The Rai1 allele has loxP sites flanking exon 3 of the retinoic acid induced 1 gene. Removal of the floxed sequence creates a null allele. These mice may be useful in studying circuit assembly and neuronal communication in human disorders such as Smith-Magenis Syndrome (SMS).

Donating Investigator

Liqun Luo, Stanford University
Haploinsufficiency of retinoic acid induced 1 (RAI1) in humans causes Smith-Magenis syndrome (SMS), which is associated with diverse neurodevelopmental and behavioral symptoms as well as obesity. RAI1 encodes a nuclear protein with emerging functions in the expression of genes involved in circuit assembly and neuronal communication.

The Rai1^fox allele has loxP sites flanking exon 3 of the retinoic acid induced 1 gene. Mice homozygous for this floxed allele are viable and fertile with no reported abnormalities. When bred to mice that express Cre recombinase, the resulting offspring will have the floxed region (encoding amino acid 1-1837) deleted in cre-expressing tissues; creating a knock-out allele (Rai1^ΔCre).

For example, when bred to mice with Cre-expression throughout the central and peripheral nervous system (Nestin-Cre; Stock No. 003771), the resulting Nestin^Cre;Rai1^ΔCre homozygotes have pan-neural loss of Rai1 and exhibit three major characteristics of SMS - deficits in body weight homeostasis, motor function and associative learning and memory. They are smaller than control littermates prior to weaning and show prominent hindlimb clasping. More than 80% die by 25 weeks of age. Females (but not males) show obesity beginning ~5 weeks of age.

Furthermore, individual aspects of these three major SMS phenotypes may be observed by crossing Rai1^fox to different cre-expressing mice.

Breeding to Gad2-ires-Cre mice (Stock No. 010802) results in Rai1 knock-out in most GABAergic inhibitory neurons. Those Gad2^Cre;Rai1^ΔCre mice show learning deficits, but no motor function abnormalities, obesity or early lethality.

When bred to Vglut2-ires-cre mice (Stock No. 016963), the resulting Vglut2^Cre;Rai1^ΔCre mice have Rai1 knock-out in subcortical excitatory neurons - leading to increased body weight, poor motor function and learning deficits, with no early lethality. In addition, Rai1 knock-out specifically in neurons of the paraventricular nucleus of hypothalamus (PVH; via breeding to Sim1-cre [see Stock No. 006395]) or ventromedial nucleus of hypothalamus (VMH; via breeding to Sf1-Cre [Stock No. 012462]) both contributed to the obesity phenotype observed in Vglut2^Cre;Rai1^ΔCre mice.

No SMS-like characteristics were observed for mice with Rai1 knock-out in astrocytes and subsets of adult neural progenitors (via breeding to Gfap-Cre73.12; Stock No. 012886) or with Rai1 knock-out in cortical and hippocampal excitatory neurons and glia (via breeding to Emx1-ires-Cre; Stock No. 005628).
Breeding Considerations

Mice homozygous for the Rai1^flox allele are viable and fertile with no reported gross physical or behavioral abnormalities.

When maintaining a live colony, heterozygous mice may be bred together, 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

Citation

When using the Rai1-flox (Rai1^flox) mouse strain in a publication, please cite the originating article(s) and include JAX stock #029103 in your Materials and Methods section.
Production of mice from cryopreserved embryos or sperm occurs in a maximum barrier room, **G200**.
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