NA-MIC - Mario Negri Institute
External Collaboration

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ISTITUTO DI RICERCHE FARMACOLOGICHE

Mario Negri Institute

Departments

Bioengineering
Cardiovascular Research
Environmental Health Sciences
Epidemiology
Molecular Biochemistry and Pharmacology
Molecular Medicine
Neuroscience
Oncology
Public Health
Renal Medicine

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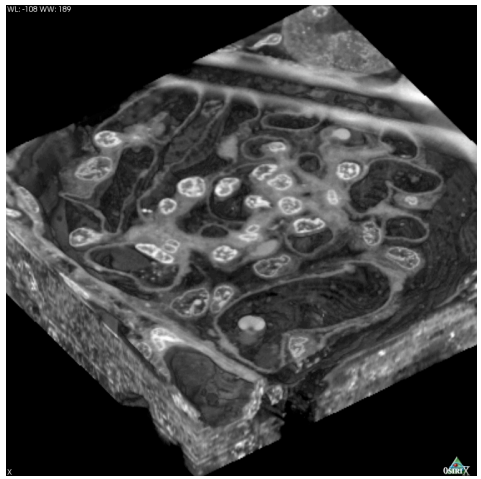
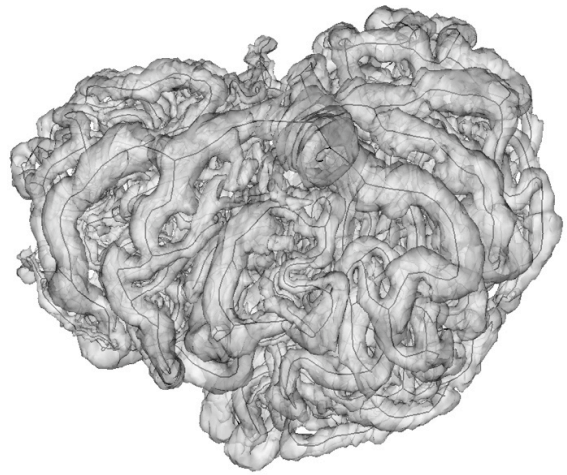
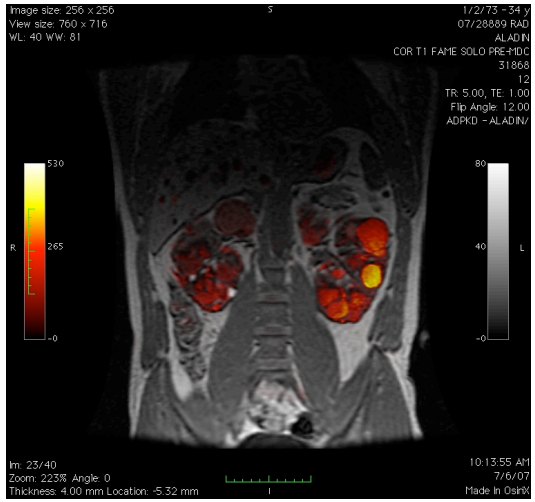
Medical Imaging Unit (Bioengineering Department)

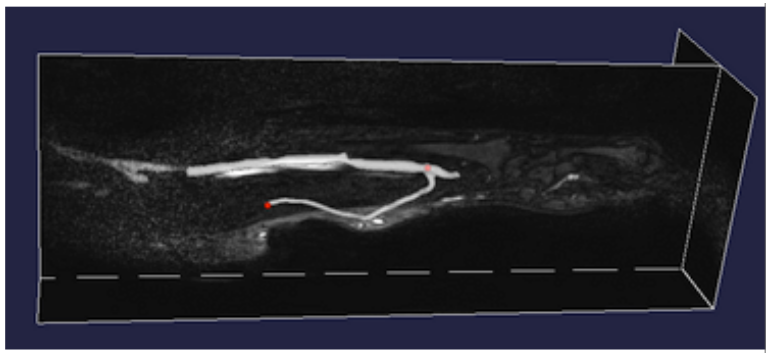
Imaging and quantification of kidney physiopathology

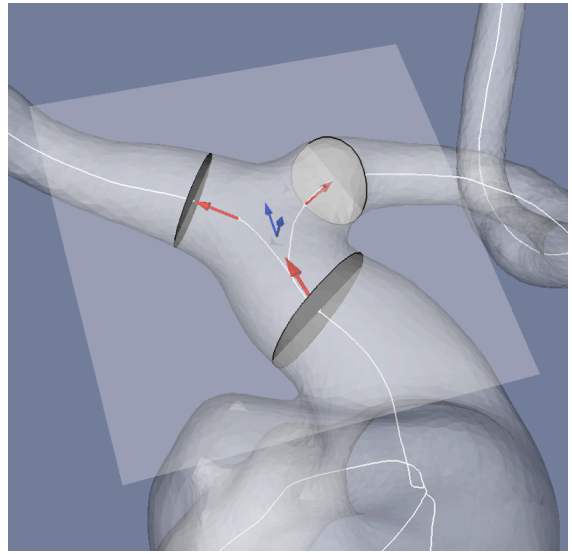


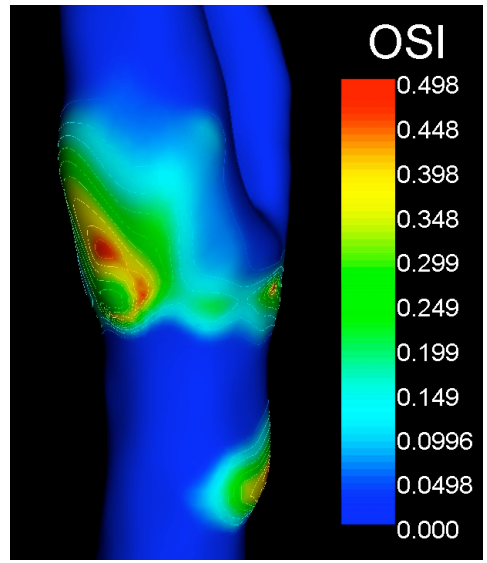




Hemodynamics and vascular disease







Hemodynamics involved in several vascular pathological processes

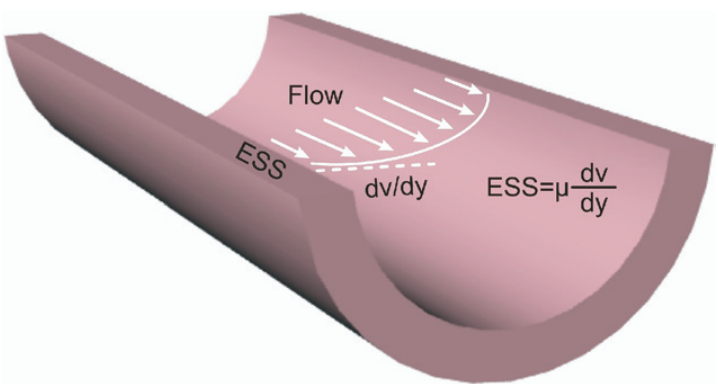
atherosclerosis

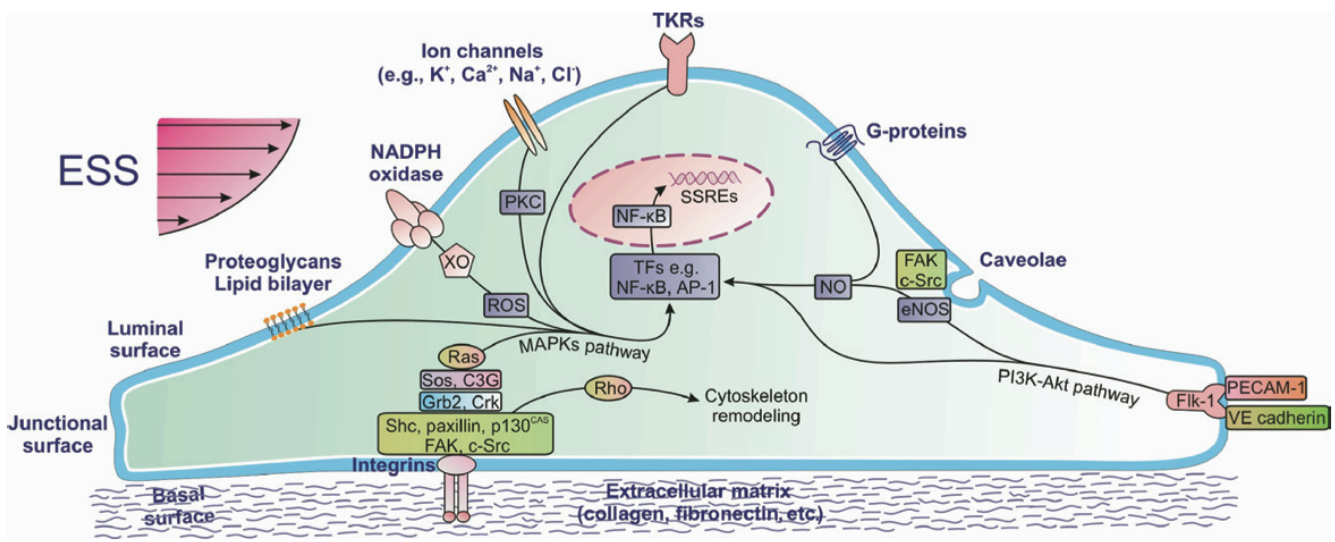
cerebral aneurysms

extra-cerebral aneurysms (AAA, ...)

intimal hyperplasia (grafts, bypasses, vascular access for HD, ...)

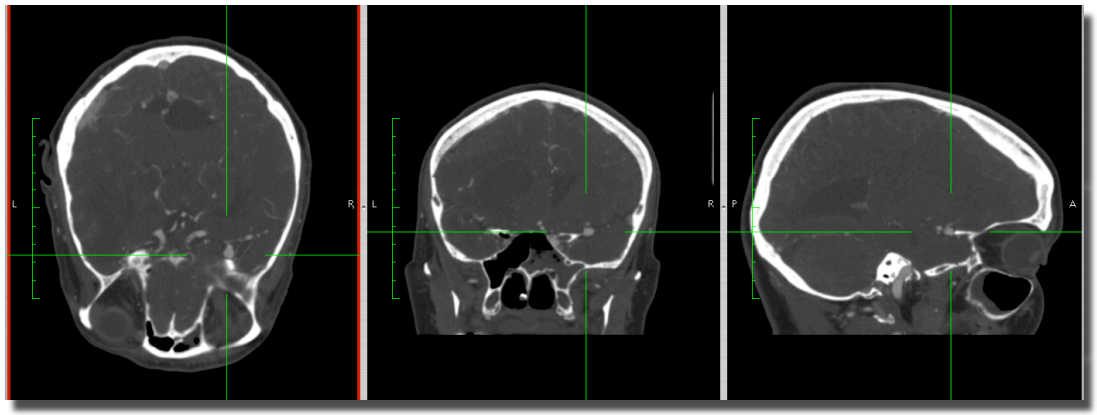
through the action of pressure, wall shear stress...

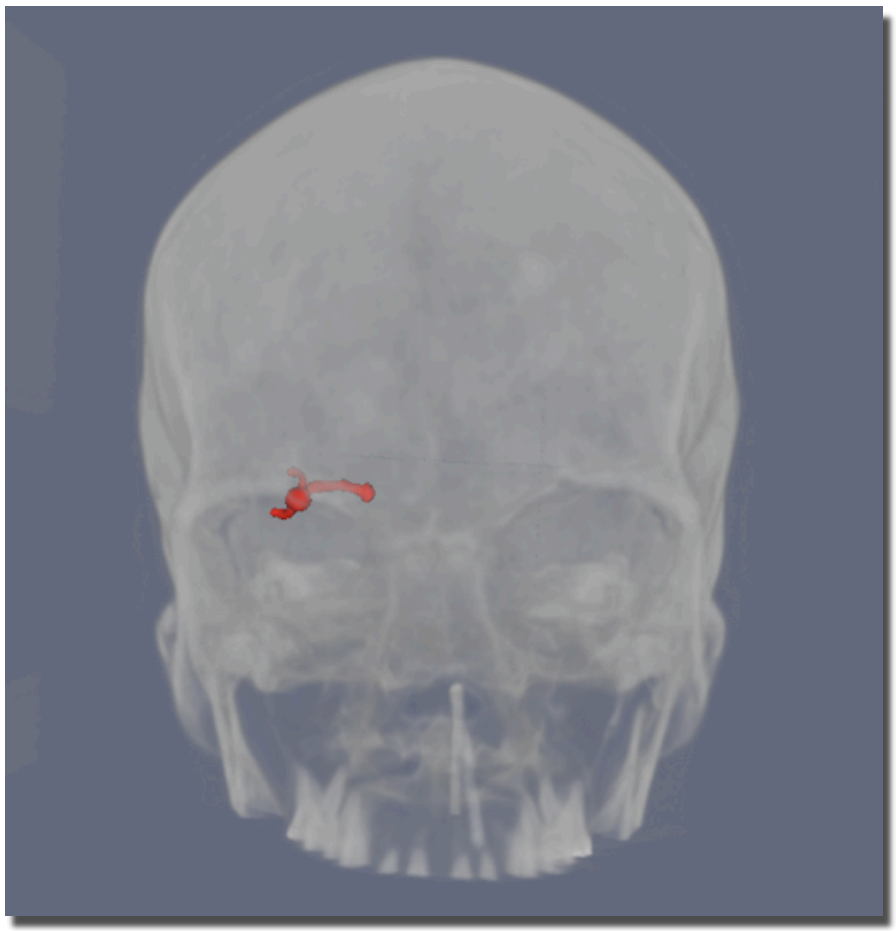




Chatzizisis et al, J Am Coll Card (2007)

Image-based computational hemodynamics





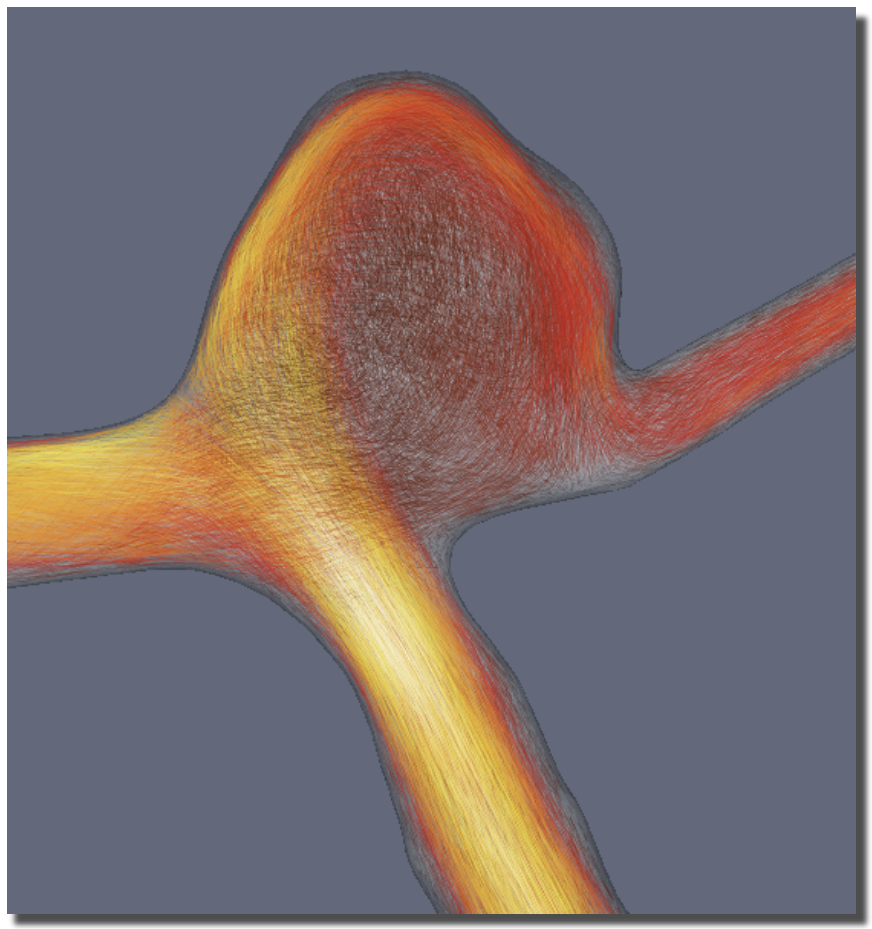


Image-based computational hemodynamics

Important to get the geometry right.

Streamlined tools needed for the generation of unstructured grids from images, for the numerical approximation of Navier-Stokes equations (using finite elements, finite volumes, ...).

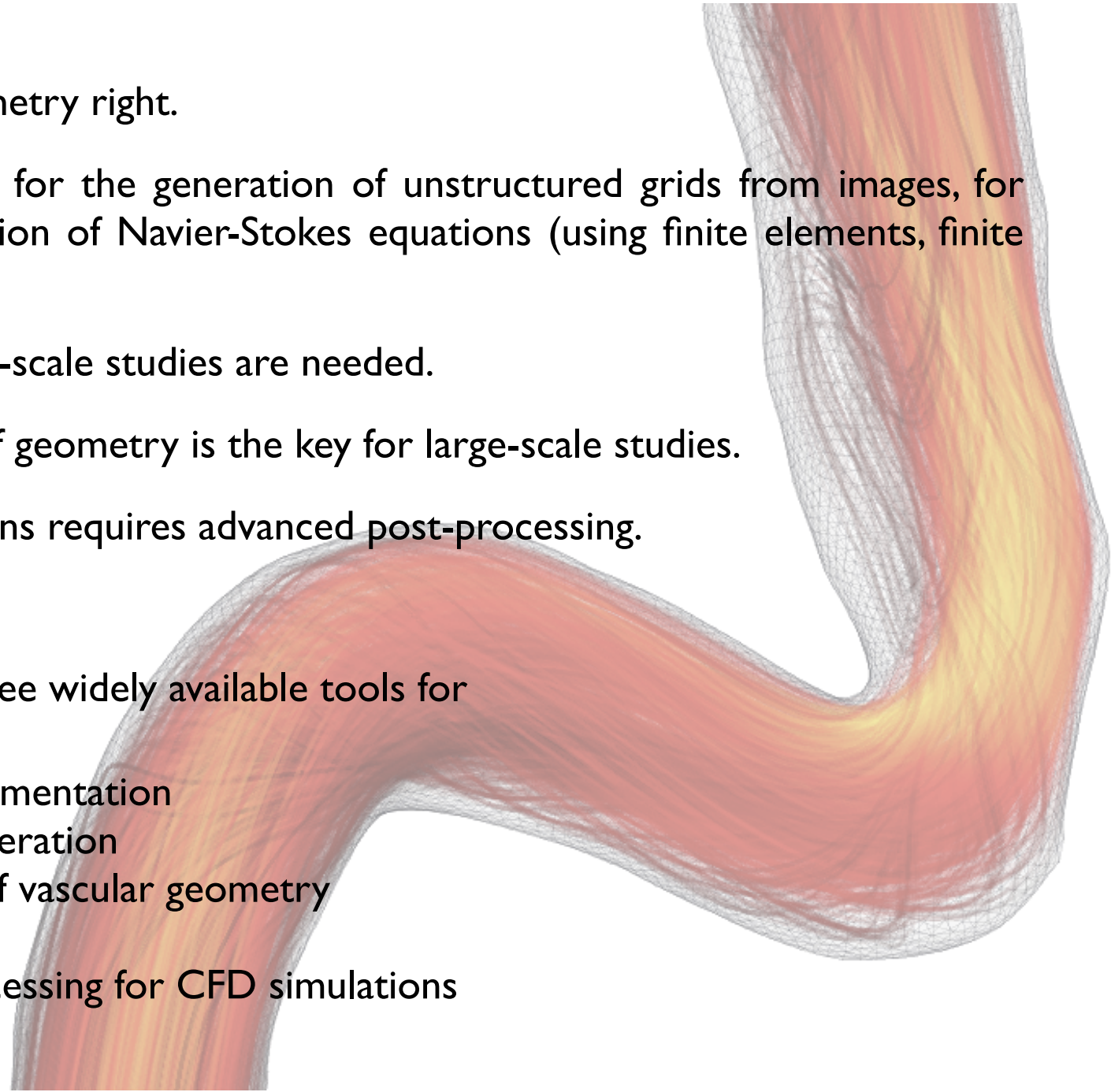
At the present stage, large-scale studies are needed.

Robust characterization of geometry is the key for large-scale studies.

Data analysis on populations requires advanced post-processing.

Effort: providing a set of free widely available tools for

- image segmentation
- mesh generation
- analysis of vascular geometry
- CFD
- post-processing for CFD simulations



The Vascular Modeling Toolkit

www.vmtk.org

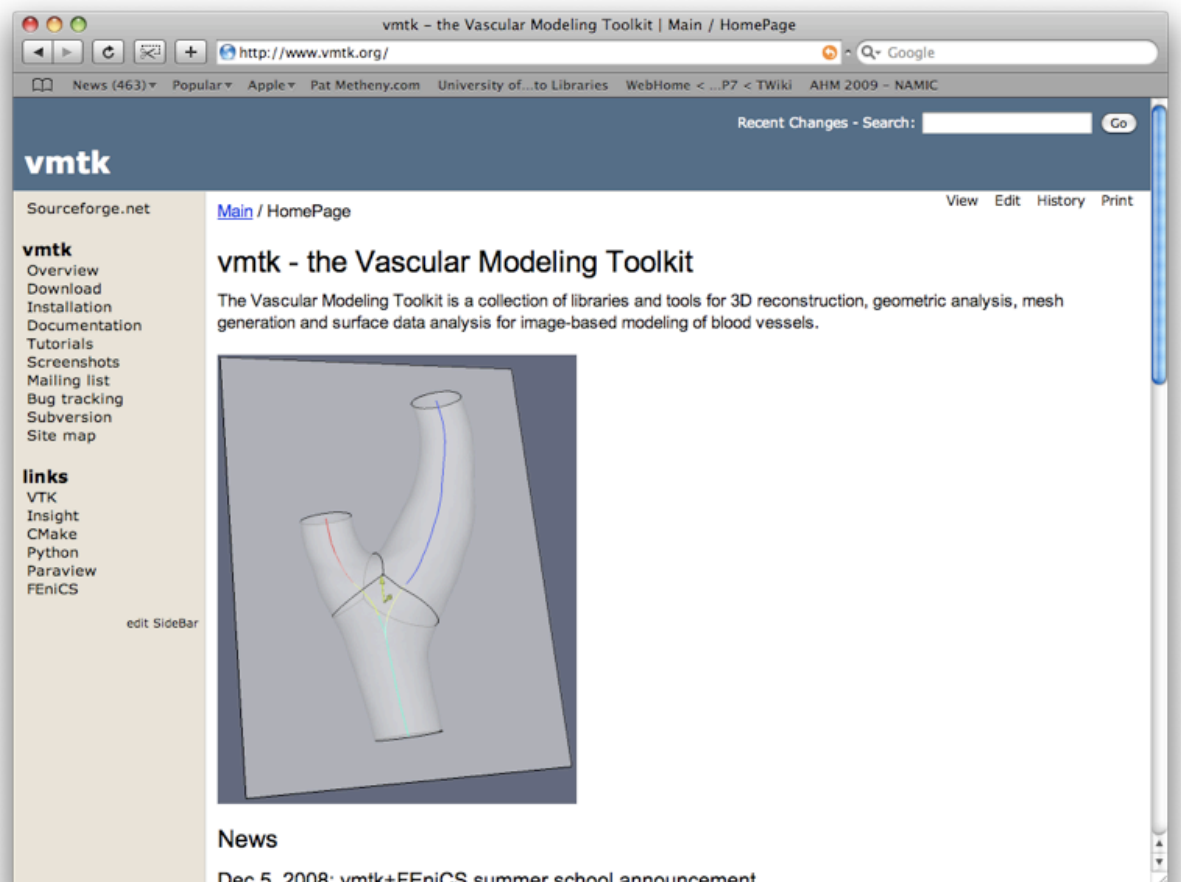
Countries		Pages	Hits
United States	us	15630	27802
Canada	ca	2909	4686
Netherlands	nl	2373	4207
Germany	de	1569	2803
Italy	it	1133	2118
Great Britain	gb	1041	1843
China	cn	1035	1886
Switzerland	ch	851	971
Unknown	ip	821	1313
Japan	jp	332	553
Norway	no	330	564
Australia	au	326	683
France	fr	303	526
Ireland	ie	244	590
Greece	gr	243	376
European country	eu	190	305
Spain	es	147	404
Austria	at	129	257
Brazil	br	102	335
Belgium	be	90	336
Singapore	sg	80	161
Portugal	pt	75	206
Argentina	ar	75	114
Sweden	se	69	184
Israel	il	65	142
Others		356	880

Jul 2008 - Dec 2008

Luca Antiga, Mario Negri Institute
David Steinman, University of Toronto

based on VTK, ITK

BSD license



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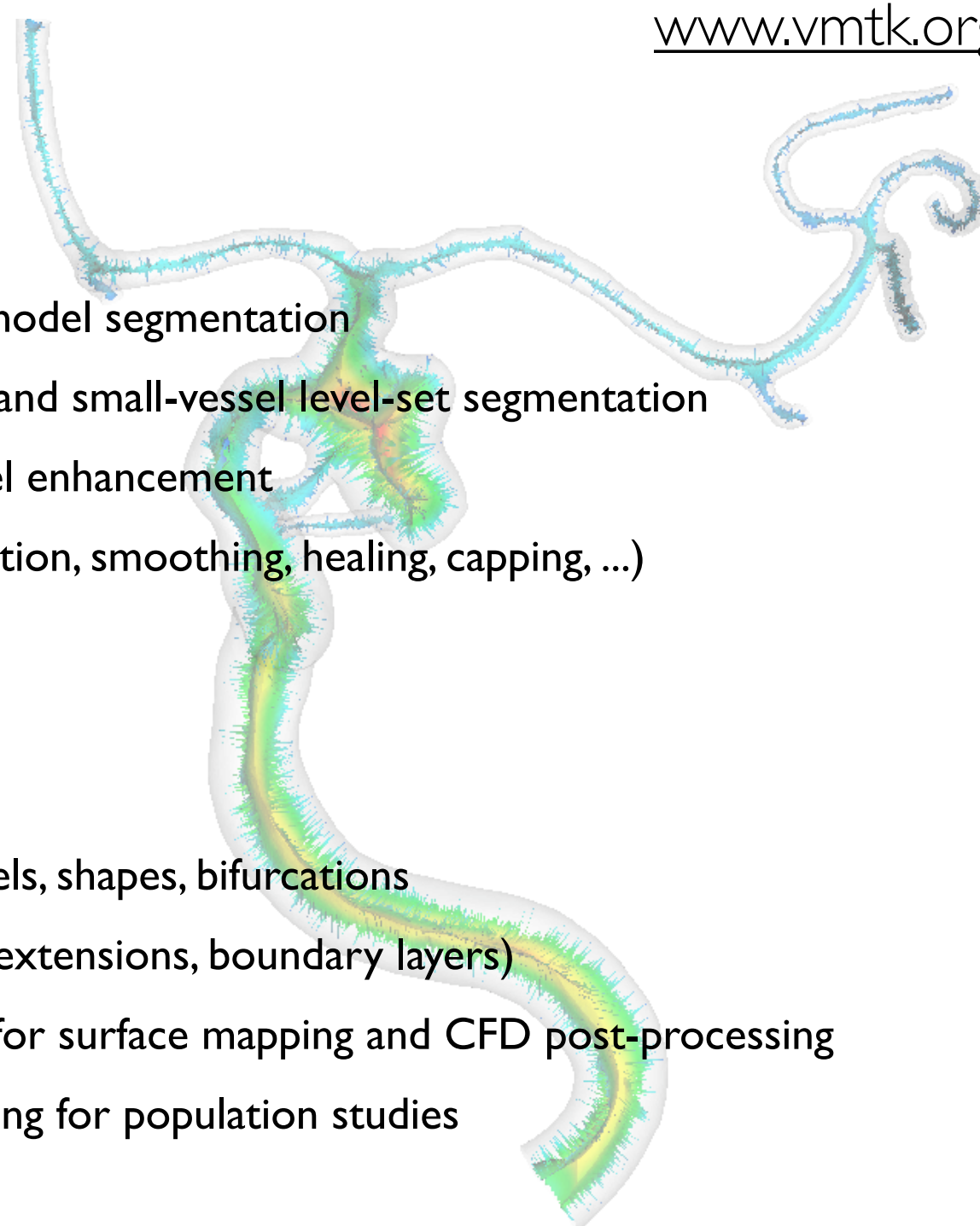
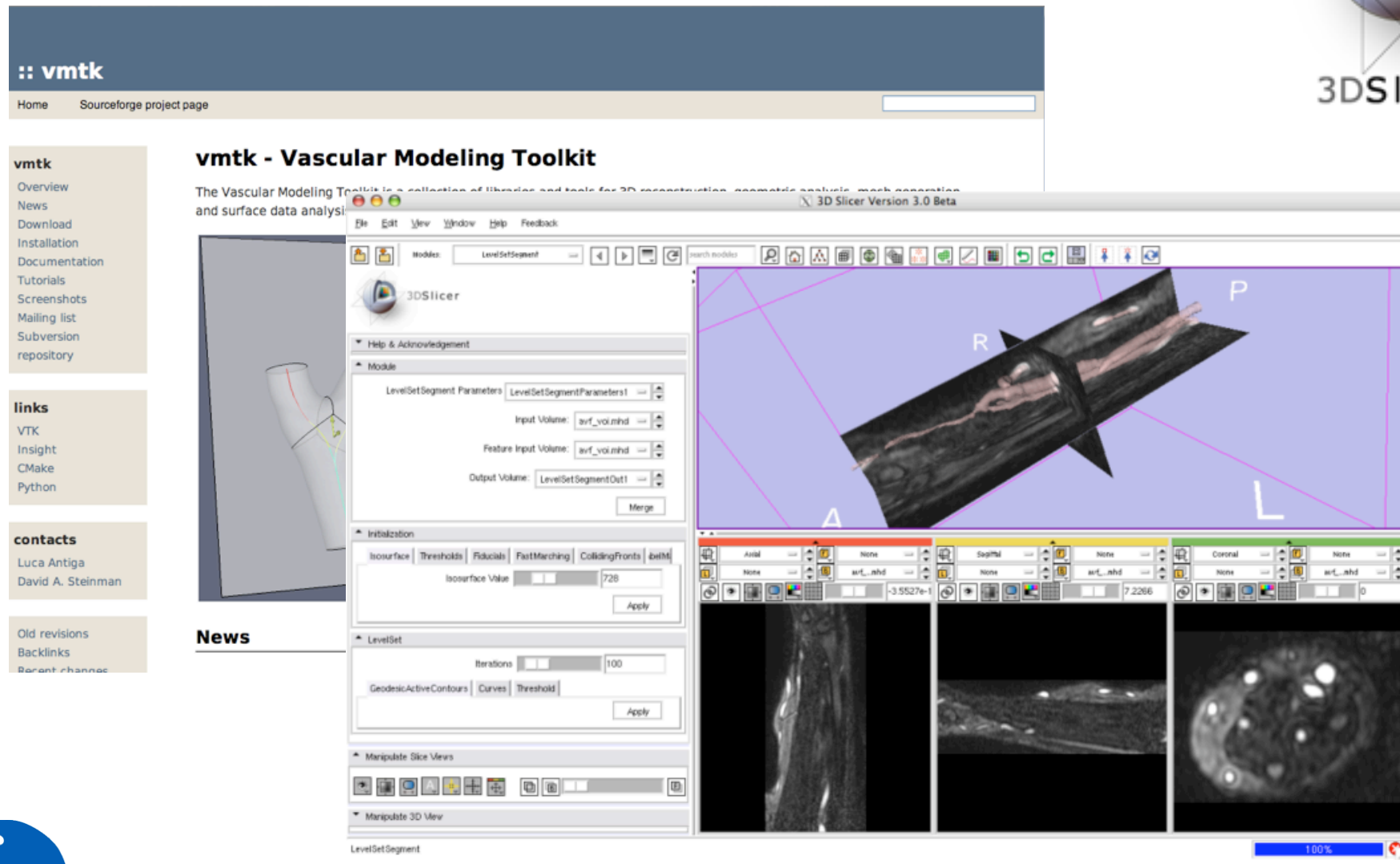
Features:



- Level-set and deformable model segmentation
- Smart branch initialization and small-vessel level-set segmentation
- Image processing and vessel enhancement
- Surface processing (decimation, smoothing, healing, capping, ...)
- Surface remeshing
- Volume meshing (Tetgen)
- Centerline computation
- Geometric analysis of vessels, shapes, bifurcations
- CFD pre-processing (flow extensions, boundary layers)
- Finite element framework for surface mapping and CFD post-processing
- Surface mapping and patching for population studies

vmtk Slicer integration



NA-MIC
National Alliance for Medical Image Computing

Summary of past and ongoing projects

vmtk Slicer integration

- automated generation of command line modules for non-interactive vmtk tasks (done)
- vmtk C++ code in Slicer as a library (done)
- interactive Slicer modules for segmentation, etc. (with Daniel Haehn) (in progress)
- vmtk Slicer as a NITRC project (to do)

Engineering core:

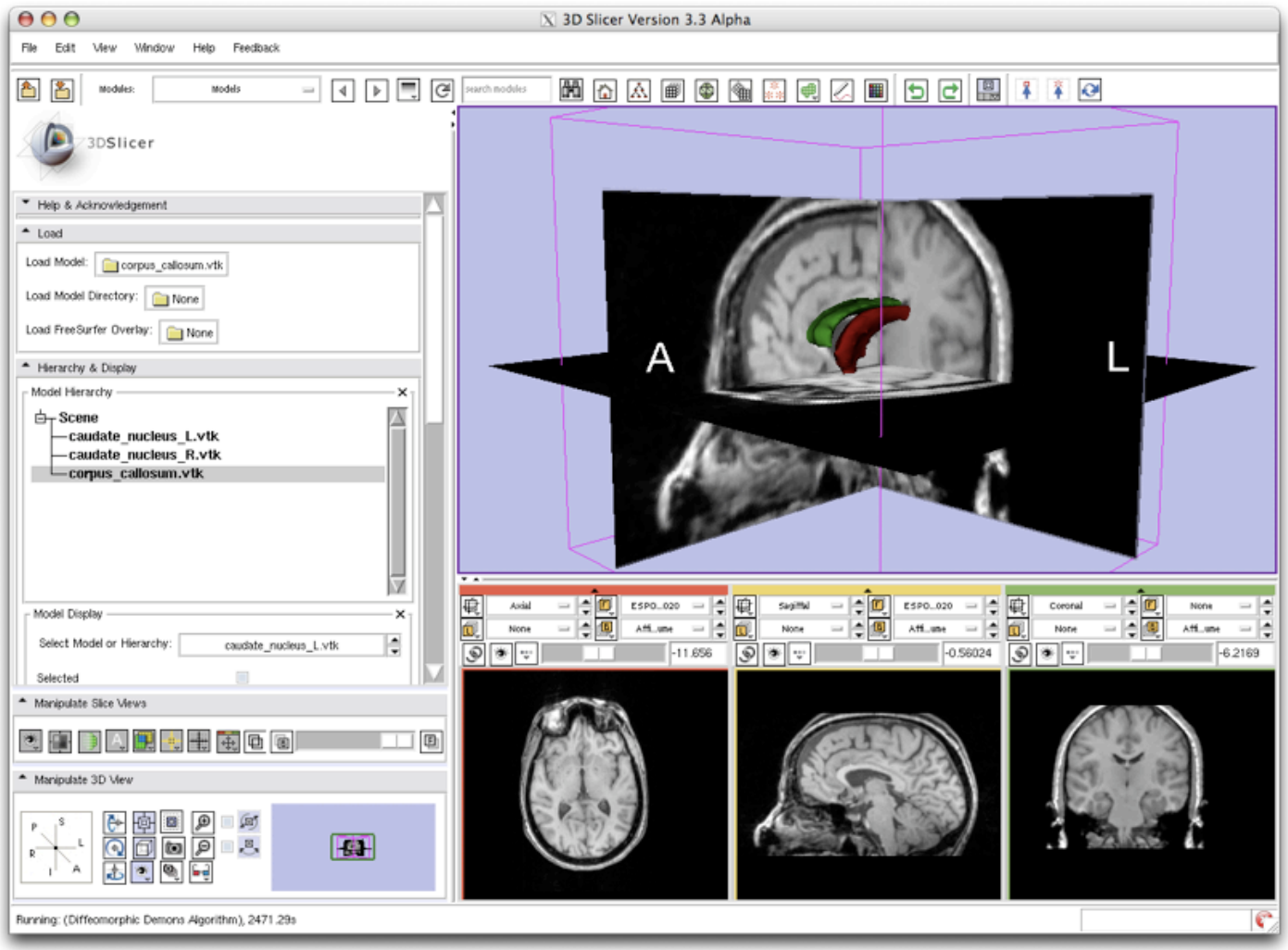
- Python interface and modules (with Dan Blezek) (done)
- Reference system issues for orientation-unaware command-line modules

Ongoing projects

With Roberto Foroni, University of Verona:

Pre-operative planning and intra-operative visualization platform for minimally-invasive neurosurgery

- Registration, segmentation, vessel extraction
- Integrated visualization
- Slicer layout customization
- Workflows

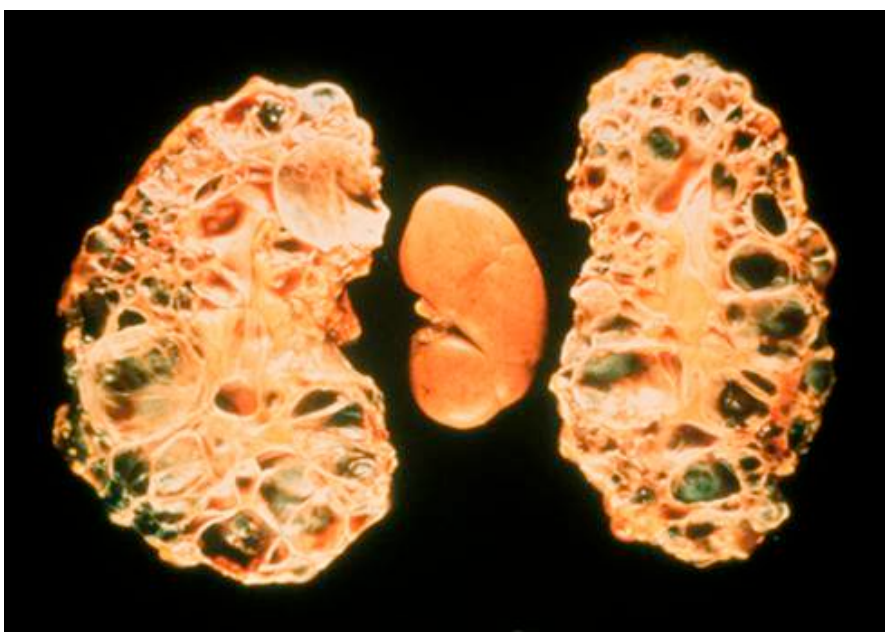


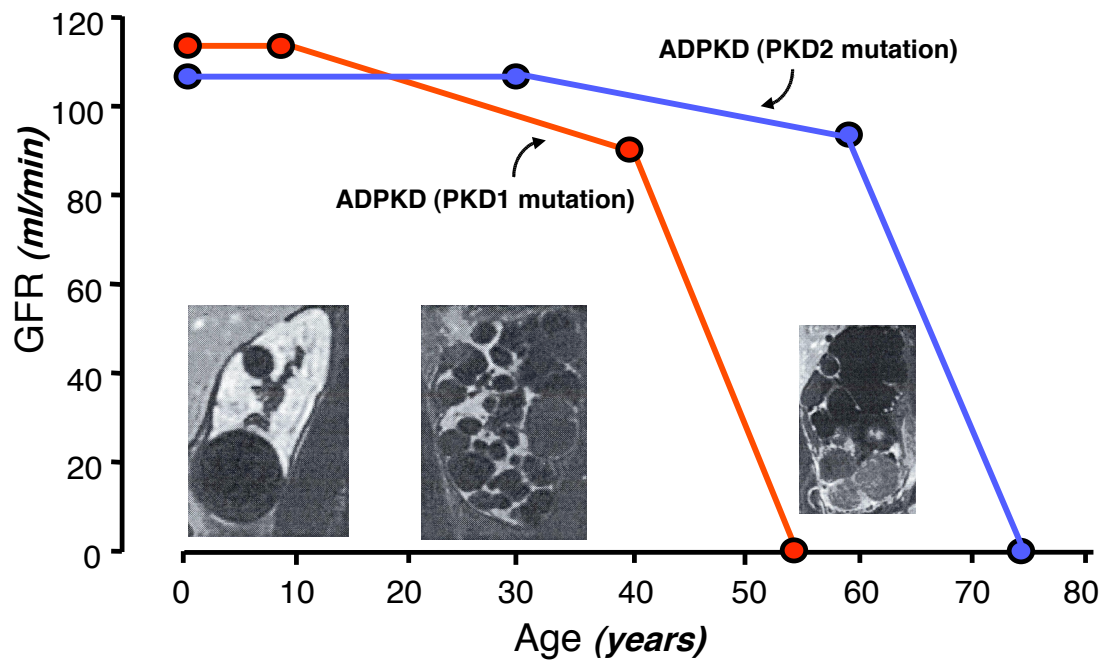
Ongoing projects

Mario Negri Institute:

Image quantification in autosomal dominant polycystic kidney disease (ADPKD)

- ADPKD: responsible for the majority of ESRD among hereditary kidney diseases, currently no treatment available
- currently at the Mario Negri Institute: 3 clinical trials on treatment with imaging endpoints (MR and CT)





Ong et al, Kidney Int 2005

Ongoing projects

Mario Negri Institute:

- Slicer as a platform for image quantification in autosomal dominant polycystic kidney disease (ADPKD)
- Image analysis methodology has been developed (ITK)
- A complete set of Slicer modules will be created