MICRO-COMPUTER-ASSISTED SYNTHESIS DESIGN

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During the last few years, we have endeavored to develop a system in which various processes, required for organic synthesis, including synthetic route planning and experiment execution, can be efficiently performed through the assistance of a micro-computer (programmed flow preparation system: in short PFP system). A new preparation system, designed in such a way that liquid is made to flow through the interconnected tubes and columns fitted together by switching valves controlling the flow, has been devised at our laboratory. In our previous papers, we reported that this system was successfully applied to the synthesis of oligopeptides and oligodeoxynucleotides,[1] making possible the derivation of the shortest synthetic sequences and the automation of the preparative processes. At present, our attention is being directed to the development and the generalization of the PFP system to make it applicable to the synthesis of a wide range of organic compounds. As a key step in these serial projects, an attempt was made to compile a micro-computer program that would design a route to synthesize complicated organic molecules.

Our program was compiled in BASIC for a micro-computer equipped with a 16 bit CPU (NEC PC-9801) and two disk drives. The program generates a tree of synthetic intermediates retrosynthetically and allows the chemist to insert his decision at any stage of the retrosynthetic processes. The reactions are represented on the basis of the mechanisms, which makes it possible to deal with a number of reactions with several patterns of C-C bond formations and 1,3-migrations, or their combinations. The program has general applicability to the synthesis design of various kinds of organic compounds such as terpenoids, steroids and alkaloids. In addition, the program produces all the possible synthetic predecessors within the bounds written in it, including some which are regarded as impracticable at first sight but may suggest novel synthetic routes. The application of this system to the synthetic route planning of certain alkaloids will be discussed.

1) S. Hara et al., Nucleic Acids Res., Symp. Ser., 11, 85 (1982).