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Group Independent Study: A Unique Approach To Undergraduate Research

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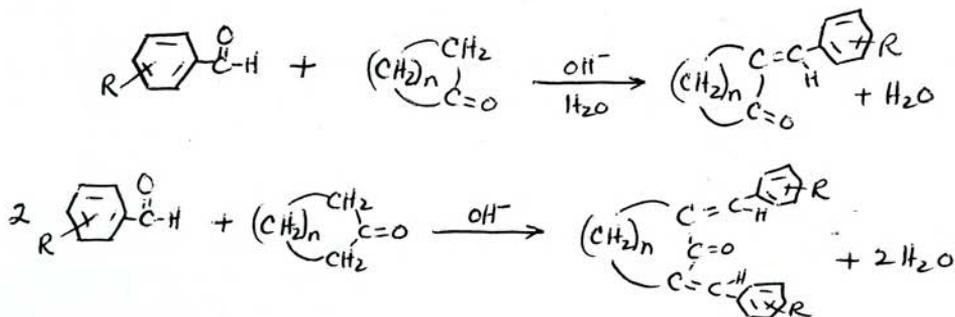
Introduction

Briar Cliff College has a program of independent study in the student's major field during the junior and senior years. In the past the program was used for library research projects and independent laboratory projects. In all cases the projects were truly independent, that is, separate projects for different students with no interconnections between projects.

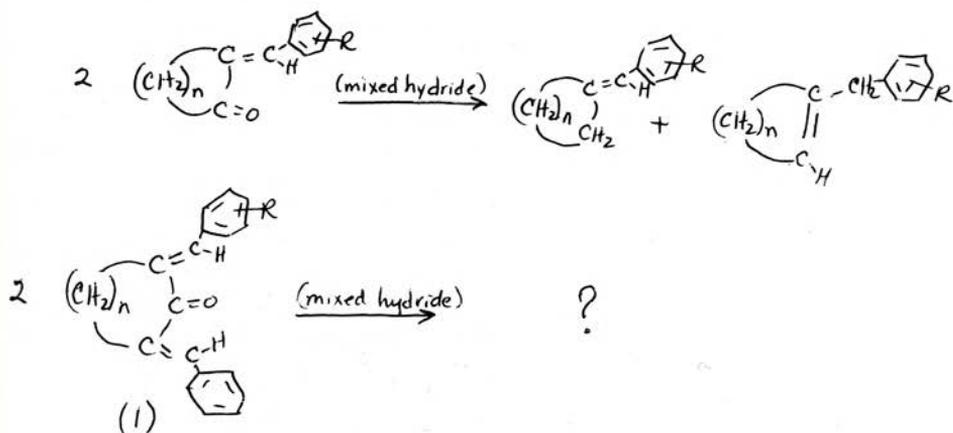
The investigator felt that it would be advantageous if all of the senior chemistry majors and some of the junior chemistry majors who felt ready for the experience would work on the same general research project but with each student studying just one aspect of the general topic. The same general reactions would be carried out by all students on the project but each student would utilize a different set of chemicals and variations on the general scheme. Essentially the students would be part of a research team.

The Project

The first part of the project was to choose a general reaction scheme that would lend itself to a diversity of subprojects. The reaction scheme chosen involved two general reactions. The first reaction, a base catalyzed condensation of benzaldehyde or a substituted benzaldehyde with a cyclic ketone, was chosen because it is a good organic reaction giving fairly easily purified products in high yields. This general reaction is illustrated below.



The second reaction, a mixed hydride (3 Al Cl₃: 1 LiAlH₄) reduction of benzylidene cyclic ketones to benzylidenecycloalkanes and benzylcycloalkenes, was chosen because very little is known about the reaction, and it offers a chance for students to carry out a laboratory investigation. The second general reaction is illustrated below.



The reduction of the dibenzylidenecycloalkanones (1) has never been explored, and this general reaction scheme is a good choice for intensive study.

Each student chose his own subproject, which involved the use of the condensation-reaction as well as the mixed hydride reduction reaction. He picked his project from the following list of suggested investigations.

1. The effect of ring size of the ketone on the yield and properties of benzylidenecycloalkane and on distribution of yields and properties of benzylidenecycloalkane and benzylcycloalkene in the mixed hydride reduction.
2. The same as project one, except that the dibenzylidene product was used.
3. A comparison of the effect of substituted benzaldehydes with benzaldehyde on the reactions, as well as a study of the properties of all products.
4. The stereochemistry involved in the mixed hydride reduction.
5. Use of the reaction scheme to prepare cis- and trans-1, 4-dibenzylidenecyclohexanes.
6. The effect of ketonic substitution on the spectral properties of the products of both reactions.
7. The effect of UV radiation on the benzylidene ketones.
8. The use of the reaction schemes to prepare aromatic steroids of known absolute configuration.

After the student chose a topic, he did an extensive literature search to obtain knowledge of all literature connected with his specific project. At this point he started the laboratory work and gathered information pertinent to his project. At various times all of the students met as a group in order for

each student to communicate his findings to the others. At other times the students talked freely to each other concerning their related projects.

The advantages of this approach have been numerous. The upper-level students were drawn more closely together as a result of the project. There was the creation of a chemical atmosphere which is sometimes missing, especially at small colleges. The students worked on a sophisticated and unified research project, while at the same time they learned to communicate research ideas to others. The students improved their laboratory research techniques. The attitudes of the students towards chemistry were enhanced greatly.

Participants

The following Briar Cliff College students have participated in the program: Theodore Lemek, Sister Dorothy Sweiniger, Paul Engle, Fred Palensky, Warren Clemens, Paul Skelton, Dennis Skelton, Ralph Gandy, Leon Stidfole and Steve Arnold. Some of these students have attended the annual meetings of the Iowa Academy of Science and some of the research results are being given at the 1971 meeting.

Acknowledgments

The investigator wishes to thank the AAAS Grants Committee of the Iowa Academy of Science for partial funding of this project. Without their help this project would never have been started.

BIOLOGICAL SPECIALTY TEACHING MATERIALS

Teaching materials for BIOTECHNICIANS will be developed for the American Institute of Biological Sciences Project BIOTECH during 1972-73, with emphasis to be placed on the following topic areas:

- Analytical biology techniques
 - e.g. Determining feed efficiency
- Animal techniques
 - e.g. Handling rodents
- Botanical techniques
 - e.g. How to transplant from flats to field plots
- Microbial culture methods
 - e.g. How to isolate a single cell
- Microscopy technique
 - e.g. Making frozen sections

- Preparative and basic skills
 - e.g. Calculate/prepare normal solutions
 - Preservation methods
 - e.g. Herbarium specimen preparation
 - Sterilizing
 - e.g. Use of chemicals for . . .
- Confined to single-task units called BIOTECH Teaching Modules, the factual data are being solicited from technicians and technologists experienced in these fields. Further information and a list of specific topics for which data is being sought may be obtained from John H. Busser, Director, Project BIOTECH, 3900 Wisconsin Avenue, NW, Washington, D.C. 20016.