A number of industrial and natural process ultimately rely on two-phase flow in heterogeneous media. One of the most prominent example is oil recovery which has driven fundamental and applied research in this field for decades. Using model microfluidic experements we show that the typical front-propagation picture fails in describing forced imbibition. Imbibition happens when a wetting fluid displaces an immiscible fluid e.g. in a porous media. We show that upon increasing the flow rate and/or the viscosity contrast between the two fluids the wetting fluid progresses via the formation of thin films on the walls. Using microfluidic devices where we control both geometry and wetting properties, we identify four different imbibition regimes at the pore scale yielding different imbibition patterns at large scales.