Motile bacteria are 'active colloids' - living particles that are capable of self propulsion. Active colloids open up a new world of possibilities of self assembling structures using 'bricks' on the microscale. I shall briefly introduce the general field of active colloids, before focussing on our recent experiments using swimming *Escherichia coli* bacteria as the 'bricks' in self assembling quasi-two-dimensional structures ('painting'). Our bacteria are genetically modified so that they only swim when illuminated, so that we can use external light field patterns to direct their motion, and therefore assemble structures. I will show how to 'tune' the bacteria so that it becomes possible to alter the assembled structures in real time, and also use these bacteria to prove a theorem in the physics of active colloids.