

## MOLECULES WITHIN THE REACH OF THE HANDS: DEVELOPMENT AND EVALUATION PROCESS

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In order to enhance the comprehension and interest of educators and students with respect to molecular biological phenomena, we developed models kits consisting of small plastic elements that emphasize chemical bonds and geometric parameters related to the molecular structures in the nucleic acid, amino acids and representative pieces. These pieces in turn are used to build secondary and tertiary protein and DNA/RNA structures. The kits were denoted: **Building the life molecules: DNA and RNA; Protein Folder: a kit for building topological models of proteins; Ludic 3-D structure of amino acids and proteins.** The development of models, process of producing the representative units in industrial scale and evaluation involved several steps. **First**, the drawings of the different pieces were made with the CAD (Computer Aided Design) software or similar. Models are designed for each different component, connection points, as hydrogen, covalent and peptidic linkages. Some pieces have a well defined model that represents its geometrical shape. The design and applicability of the representative unities are discussed with many teachers and suggestions are implemented to the models. **Second**, after model definition, prototypes are made and presented to the teachers. Again they are presented for some teachers and suggestions are implemented to the models before the definitive moulds will be made in iron and trial in specialized tool facilities. The models are made of plastic pieces that can demonstrate the interaction among the functional groups, such as polarity, electronegativity, mass, that are represented by colors, shapes, appropriate sizes, facilitating the assembly interpretation of the 3-D structure. **Third**, the last term will consist of an effective evaluation as a facilitative didactic tool of the teaching/learning process. In these cases, the evaluations were based on a pilot study involving about 300 students and teachers (from basic School to University). Questionnaires were elaborated, containing simple and objective questions, and our results show that the model has high educational potential, aiding participants in their conceptual understanding of the molecular structures and their functions. In addition, it was also observed that the model leads students to critical associations of these concepts with actual scientific themes of Molecular Biology and Biotechnology, such as the cloning, transgenic organisms and the genome.

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