Human Genetics, Birth Defects, and Values: A Review of Audiovisuals

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DURING THE PAST YEAR, we have reviewed more than twenty of the films, filmstrips, slide sets, and tapes presently on the market on the subjects of human genetics, human genetic diseases, and birth defects. These reviews were one aspect of the needs assessment studies in human genetics education conducted in 1976 and 1977 by the Biological Sciences Curriculum Study under a grant from the National Foundation/March of Dimes. The twenty programs we reviewed were selected from an original list of approximately sixty audiovisual units on genetics and human biology. The materials were collected for review on the basis of information obtained from brochures and publisher's descriptions and advertisements (often vague and of little value).

Each of us initially prepared a review of the material independently of the other two members of the committee; but we all used the same criteria. We considered several factors that can influence the efficacy of an audiovisual presentation, including the accuracy of the content; the sensitivity and honesty employed in dealing with ethical and moral issues; the extent of repetition within a series; the pedagogical design of the presentation (from straight factual information to questioning and inquiry approaches); the availability and completeness of teachers' guides (including descriptions of vocabulary requirements); and the availability of pre- and posttests. We also considered the technical quality of the music, narration, and visuals because such characteristics can determine whether a program will attract and hold student interest. Though all of us teach elementary human genetics in the beginning biology courses, and two of us teach the advanced genetics course for biology majors, and despite the fact that all of us have participated in the development and evaluation of curriculum materials for schools, we often disagreed about which of the reviewed materials could finally be considered the best. Such disagreements were undoubtedly the result of our different teaching interests and our preferences for different kinds of instructional resources. For this reason, we suggest that life science teachers planning to use these materials in their classes carefully preview the films, slide sets, or filmstrips before showing or purchasing them.

The short reviews included in this article cover only those materials that were rated from fair to excellent or those materials on which we disagreed. Materials rated fair to very poor by all of us have been excluded, except when they were a part of a series.

Materials Reviewed

Three filmstrip/tape cassette programs developed by Ward's as part of the Solo-Learn System were selected

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for review. Two of the programs—*Linkage, Crossing-Over and Chromosome Maps,* and *Introduction to Mendelian Inheritance*—were rated good to excellent by all three reviewers. A third program entitled *Introduction to Probability* was rated fair to poor. These programs may be used either as a class activity encouraging group interaction or as individualized programs in a learning center. Student work sheets that accompany the program can, with modification, be used as pre- and posttests. As a class activity, these programs would each require 35 to 60 minutes to complete, depending on the background of the students. These programs are appropriate for grades 9 through 12 for students who have had some advance preparation. They should also serve as excellent review material for introductory college biology courses. Because all of these programs include much terminology and assume that the students have considerable knowledge of meiosis and genetics, class discussions prior to the presentation of the programs should speed up the learning process.

Minor errors were found in all three programs, but in *Introduction to Probability,* the errors are major. Probability is shown as based on equally likely events—a situation not always found in nature. The direct effect of genotype on phenotype is implied without qualification, and incorrect numbers of gametes from one gametogenic event are shown. These are not new programs, and, in spite of the criticisms of the probability filmstrip, they are among the best.

Under three separate titles, Harper and Row has created a variety of materials that deal not only with the present state of our human genetic knowledge, but also with provocative questions about relationships among science, technology, human values, and options for the future.

The program titled *Biological Aspects of Sexuality* is a series of slides with cassette tapes. It is divided into 18- to 20-minute modules, two of which were appropriate for review in this study. Module 5, *Accidents of Development,* demonstrated developmental abnormalities in humans that are the result of mutations and environmental influences such as drugs and infections during pregnancy. Prenatal diagnosis using amniocentesis, postnatal diagnosis, and treatments of some abnormalities are described. The module also presents the option of abortion for known fetal abnormalities with sensitivity and taste. The program does an excellent job of describing some common abnormalities, but it makes a poor effort at describing the biological causes. The module is informative, arouses considerable interest, and could be useful with the general public; but teachers may be dissatisfied with the limited presentation of basic biological concepts. One slide showing the vulva during birth seems unnecessarily bloody, and another photograph has an arrow pointing to chromosomes labeled as genes.

Module 7, *Germ Cell Formation and Fertilization,* might be described as an above-average lecture with an excellent set of slides. Occasionally the comments are short, simplistic and authoritarian, but the content is basically correct. The description and review of gametogenesis is outstanding. The module might be useful in senior high school and college biology courses.

Another Harper and Row program titled *Forecasting the Future: Can We Make Tomorrow Work?,* consisting of five color-sound filmstrips and cassette tapes, received good to excellent reviews from all of us. These filmstrips stress that our concept of the future has changed from one of a helpless fixed future to one of a fluid future that can be molded by our actions. The idea that all persons should be involved in deciding the future pervades the program. This value-laden program will cause many students of high school and college age to think seriously about their futures. It is just as appropriate for use with the social sciences as it is for use with the natural sciences. The teachers' guide is excellent. Objectives are stated well, and important questions are raised; a glossary is also included.

The third Harper and Row program titled *Redesigning Man: Science and Human Values* received mixed ratings. This program of six color filmstrips and accompanying cassette tapes raises ethical questions related to new discoveries and developments in biological research. The research areas included are gene manipulation, transplantation, behavior modification and control, fetal research, and aging. Some examples are presented as fact, even though they are questioned by large numbers of scientists and have not been confirmed by recent research. The teacher using this program is going to get a barrage of questions, and, if s/he is not prepared to present alternative points of view, some students might leave the classroom with great fears of what scientific research may produce.

Once again, the teachers' guide is excellent. Objectives are clearly stated, and a glossary is included. The guide correlates the program to specific units of several high school biology programs. A teacher planning to use this program should involve several thoughtful parents and colleagues in previews before the materials are actually used in the classroom. Evaluating the presentation of ethical issues in this program in light of the social maturity of the intended audience and the attitudes of the community is important.

Three 16 mm color-sound films produced by McGraw-Hill were reviewed. These films could have been omitted from the study because they are relatively old, but their subjects made them suitable candidates for review. The 14-minute film titled *The Mechanisms of Inheritance* received good to excellent ratings. The content and illustrations of dominance, incomplete dominance, hybrids, Mendelian ratios and probability are accurate and appropriate for middle or junior high school students. Because many new terms used in the narration are not shown on the screen, the teacher may want to provide spellings and definitions. This film could set the stage for a number of class activities. An adequate film guide is provided; and

if it is properly used in conjunction with the film, student learning should be enhanced.

A second McGraw-Hill film, *Prenatal Development*, was rated good to fair. This 20-minute film, which stresses the importance of environment in prenatal development, is designed for senior high school or beginning college level students enrolled in biology, psychology, or social science courses. The adverse effects on humans and animals of drugs such as thalidomide and heroin are presented without drawing unwarranted conclusions. Brain size in newborn rats suffering from malnutrition is presented without sensationalism. One error is the substitution of fruit fly chromosomes for human chromosomes. The film guide is well-prepared and helpful. Distributing the questions suggested for discussion before the film is shown should help direct student attention to the major objectives of the film.

Riddle of Heredity, the third McGraw-Hill film, is not as good as the other two. The introduction uses scare tactics to attract student attention and depicts scientists as frightening people. Technical subjects are treated superficially, and complicated concepts are poorly explained or ignored. There are several errors. Cell walls are shown as enclosing both plant and animal cells. "Mongolism" is used instead of the preferred term "Down syndrome," and the role of maternal age in Down syndrome vs. hemophilia is confused.

A group of five 8- to 14-minute, 16 mm color-sound films have been produced by the National Foundation/March of Dimes in collaboration with Milner Fenwick. These films, all rated as fair to excellent, are content centered, and they are appropriate for use with senior high school students, college-age students, young adults, and prospective parents in continuing education programs. Teachers' guides are not available. The topics included are somewhat technical and require considerable explanation. Thus, teachers should study the films carefully before using them in class. Many definitions are presented rapidly, and because new terms are not shown on the screen, teachers may wish to write them on the board or develop a handout to be distributed and discussed prior to showing the film. Several controversial issues are dealt with in a sensitive and acceptable manner. The titles of these short films are *Blueprint for Life, Autosomal Dominant Inheritance, Autosomal Recessive Inheritance, X-Linked Inheritance,* and *Chromosomal Errors.*

Blueprint for Life presents scientific information through an interview involving the parents of a child possibly affected with Down syndrome, a physician, and a genetic counselor. The film not only presents sound information concerning Down syndrome, but also explains Turner syndrome, Klinefelter syndrome, and the commonly referred to extra Y-chromosome in males. *Chromosomal Errors* is similar to *Blueprint for Life.* This film treats many of the same examples of birth defects, but in addition, it contains an excellent review of trisomy. The music is good, but somewhat dated, and it may make some students lose interest before the valuable content of the film is presented.

Autosomal Dominant Inheritance and *Autosomal Recessive Inheritance* are strictly content films with few errors. The language is sloppy; genes are said to "dominate," alleles to "interact." One of the films also states that albino men have brown eyes rather than blue or pink eyes. Nevertheless, important basic information on meiosis, basic statistics, and probability is included in these films.

In addition to covering the traditional examples of hemophilia and color-blindness, *X-Linked Inheritance* also treats muscular dystrophy, vitamin D-resistant rickets, Lesch-Nyhan syndrome and Hunter syndrome. This film has an excellent summary, which was not included in the other films in the series.

Genetics and You, the sixth film in the series is poor. Much of its content is futuristic nonsense, and the film is simplistic, unscientific, and often scary. We do not recommend its use.

We rated a color filmstrip/cassette tape program produced by the National Foundation/March of Dimes as excellent. This program, *From Generation to Generation,* is used regularly by March of Dimes staff members and volunteers. The presentation can be used with middle school and junior high school or college-age students. In addition to providing an excellent introduction to human genetic diseases, this program encourages the audience to seek genetic counseling. The program moves quickly, and students' understanding of important areas of biology is assumed. One effective way to use this program is to show it without discussion on the first day of a unit on human genetic diseases; later, after terms and concepts have been taught, the program can be shown again and discussed thoroughly. Used in this way, there is little doubt that student learning can be enhanced and the relationship between knowledge and the decision-making process demonstrated.

Recently, Document Associates and Hobel Leiterman have released two 16 mm color-sound films—*Evolution by DNA: Changing the Blueprint of Life,* and *Man the Creator.* Of the approximately 40 minutes of footage in these films, only about 15 minutes is worthy of classroom use with senior high school and beginning college students. *Genetics: Man the Creator* should be X-rated. The few short minutes of narration are spooky and set to horror-movie music—leaving the impression of fear for the future if we do not stop those wretched geneticists. *Evolution by DNA* was rated fair to good; it contains some sound content, including a description of the action of DNA. Crossing-over is described as "genes jumping from one chromosome to another looking for new partners." Such statements do not help the serious teacher or learner better understand the concept. David Suzuki, as the scientist, makes an important contribution to the early portion of the film; but David Suzuki, as the politician, later in the film, comes close to rendering the

film inappropriate for use in many public schools. Teachers would be wise to review this film carefully with other teachers and with parents of secondary school students before showing it to their classes. The film might stimulate interest in research among some students. Part of the content is basically sound, and the idea that the scientist has a role as both a researcher and citizen is well-presented.

Some Comments and Suggestions

As we reviewed audiovisual materials in the fields of human genetics, human genetic diseases, and birth defects, we were disappointed by the severe shortage in the marketplace today of quality materials for students of all ages. Commercial film makers have used a shotgun approach in producing a variety of materials. They have hit random areas of the target, but most of the available materials have missed the mark. Perhaps even more significant is the waste of millions of dollars. Quality audiovisual materials for specific audiences with specific objectives are valuable educational tools. But, for some reason, that message seems either not to have reached or not been considered important by commercial producers of audiovisual materials. Perhaps private publishers feel that they cannot afford the time and financial risk that must go into producing and testing well-designed products for a carefully selected audience. If commercial funding is not available, private foundations and government agencies should consider filling the gap.

Genetic counselors, health care specialists, and educators generally agree that improved education in this field could pay dividends by reducing both human suffering and the cost of health care. Medical research in human genetic diseases is important and must continue. But, the most important lesson that has emerged from the BSCS needs assessment project is that the public needs to be informed about human genetics and human genetic diseases. Geneticists, genetic counselors, and physicians can deliver their services effectively only within the societal context of an educated and enlightened citizenry.

For audiovisual producers who are interested in this area of development, we make the following suggestions:

1. Before beginning to develop audiovisual materials on these or any topics, the intended audience should be carefully defined and described. Far too many materials have been developed to attract a large segment of the marketplace. Although this approach makes sense superficially, we found that the broader the audience the film attempts to reach, the shallower the treatment and the lesser the value of the program for any specific audience. Audiovisual materials in the field of human genetics are needed for kindergarten through adult education, including professional education for physicians and genetic counselors. But the same materials cannot be appropriate to all audiences.

2. Classroom teachers, content experts, audiovisual specialists, and educators in the life and social sciences should all participate in the selection, development, testing, and editing of materials. Testing of the materials with the intended audience is vital.

3. Development of the visual materials should be accompanied by development of sound teachers' guides that include vocabulary lists, objectives for the program, and pre- and posttest questions. Poor teachers may never use the guides, but good teachers will demand them.

4. Slide sets, filmstrips, and cassette tapes are 40% to 60% less expensive than 16 mm films, but, if used properly, they can be just as effective in promoting learning. They also offer other advantages, including their use in a self-contained classroom or in individualized learning centers. Schools are more likely to purchase materials that may be placed in audiovisual centers and that students can observe several times over a period of days or weeks.

To teachers and other individuals who wish to use audiovisual materials in human genetics, we offer the following suggestions:

1. Be certain audiovisual materials in human genetics are appropriate to the developmental level of your students and that any program you present will aid your students in achieving the objectives of the course.

2. If the audiovisual materials contain topics that are value-laden or potentially controversial, call on other teachers and parents to review the materials and help you decide their appropriateness for your students.

3. Make an honest effort to locate and use the very best audiovisual materials in your classes. Place pressure on local administrators to make funds available to purchase and rent audiovisual materials. Good materials will improve both teaching and learning, but poor materials can have negative effects.

4. Use the teachers' guides when they are provided and develop short pre- and posttests that will help you to determine whether your students are learning the basic concepts. Encourage students to express themselves concerning the content, as well as the ethical and moral issues presented in the program.

5. As stated in the suggestions for publishers, slide sets or filmstrips with cassette tapes are less expensive and sometimes qually effective. They have the advantage of being used easily either in the classroom or in a learning center.

6. Remember that even the best audiovisual materials can never replace good teaching. The materials in the field of human genetics and human genetic diseases that we reviewed in this study demand the presence of a knowledgeable, thoughtful, and humane teacher. Quality materials, if properly used, will strengthen both teaching and learning.

Audiovisual Materials Reviewed

AUTOSOMAL DOMINANT INHERITANCE.
1977. The National Foundation/March of Dimes and Milner-Fenwick (3800 Liberty Heights Avenue, Baltimore, Maryland 21215). 16 mm color-sound film. 12 minutes. Purchase $125; rental varies $20-$30.

AUTOSOMAL RECESSIVE INHERITANCE.
1977. The National Foundation/March of Dimes and Milner-Fenwick (3800 Liberty Heights Avenue, Baltimore, Maryland 21215). 16 mm color-sound film. 8 minutes. Purchase $125; rental varies $20-$30.

BLUEPRINT FOR LIFE.
1972. The National Foundation/March of Dimes and Milner-Fenwick (3800 Liberty Heights Avenue, Baltimore, Maryland 21215). 16 mm color-sound film. 14 minutes. Purchase $125; rental varies $20-$30.

CHROMOSOMAL ERRORS.
1977. The National Foundation/March of Dimes and Milner-Fenwick (3800 Liberty Heights Avenue, Baltimore, Maryland 21215). 16 mm color-sound film. 11 minutes. Purchase $125; rental varies $20-$30.

GENETICS AND YOU.
1977. The National Foundation/March of dimes and Milner-Fenwick (3800 Liberty Heights Avenue, Baltimore, Maryland 21215). 16 mm color-sound film. 11 minutes. Purchase $125; rental varies $20-$30.

X-LINKED INHERITANCE.
1977. The National Foundation/March of Dimes and Milner-Fenwick (3800 Liberty Heights Avenue, Baltimore, Maryland 21215). 16 mm color-sound film. 11 minutes. Purchase $125; rental varies $20-$30.

FROM GENERATION TO GENERATION: GENETIC COUNSELING.
1977. The National Foundation/March of Dimes. Available at local chapters. Filmstrip or slides and cassette. 20 minutes. Rental free.

BIOLOGICAL ASPECTS OF SEXUALITY.
1973. Harper and Row Publishers, Inc. (10 East 53d Street, New York 10022). Slides and cassette. *Module 5: Accidents of Development; Module 6: Mechanisms of Differentiation; Module 7: Germ Cell Formation and Fertilization.* 20 minutes. Purchase $92 each.

FORECASTING THE FUTURE.
1976. Harper and Row Publishers, Inc. (10 East 53d Street, New York 10022). Color filmstrip, cassette and teacher's guide. *Choosing Tomorrow's World; Energy and Human Values; Technology and the Year 2000; The Future of Work; The Family in Transition.* 15 minutes. Purchase $120 (all 5 filmstrips).

REDESIGNING MAN: SCIENCE AND HUMAN VALUES.
1974. Harper and Row Publishers, Inc. (10 East 53d Street, New York 10022). Color filmstrip and cassette. *Corrections and Carbon Copies; Breeding Tomorrow's Man; Transplants and Implants; Exploring Man's Mind; World of the Unborn; The Search for Immortality.* 15 minutes. Purchase $125 (all 6 filmstrips).

THE MECHANISM OF INHERITANCE.
1966. McGraw-Hill Films (1221 Avenue of the Americas, New York 10020). 16 mm color-sound film. 14 minutes. (Out of print)

PRENATAL DEVELOPMENT.
1974. McGraw-Hill Films (1221 Avenue of the Americas, New York 10020). 16 mm color-sound film. 20 minutes. Purchase $295; rental $35.

RIDDLE OF HEREDITY.
1969. McGraw-Hill Films (1221 Avenue of the Americas, New York 10020). 16 mm color-sound film. 30 minutes. Purchase $425; rental $20.

EVOLUTION BY DNA: CHANGING THE BLUEPRINT OF LIFE.
1976. Document Associates, Inc. and Hobel Leiterman (880 Third Avenue, New York 10022). 16 mm color-sound film. 23 minutes. Purchase $300; rental $40.

GENETICS: MAN THE CREATOR.
1976. Document Associates, Inc. and Hobel Leiterman (880 third Avenue, New York 10022). 16 mm color-sound film. 19 minutes. Purchase $285; rental $40.

WARD'S SOLO-LEARN SYSTEM.
1970. Ward's Natural Science Establishment, Inc. (P.O. Box 1712, Rochester, New York 14603). Color filmstrip, cassette and student worksheet. *Linkage, Crossing-Over, and Chromosome Maps; Introduction to Mendelian Inheritance; Introduction to Probability.* 40 minutes. Purchase $29 each.

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_____, and EISENBERG, H. 1975. *How to be your own doctor—sometimes.* New York: Grosset and Dunlap.

VICKERY, D. M. and FRIES, J. F. 1976. *Take care of yourself: a consumer's guide to medical care.* Reading, Mass.: Addison-Wesley.

Wisdom

The wise man does nothing of which he can repent, nothing against his will, but does everything nobly, consistently, soberly, rightly. *Cicero*

Consists in the highest use of the intellect for the discernment of the largest moral interest of humanity.
Felix Adler