

Figure 1 | Remote neural activation *in vivo* using radio waves. **a**, Schema of activation system. **b**, **c**, Change in blood glucose (**b**) and cumulative blood glucose (**c**) with RF treatment of Gk-Cre mice (VMH injection Ad-FLEX-anti-GFP-TRPV1/GFP-ferritin, $n = 13$; VMH injection rAAV-FLEX-ChR2, $n = 4$). Values are mean \pm s.e.m.; two-way ANOVA with Sidak's multiple comparison test; * $P < 0.05$, ** $P < 0.01$, **** $P < 0.0001$. ChR2, channelrhodopsin 2. **d**, RF treatment of Gk-Cre (GK) or wild-type (WT) mice with VMH Ad-FLEX-anti-GFP-TRPV1/GFP-ferritin on

plasma insulin (Gk-Cre, $n = 8$; wild type, $n = 8$), glucagon (Gk-Cre, $n = 6$; wild type, $n = 11$) and hepatic glucose-6-phosphatase expression (Gk-Cre, $n = 12$; wild type, $n = 9$). Values are mean \pm s.e.m.; two-tailed, unpaired Student's t -test or Mann-Whitney U -test; * $P < 0.05$, *** $P < 0.005$. WT nanoV1 refers to wild-type mice with VMH injection of Ad-FLEX-anti-GFP-TRPV1/GFP-ferritin. Gck NanoV1 indicates Gk-Cre mice with VMH injection of Ad-FLEX-anti-GFP-TRPV1/GFP-ferritin.

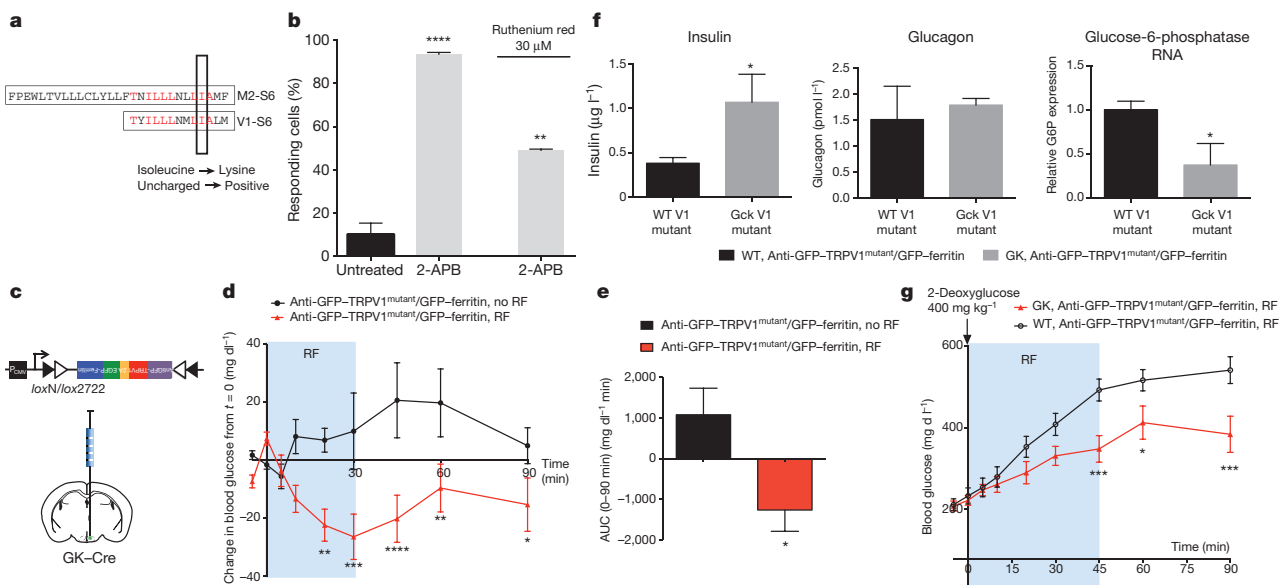


Figure 2 | Remote neural inhibition *in vitro* and *in vivo* using radio waves. **a**, Amino acid sequences for TRPM2 and TRPV1 S6 regions indicating substitution site. **b**, Responding cells (>10% decrease in MQAE (N -(ethoxycarbonylmethyl)-6-methoxyquinolinium bromide) fluorescence) with 2-APB (4 replicates, 20 cells) alone or with ruthenium red (2 replicates, 6 cells). Values are mean \pm s.e.m. Kruskal-Wallis with Dunn's multiple comparison test; ** $P < 0.01$, **** $P < 0.001$ versus untreated. **c**, Construct for Cre-dependent expression of anti-GFP-TRPV1^{mutant}/GFP-ferritin. **d**, **e**, Change in blood glucose (**d**) and cumulative blood glucose (**e**) with RF treatment of Gk-Cre mice with VMH injection of Ad-FLEX-anti-GFP-TRPV1^{mutant}/GFP-ferritin ($n = 13$). Values are mean \pm s.e.m.; two-way ANOVA with Sidak's multiple

comparison test and two-tailed Student's t -test; * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, **** $P < 0.0001$. **f**, RF treatment of Gk-Cre (GK) or wild-type (WT) mice with VMH injection of Ad-FLEX-anti-GFP-TRPV1^{mutant}/GFP-ferritin on plasma insulin (Gk-Cre, $n = 9$; wild type, $n = 9$), glucagon (Gk-Cre, $n = 5$; wild type, $n = 9$) and hepatic glucose-6-phosphatase expression (Gk-Cre, $n = 4$; wild type, $n = 8$). Values are mean \pm s.e.m.; two-tailed, unpaired Student's t -test; * $P < 0.05$. **g**, RF treatment of Gk-Cre ($n = 6$) or wild-type ($n = 9$) mice with VMH injection of Ad-FLEX-anti-GFP-TRPV1^{mutant}/GFP-ferritin on blood glucose with 2-deoxyglucose treatment. Values are mean \pm s.e.m.; two-way ANOVA with Sidak's multiple comparison test; * $P < 0.05$, *** $P < 0.001$.