Supplemental Movie 1 : Time-lapse *in vivo* MPM imaging of a glomerulus in the intact kidney of a control Pod-GCaMP3 mouse. Low level of GCaMP3 fluorescence (green) is visible in podocytes around the glomerular capillary loops. Alexa594-albumin (red) was injected iv to label the intravascular space (plasma). Circulating red blood cells appear as dark objects within capillaries. Note the normal glomerular anatomy and the high structural detail provided by MPM imaging including the clear view of podocytes, the glomerular capillaries, and the dark Bowman's (filtration) space around podocytes. Non-specific green autofluorescence is visible in proximal tubule segments. Filtered and endocytosed Alexa594-albumin appears accumulated in some proximal tubules (red). Although intact glomerular hemodynamics (oscillations in the area of glomerular tuft due to physiological control mechanisms) is visible during the 3 minutes of video, no significant changes can be observed in podocyte GCaMP3 fluorescence.

Supplemental Movie 2 : Time-lapse *in vivo* MPM imaging of a podocyte $[Ca^{2+}]_i$ wave in a Pod-GCaMP3 mouse glomerulus after laser-induced focal podocyte injury. The site of laser injury is indicated by an arrow. Changes in GCaMP3 fluorescence intensity (green) demonstrate the sustained high podocyte $[Ca^{2+}]_i$ around the primary injury site, and the cell-to-cell propagation of high $[Ca^{2+}]_i$ to adjacent podocytes along the glomerular capillary loops which involves the entire glomerulus. The same glomerulus is shown in Figure 2A.

Supplemental Movie 3 : Quantitative MPM imaging of the effects of increased podocyte $[Ca^{2+}]_i$ on glomerular function. Time-lapse *in vivo* MPM imaging of a Pod-GCaMP3 mouse glomerulus after laser-induced focal podocyte injury shows the propagating podocyte $[Ca^{2+}]_i$ wave (increased green GCaMP3 fluorescence). During the propagation of the $[Ca^{2+}]_i$ wave the contraction of the entire glomerular tuft (the arrow can serve as a fix reference point) and a robust increase in GFB albumin permeability (appearance of the red plasma marker Alexa594-albumin in the Bowman's space and its tubular transit) are visible. The site of laser injury at the top of the glomerulus is indicated by an arrow.

Supplemental Movie 4 : Time-lapse confocal fluorescence imaging of a podocyte $[Ca^{2+}]_i$ wave in a freshly dissected and *in vitro* microperfused Pod-GCaMP3 mouse glomerulus. Focal podocyte injury was induced by mechanical stimulation (touch) with a glass micropipette. The site of injury is indicated by the arrow. Changes in GCaMP3 fluorescence intensity (green) demonstrate the increased podocyte $[Ca^{2+}]_i$ around the primary injury site, and the cell-to-cell propagation of high $[Ca^{2+}]_i$ to adjacent podocytes along the glomerular capillary loops which involves the entire glomerulus. The preparation was loaded with the calcium indicator Fura Red, but no changes are visible in Fura Red fluorescence (red) in the endothelium or mesangium during the podocyte $[Ca^{2+}]_i$ wave. The same glomerulus is shown in Figure 4A.