

**Title: Supplementary Data 1:**

**Description:** Rare, potentially bi-allelic coding variants identified through whole exome / genome sequencing in families A-D are listed.

**Title: Supplementary Movie 1:**

**Description:** Defective motility was observed in rnf170 morphant embryos at 48 hpf, as indicated using a touch response assay. (a) Control morpholino injected embryos show the normal response to a gentle prod from a blunt implement, the embryos rapidly swim away.

**Title: Supplementary Movie 2:**

**Description:** Embryos injected with E3MO almost completely fail to respond to the stimulus, with the majority of embryos unable to move.

**Title: Supplementary Movie 3:**

**Description:** Embryos injected with E4MO also show loss of motility when gently prodded with a blunt implement, embryos fail to swim away.

**Title: Supplementary Movie 4:**

**Description:** Control morpholino injected embryos show the normal response to a gentle prod from a blunt implement, the embryos rapidly swim away at 48hpf.

**Title: Supplementary Movie 5:**

**Description:** Injections of a translational blocking rnf170 AUG MO results in movement defects when compared to control MO treated embryos (Supplementary Movie 4) at 48hpf.