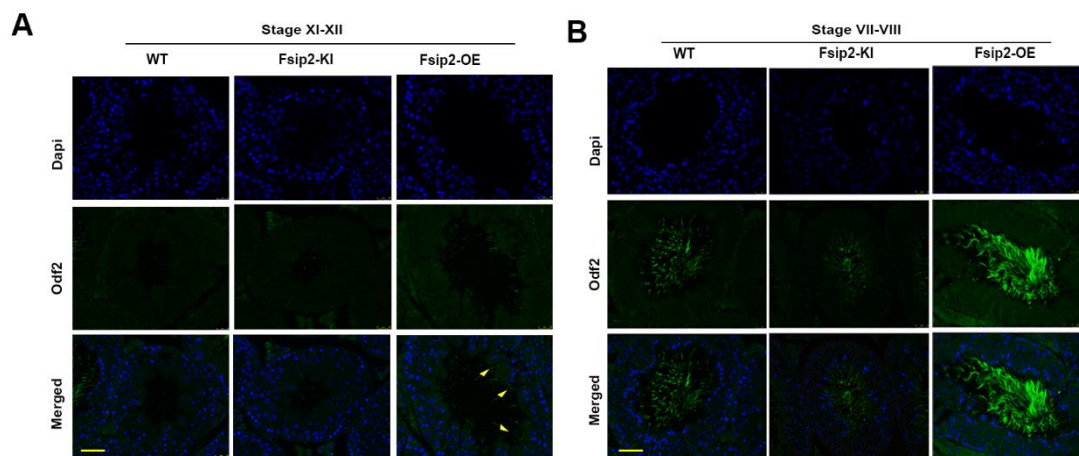


Fig. S1. Fluorescence intensity of Fsp2 of the WT, KI and OE mice sperm.



**Fig. S2. Immunofluorescence staining of testicular sections.** (A) Odf2 expression and distribution in the seminiferous tubule at stage XI-XII. Yellow arrows indicate the accelerated development of spermatid. (B) Odf2 expression at stage VII-VIII.

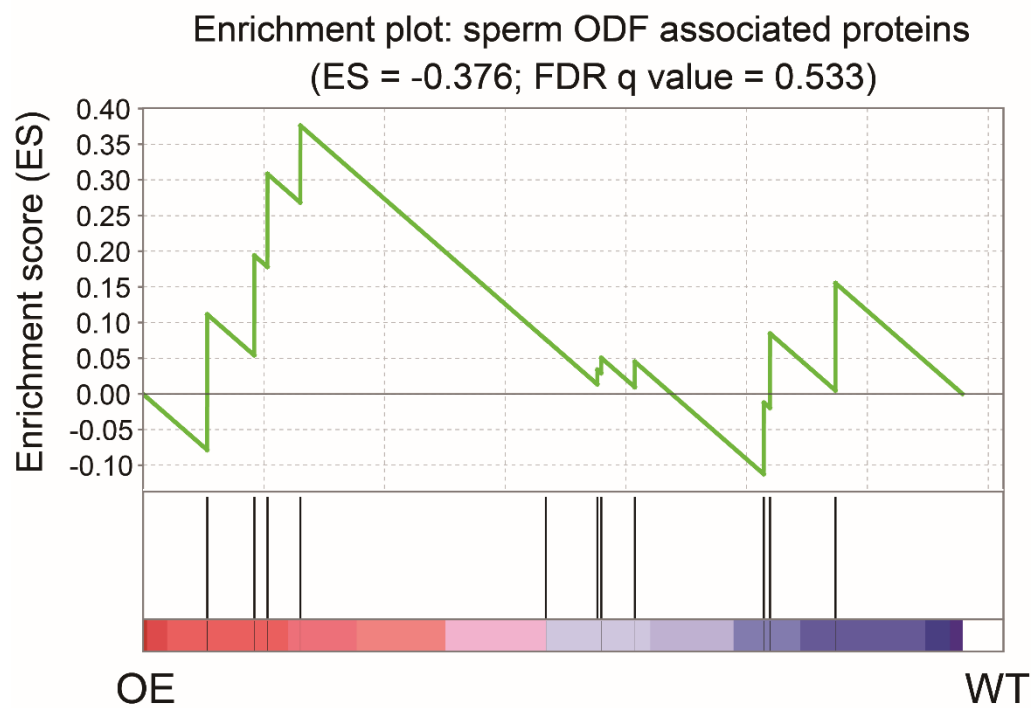
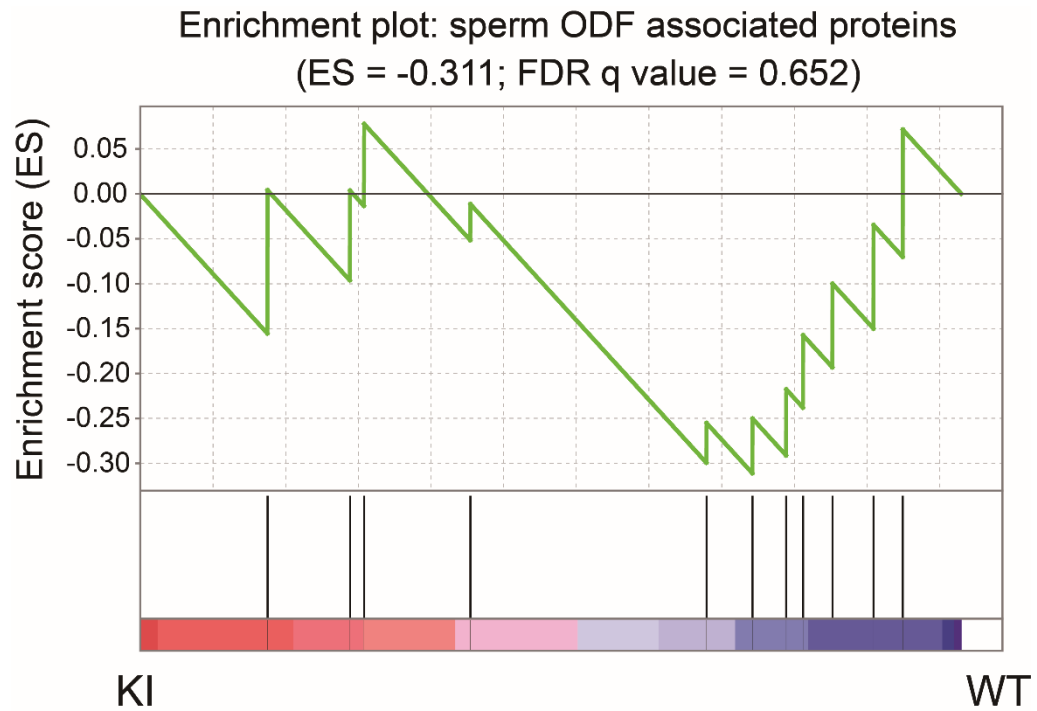


Fig. S3. Gene Set Enrichment Analysis (GSEA) for ODF associated proteins.

**Table S1. Testis weight of WT, KI and OE male**

Group	Testis Weight/Body Weight (n=11)		
	Mean±SD	P-value	Significance
WT	0.007503 ± 0.000222		
KI	0.007022 ± 0.0003188	0.2298a	n.s.
OE	0.006927 ± 0.000241	0.094b	n.s.

a WT vs KI

b WT vs OE

**Table S2. Top three downregulated genes between the 4 subclusters of Round spermatid of the KI and WT mice.**

Sub-clusters	Gene 1	Gene 2	Gene 3
Round spermatid 1	<i>Fsip2</i>	<i>Tcte3</i>	<i>Tuba3b</i>
Round spermatid 2	<i>Fsip2</i>	<i>Tcte3</i>	<i>1700017L05Rik</i>
Round spermatid 3	<i>Fsip2</i>	<i>1700109H08Rik</i>	<i>Gm36368</i>
Round spermatid 4	<i>Fsip2</i>	<i>Tcte3</i>	<i>Slx1</i>

**Table S3. List of antibodies.**

	Antibody	Catalog number	Supplier	RRID	WB dilution	IF dilution
1	Rabbit anti-Fsip2 antibody	bs-16187R	Bioss	AB_2876860	-	1:100
2	Mouse anti-Acrv1 antibody (A-9)	sc-398536	Santa Cruz	AB_2876861	-	1:20
3	Rabbit anti-Akap3 antibody	13907-1-AP	ProteinTech	AB_2273887	1:2000	1:100
4	Rabbit anti-Akap4 polyclonal antibody	24986-1-AP	ProteinTech	AB_2876859	1:2000	1:200
5	Rabbit anti-Odf2 antibody	12058-1-AP	ProteinTech	AB_2156630 )	1:500	1:100
6	Rabbit anti-Acrv1 polyclonal antibody	14040-1-AP	ProteinTech	AB_1064042 6	1:1000	-
7	Rabbit anti-Cabyr polyclonal antibody	12351-1-AP	ProteinTech	AB_2069257	1:5000	1:100
8	Rabbit anti-Gapdhs polyclonal antibody	13937-1-AP	ProteinTech	AB_2107611	1:1000	1:100
9	Rabbit anti- $\beta$ -Actin (13E5) rabbit mAb	#4970	Cell Signalling Technology	AB_2223172	1:1000	-
10	Goat anti-rabbit IgG (H+L) highly cross-adsorbed secondary antibody, Alexa Fluor 488	A11034	Thermo Fisher Scientific	AB_2576217	-	1:600
11	Goat anti-mouse IgG (H+L) cross-adsorbed secondary antibody, Alexa Fluor 568	A11004	Invitrogen	AB_2534072	-	1:600
12	Goat anti-rabbit H&L (HRP)	IgG ab205718	Abcam	AB_2819160	1:10000	-