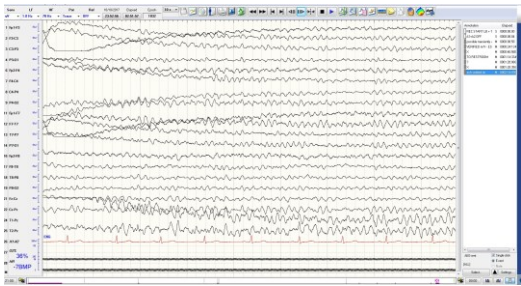
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32 **SPECTRUM HEALTH**

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Therapy Administration/Magnet recording



33 **SPECTRUM HEALTH**

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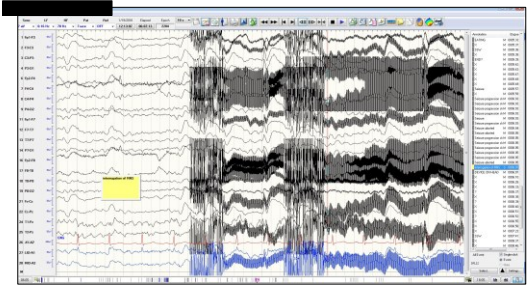
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34 **SPECTRUM HEALTH**

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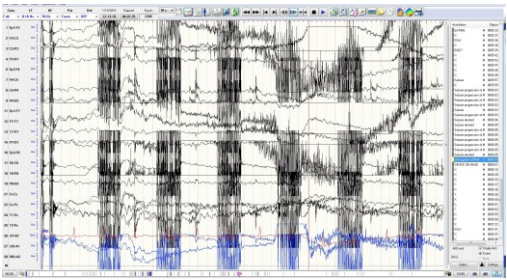
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35 **SPECTRUM HEALTH**

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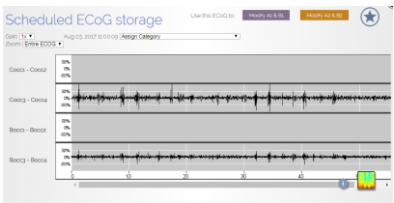
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36 **SPECTRUM HEALTH**

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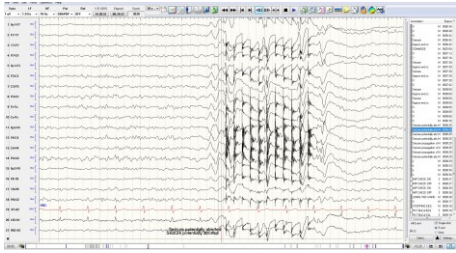
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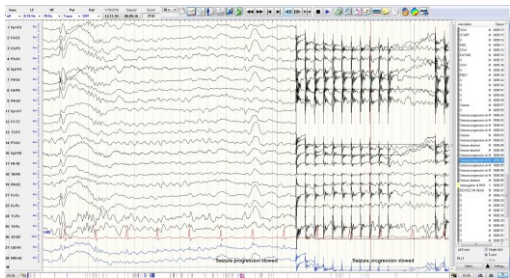
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38 **SPECTRUM HEALTH**

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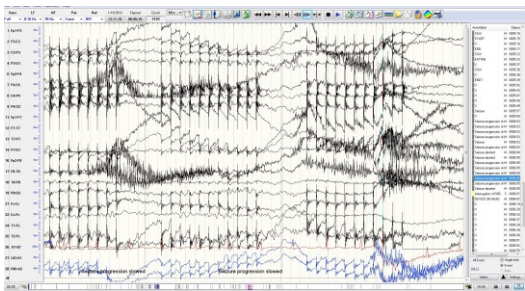
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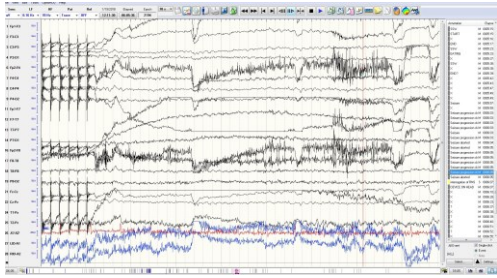
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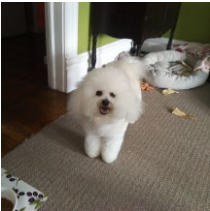
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## Let's Network!



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[linkedin.com/in/malloryschmidt](https://www.linkedin.com/in/malloryschmidt)

[instagram.com/freddiemercuryfanclub](https://www.instagram.com/freddiemercuryfanclub)




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## What makes the RNS so special

The neurostimulator senses and records electrocorticographic (ECoG) patterns from up to four amplifier channels. Upon detection of previously identified ECoG patterns, the neurostimulator delivers short trains of current pulses through the leads to interrupt those ECoG patterns. This is referred to as responsive electrical stimulation.

The RNS® Neurostimulator is a battery powered, microprocessor-controlled medical device that is surgically implanted in the cranium and is covered by the scalp. The neurostimulator is connected to one or two leads that are surgically implanted within (depth leads) or on the surface (cortical strip lead) of the brain in the area of the epileptic seizure focus. Each lead contains four electrodes that can be assigned to one or two of four amplifier channels.

The RNS® Neurostimulator can be programmed to monitor and deliver responsive stimulation to one or two epileptic foci. Up to five individually configured sequential stimulations can be delivered when a specific ECoG pattern is detected. Each stimulation can contain two bursts that can be independently configured.

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