Molecular Mechanisms (MM) is a required course for all medical and dental students during their first semester of study. The primary objective of MM is to introduce students to the mechanisms that generate, regulate, and/or damage the various cell types that comprise our organ systems. We emphasize the common biochemical and molecular processes shared by different organ systems that ultimately explain the basic mechanisms underlying and predicting human disease. The course is organized into five consecutive blocks, each approximately four weeks in duration. To date, lectures are delivered by invited researchers and clinicians, punctuated by small group sessions for emphasis. In the Fall of 2015, we intend to pilot a redesign of the first course block, “The Biochemistry of Biomolecules and Cells” reimagining classroom time. The pilot will introduce Team-based learning (TBL) and Flipped Classroom approaches to rapidly support the learning of clinically relevant chemistry and to test this newfound knowledge in the diagnosis of patients both in silico and in vivo. To support active learning and peer teaching, students will engage with course content outside of class via Kahn Academy-style videos and interactive problem solving and simulation technology that requires them to simultaneously adopt the perspectives of a clinical biochemist and a clinician who typically both interpret clinical data. A comprehensive evaluation plan will be developed with the Center for Education Research and Evaluation (CERE). If successful, this pilot will serve as the model for each block of MM in 2016.