

1. **biochemistry** The study of the chemistry of living organisms, especially the structure and function of their chemical components (principally proteins, carbohydrates, lipids, and nucleic acids). Biochemistry has advanced rapidly with the development, from the mid-20th century, of such techniques as chromatography, X-ray diffraction, radioisotopic labelling, and electron microscopy. Using these techniques to separate and analyse biologically important molecules, the steps of the metabolic pathways in which they are involved (e.g. glycolysis) have been determined. This has provided some knowledge of how organisms obtain and store energy, how they manufacture and degrade their biomolecules, and how they sense and respond to their environment.
2. **bioreactor** (industrial fermenter) A large stainless steel tank used to grow producer microorganisms in the industrial production of enzymes and other chemicals. After the tank is steam-sterilized, an inoculum of the producer cells is introduced into a medium that is maintained by probes at optimum conditions of temperature, pressure, pH, and oxygen levels for enzyme production. An agitator (stirrer) mixes the medium, which is constantly aerated. It is essential that the culture medium is sterile and contains the appropriate nutritional requirements for the microorganism. When the nutrients have been utilized the product is separated, if the product is an extracellular compound the medium can be removed during the growth phase of the microorganisms, but an intracellular product must be harvested when the batch culture growth stops. Some bioreactors are designed for continuous culture.
3. **biotechnology** The development of techniques for the application of biological processes to the production of materials of use in medicine and industry. For example, the production of antibiotics, cheese, and wine rely on the activity of various fungi and bacteria. Genetic engineering can modify bacterial cells to synthesize completely new substances, e.g. hormones, vaccines, monoclonal antibodies, etc.
4. Process flowsheets embody the material and energy balances between and the sizing of the major equipment of the plant. They include all vessels such as reactors, separators, and drums; special processing equipment, heat exchangers, pumps, and so on. Numerical data include flow quantities, compositions, pressures, temperatures, and so on. Inclusion of major instrumentation that is essential to process control and to complete understanding of the flowsheet without reference to other information is required particularly during the early stages of a job, since the process flowsheet is drawn first and is for some time the only diagram representing the process. As the design develops and a mechanical flowsheet gets underway, instrumentation may be taken off the process diagram to reduce the clutter.
5. Two extremes are encountered in flowsheeting software. At one extreme the entire set of equations (and inequalities) representing the process is written down, including the material and energy balances, the stream connections, and the relations representing the equipment functions. This representation is known as the **equation-oriented method** of flowsheeting. The equations can be solved in a sequential fashion analogous to the modular representation described below or simultaneously by Newton's method (or the equivalent), or by employing sparse matrix techniques to reduce the extent of matrix manipulations.
6. At the other extreme, the process can be represented by a collection of modules (the **modular method**) in which the equations (and other information) representing each subsystem or piece of equipment are collected together and coded so that the module may be used in isolation from the rest of the flowsheet and hence is portable from one flowsheet to another or can be used repeatedly in a given flowsheet. A module is a model of an individual element in flowsheet (such as a reactor) that can be coded, analyzed, debugged, and interpreted by itself. Each module contains the equipment sizes, material and energy balance relations, the component flow rates, and the temperatures, pressures, and phase conditions of each stream that enters and leaves the physical equipment represented by the module. Values of certain of these parameters and variables determine the capital and operating costs for the units. Of course, the interconnections set up for the modules must be such that information can be transferred from module to module concerning the streams, compositions, flow rates, coefficients, and so on. In other words, the modules comprise a set of building blocks that can be arranged in general ways to represent any process.