The NeuLogiq™ Platform for frequent broad-spectrum measurement of mechanisms and symptomology in CNS clinical trials

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Cumulus NeuLogiq™ platform for use in real-world settings

Developed in collaboration with leading pharma companies and KOLs (below).

Cumulus provides full service:
- Protocol / study / SAP design
- On-site training, off-site support
- Data package
- Reporting and custom analytics

Audit ready including FDA 510(k), UKCA, HIPAA, GDPR, ISO13485.

Designed for and with patients and clinicians, deployed in Phase 0-1b CNS trials.

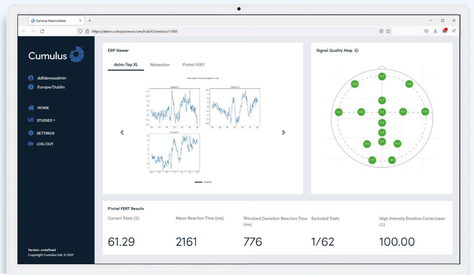
Secure automatic upload and QC.

Real-time dashboard monitoring of decentralized and home-based data collection.

Cumulus cognitive and EEG / ERP tests are designed to be highly repeatable, with large banks of non-repeating stimuli.

- Objectively administered and automatically scored
- Results (including EEG metrics) available in minutes, enabling remote monitoring and QC
- Suitable for detecting change over time

Memory Match: visual episodic memory



Symbol Swap: Symbol/digit coding

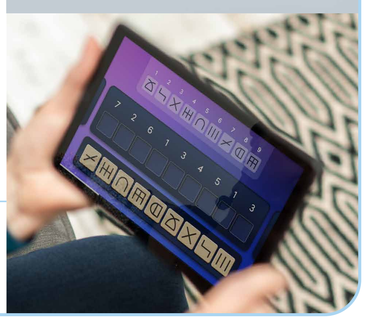
Biogen · Boehringer Ingelheim · Bristol Myers Squibb · GSK · janssen · Lilly · MSD · Pfizer · Roche · Takeda

Continuous engagement with patients informs task design

Patient Advocate User Panel members are chosen for their experience with dementia, depression, schizophrenia and other neurological conditions. Each group includes a mix of patients, family members, and healthcare professionals.

Key Activities:
- Focus groups
- Usability testing
- User scenario simulation
  - In-clinic sessions
  - Remote sessions
  - Study schedules

Outcomes may influence:
- Task development
- Hardware selection
- Onboarding procedures
- Session/task list features
- Study scheduling features
- Site staff training
- Participant facing materials



FDA CLEARED · UKCA · reddot design award · iF DESIGN AWARD 2023 · GOOD DESIGN

Introduction

- Current gold standard measurement tools in CNS clinical trials are insensitive in early disease and require very large samples to detect any change (if such tests are even repeatable in principle) [1, 2].
- Digital biomarkers may provide the ability to collect clinically meaningful data at scale, outside the clinic.
- To capture the dynamics of longitudinal change, self-administration in the home environment may be preferred.
- A variety of biomarkers, including cognition, EEG and mood, are of interest to sponsors, especially in early-phase trials.
- Consolidation within a single platform has advantages for both sponsors and patients.
- Cumulus Neuroscience was founded to meet this need, and has developed the NeuLogiq™ platform to the specifications of 10 leading pharma companies (above).

Three validation studies to assess usability in patients and pharmacodynamic effects

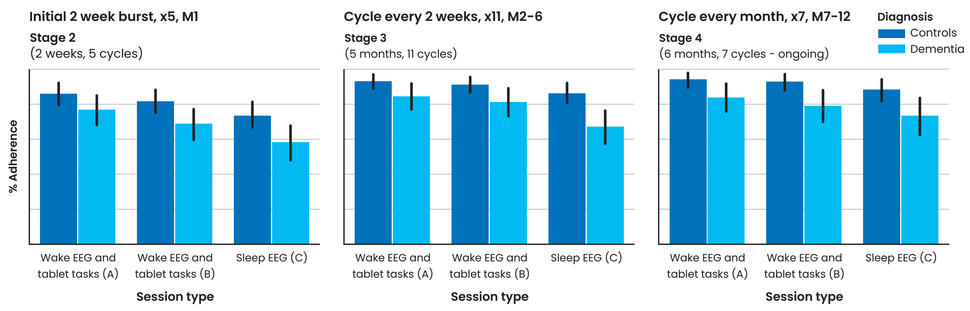
CNS-101 Alzheimer's dementia study
- N=59 mild dementia patients (ADAS-Cog 25.1) and N=60 age-matched healthy controls (ADAS-Cog 8.9)
- Asked to use the Platform as well as a sleep EEG device over a year at home. Protocol requested 56 ~30m daytime sessions, with overnight sleep on 23 nights. Protocol started with "burst" phase, followed by tapering maintenance phase.
- Each daytime session assessed several domains of neurocognitive function, overlaid with EEG, including episodic memory, working memory, emotional processing, executive functioning, psychomotor speed, and more.

CNS-102 Frontotemporal dementia / Amyotrophic Lateral Sclerosis study (FTD/ALS)
- N=11 ALS; 7FTD; 10 age- and education-matched healthy controls.
- Asked to perform 3 ~25m sessions every 2 weeks, over 8 months at home.
- Sessions included Cumulus neurocognitive assessments of memory, executive function, as well as EEG paradigms, such as P300 and Mismatch Negativity (MMN).

Ketamine pharmacological challenge study
- N=30 healthy younger adults administered racemic ketamine
- Placebo-controlled, single-blind, counterbalanced crossover design.
- Multiple Cumulus EEG and cognitive tasks, including Oddball (P300); Flanker (Error-related negativity); MMN.
- Supervised sessions in lab to detect acute effects, and unsupervised sessions at home in the weeks either side.

Patient feasibility and usability in AD, FTD and ALS

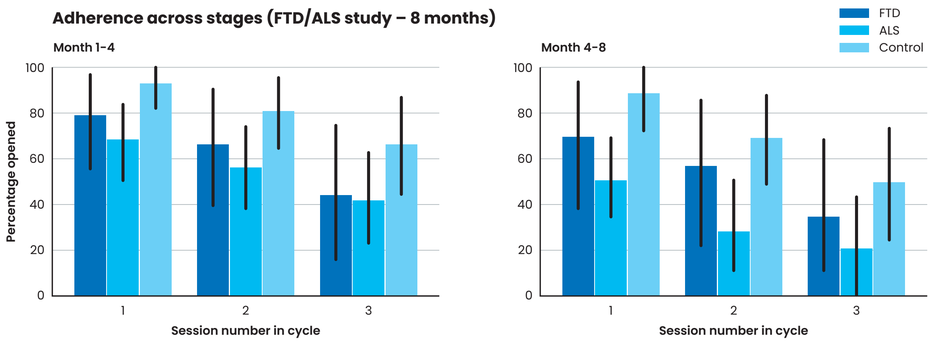
Adherence across stages, per session type (AD study – 1 year)



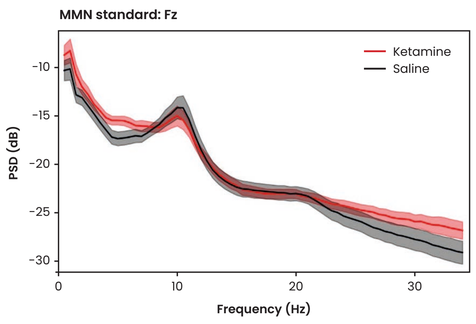
- Over 4,500 Cumulus EEG sessions recorded, 18,000+ tasks completed, 130+ hours of audio

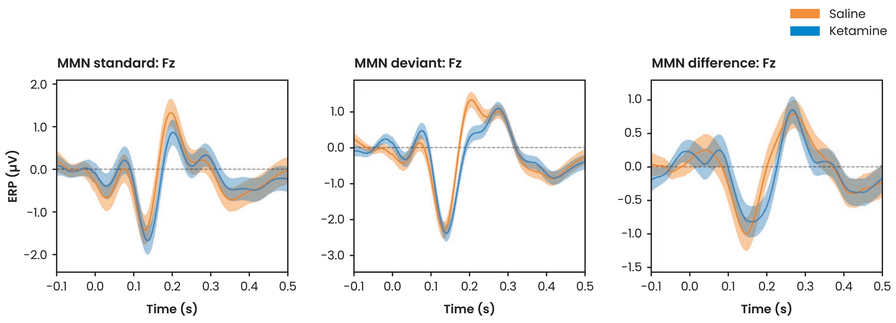
Usability ratings (AD dementia study)
Only 30% of patients stated that they felt "confident" about using the system at week 2 of the study (after the familiarisation phase). Despite this, adherence remained high.

Adherence across stages (FTD/ALS study – 8 months)



Detecting pharmacodynamics of ketamine infusion





Eyes-closed qEEG changes seen during acute phase: disruption of alpha/beta activity, and enhancement of gamma activity.

Disruption of MMN: MMN peak is delayed and reduced in amplitude during ketamine infusion, reflecting NMDA receptor engagement.

Impact of Cumulus NeuLogiq™ platform in BioPharma trial design

Case study 1: Timesaver in the lab

Comparison with traditional, wet-gel lab-based alternative

<30 minutes for a typical EEG session (multi-domain, EEG and cognitive assessment)

Dry sensor design penetrates hair with no need for wet gel

Can be applied by non-technical users in low-support environments

90 minutes minimum session duration is typical

Hair washing required after each session

Requires staff who are expert EEG technicians

Impact

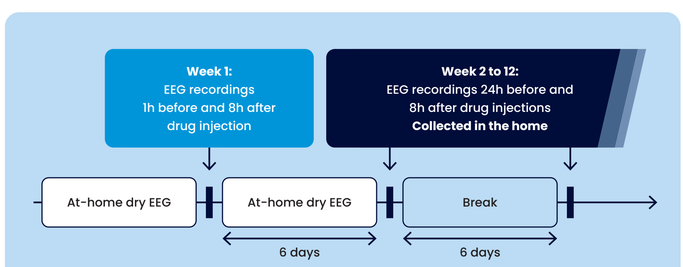
Phase 1 inpatient clinical trial setting was made possible with acceptable user burden, **reducing conventional VEP-LTP paradigm time by ~75%.**

Reported that use of Cumulus made it feasible to collect in **low-support environments.**

Milanovic et al., ECNP 2023

Case study 2: Hybrid home and lab multisite deployment

Late addition to an ongoing trial in Australia, during Covid-19 pandemic



AD dementia study with mild-moderate dementia patients (MMSE 13-25).

NeuLogiq™ deployed to 6 sites with a hybrid design, including in-clinic measurements at administration and at-home measurements over full study duration.

Patients achieved >90% adherence to the at-home protocol.

Impact

A hybrid-remote clinical trial during the height of lockdown was made possible, accommodating vulnerable patients who were reluctant to travel to clinical sites.

Significant improvement in EEG markers of brain function following drug infusion was found.

Barbey et al., CTAD 2023

Conclusion

- Cognitive and EEG biomarkers are feasible to deploy in the home environment in CNS clinical trials, making deep longitudinal phenotyping practical for the first time.
- Patients with mild AD report good usability and adhere well in a longitudinal (1yr) protocol.
- Adherence is relatively lower in FTD/ALS patients, perhaps reflecting greater impact of disease on ability to use the system repeatedly over 8 months.
- qEEG and ERP results validate the headset's ability to detect canonical effects of a dissociative drug (ketamine).
- NeuLogiq™ is used in clinical trials to enhance rapid measurement and enable distributed / hybrid trial designs.

Clinical trials completed

INmuneBio INNATE IMMUNITY

Sumitomo Pharma

View this poster online

References

1. Goldberg, T. E., Harvey, P. D., Wesnes, K. A., Snyder, P. J., & Schneider, L. S. (2015). Practice effects due to serial cognitive assessment: Implications for preclinical Alzheimer's disease randomized controlled trials. Alzheimer's and Dementia: Diagnosis, Assessment and Disease Monitoring, 1(1), 103–111. https://doi.org/10.1016/j.dadm.2014.11.00
2. Hassenstab, J., Aschenbrenner, A. J., Sliwinski, M. J., McDade, E., Lim, Y. Y., Maruff, P. T., Balota, D. A., Morris, J. C., Bateman, R. J., & The Dominantly Inherited Alzheimer Network Trials Unit. (2017). Rapid, Remote, and Repeatable: Smartphone-Based "Burst" Cognitive Assessments for Global AD Prevention Trials. Clinical Trials on Alzheimer's Disease (CTAD)