Have you ever dreamed to be an architect? I have. In my childhood, I created various objects with use of the Lego bricks. Even today I am Adult Fan of Lego (AFOL). For years I have been fascinated and but also influenced by the fantasy and creativity of great contemporary architects, to mention Gaudi, Corbusier or Fuller. A man can design and build in a macro scale fantastic objects(!) - the constructions that seem to have no right to exist, as their shape often seem to defy the laws of physics. As a graduate student of chemistry, and now as a young scientist I have been fascinated by crystallography, the world created by the nature using the simplest building blocks - atoms, ions, molecules. Is it possible to design in the world of atoms and molecules? Yes it is, but it is not an easy task. Why is it so? We have a huge variety of molecules, which we use as building blocks, a kind of bricks. Each of them has a different shape, morphology, and a set of functional groups that interact with the surrounding objects (most often molecules). The molecular glue play intermolecular interactions. These can vary much - from very strong (e.g. ionic) by the average ones (hydrogen bonds) to very weak (e.g. van der Waals interactions). To consider a molecule as a valuable building block its interactions with other objects must be very well defined, so that its behavior in the presence of other objects should led to the same structural motifs. The objects, which I deal with in this project are alcohols and amines, very simple model compounds, important for life, which are also characterized by a large structural complexity in the context of the creation of crystals with a substantially large variety of motives. I wish to find out the conditions which allow to create cocrystals (complex systems composed of both types of compounds), which structural motifs are created (both amines and alcohols can be both hydrogen bond donor and hydrogen bond acceptor), how to obtain most stable systems, to learn if one or more different types of crystal architectures having the same composition are formed (in other words: if there is one polymorph or more), to find whether it is possible, in a rational way, include also other building blocks and create *e.g.* host-guest systems. Further, I wish to know whether there exits the relationship between the structure and physical properties (eg. melting point) and last but not least how to synthesize such systems. The resulting knowledge is of fundamental nature, very important for the rational design of new materials with desired, specific properties. You should be aware that that vast majority of simple alcohols and amines are liquids. In order to create crystals a special equipment is required. In the laboratory, where this project is performed, an *in situ* crystallization device is installed. This is very unique instrument (one of approx. 15-20 worldwide, the only installation in Poland) allows crystallization of almost any compound (also the mixtures) ,willing to crystallize of course, by appropriate coupling of power laser radiation and temperature-controlled stream of cold nitrogen. Another way to obtain crystals is their growth in Diamond Anvil Cells (DAC). The architecture of such obtained crystals is analyzed by X-ray diffraction experiment on single crystal. The research will be complemented by measurements with use of spectroscopic methods, thanks to the very unique coupling of X-ray diffractometer with a Raman spectrometer (again one of very unique couplings world-wide, the only installation in Poland in our laboratory of advanced crystal engineering) and the thermal experiments using differential scanning calorimetry method. The synthesized cocrystals will be studied at various temperatures to investigate possible phase transitions (transition from one crystal architecture to another). A very interesting aspect of the project is also a systematic examination of the architecture of crystals obtained by the *in situ* crystallization with use of the laser support and by high-pressure with use of DAC to analyze whether the same or different kind of crystal packing (polymorphs) is obtained. The explanation of the observed experimental facts, in-depth structural analysis and new predictions will be made with use of advanced methods of theoretical chemistry for periodic systems.