INTRODUCTION

Biochemical reactions create form and function according to the instructions found in the genes. The past 15 to 20 years have produced exciting developments in our knowledge of how genetic instructions are read. This has been accompanied by and brought about by a stunning array of techniques--physical, chemical and genetic--that gets results, easily and quickly with great precision and small amounts of material.

Meanwhile our information about metabolic pathways and the regulation of flow through these pathways has increased marginally. We have not passed along what we know of plant biochemistry to our younger colleagues; and we have done little to let our chemist and biochemist colleagues know of the exciting opportunities for them to use their skills in plant biology.

In an effort to address some of these concerns, a group of plant scientists organized a summer lecture course in plant biochemistry. This course, originally conceived by Professor Joseph Varner, was first held during the summer of 1992, and was repeated during the summer of 1993. Both times support for the course was provided by the National Science Foundation, the Department of Energy and the Department of Agriculture. This proposal briefly reviews the lessons learned from the last two summers and outlines our plans to present a third version of the course in the summer of 1994.

PLANT BIOCHEMISTRY 1992

The first version, Plant Biochemistry 1992, was held in La Jolla, CA, from June 28 through July 19, 1992. Twenty four students registered and attended the entire course with another 20-25 local students attending parts of the course. The course had a unique format, bringing in expert plant biochemists from various parts of the USA and Europe to present up-to-date lectures on various topics of plant biochemistry. Dr. James Bonner and Dr. Joseph Varner, the authors of the famous Plant Biochemistry textbook, were the inaugural lecturers. Other lecturers were: N. Amrhein, R. Buchanan, W. Briggs, M. Chrispeels, E. Conn, G. Coruzzi, N. Crawford, A. Darvill, D. Delmer, E. Farmer, D. Ho, A. Huang, K. Keegstra, G. Kishore, P. Kolattukudy, C. Lamb, G. Lorimer, R. Malkin, R. McCarty, B. Mudd, W. Ogren, H. Pakrasi, D. Phillips, D. Randall, J. Siedow, D. Soll, C. Somerville, I. Ting, R. Vierstra, C. West, J. Whitmarsh, S.F. Yang, C. Yocum and J. Zeegaart.

The topics, in order of presentation, were: amino acid metabolism, ethylene biosynthesis and action, plant hormone analysis, biosynthesis and metabolism of hormones, hormonal regulation of gene expression, nitrate assimilation, nodulation and nitrogen fixation, chlorophyll biosynthesis, cyanide resistant respiration, cutin, suberin, mitochondrial physiology and biochemistry, protein kinases and related metabolism, Photosystem I and II, thylakoid
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architecture, cytochrome bf complex, use of molecular biology in the study of photosynthesis, ATP synthase, metabolite transport across chloroplast membranes, targeting proteins to chloroplasts, Rubisco assembly, CO₂ fixation, C₃/C₄ photosynthesis, assembly of oleosomes, redox metabolism in chloroplasts and seeds, C₄ and CAM photosynthesis, protein turnover, glycoprotein biosynthesis and the secretory pathway, vacuolar targeting, wound signaling via systemin and jasmonate, lipid metabolism, sulfur metabolism, phospho- and sulfo-lipids, blue light/photocell, cell wall proteins, novel regulatory mechanisms, terpenes, oligosaccharins, cell wall polysaccharides, cellulose, phenolic acids and cyanogenic glycosides.

The course was organized primarily by H. Pakrasi and J. Varner (both from Washington University) with some assistance from an organizing committee. The local organizers in La Jolla were C. Lamb (Salk Institute), M. Chrispeels and S. Brody (both from UCSD). The lectures were held at the Salk Institute with the out-of-town students and lecturers being housed at Muir Commons, a student housing complex at UCSD, located a half-mile from the lecture halls. Meals were provided in the cafeteria of Muir Commons. The total immersion character of the course was considered one of the most important features, with the students and lecturers living and eating together. Impromptu late-night sessions in one of the student apartments, with students and visiting lecturers discussing various current issues in the plant sciences, were also a valuable feature.

PLANT BIOCHEMISTRY 1993

Plant Biochemistry 1992 achieved many of the objectives of the organizers and the funding agencies, although it suffered from some problems associated with a first attempt to organize such a course. For example, advertisements for the course went out late and to a limited audience, resulting in poor attendance. The course had too many lecturers and too few breaks. Despite these and other concerns, most faculty and participants thought the course was successful. Consequently, a second course was planned, attempting to build on the successes of the first edition, while addressing some of the problems.

Plant Biochemistry 1993, was held in Madison, WI, from June 30 to July 18, 1993. Thirty eight students registered for the course and many local plant biologists (mostly faculty, postdoctoral associates and graduate students from UW-Madison) attended parts of the course. The course was organized primarily by H. Pakrasi and P. Ludden, with some assistance from an organizing committee consisting of K. Keegstra, C. Lamb, W. Ogren and R. Quatrano. H. Pakrasi provided a connection to the previous year and P. Ludden provided both new ideas and local arrangements.

Several changes in the course were made in response to the problems perceived in the first course. First, the course was well advertised with letters to many universities and colleges as well as announcements in the newsletters of several scientific societies. The course schedule was modified to include free time, one full day and two half-days without lectures when optional recreational activities were planned. A course coordinator was hired to attend all of the lectures and course activities. This provided continuity between lecturers and allowed problems to be
addressed as they arose. Finally, the number of lecturers was reduced from 34 to 25 and each lecturer was given instructions regarding the format and level of their presentations. A lecture schedule listing the instructors involved in the course and their topics is presented in Appendix 1.

The students in the course had diverse backgrounds and consequently had different expectations for the course. Several participants were graduate students in a plant science, often at institutions that did not offer a plant biochemistry course. Others were postdoctoral associates, often having moved into the plant sciences from other disciplines. Finally, several participants were presently employed, but sought additional training, including two or three teachers from small colleges and participants from industrial and government laboratories.

In an effort to evaluate the course from a student perspective, comments were solicited from all participants in the course. Most students took advantage of this opportunity, with 24 participants providing more than 70 pages of detailed commentary covering all aspects of the course, including the quality of individual lectures, the quality of handouts and visual aides, the value and format of the discussions, the quality of the food, etc.. It is difficult to provide a succinct summary, but in general the students thought the course was a valuable experience and would recommend it to their colleagues and friends. Several had constructive suggestions that have been incorporated into the plans described below.

PROPOSAL FOR PLANT BIOCHEMISTRY 1994

In view of the success of the course during the last two summers, we propose that it be offered again in the summer of 1994. Discussions among members of the organizing committee held after the course last summer led to an agreement that the next edition of the course would be held on the campus of Michigan State University in East Lansing, MI. Kenneth Keegstra has agreed to be the principal local organizer, but will be assisted by a local organizing committee including Hans Kende, Lee McIntosh and Jan Zeevaart. On behalf of ASPP, the organizing committee will consist of Kenneth Keegstra (principal local organizer), Paul Ludden (principal organizer last year), Himadri Pakrasi and Ralph Quatrano. We will continue to follow the philosophy that guided the planning during the previous two years, i.e. a total immersion course covering all aspects of plant biochemistry. We hope to build upon earlier successes, while at the same making changes to address problems from earlier years that have been identified by both the course organizers and the participants. Our plans for Plant Biochemistry 1994 are briefly described below.

1. The curriculum. Plant Biochemistry 1992 provided a complete overview of plant biochemistry, touching on almost all aspects of this discipline. Because the inclusion of 35 lecturers in 21 days was too intense, only 25 lecturers were included in 1993 (see Appendix 1). Unfortunately, in making this reduction several important topics were not covered in 1993, while other topics received excess coverage. For example, there was no coverage of lipid metabolism, while protein targeting was covered by three different people. Furthermore, because of the difficulty of arranging travel schedules, the sequence of topics was not logical (see Appendix 1).
In an effort to alleviate these problems we have generated a course outline that provides a plan for both the sequence of topics and the approximate emphasis to be placed on each. The sequence of topics is somewhat arbitrary and may need to be changed to accommodate the schedule of the various speakers. However, we hope to maintain this balance of topics and to keep lecturers organized into topical groups that make sense didactically. We have also assigned one member of the local organizing committee to interface with the speakers on a particular topic with the goal of providing better coordination within each section. The proposed list of topics and the responsible local organizer is shown below.

2. Lecturers. Similar to the summer of 1993, we plan to include approximately 25 lecturers. Professor Ed Tolbert will be the inaugural speaker. He is a major contributor to our current understanding of plant biochemistry and is Emeritus Professor of Biochemistry at MSU. The identity of the various lecturers is still uncertain. We have several possibilities for lecturers on most topics, and will attempt to utilize a mixture of those who have participated in the course in past years and others who have not previously participated. By having a flexible list of possible lecturers, we hope to utilize those who can lecture on each topic in a logical sequence, rather than adjusting the sequence of topics to fit the travel schedule of specific individuals.

Each lecturer will be asked to provide significant background material before presenting current research activities and a look ahead to the unsolved problems. Their lectures should address the following points: (1) Summary of the topic, (2) Status of current problems being addressed in their own labs, (3) Prospects for the future, and (4) How is their area impacted by molecular approaches. Lecturers will be asked to provide, in advance, an outline of their lecture and copies of their visual aids so that these materials can be provided to the students as a handout. The discussion sessions should be informal and interactive. Lecturers will be asked to provide a list of questions for discussion or a journal article that can be read by students and used as the basis for a discussion.

3. Announcement of the course and recruitment of students. As with last year, we will attempt to advertise the course as widely as possible. Comments from last year’s students indicated that mailings to individuals and department chairs were not very productive. Advertisements in newsletters and scientific journals were more effective. In addition, it was suggested that notices should be placed on various e-mail networks; we intend to follow this suggestion. Notices will be posted on the electronic bulletin boards before February 20, 1994.

The reputation of the course has spread, and both Paul Ludden and Ken Keegstra have already received inquiries regarding Plant Biochemistry 1994. In addition, one preliminary announcement has appeared in the ASPP newsletter. This notice also produced several inquiries; in total, we already have more than 10 inquiries. Our goal is to accept 40 students.