CCF Workshop Kidney (BUKMAP)

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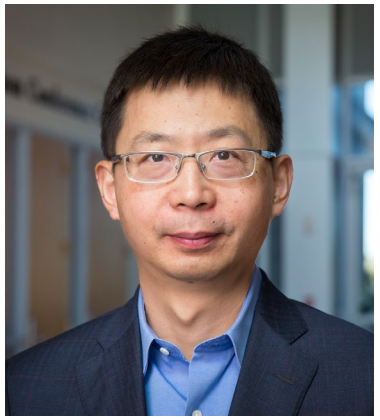
HuBMAP U54 KULMAP Team –Thank You



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Contact PI

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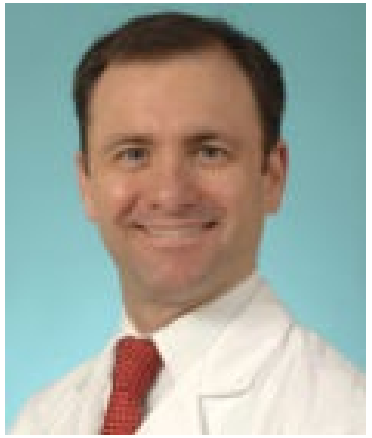
James Hagood@UNC,
LAPMAP; Co-PI

Xin Sun @UCSD,
LAPMAP; Co-PI

Blue Lake @UCSD
Co-I



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Peter Kharchenko @ HMS
Data Core, Co-PI

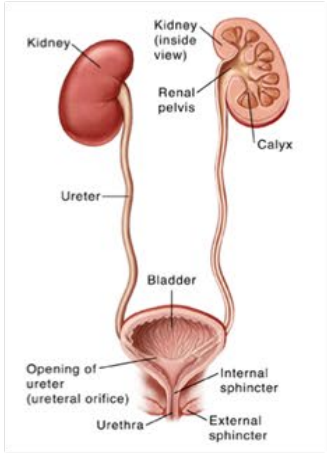
Project overview

Hagood/Sun @UCSD

LAPMAP

Jain@WashU

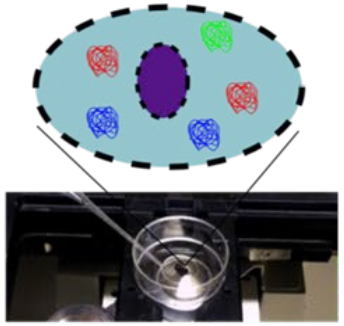
BUKMAP



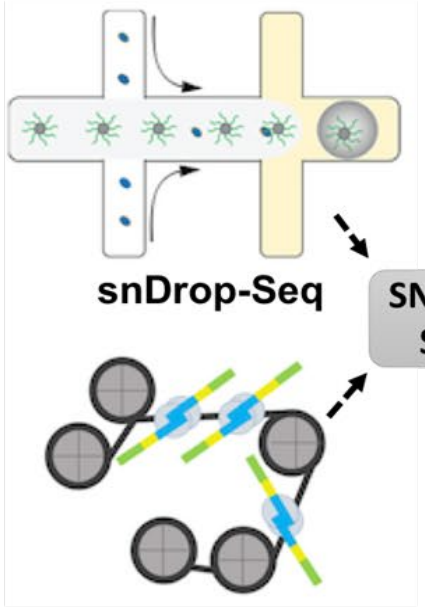
Tissue blocks

Nuclei

Zhang@UCSD



DART-FISH

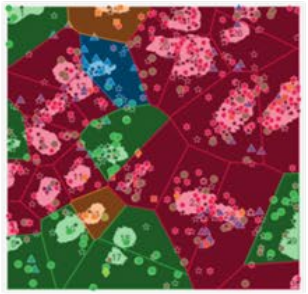


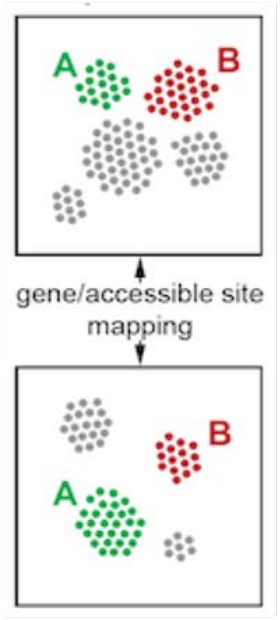
snDrop-Seq

SNARE-Seq

scTHS-Seq

Kharchenko@HMS





Atlases

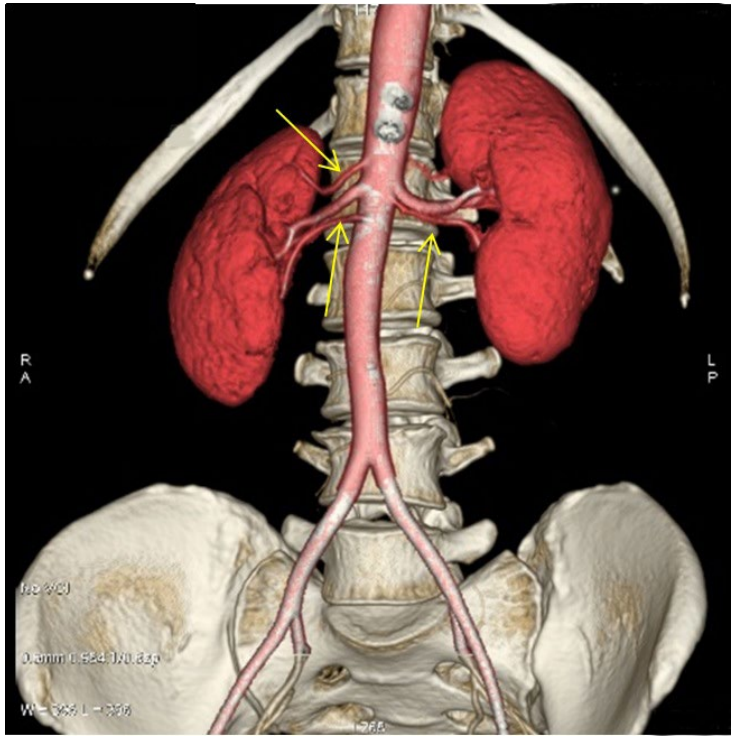
Organ spatial maps

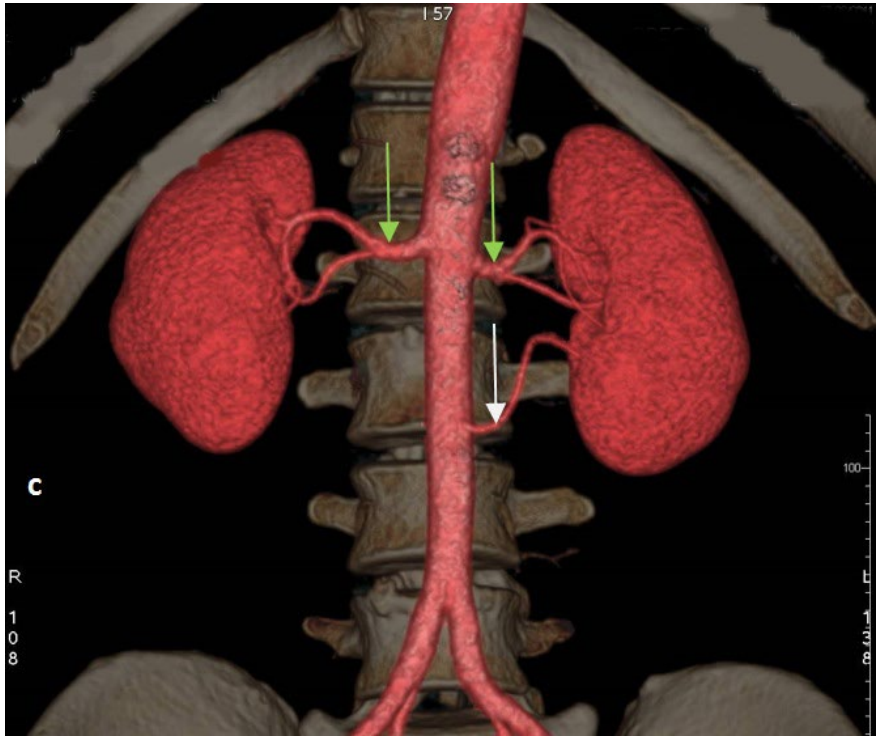
- All cell types;
- Spatial distribution;
- Reference transcriptome;
- Reference chromatin accessibility map;
- Selected proteins

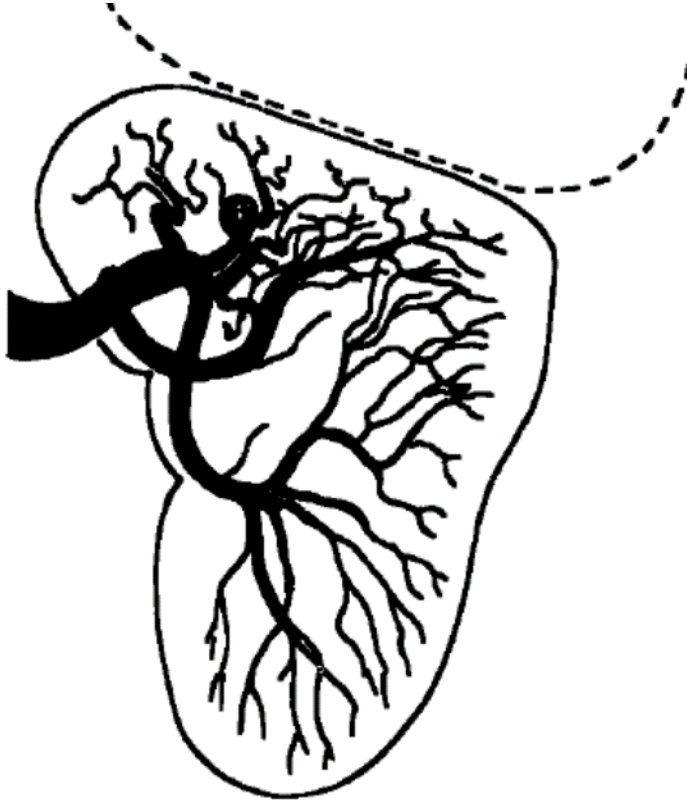
Overview

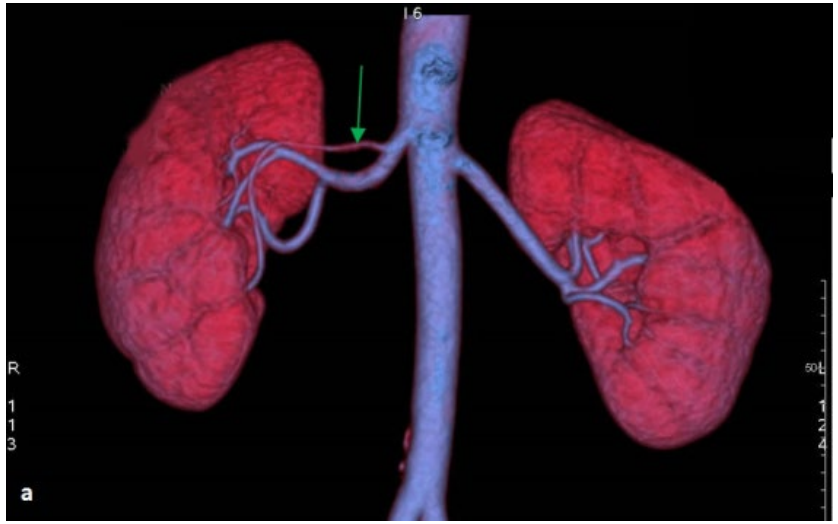
- Challenges in using common coordinates in kidney
- Approach to minimize challenges
- Glimpse of the workflow for BUKMAP

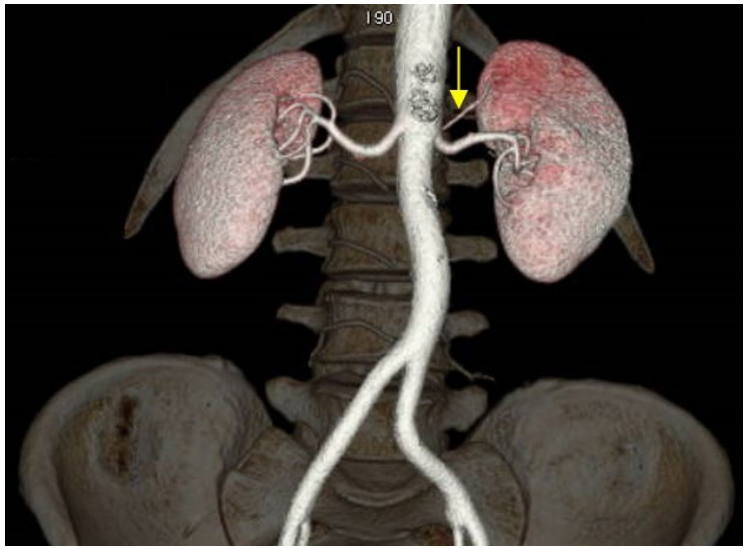
Variations in Kidney Vasculature:Intrinsic and Extrinsic Factors







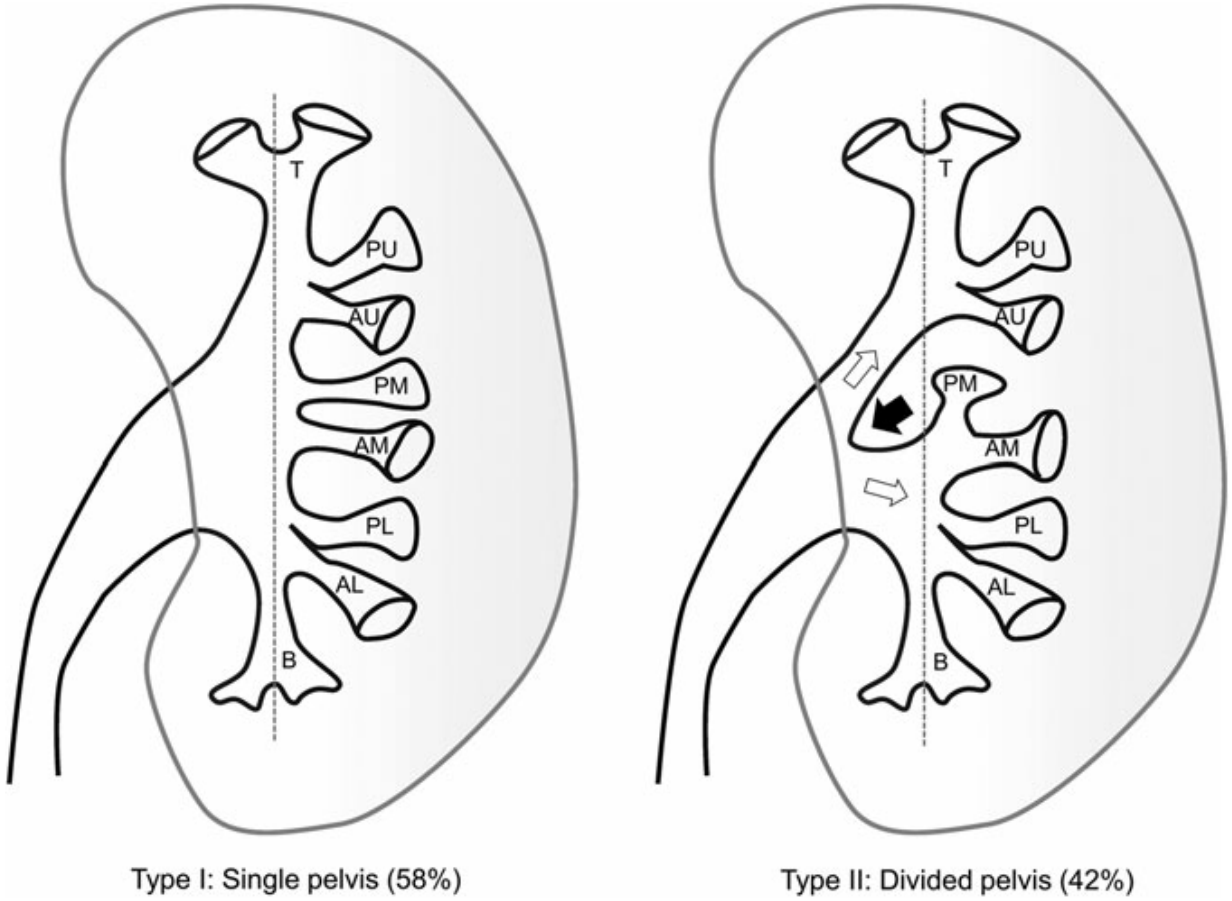




J. Frimann-Dahl (1961) Normal Variations of the Left Kidney, Acta Radiologica, 55:3, 207-216, DOI: 10.3109/00016926109174541

Munnusamy et al, Variations in Branching Pattern of Renal Artery in Kidney Donors Using CT Angiography, 2016, J. Clin Diag Res

Variations in Kidney Pelvicaliceal System:Intrinsic and Extrinsic Factors



Type I: Single pelvis (58%)

Type II: Divided pelvis (42%)

Proposal for a Simple Anatomical Classification of the Pelvicaliceal System for Endoscopic Surgery
Ryoji Takazawa, MD, PhD, Sachi Kitayama, MD, Yusuke Uchida, MD, Satoshi Yoshida, MD,Yusuke Kohno, MD, and Toshihiko Tsujii, MD, PhD, J of Endourology, 2018

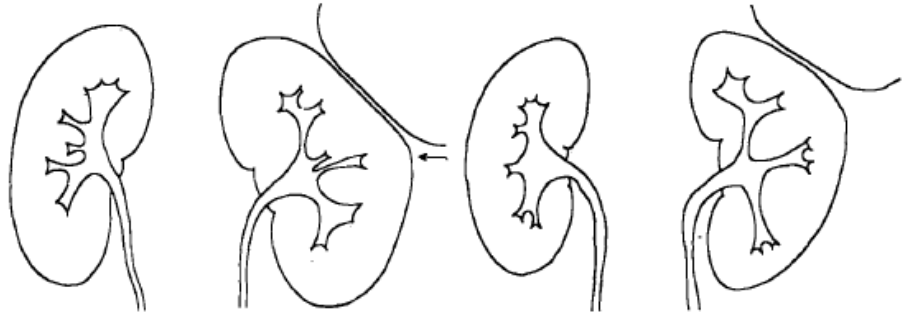


Fig. 8. Diagrammatic representations of typical normal variations of the calyces of the middle lobe of the left kidney.

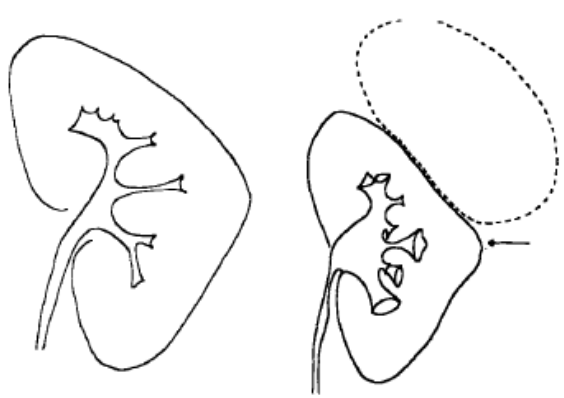


Fig. 9. Drawings showing influence of the spleen upon the renal pelvis.

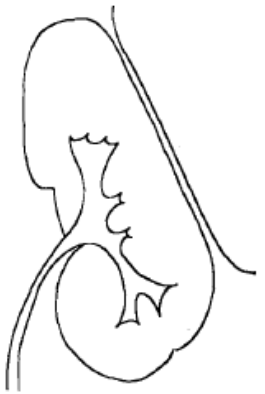


Fig. 10. Normal variation of the upper, middle and lower lobe calyces.

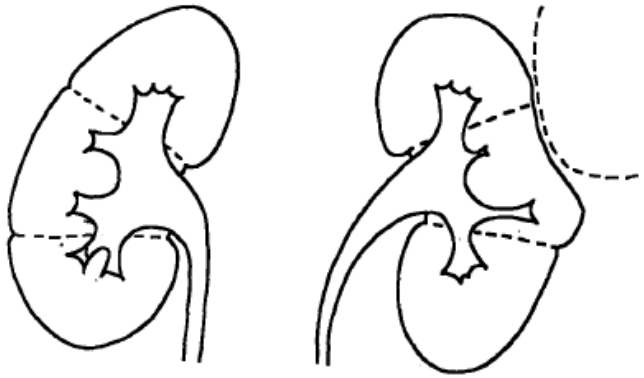
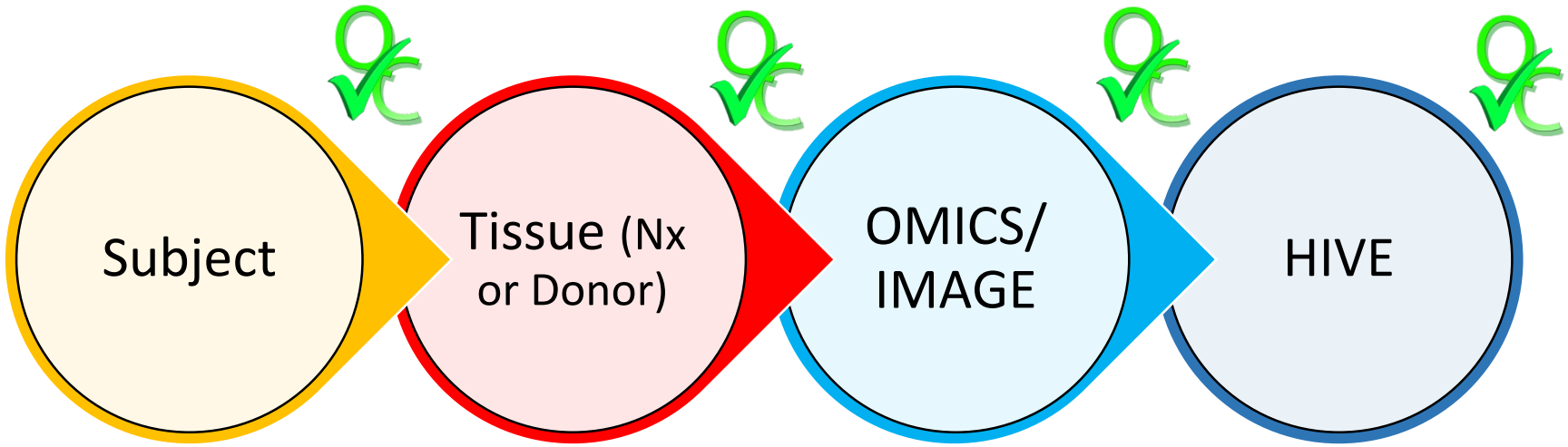


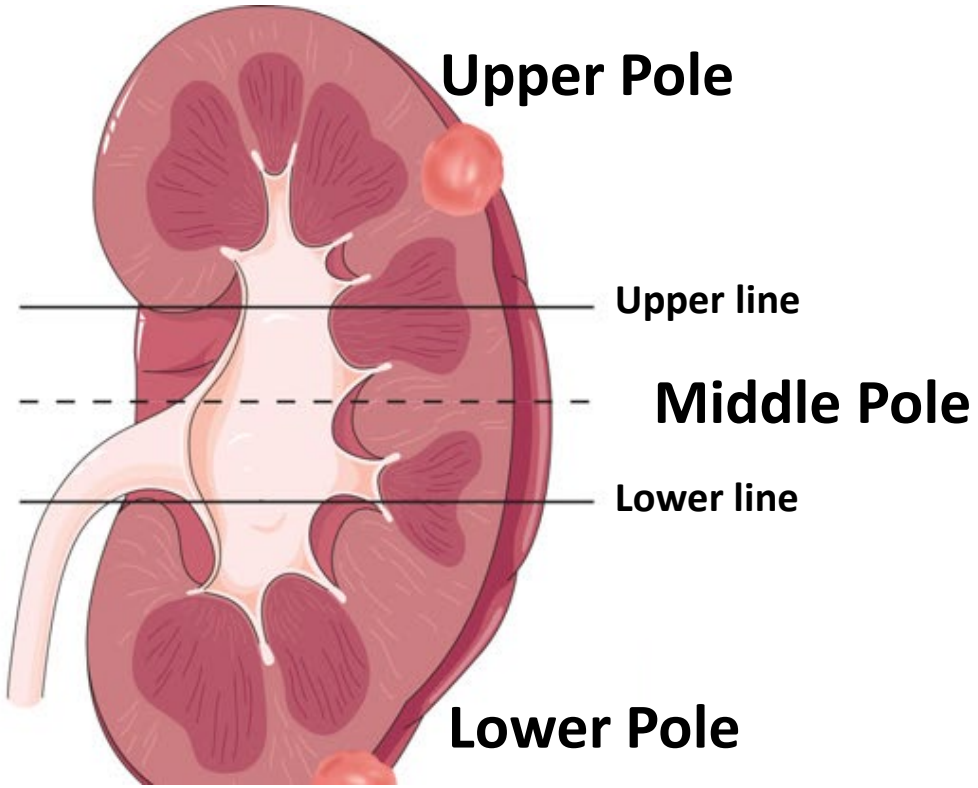
Fig. 11. Schematic drawing showing bulging of lateral contour of a lobulated left kidney.

Quality Control and Standardization = effective CCF

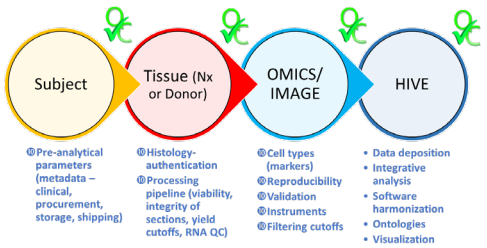


- ⑩ Pre-analytical parameters (metadata – clinical, procurement, storage, shipping)
- ⑩ Histology-authentication
- ⑩ Processing pipeline (viability, integrity of sections, yield cutoffs, RNA QC)
- ⑩ Cell types (markers)
- ⑩ Reproducibility
- ⑩ Validation
- ⑩ Instruments
- ⑩ Filtering cutoffs
- Data deposition
- Integrative analysis
- Software harmonization
- Ontologies
- Visualization

Gross Registration Using polar lines

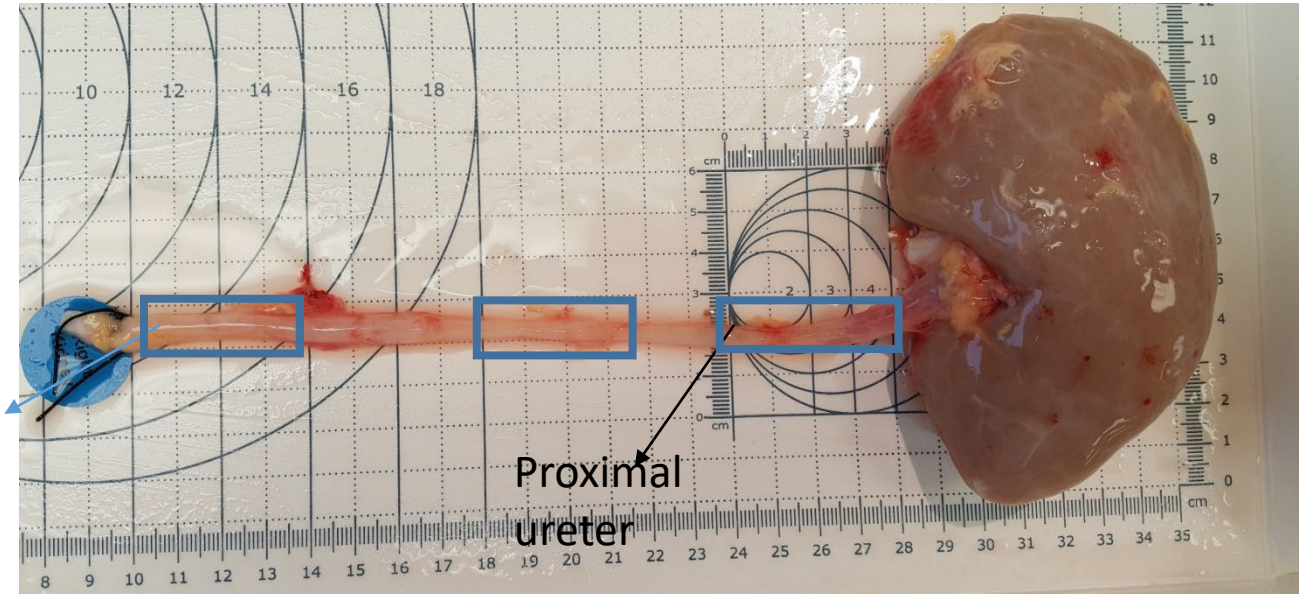


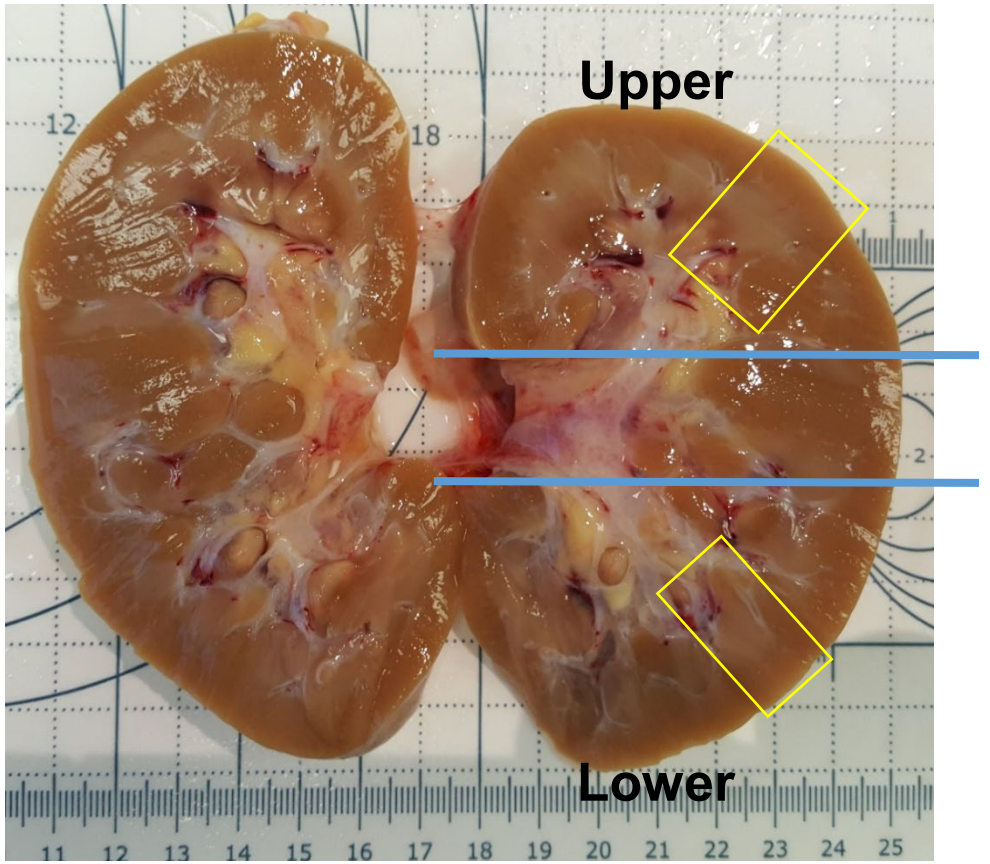
The R.E.N.A.L. Nephrometry Score: A Comprehensive Standardized System for Quantitating Renal Tumor Size, Location and Depth
Alexander Kutikov and Robert G. Uzzo*, J. of Urology 2009



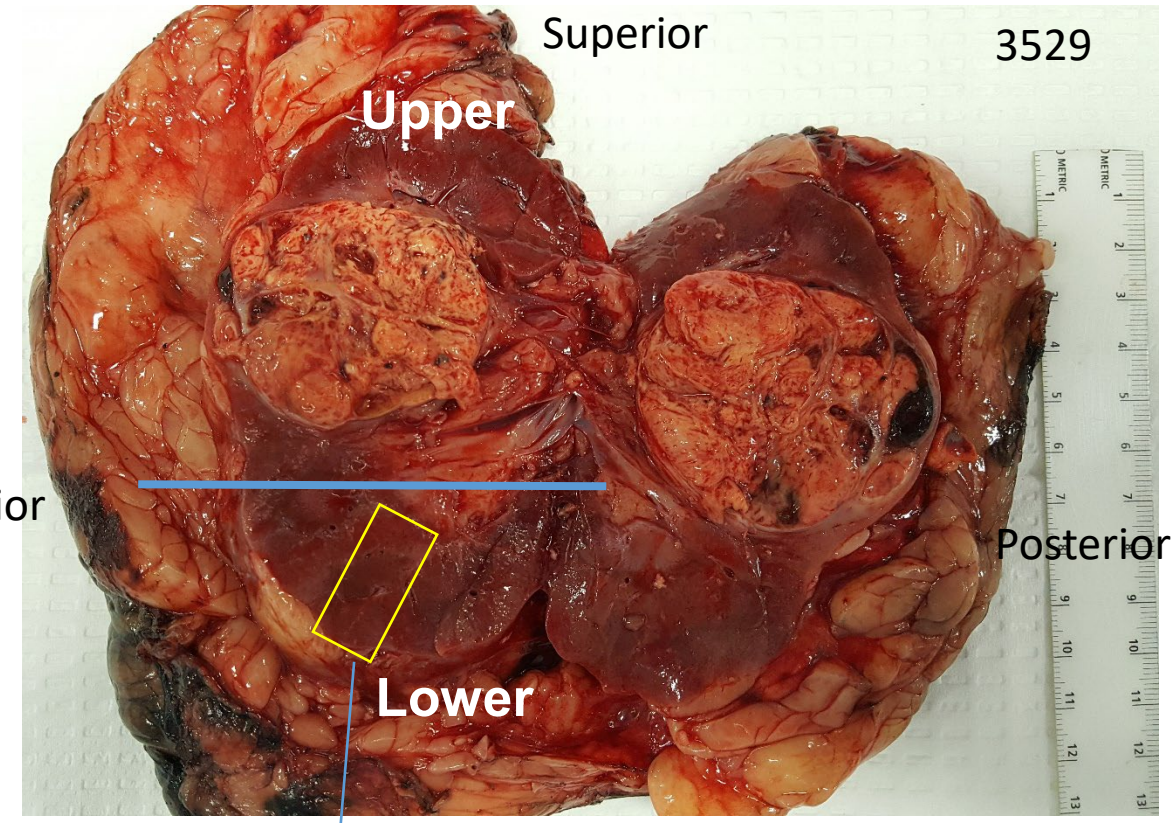
EXAMPLE

3505





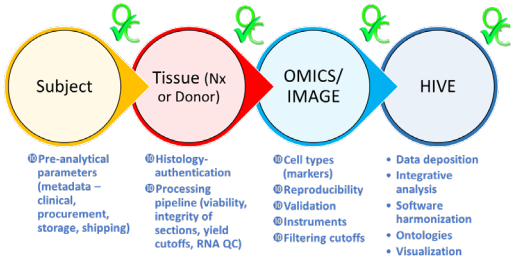
EXAMPLE

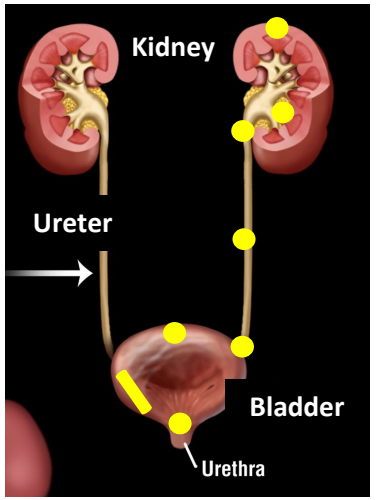


C-M1 3.8cm from the posterior

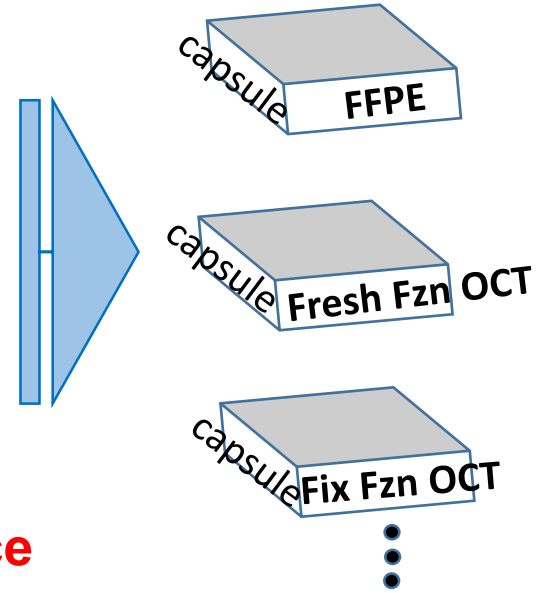
Depth 4.5cm.

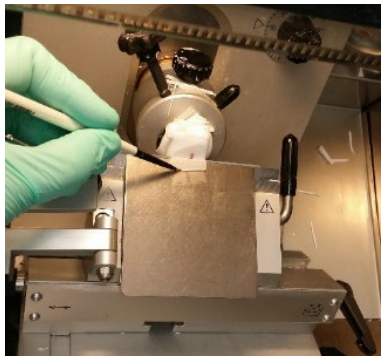
Workflow

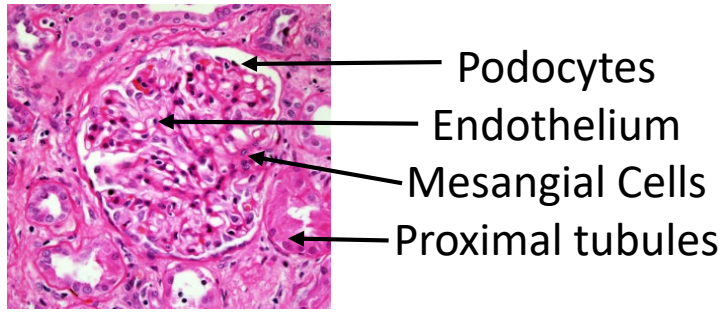




Gross reference







Histological reference

Chromatin accessibility (scTHS-Seq)

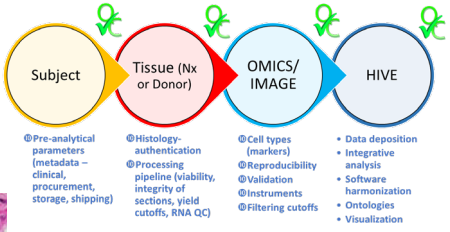
Single nucleus RNA seq (SPLIT-Seq)

3D RNA spatial mapping (DART-FISH)

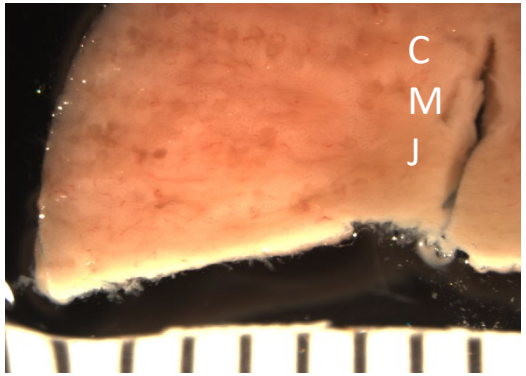
Cell type/state reference

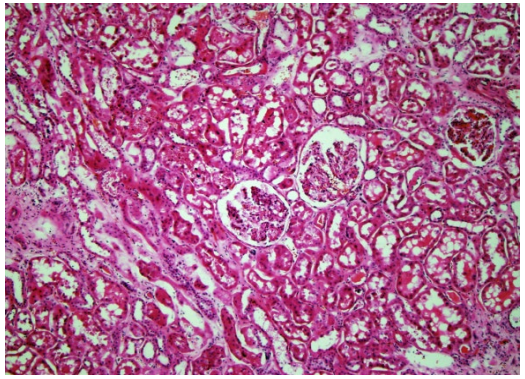
Structure/region reference

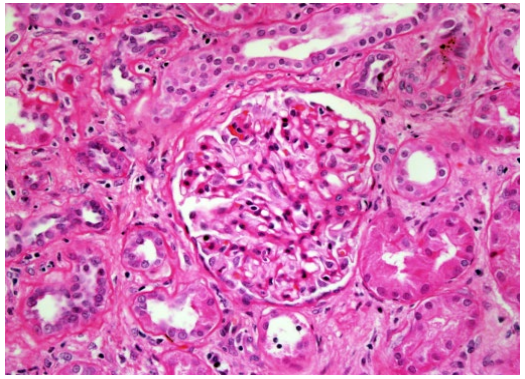
Structure - microscopic



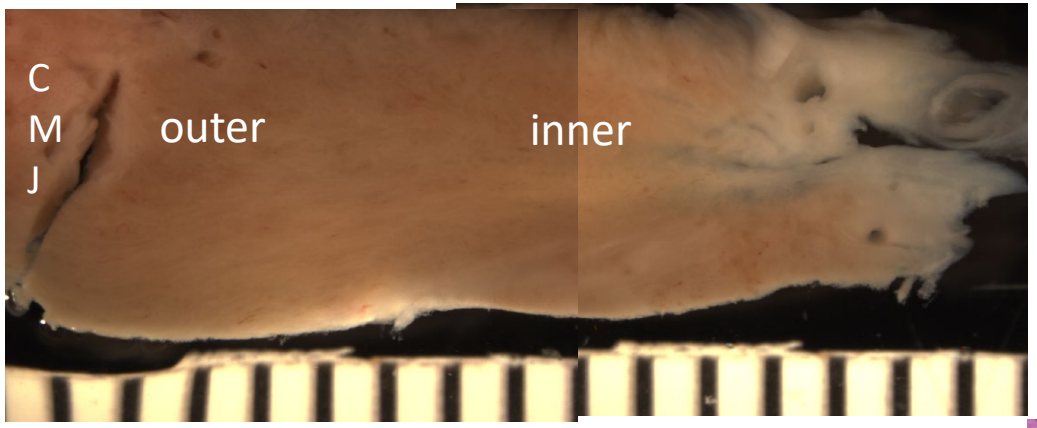
Cortex

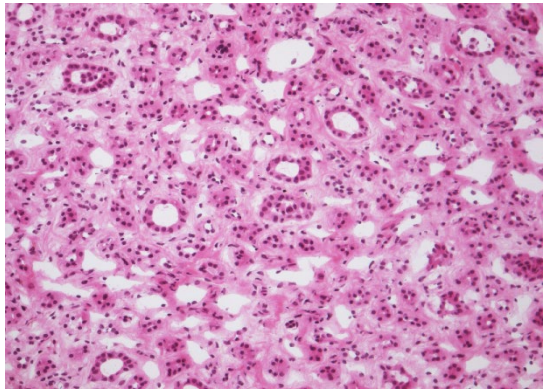




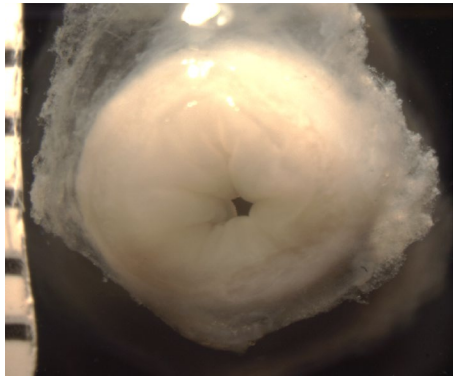


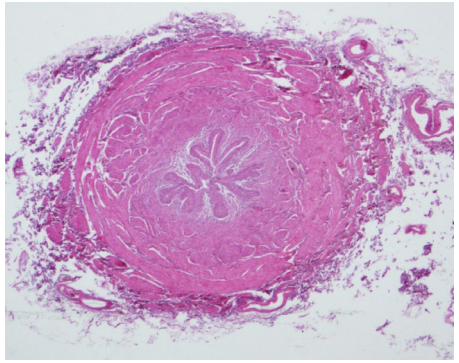
Medulla

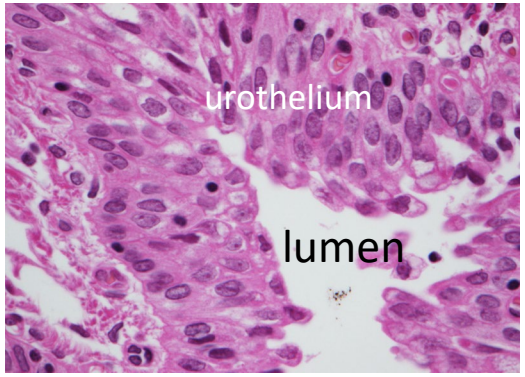




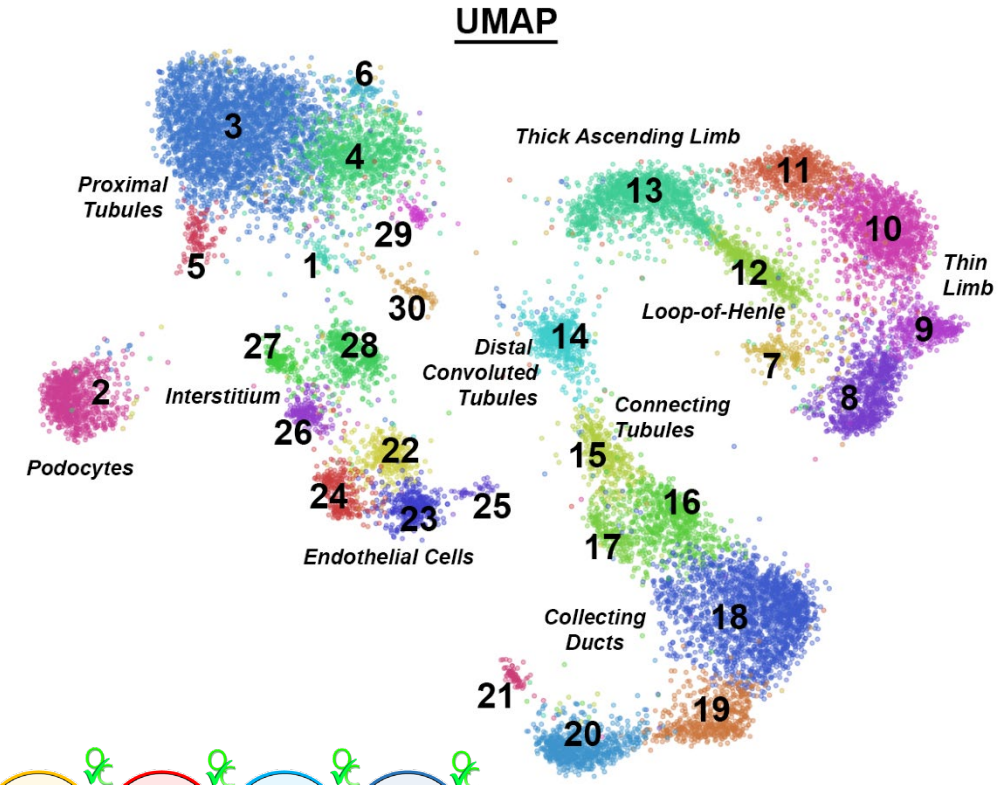
Ureter

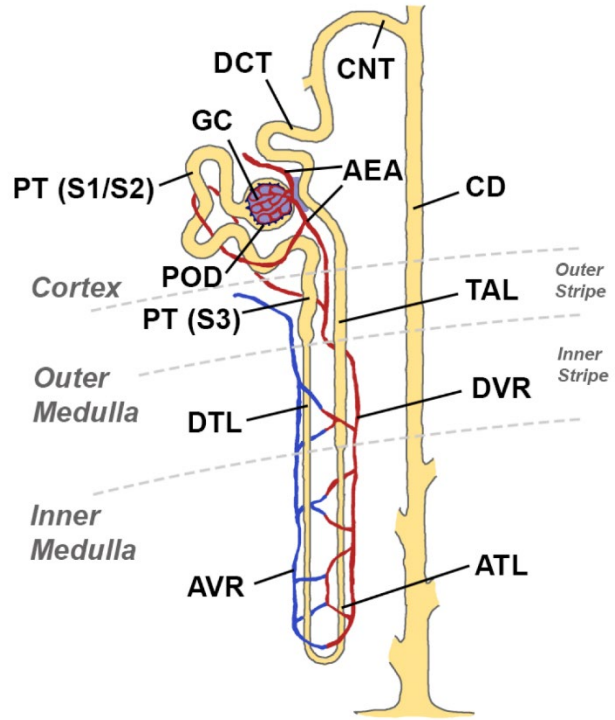






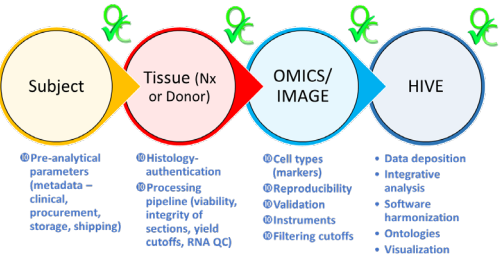
snDrop-Seq: Clustering and Initial Annotation





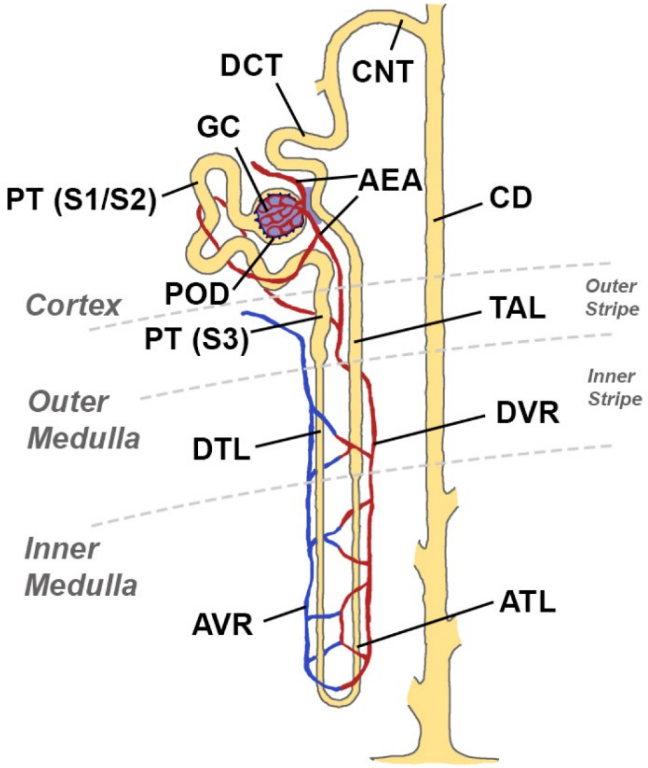
Cluster	Abbn	Annotation	# Nuc	Region Sampled (0–1)
1	EPC	Epithelial Cells	55	
2	POD	Podocytes	859	
3	PT-1	Proximal Tubule Ep. Cells (S1/S2)	3238	
4	PT-2	Proximal Tubule Ep. Cells (S2)	920	
5	PT-3	*PT Ep. Cells - Inflam. Response*	124	
6	PT-4	PT Ep. Cells - Fibrinogen+ (S3)	86	
7	PT-5	Proximal Tubule Ep. Cells (S3)	219	
8	DTL	Decending Thin Limb	844	
9	ATL-1	Thin Ascending Limb	431	
10	ATL-2	Thin Ascending Limb	1325	
11	ATL-3	Thin Ascending Limb	623	
12	TAL-1	*Thick Ascending Limb - Surgery*	536	
13	TAL-2	Thick Ascending Limb	1217	
14	DCT	Distal Convoluted Tubule	568	
15	CNT	Connecting Tubule	395	
16	PC-1	Collecting System - PCs (Cortex)	663	
17	PC-2	*Collecting System - PCs - Stressed*	208	
18	PC-3	Collecting Duct - Principal Cells	1970	
19	IC-A2	Collecting Duct - Intercalated Cells	540	
20	IC-A1	Collecting Duct - Intercalated Cells	772	
21	IC-B	Collecting Duct - Intercalated Cells	84	
22	EC-1	Endothelial Cells - Glomerular Cap.	344	
23	EC-2	Endothelial Cells - AVR	366	
24	EC-3	Endothelial Cells - AEA & DVR	281	
25	EC-4	Endothelial Cells	42	
26	MC	Mesangial Cells	215	
27	vSMC/P	Vas. Sm. Muscle Cells/Pericytes	168	
28	INT	Interstitium	410	
29	Unk	Unknown - Novel PT (S2) Ep. Cells?	68	
30	IMM	Immune Cells - Macrophages	88	

Cortex
Medulla
Both

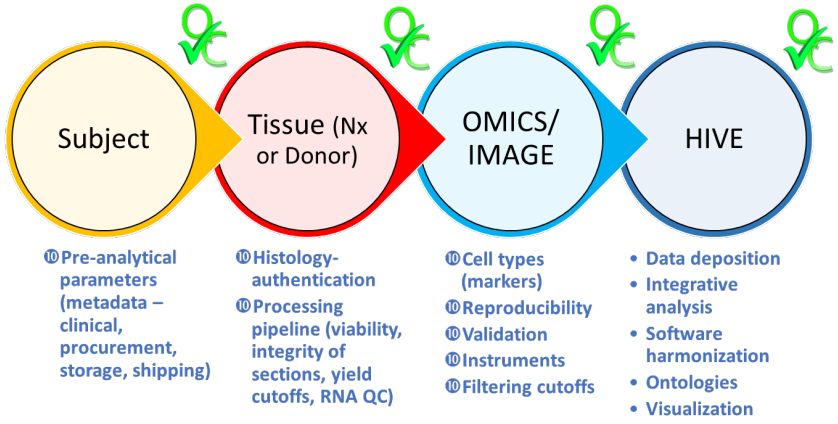


Standardize segment names, cell types, markers

Harmonize – VUMC and BUKMAP



Metadata (many levels)
Anatomical coordinates
Structures
Regions
Cell types
Markers



There has been significant progress, but some more challenges