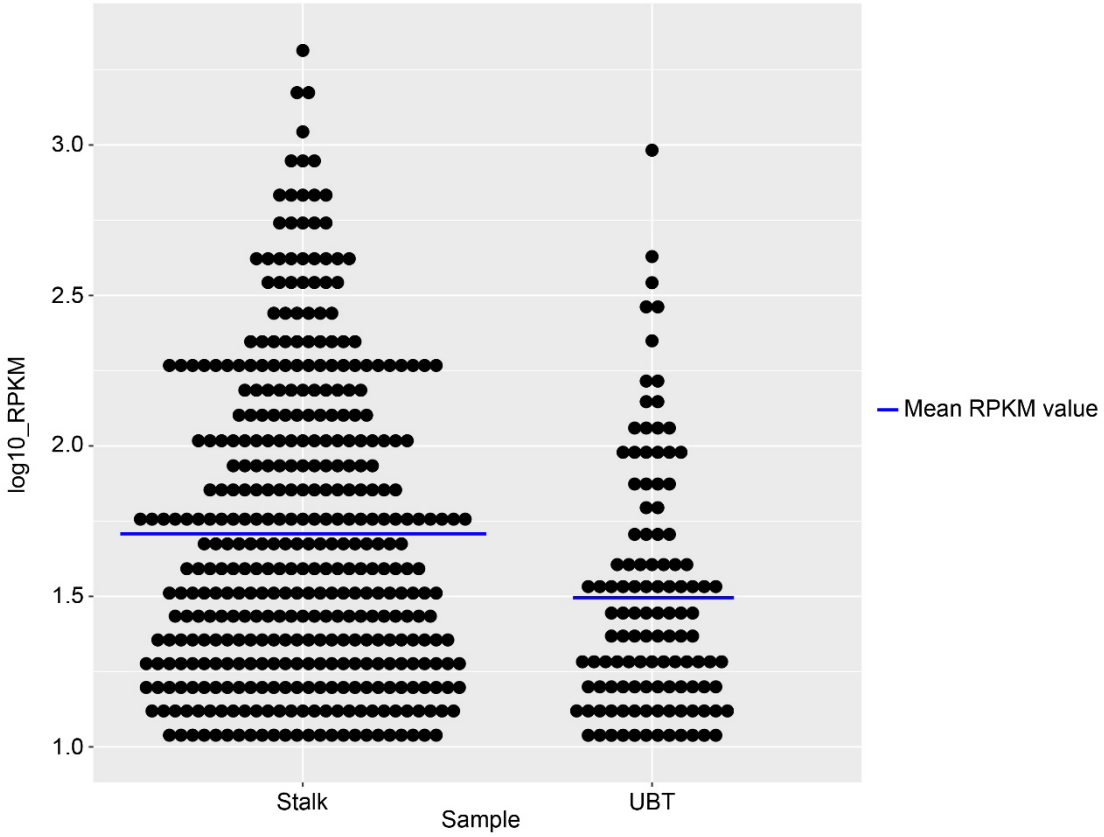

Fig. S1: Dot plot of the RPKM values for the UBT- and stalk-enriched genes.

Table S1: UBT-enriched genes identified by RNA sequencing of FACS-enriched cell populations analyzed by *in situ* hybridization

Gene	FC	RPKM	Gene	FC	RPKM	Gene	FC	RPKM
Wnt11	55.57	426.25	Mfsd2a	9.43	13.97	Rps3	6.18	14.05
Stra6	49.12	31.91	Hs3st3b1	9.40	108.65	Psmc3ip	6.15	11.73
4931406C07Rik	48.64	38.95	F930015N05Rik	9.38	20.89	Serpine2	6.13	27.06
Adamts18	47.47	15.25	Gm14133	9.36	11.53	Rhoj	6.13	13.53
Etv4	33.10	130.48	Ror2	9.31	15.10	Stmn1	6.12	10.17
Etv5	32.74	115.23	Chadl	8.66	25.18	Fn1	6.09	40.22
Hs3st3a1	32.44	39.18	Epha4	8.64	14.55	4930503L19Rik	6.00	16.47
Crlf1	31.87	168.84	Kdm2b	8.57	100.50	Cdca7l	5.99	57.90
Crispld2	30.24	20.32	Arnt2	8.52	31.66	Drd4	5.99	10.45
Sox8	29.46	11.21	Ak1	8.09	10.94	Cpxm1	5.95	11.95
Fbln2	25.07	34.82	Nkain1	8.04	20.31	Tmpo	5.90	13.77
Ret	24.89	122.26	Rprm	7.98	348.98	Ros1	5.82	23.84
Wif1	22.10	11.02	Ccnd1	7.85	91.55	Acot7	5.81	31.50
Slc27a6	20.88	42.39	Asb4	7.83	25.76	2810417H13Rik	5.77	69.79
Kcnn4	20.09	22.93	Tcf7	7.63	17.64	Fbln1	5.73	30.14
Cxcl14	18.88	55.33	Ung	7.62	21.50	Spred1	5.69	29.50
Cpa2	18.39	19.00	Capn6	7.56	151.22	Vldlr	5.67	32.27
Tmem59l	18.13	21.58	Dctd	7.55	36.98	Gpc3	5.66	223.69
Rbp1	18.09	47.76	Nsg1	7.38	10.76	Ncapg	5.61	17.88
Lcn2	17.50	77.24	Socs2	7.09	13.84	Lhx1	5.59	18.45
Nkd1	16.00	10.82	Pcbp4	7.00	88.78	Nasp	5.55	70.02
Moxd1	15.98	43.02	Abcc4	6.99	12.27	Leprel2	5.52	12.08
Gulo	13.33	12.43	Gpc6	6.91	19.05	Igfbp4	5.44	80.15
Ppp1r1b	13.30	27.89	Axin2	6.90	17.26	Spred2	5.41	32.74
Slco4c1	13.17	67.26	Mest	6.78	285.68	Panx1	5.39	14.90
Metrn	13.13	32.57	Cadm1	6.75	43.26	Cdca7	5.34	31.54
Col9a3	12.80	29.29	Fbn2	6.71	28.27	Nrtn	5.30	48.96
H2-Ab1	12.37	13.37	Calb1	6.64	294.45	Khdrbs3	5.28	19.71
Rps14	11.97	32.43	Eef1a1	6.58	102.41	Gm12397	5.24	90.74
Ctnnd2	11.65	16.37	Frem2	6.47	97.42	Bub1	5.24	19.81
Mycn	11.07	16.09	Sfrp2	6.41	12.88	Gfra1	5.18	160.10
Mdk	10.96	961.80	Tenm3	6.39	15.35	Dok6	5.16	10.01
Spry4	10.56	12.86	Pkdcc	6.38	46.79	Dtl	5.13	23.69
Trib2	10.22	12.16	Psrc1	6.30	15.76	Ttk	5.12	11.70
B4galnt4	10.21	18.17	S100a16	6.28	37.68	Pbk	5.10	33.24
Kank4	10.17	19.75	Uhrf1	6.27	21.78	D17H6S56E-5	5.10	25.40
Sema6a	10.02	14.66	Pgm2l1	6.25	15.22	Cachd1	5.10	19.93
Vstm5	9.87	14.36	Fxyd6	6.23	14.38	Cib2	5.08	30.02
Nnat	9.49	107.79	Gja1	6.20	31.48			

FC = fold change, RPKM = reads per kilobases per million

Table S2

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Table S3: Comparative analysis of mouse UBT expression with LBTs and SGTs

UBT, LBT, and SBT	UBT and LBT	UBT and SBT Tip	UBT Only
Abcc4	Cachd1	2810417H13Rik	Axin2
Acot7[ł]	Ctnnd2	Crispld2	4931406C07Rik*°
Adamts18[ł]	Dtl	Etv4	Calb1
Ak1*	Epha4	Fbln2	Capn6
Arnt2	Fbn2*	Hs3st3b1*	Chadl*°
B4galnt4	Frem2	Kcnn4	Cib2
Cadm1*	Gm12397*°	Khdrbs3*	Cxcl14
Ccnd1	Kdm2b*°	Metrn	Dok6°
Cdca7	Mfsd2a*°	Moxd1*	Fxyd6
Cdca7l	Mycn	Panx1	Gfra1
Col9a3	Nkain1*°	Ppp1r1b[ł]	Kank4*°
Crlf1	Ret*°	Rbp1	Lcn2
D17H6S56E-5	Stmn1	Slco4c1[ł]	Lhx1
Dctd		Socs2*	Mest
Etv5		Spred1*	Nnat
Gja1[ł]		Spred2	Pgm2l1
Hs3st3a1°		Ttk	Pkdcc*
Mdk[ł]		Vldlr	Ros1
Nasp		Vstm5*°	Rprm
Pbk		Wif1°	Sfrp2
Pcbp4			Slc27a6
Sema6a			Sox8
Tmem59l*			Stra6
Tmpo[ł]			Tcf7
Uhrf1			Wnt11
Ung			

* Not confirmed by Eurexpress

° Not confirmed by SGMAP

[ł] Confirmed by Eurexpress, ratio less than 1.15 on SGMAP

Table S4: UBT-enriched genes associated with aspects of kidney branching morphogenesis

Signaling Pathways			Cellular Processes/Components		
Receptor tyrosine kinase	Wnt	Retinoic acid	Cell cycle/proliferation	Extracellular matrix-related	Calcium-related
Dok6	Axin2	Lhx1	Ccnd1	Adamts18	Calb1
Etv4	Ccnd1	Mdk	Cdca7	Cadm1	Capn6
Etv5	Ctnnd2	Mycn	Cdca7l	Col9a3	Cib2
Gfra1	Kdm2b	Rbp1	Mdk	Fbln2	Fbln2
Ret	Mycn	Stra6	Mycn	Fbn2	Fbn2
Sox8	Sfrp2		Nasp	Frem2	Frem2
Spred1	Tcf7		Rprm	Hs3st3a1	Kcnn4
Spred2	Wif1		Ttk	Hs3st3b1	Nnat
	Wnt11		Uhrf1	Pkdcc	Panx1

Table S5: UBT-enriched genes implicated in kidney development

Gene	Name	Research/Patient Studies	Reference
Arnt2	Aryl hydrocarbon receptor nuclear translocator 2	Patients with deleted Arnt2 have developmental renal abnormalities, including dilated collecting ducts, renal reflux, and poor corticomedullary differentiation.	Webb *et al*., 2013
Crispld2	Cysteine-rich secretory protein LCCL domain containing 2	Heterozygote mice show a 20% reduction in branching morphogenesis compared to wild type littermates. Suggested to be activated by retinoic acid to promote branching morphogenesis	Quinlan *et al*., 2007
Crlf1	Cytokine receptor-like factor 1	Induces epithelial conversion in isolated metanephric mesenchyme when complexed with CLC in rats.	Schmidt-Ott *et al*., 2005
Epha4	Eph receptor A4	Epha4-/- mice develop hydronephrosis. Epha4-/-;Epha7-/- mice show distal ureter malformations.	Sallstrom *et al*.,2013; Weiss *et al*., 2014
Etv4/5	Ets variant 4/5	Etv4-/-;Etv5+/- mice show renal agenesis or hypoplasia due to branching defects.	Lu *et al*., 2009
Gfra1	Glial cell line derived neurotrophic factor family receptor alpha 1	Gfra1-/- mice show kidney agenesis. This is was also observed when Gfra1 was deleted specifically within the ureteric epithelium.	Enomoto *et al*., 1998; Keefe *et al*., 2013
Mdk	Midkine	Mdk neutralizing antibodies inhibit nephrogenesis by 50% in rats. Suggested to suppress apoptosis, stimulate cellular proliferation of nephrogenic mesenchymal cells, and suppress UB growth. Maintains viability of isolated mesenchyme without the UB. May play a role in maintaining epithelial progenitor cell population.	Vilar *et al*., 2002; Qiu *et al*., 2004
Mycn	V-myc myelocytomatosis viral related oncogene, neuroblastoma derived	Duplications of Mycn have been linked to Wilm's Tumor.	Williams *et al*., 2015
Ret	Ret proto-oncogene	Ret-/- mice display renal agenesis or severe dysgenesis. RET mutations are associated with CAKUT patients.	Schuchardt *et al*., 1994; Skinner *et al*., 2008
Ros1	Ros1 proto-oncogene	Antisense knockdown of Ros1 resulted in blunting of the UB tips in mice.	Liu *et al*., 1996
Sfrp2	Secreted frizzled-related protein 2	Competes with Sfrp1 to modulate Wnt signaling. Suggested to stimulate tubule formation by promoting Wnt4.	Yoshino *et al*., 2001
Wnt11	Wingless-type MMTV integration site family, member 11	Wnt11-/- mice have hypoplastic kidneys and is suggested that Wnt11 is part of a positive autoregulatory feedback loop with Ret/Gdnf to maintain branching morphogenesis.	Majumdar *et al*., 2003