

“Molecules and Cells of the Immune System” An Interdisciplinary Teaching Unit in Chemistry and Biology Development, Implementation and Evaluation

Thesis for the degree Doctor of Philosophy

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Submitted to the Scientific Council of the Weizmann Institute of Science

Rehovot, Israel

April 1986

Abstract

This thesis describes the development, implementation and evaluation of a teaching unit – “molecules and Cells of the Immune System”. The unit was offered as an option for high school students in grade 12 (18 years old) who major in chemistry and biology.

The unit is innovative in its interdisciplinary approach and in its use of diversified instructional strategies.

It includes relevant examples from the field of immunology which “require” explanation at a molecular level, which implies that central subjects from chemistry must be taught. Amongst others, the unit includes examples from medicine, which demonstrate the link between the teaching of science and problem solving in real life. Immunological issues are presented by describing the research studies in which they were first discovered. Thus the student learns practical methods in immunology research and something of the central ideas concerning the development of immunology.

Intensive teacher training courses were held to train teachers in the principles of the teaching unit, its theoretical background and its content. In addition many ways of presenting the unit in the classroom were suggested and invited lectures on issues in the forefront of immunological research were given by practicing research immunologists.

The unit was tested over three years (1982/83 – 1984/85) in twenty 12th grade classes (~ 400 students). The students in each year were examined as a part of the final matriculation examination.

Evaluation of the unit was conducted simultaneously with the implementation. The evaluation research was conducted in two stages:

During 1982/83 – 1983/84, the unit was used while still in its final stages of development. In this formative evaluation it was found that the content of the unit was appropriate to the previous knowledge of students.

Several learning difficulties were identified and also several teaching difficulties. As a result, the unit was rewritten, teaching aids were added, a detailed bibliography was recommended and the in-service teacher training courses were redesigned.

In 1984-85 a revised unit was implemented and summative evaluation was conducted. The experimental group consisted of 200 grade 12 students, majoring in either chemistry or biology. The control group consisted of 100 grade 12 chemistry or biology majors, who studied according to the existing curricula. The experimental group was compared with the control grouping order to account for any possible incidental learning from external sources, e.g. open university or T.V. programs.

On the basis of this evaluation, it was found that in comparison to the control group, the experimental group significantly improved their knowledge of immunology. In addition, students in the experimental group outperformed the control group in their ability to solve practical problems, and thereby apply the knowledge which they had acquired in a new context. They also obtained high scores (~ 80%) in that part of the matriculation exam dealing with immunology.

In answering a questionnaire students indicated their interest in and the importance of studying the various topics included in the unit. They explained that the unit gave them general knowledge, an ability to deal with practical problems, and that it was both relevant and interesting.

Despite some difficulties, teachers were uniformly positive about teaching the unit. Most of them agreed to teach it again the following year. Apparently, their positive attitude was due, in large measure, to the degrees of interest they were able to arouse in the students, and from their own interest in the content of the unit.