Title
Electron Microtomy Training: A Self-Contained Learning Package

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ELECTRON MICROTOMY TRAINING: A SELF-CONTAINED LEARNING PACKAGE

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An electron microtomy training program has been prepared and tested at junior college, state college and university levels. This program consists of 5 basic units: fixation, dehydration, embedding, sectioning and staining. The materials, planned and prepared by utilizing modern educational theory, are designed to be largely self-instructional. Both theoretical and laboratory materials are presented by various styles of programmed instruction. For fixation, dehydration, embedding and staining, the theoretical materials carry on a "dialog" with the student. Concepts or tasks are presented to him in a stepwise manner. He is then asked to interact with the materials by responding to questions which test his grasp of what has been taught. His correct responses are reinforced by the presence of the correct answer, either on an answer sheet at the end of the programmed lesson or immediately following the space provided for his answer. An excerpt from the Fixation Unit which illustrates this point is shown in the accompanying figure. The laboratory directions for these units consist of a series of black and white sketches accompanied by a few lines of text which guide the student through a standard introductory microtomy procedure. The sectioning unit integrates theoretical and laboratory materials. It consists of the following: 1) a stepwise series of directions for operating the microtome, presented with colored photographs and line drawings; 2) a theoretical overview of each major portion of the unit; 3) an optional simple computer program to aid the student in the diagnosis of thin sections; 4) a vacuum-formed plastic model of the advance system of the microtome; and 5) charts helping the student to diagnose sectioning problems.

Pre- and post-tests on all units, except sectioning, were given to the students in order to learn which objectives were successfully taught. A net gain (of information) score for each of these units was also determined. Sectioning was taught tutorially in 1970, while in 1971 the students trained themselves by using the programmed unit. Block facing, boat preparation, and grid quality for the 1971 student group were evaluated by two experienced technicians. Results indicated that the students were able to teach themselves to face a block, put a boat on a knife, and gather sections on grids. Pictures were taken from the student grids, both in 1970 and 1971. The pictures were scrambled and then given to 3 professional electron microscopists for evaluation. The results indicated that the students trained by the sectioning unit (1971) produced slightly better pictures than those trained tutorially (1970). Therefore, students can be successfully self-trained to produce a good quality electron micrograph.

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DISCLAIMER

FIXATION

9 If you were asked to choose the best fixative for proteins, which one would you choose?

_____ a) glutaraldehyde — Check answer 4.

_____ b) osmium tetroxide — Check answer 1.

Go on to frame 10.

10 The best fixative for unsaturated lipids is:

_____ a) glutaraldehyde — Check answer 24.

_____ b) osmium tetroxide — Check answer 30.

Go on to frame 11.

11 The two fixatives listed below can work by one or more of the mechanisms, a, b, and c. Indicate which mechanism(s) are applicable.

_____ 1) glutaraldehyde

_____ 2) osmium tetroxide

a) oxidation

b) denaturation

c) cross-linking

Check answer 8.

Go on to frame 12.

12 You are given some plant tissue to fix. You want to observe the cell lipids and proteins. You will have to use both fixatives to achieve your best results. Fill in the following chart and then decide whether to begin fixation with glutaraldehyde or with OsO_4.

Fixation Process →	Cross-linking		Denaturation by oxidation	
Cell Component → / Fixative ↓	Protein	Lipid	Protein	Lipid
glutaraldehyde				
osmium tetroxide			//	

Conclusion: I would begin fixation with

_____ a) glutaraldehyde

_____ b) osmium tetroxide

because _____.