## Supplemental Tables:

Supplemental Table 1: Targeted deletions of *Fgfr1*, *Fgfr2*, and/or *Frs2a* that result in renal developmental anomalies in mice

| Targeted gene | Cre line used/lineage targeted | Results | References: |
|---|---|---|---|
| *Fgfr2* | Hoxb7cre/UB | Small kidneys with aberrant UB branching, fewer nephrons and stromal mesenchymal patterning defects | [53] |
| *Frs2α* | Hoxb7cre/UB | Mild renal hypoplasia with less ureteric branching and fewer nephrons | [43] |
| *Fgfr2/ Frs2α* | Hoxb7cre/UB | Small, cystic dysplastic kidneys and severe UB branching defects | [45] |
| *Fgfr1/Fgfr2* | Pax3cre/MM | Aplasia with poorly formed MM and unbranched UBs | [36] |
| *Fgfr1/Fgfr2IIIc* | Pax3cre/MM* | Similar to *Fgfr1/Fgfr2* MM deletion except MM formation is partially rescued | [44] |
| *Fgfr2* | Pax3cre/MM | Partially penetrant abnormalities including duplex ureters, duplex kidneys, obstructive hydroureter, renal aplasia, anterior shift of UB, vesicoureteral reflux | [13, 14] |

**Fgfr1* is conditionally deleted in MM and *Fgfr2IIIc* is globally deleted

Supplemental Table 2: Real time PCR results of genes that could affect ureteric induction in E10.5 $Fgfr1^{Mes-/-}/Fgfr2^{LR/LR}$

| Gene | Percentage of control | p value |
|---|---|---|
| *Slit2* | 108% | 0.87 |
| *Robo2* | 90% | 0.73 |
| *Ret* | 92% | 0.75 |
| *Etv4* | 77% | 0.27 |
| *Etv5* | 100% | 0.98 |

**Supplemental Figure Legends:**

**Supplemental Figure 1: Whole mount staining of the Wolffian duct and ureteric bud shows no delay in *Fgfr1*$^{Mes-/-}$/*Fgfr2*$^{LR/LR}$ (mutant) first ureteric branching events.**

A, B. Whole mount immunofluorescence for CalbindinD$_{28k}$ at E11.25 shows a similar early ureteric ampulla in mutant (B, arrowhead) and control (A, arrowhead). C, D. Whole mount in situ hybridization for *Ret* at E11.5 shows similar progression of ureteric branching to two nascent ureteric ampullae per kidney (arrowheads) in controls (A) and mutants (B). Scale bars (A-D) = 100 μm.

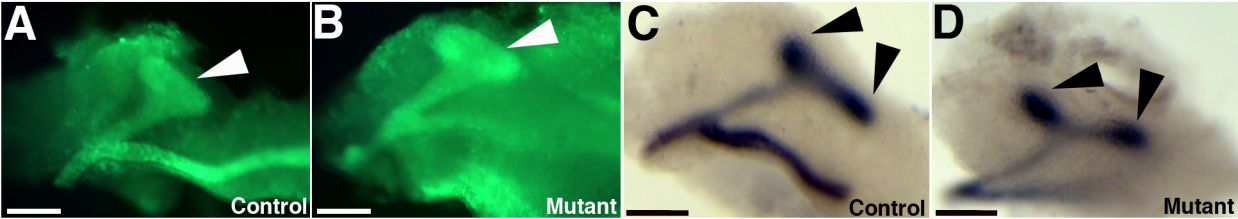
**Supplemental Figure 2: Whole mount ISH of *Bmp4* in E10.5 *Fgfr1*$^{Mes-/-}$/*Fgfr2*$^{LR/LR}$ (mutant) urogenital ridges.** A, B. Whole mount in situ hybridization shows expanded and increased expression of *Bmp4* in control (A) stromal mesenchyme near the Wolffian ducts (dotted region) versus mutant (B), particularly in caudal regions near the ureteric bud (arrowheads). WD = Wolffian duct. S = somites. 400x magnification.

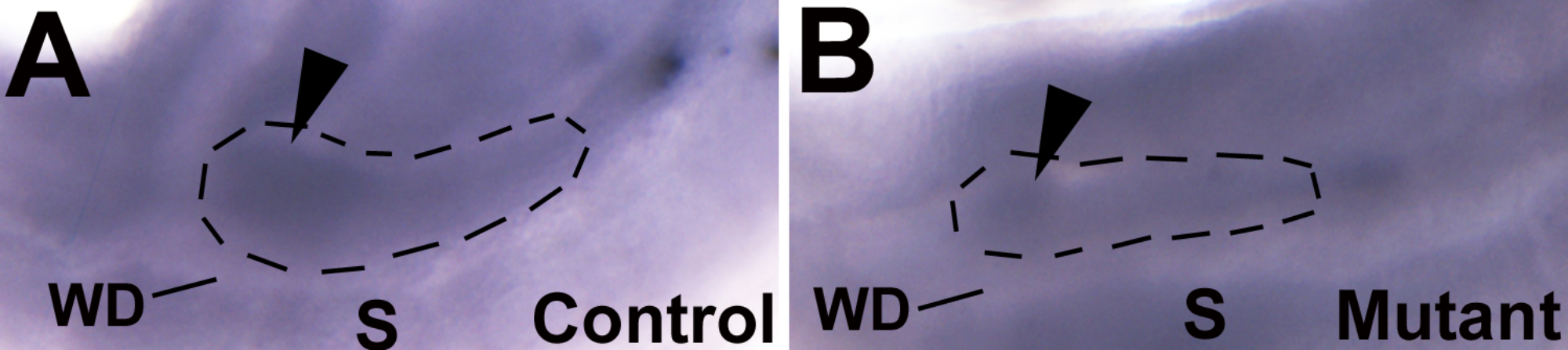
**Supplemental Figure 3: Histological sections of E16.5 *Fgfr1*$^{Mes-/-}$/*Fgfr2*$^{LR/LR}$ (mutant) and control kidneys.**

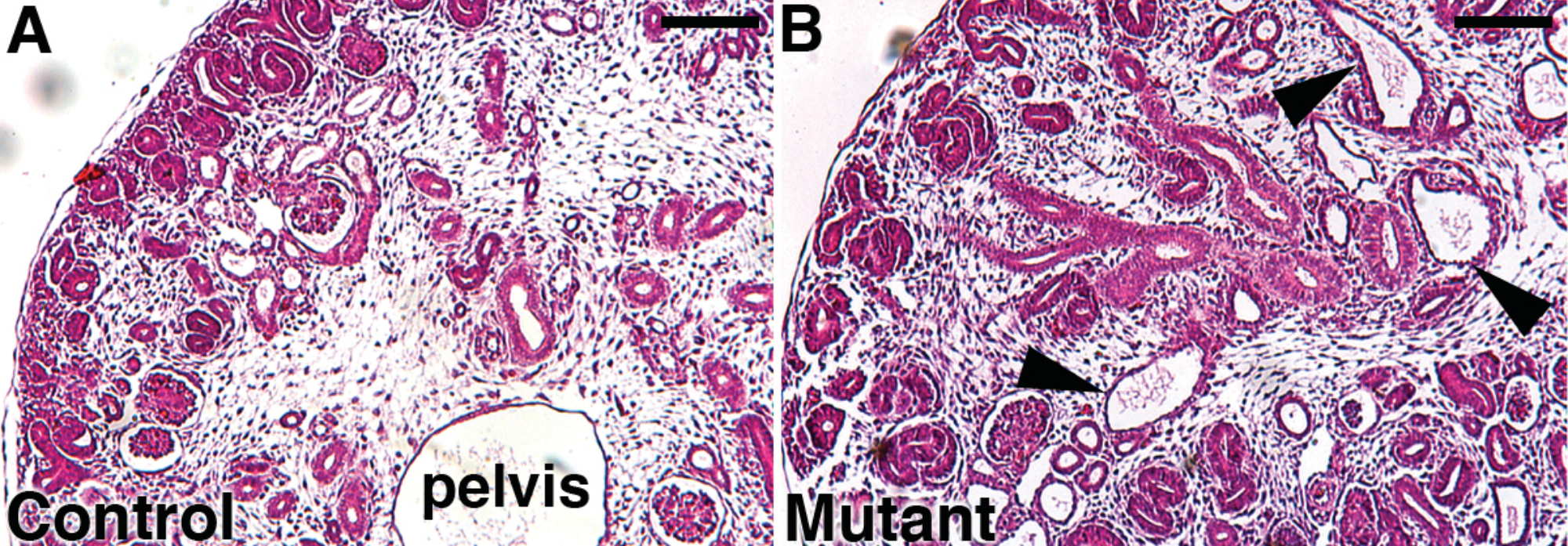
A, B. H&E staining through transverse sections reveals that compared with controls (A), mutants (B) have several dilated tubules (arrowheads). pelvis = renal pelvis. Scale bars (A, B) = 100 μm.

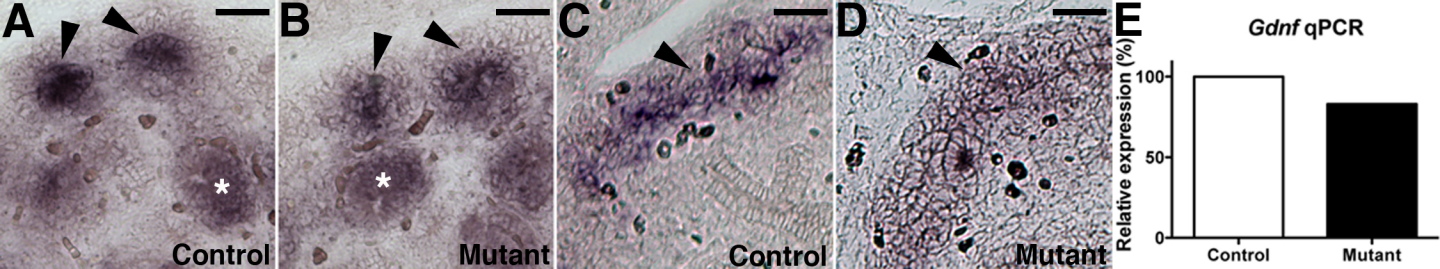
**Supplemental Figure 4: Expression of *Sprouty1* and *Gdnf* in E13.5 *Fgfr1*$^{Mes-/-}$/*Fgfr2*$^{LR/LR}$ (mutant) and control kidneys**

A,B. In situ hybridization showing equivalent *Sprouty1* staining in controls (A) and mutants (B), predominantly in ureteric tips (arrowheads) and in differentiating nephrons (asterisks). C,D. In situ hybridization showing similar *Gdnf* expression in controls (C) and mutants (D) in outer nephrogenic zone (arrowheads). E. Graph showing that the relative expression levels of *Gdnf* are similar between controls and mutants by qPCR (p=0.39). Scale Bars (A-D) = 50 μm.


A
Control
B
Mutant
C
Control
D
Mutant


A
WD
S
Control
B
WD
S
Mutant


A
B
pelvis
Control
Mutant


A
Control
B
Mutant
C
Control
D
Mutant
E
Gdnf qPCR
Relative expression (%)
100
50
0
Control
Mutant

**Supplemental Movies:**

**Supplemental Movie 1: 3D reconstruction through kidneys and lower urinary tract in an E13.5 *Fgfr1*$^{Mes-/-}$*Fgfr2*$^{LR/LR}$ embryo.**

Left kidney capsule = gray. Left ureteric tree = purple. Left ureter = light blue. Right kidney capsule = blue-green. Right upper pole ureteric tree = red. Right upper pole ureter = blue. Right lower pole ureteric tree = purple. Right lower pole ureter = green. Ductus deferens = gray. Urogenital sinus = orange.

**Supplemental Movie 2: Skeletonization of the ureteric tree (green) in an E13.5 control embryo.**

**Supplemental Movie 3: Skeletonization of the ureteric tree (green) in an E13.5 *Fgfr1*$^{Mes-/-}$*Fgfr2*$^{LR/LR}$ embryo.**