Texas Association of Biology Teachers
Position Statements

TABT's Statement on Teaching Evolution

As published in *The American Biology Teacher* by Theodosius Dobzhansky (1973), "Nothing in biology makes sense except in the light of evolution." This brief statement reflects the central and unifying role of evolution in biology accepted by the Texas Association of Biology Teachers and mainstream biologists throughout the world. The theory of evolution provides a framework that explains both the history of life and the ongoing adaptation of organisms to environmental challenges and changes.

Biologists continue to study, ponder, and discuss – often in heated debates – the patterns, mechanisms, and pace of evolution. However, they are in nearly unanimous agreement that all living things share common ancestors. The fossil record and the diversity of living organisms, combined with the techniques of molecular biology, taxonomy, and geology, provide exhaustive examples of and powerful evidence for current evolutionary theory. Genetic variation, natural selection, speciation, and extinction are well-established components of modern evolutionary theory. Explanations are modified and refined as warranted by new scientific evidence that accumulates over time, demonstrating the integrity and validity of the field.

Evolutionary theory is the only scientific theory – as opposed to the lay definition of theory – that clearly explains current evidence for the observed natural process of long-term changes in living things, and that makes predictions about future discoveries with regard to the biodiversity of living things. Experimentation, analysis, and revision based on verifiable evidence are procedures that clearly differentiate and separate science from other ways of knowing. Explanations or ways of knowing that invoke non-naturalistic or supernatural events or beings, whether called "intelligent design theory," "scientific creationism," "creation science," "young earth theory," or similar designations, are outside the realm of science and not part of a valid science curriculum. For this reason, and because the selection of topics for a biology curriculum that includes classroom discussion and laboratory experiences should accurately reflect the principles of biological science, the Texas Association of Biology Teachers, in order to assure an effective and scientifically honest standards-based instructional framework, asks that only acceptable scientific theory be taught in life sciences classrooms of Texas.

TABT gratefully acknowledges the work done by the National Association of Biology Teachers in producing its Statement on Evolution Teaching as revised in May 2004, and borrowed heavily from that work in producing this Statement.

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Role of Laboratory and Field Instruction in Biology Education

Biologists recognize that knowledge based upon experimental results and accurate observations is gained through a variety of experiences. Thus, the role of the laboratory and field learning becomes a key component in understanding biology. Laboratory and field activities and inquiry provide students with opportunities to question, observe, sample, experience, and experiment with scientific phenomena in their quest for knowledge of living things.

The most effective vehicle by which the process of inquiry can be learned appears to be a laboratory or field setting where the student experiences, firsthand, the inquiry process. Laboratory and field study have also been demonstrated to be effective means for comprehension, understanding and application of biological knowledge. Lab and field experiences provide opportunities for teachers to model best practices in the study of biology, including application of scientific methodologies, respect for life and the environment, inclusion of learners of all abilities, and consistent adherence to safety standards. Thus, study in a laboratory and/or field setting is an integral and essential part of a biology course. The following are recommendations regarding teaching strategies, physical resources, and curriculum development that will enhance the study of biology and improve the quality of biology instruction in our schools.

In a laboratory or field learning environment, students work individually or in small groups on a question, problem or hypothesis. They use the processes and materials of science to construct their own explanation of biological phenomena. They observe, collect data and interpret data of life processes, living organisms, and/or simulations of living phenomena. The distinction between laboratory or field learning and traditional classroom learning is that activities are student-centered, with students actively engaged in hands-on, minds-on activities using laboratory or field materials and techniques.

The laboratory and field components of biology instruction should provide experiences for direct student involvement which emphasize the above process skills and the tentative nature of science. Also, students must be given opportunities to pursue procedural options rather than simply follow recipes. They must be provided opportunities to design and carry out their own experiments. While computer-assisted instruction and video materials contribute to biology learning, they should not be used to completely replace direct observation of living organisms or for experiments in which students learn cause and effect relationships between and among biological phenomena. School administrators need to recognize the expenses related to offering experiential, hands-on laboratory courses and strive to provide adequate funding.

Biology courses should have an integrated laboratory and/or field experience component in which students spend at least 40% of their total instructional time. Provisions for this amount of laboratory and field work should be made in the curriculum of a biology course. Research has shown that beginning a unit of study with experiences in a laboratory or field setting allows students to construct new knowledge for themselves. These experiences can provide the basis for the introduction of more abstract concepts presented in lectures, discussions or reading assignments. Teachers should be supported in introducing such experiences at the beginning of each unit.

Biology teachers must be provided with an annual budget sufficient to purchase both expendable material and equipment necessary to conduct inquiry-based learning. Biology laboratory instruction should provide students with frequent opportunities to observe and experiment with living materials, as opposed to nonliving specimens or artifacts. Use of preserved specimens rather than models should be incorporated when models cannot provide the same experience adequately. Every student should have direct, hands-on experiences with laboratory materials. Resources should be available to allow all students, regardless of ability, to experience laboratory and field instruction in a safe environment.

Secondary biology teachers are expected to have a major in the biological sciences and formal training in laboratory and field teaching strategies. Instruction in biology laboratory and field study should be an integral part of pre-service and in-service teacher training. Ideally, pre-service teachers should do "lab and/or field science" under the guidance of a trained specialist. Universities should encourage their life science teachers to grow professionally by attending summer institutes and professional meetings, as well as taking graduate courses in biology and biology education. Administrators should seek educational funding from available sources to support and compensate teachers in their efforts to update their current knowledge and to network with colleagues from different schools.

Adequate and appropriate facilities, materials and equipment need to be provided for students to learn biology in a laboratory and field setting. The laboratory classroom should be equipped with work tables that have sinks, a water supply, and natural gas and electrical outlets available in sufficient quantity. Adequate ventilation, fume hoods, reference materials and laboratory size must allow all students to participate in hands-on activities. Adequate space for storage of materials and secure areas for storage of solvents, reactants, or potentially hazardous or dangerous chemicals is required as per guidelines set by the American Chemical Society. Facilities should be inspected for structural and configuration updating every 10 years. There should also be a space dedicated to growing living specimens for study in biology classes. Approved guidelines for the safe use, maintenance storage and disposal of laboratory materials must be followed. This includes classroom instruction on safety and emergency procedures. Position statements or safety guidelines from organizations such as NABT, OSHA, NIH, the American Chemical Society, Flinn Scientific, etc. and appropriate safety procedures for using plants and microorganisms should be followed. Each laboratory room must be equipped with appropriate safety equipment, such as safety goggles and laboratory aprons for all students, a first-aid kit, a fire blanket, and an all-purpose fire extinguisher. A safety shower and eyewash station should be available within a 20-second walk if exposure to hazardous chemicals is a risk. Safety goggles, if used by different students, must be disinfected. The State Department of Education guidelines for safety procedures should be rigorously followed. Administrators must ensure adherence to applicable safety standards. Professional development for teacher in lab/field safety should be a high priority, along with funding to provide appropriate safety equipment, ensure proper disposal of hazardous materials, and provide sufficient space for students in the laboratory classroom.

A student-to-instructor ratio in the biology laboratory classroom must permit safe and effective instruction. Class size should be determined by the physical design of the classroom and should not exceed 24 students in a laboratory setting for any reason when students are assigned to a single teacher. Smaller limits should be set if students with special needs require more assistance from the teacher.

Due to the extra time and preparation that laboratory courses require, life science teachers should be assigned fewer classes per semester than teachers who do not require such time. When possible, teachers should have their own science classrooms and have access to those classrooms during their preparation times. Time must also be allowed within the teaching day for the setup and dismantling of laboratory preparations. Where possible, student or adult laboratory assistance should be provided, and in high school, we strongly recommend that a laboratory manager (or instructional aid) be hired to assist in preparation, setup, and dismantling of laboratory materials for experiential learning lessons.

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Texas Association of Biology Teachers
Position Statement on Science Teacher Certification

The Texas Association of Biology Teachers, an affiliate of the National Association of Biology Teachers and the Science Teachers Association of Texas, fully supports the positions taken by the Science Teachers Association of Texas and the Texas Academy of Science Texas Education Agency. Our membership of over 600 is composed of life sciences teachers in elementary, middle school, secondary, and university levels of state public and private schools, private business, and national organizations.

The Texas Association of Biology Teachers calls upon the State Board of Education and the State Board for Educator Certification to adopt science teacher certification standards that ensure Texas students are taught by well-prepared teachers. For the Texas public to maintain faith in our educational system, certification must guarantee competency. The presently proposed standards do not do so. In addition to general teaching skills and attitudes, the preparation should include adequate

- Science curriculum content.
- Science education pedagogy.
- Safety training.
- Laboratory and field experiences.

This preparation should be documented by the certifying program and authenticated by external review. Valid evaluation requires multiple lines of evidence. The documentation of evidence of competency in the above areas should be in place in the Texas certification process. In addition to a rigorous science TExES, there should be additional evidence of competency before a candidate is allowed to enter the classroom. The documentation of performance both before and after the candidate enters the classroom should be made by science education specialists.

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Texas Association of Biology Teachers
Position Statement on the Revision of the Science TEKS

Through the process of revising the science standards, the State of Texas has an opportunity to continue as a leader in science education. The TABT supports a revision of the TEKS that reinforces the following areas:

1. The TABT supports language in the revised TEKS that encourages a prominent laboratory presence in Texas biology classrooms. The TEKS should be a source of encouragement for teachers to engage students in as many laboratory experiences as possible, and for administrators to support these experiences.

2. The TEKS revision should result in a document that is clear, concise, and provides for a sound, foundational understanding of biology, that will prepare Texas students for college, career, and life as a consumer and voter.

3. The revised standards should reinforce the consensus opinion of the scientific community that biological evolution is the unifying theme of Biology. The TABT strongly opposes the inclusion of pseudoscience, including, but not limited to "creation science", "Intelligent Design", and all other pseudoscience approaches to interpreting the scientific evidence from natural phenomena.

4. The TABT recognizes, and supports, the incredible effort of the Science Teachers Association of Texas (STAT) in proactively creating a comprehensive recommendation for the science TEKS revision. We feel that the recommendations made by them should be given consideration.

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