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Presentation Abstract

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Presentation Title:	A fully wireless toolset for high-throughput freely-behaving optogenetic research.
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Abstract: The ability to control specific cell types or pathways with optical neural control methods, utilizing 'optogenetic' sensitizers that make specific cellular functions controllable by light, is enabling the parsing of the causal substrates of normal and pathological brain functions. We have shown in prior demonstrations (SfN 2010, 2009) the ability to reliably perturb behavior in freely behaving animals using miniature, wirelessly powered and controlled systems for optogenetic control, as well as use of custom arrays of implanted LEDs for precise optogenetic targeting of deep brain structures. We here present an integrated system incorporating both of these technologies in a scalable, easy to use toolset for optogenetic research.

Power is wirelessly provided to miniature, <2 gram headborne devices using tile-able coils placed under-cage, which deliver a low strength oscillating magnetic field optimized for power efficiency over a wide range of animal head orientations. Integrated multi-channel optics drivers on the headborne device provide precise wireless control of an array of headborne LEDs. During a behavioral experiment, high-speed data and control telemetry is handled by an onboard microprocessor and a 2.4 GHz data telemetry system on the head, and a custom USB-compatible microprocessor radio card up to 10 meters away that can be interfaced to a standard PC or laptop. The headborne device can additionally record sensor information using a multi-channel onboard digitizer.

Finally, we present a software interface for monitoring and control of dozens of implants simultaneously, making this system suitable for institution-scale high-throughput optogenetic screening, including real-time remote triggering of light delivery, allowing for closed-loop perturbation.

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IMPLANT

COGNITIVE CONTROL

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