FACULTY OF ENGINEERING AND TECHNOLOGY

Department of Biotechnology

Molecular modeling

Molecular modeling (MM) is one of the fastest growing fields in science. It may vary from building and visualizing simple molecules in three dimensions (3D) to performing complex computer simulations on large proteins and nanostructures. MM is a collection of computer-based techniques for driving, representing and manipulating the structures and reactions of molecules, and those properties that are dependent on these 3D structures. The techniques in MM cover several issues among them computational chemistry, drug design, computational biology, nanostructures, and material science.

In the direct approach, the three-dimensional **features of the known receptor site are determined from X-ray crystallography to design a lead molecule.**

In direct design, the receptor site geometry is known; the problem is to find a molecule that satisfies some geometric constraints and is also a good chemical match. After finding good candidates according to these criteria, a docking step with energy minimization can be used to predict binding strength.

Molecular Modeling Applications

The starting point for many computer assisted molecular modeling studies is generally a two-dimensional drawing of a required molecule. These diagrams can range from note-book sketches to electronically stored connection tables in which one defines the types of atoms in the molecule, their hybridization and how they are bonded to each other. Then the two-dimensional structures are transformed into three-dimensional representations to study chemical properties. However, more accurate molecular structures may be available from the Cambridge X-ray crystallographic database (about 50,000 structures). Various applications of computer assisted molecular modeling techniques are reviewed here.

Molecular modeling encompasses all theoretical methods and computational techniques used to model or mimic the behaviour of molecule.

Molecular model is concerned with ways to describe the behaviour of molecules and molecular system.

The common features of molecular modeling techniques is the atomistic level description of the molecular system.

Why modeling and molecular modeling ?

Modeling is a tool for doing chemistry. Models are central for understanding of chemistry.

Molecular modeling is a discipline concerned with developing models of molecular system , chemical reactions.

Models are some kind of representation of a system, usually simplified, that allows for description and prediction of properties of interest

Molecular modeling can be performed by currently available software.

Why chemists use models?

- To help with analysis and interpretation of experimental data
- To uncover new laws and formulate new theories
- To help solve problems and hint solutions before doing experiments
- To help design new experiments
- To predict properties and quantities that is difficult or even impossible to observe experimentally

Molecular Modeling Tools

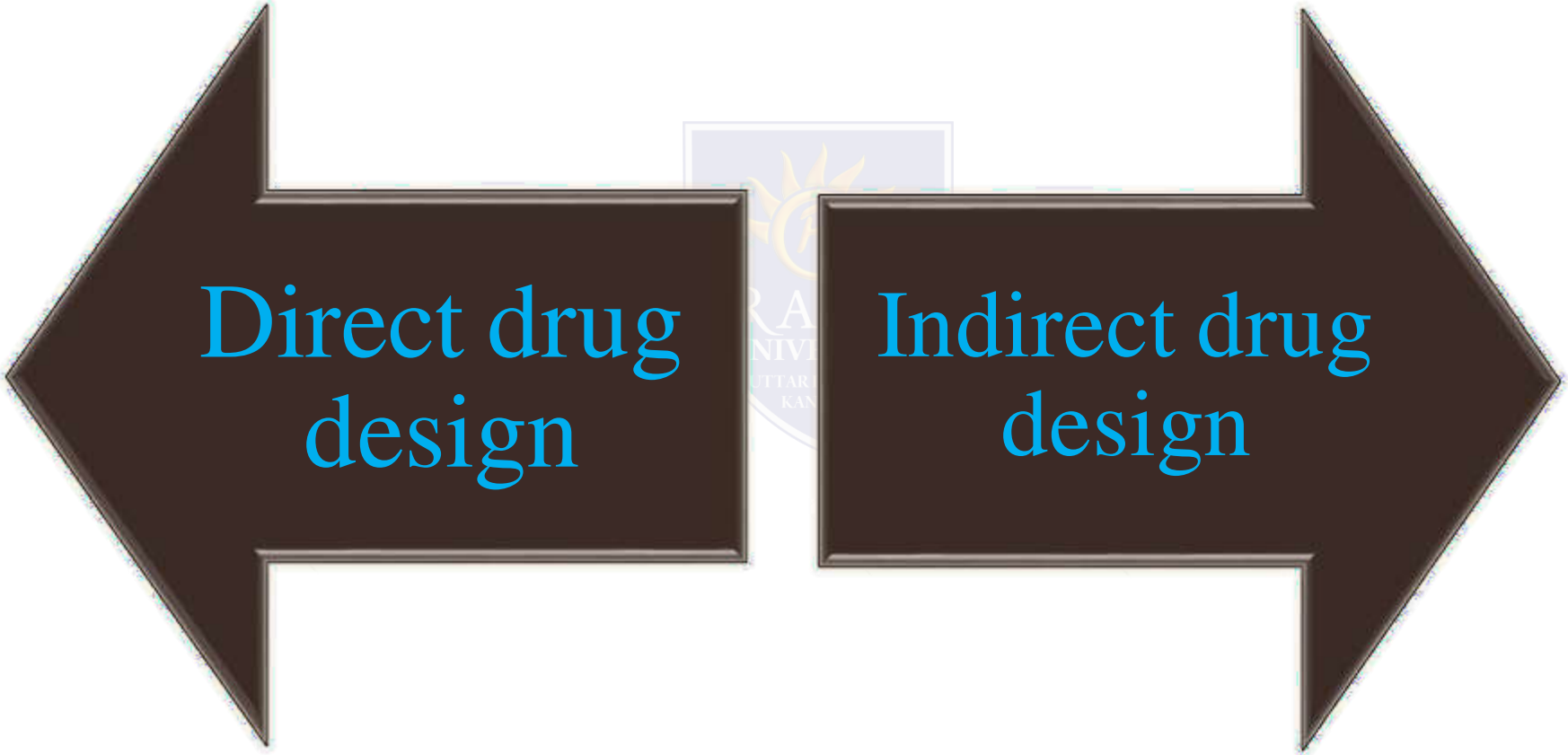
HARDWARE

- Various classes of computers are required formolecular modeling.
- For chemical information systems the choice of a computer is generally larger, and many packages run on VAX, IBM, or PRIME machines.

SOFTWARE

- The computational chemistry programmes allow scientists to generate and present molecular data including geometries, energies and properties.

Molecular Modeling Strategies



DIRECTDRUG DESIGN

In the direct approach, the three dimensional features of the known receptor site are determined from X-ray crystallography to design a lead molecule.

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After finding good candidates according to these criteria a docking step with energy minimization can be used to predict binding strength.

abc

INDIRECTDRUG DESIGN

The indirect drug design approach involves comparative analysis of structural features of known active and inactive molecules that are complementary with a hypothetical receptor site.

If the site geometry is not known, as is often the case, the designer must base the design on other ligand molecules that design on the other ligand molecules that bind well to the site.

XYZ

abc

XYZ

abc

MCQs

1. A
2. A
3. A
4. A
5. A
6. A
7. A
8. A
9. A
10. A