

# **Personalized neuromodulation therapy for treating tinnitus and other conditions**

Several proof-of-concept and observational studies already have documented significant therapeutic long-term effects of Acoustic Coordinated Reset (CR) neuromodulation therapy using fixed ratio acoustic stimuli. These include reduction of tinnitus loudness, reduction of tinnitus annoyance and in some cases elimination of the tinnitus percept altogether. This CR approach is fundamentally different compared to all previous sound therapy approaches that either just cover up the tinnitus (masking) or address only maladaptive emotional reactions to the tinnitus, but do not change the nature of the tinnitus itself. The technology described here is a device and algorithm that optimizes the CR stimuli for each individual patient to provide more effective treatment for tinnitus. The invention is designed to quickly select and calibrate the frequencies of the CR treatment tones that account for a patient's individual magnitude of related hearing loss, the individual frequency characteristics of their tinnitus and more precisely defined neuronal subpopulations separately to optimize the therapy by personalizing the therapy signals for each patient. The new CR treatment stimuli can also be optimally re-adjusted as a patient's tinnitus frequency changes during the course of therapy. The technology could be implemented as a stand-alone device or incorporated into existing devices such as hearing aids, smart phones or tablets. The invention has been developed to improve tinnitus therapy, with potential future applications for tinnitus diagnostics or for treating other disorders of neural synchrony such as depression.

## **Stage of Research**

Most recently, the inventors demonstrated that stimuli selected to account for an individual patient's specific hearing levels and to incorporate newly identified frequency spacing in relation to the frequency of the patient's tinnitus the more precisely targets the affected neuronal subpopulations produces the largest effects. Future research will determine if the use of these optimized stimuli reduces the

duration of therapy needed, increases the magnitude of the benefit, or both, compared to therapy with the existing fixed ratio, non-optimized stimuli. It is expected that the optimized and personalized therapy stimuli will increase the number of patients whose tinnitus has been eliminated, reduce the magnitude of the symptoms of the remaining patients and reduce the therapy duration compared to use of the fixed stimuli.

## Applications

- **CR therapy for tinnitus** - personalized acoustic treatment based on an individual patient's tinnitus frequency and any associated hearing loss, with potential implementation as:
  - a stand-alone sound stimulator
  - software integrated into another device or component (e.g., firmware for a hearing aid or an application for a smart phone or tablet)
  - component for EEG data analysis
- **CR sound stimulation for potential future applications**, including:
  - tinnitus diagnostics
  - neuromodulation therapy for other disorders of neuronal synchrony, such as depression

## Advantages

- **Improved therapeutic outcome** - personalized CR tone spacing for tinnitus is related to significantly better therapeutic outcome based on re-analysis of existing clinical data
- **Fast calibration** - algorithm provides a small number of possible CR tones, enabling quick calibration that is practical for a clinical setting
- **Adapts to existing hardware** - CR treatment could be provided by stand-alone device or implemented through software integrated into an existing hearing aid, smartphone or other digital device such as a tablet.
- **Objective assessment** - device could be used to record stimulation induced effects to assess and re-calibrate treatment

## Patents

- Published Application: [WO2018031215](#)
- Published Application: [20190201657](#)
- Issued: [10,933,213 \(USA\)](#)

## Innovators

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