A (completely contractive) Banach algebra $\mathcal{A}$ is called (completely) representable as an operator algebra if there is a (complete) isomorphism from $\mathcal{A}$ into a closed subalgebra of $B(H)$, and we will focus on the case of convolution algebras $\mathcal{A} = L^1(G)$ of locally compact quantum groups $G$. The complete answer for locally compact groups $G$ and their duals $\hat{G}$, and several recent results for locally compact quantum groups $G$ will be presented.