endogenous \textit{Gt(ROSA)26Sor} locus. Expression is enhanced by the presence of a CAG promoter. Following Cre-mediated removal of the floxed-STOP cassette, ArchT-EGFP expression is observed in the \textit{cre}-expressing cells. Subsequent illumination of these cells with yellow-green light (~575 nm) leads to reversible photoinhibition of action potential firing/neural activity in these cells. These Ai40D mice are useful for optogenetic studies to express an inhibitory opsin that effectively silences the activity of cortical neurons (and perhaps other excitable cell types such as muscle cells and immune cells). ArchT has greater than 3-fold improvement in light sensitivity compared to Arch, equating to greater than 200\% increase in brain tissue volume addressed by a typical single optical fiber.

**Donating Investigator**

Hongkui Zeng, Allen Institute for Brain Science
Ai40D mice homozygous for the Rosa-CAG-LSL-ArchT-EGFP-WPRE-bGHpA conditional allele are viable and fertile. A loxP-flanked STOP cassette prevents transcription of the downstream ArchT-EGFP fusion gene (see below for detailed description of ArchT-EGFP). Because the CAG promoter driven reporter construct was targeted for insertion into the Gt(ROSA)26Sor locus, ArchT-EGFP expression is determined by which tissue(s) express Cre recombinase. When bred to mice that express Cre recombinase, the resulting offspring will have the STOP cassette deleted in the cre-expressing tissues; resulting in expression of the ArchT-EGFP fusion protein.

The donating investigator reports that Ai40D mice do not express ArchT-EGFP prior to introduction of Cre recombinase. Fusion protein expression following exposure to cre can be detected by native EGFP fluorescence and in situ hybridization (using an EGFP probe) [and presumably by antibody staining (immunohistochemistry); although this was not tested by the donating investigator]. Following exposure to Cre recombinase, illuminating ArchT-expressing neurons with yellow-green light (~575 nm) leads to reversible photoinhibition of action potential firing/neural activity in these cells. The donating investigator did not examine ArchT-EGFP fusion protein expression in tissues other than brain, and did not attempt to generate homozygous mice to date (January 2013). Unlike the Ai40 mice from which they were derived, these Ai40D mice no longer harbor the downstream frt site or attB/attP-flanked selection cassette.

For characterization information, see images at the Allen Institute for Brain Science website (Ai40 images).

The bacterial opsins are retinal-binding proteins that combine a light-sensitive domain with an ion channel or pump; providing light-dependent ion transport, membrane potential alteration, and sensory functions to bacteria. Archaerhodopsin-3 (aop3) is a yellow-green light-driven (~575 nm) outward proton pump that causes hyperpolarization and prevents action potentials. Unlike light-driven chloride pumps that enter long-lasting inactive states in response to light, Arch spontaneously recovers from light-dependent inactivation. Arch is capable of generating photocurrents at several hundred picoamps (pA) even at low light powers. For example, illumination of Arch-expressing cells leads to reversible photoinhibition of action potential firing/neural activity in these cells.

The ArchT-EGFP fusion protein is a mammalian codon-optimized, Halorubrum strain TP009-derived Archaerhodopsin-3 (ArchT or aR-TP009) fused in-frame with an enhanced green fluorescent protein (EGFP). Compared to Arch derived from Halorubrum sodomense, ArchT can mediate photocurrents of similar maximum amplitude (~900 pA in vitro), but with a greater-than-three-fold improvement in light sensitivity over Arch, most notably in the optogenetic range of 1-10 mW/mm2, equating to greater-than-two-fold increase in brain tissue volume addressed by a typical single optical fiber. ArchT expresses extremely well on the membranes of neurons, including good expression on axons, which may support improved neural pathway silencing. Such net suppression of activity suggests that ArchT silencing technology may be useful in studying the causal analysis of neural circuits and therapeutic applications (Han et al. 2011 Front Syst Neurosci 5:18).
For characterization information, see images at the Allen Institute for Brain Science website (Ai40D images).

- Development
- Expression Data
- Control Suggestions
- Selected References

- Genetics
  - Gt(ROSA)26Sor<sup>tm40.1(CAG-aop3/EGFP)Hze</sup>

- Disease/Phenotype
  - Disease Terms
  - Research Areas By Phenotype
  - Mammalian Phenotype Terms by Genotype
  - References

- Technical Support

Genotyping Protocols
Separated PCR: Gt(ROSA)26SorAlternate1
Standard PCR: Gt(Rosa)26sor(PolyA)
Genotyping resources and troubleshooting
Dietary Information
LabDiet® 5K52 formulation (6% fat)

Breeding Considerations

When maintaining the live colony, heterozygous mice may be bred to wildtype mice from the colony or to C57BL/6J inbred mice (Stock No. 000664). Alternatively, homozygous mice may be bred together.

Additional Breeding and Husbandry Support
Mating System
Homozygote x Homozygote

Citation
When using the Ai40(RCL-ArchT/EGFP)-D or Ai40D mouse strain in a publication, please cite the originating article(s) and include JAX stock #021188 in your Materials and Methods section.

Animal Health Reports
Facility Barrier Level Descriptions

 AX12 (Maximum)

Pricing & Availability

Live mice available in varying quantities. Ask Customer Service for details.

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<th>AGE</th>
<th>SEX</th>
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<th>PRICE</th>
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**PAYMENT TERMS AND CONDITIONS**

Terms are granted by individual review and stated on the customer invoice(s) and account statement. These transactions are payable in U.S. currency within the granted terms. Payment for services, products, shipping containers, and shipping costs that are rendered are expected within the payment terms indicated on the invoice or stated by contract. Invoices and account balances in arrears of stated terms may result in The Jackson Laboratory pursuing collection activities including but not limited to outside agencies and court filings.

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The Jackson Laboratory has rigorous genetic quality control and mutant gene genotyping programs to ensure the genetic background of JAX® Mice strains as well as the genotypes of strains with identified molecular mutations. JAX® Mice strains are only made available to researchers after meeting our standards. However, the phenotype of each strain may not be fully characterized and/or captured in the strain data sheets. **Therefore, we cannot guarantee a strain’s phenotype will meet all expectations.** To ensure that JAX® Mice will meet the needs of individual research projects or when requesting a strain that is new to your research, we suggest ordering and performing tests on a small number of mice to determine suitability for your particular project. We do not guarantee breeding performance and therefore suggest that investigators order more than one breeding pair to avoid delays in their research.

**TERMS OF USE**

**General Terms and Conditions**

**ADDITIONAL USE RESTRICTIONS APPLY**

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**LICENSING INFORMATION**

Phone: 207-288-6470
Email: TechTran@jax.org

**Related Strains**