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Rethinking Advanced Placement

By **CHRISTOPHER DREW**

WHEN Joan Carlson started teaching high school biology more than 30 years ago, the Advanced Placement textbook was daunting enough, at 36 chapters and 870 pages. But as an explosion of research into cells and genes reshapes our sense of how life evolves, the flood of new material has been staggering. Mrs. Carlson's A.P. class in Worcester, Mass., now confronts a book with 56 chapters and 1,400 pages, along with a profusion of animated videos and Web-based aids that supplement the text.

And what fuels the panic is that nearly every tongue-twisting term and microscopic fact is fair game for the year-end test that decides who will receive college credit for the course.

"Some of the students look at the book and say, 'My gosh, it's just like an encyclopedia,'" Mrs. Carlson says. And when new A.P. teachers encounter it, "they almost want to start sobbing."

As A.P. has proliferated, spreading to more than 30 subjects with 1.8 million students taking 3.2 million tests, the program has won praise for giving students an early chance at more challenging work. But many of the courses, particularly in the sciences and history, have also been criticized for overwhelming students with facts to memorize and then rushing through important topics. Students and educators alike say that biology, with 172,000 test-takers this year, is one of the worst offenders.

A.P. teachers have long complained that lingering for an extra 10 or 15 minutes on a topic can be a zero-sum game, squeezing out something else that needs to be covered for the exam. PowerPoint lectures are the rule. The homework wears down many students. And studies show that most schools do the same canned laboratory exercises, providing little sense of the thrill of scientific discovery.

All that, says the [College Board](#), is about to change.

Next month, the board, the nonprofit organization that owns the A.P. exams as well as the SAT, will release a wholesale revamping of A.P. biology as well as United States history — with 387,000 test-takers the most popular A.P. subject. A preview of the changes shows that the board will slash the amount of material students need to know for the tests and provide, for the first time, a curriculum framework for what courses should look like. The goal is to clear students' minds to focus on bigger concepts and stimulate more analytic thinking. In biology, a host of more creative, hands-on experiments are intended to help students think more like scientists.

The changes, which are to take effect in the 2012-13 school year, are part of a sweeping redesign of the entire A.P. program. Instead of just providing teachers with a list of points that need to be covered for the exams, the College Board will create these detailed standards for each subject and create new exams to match.

Trevor Packer, the College Board's vice president for Advanced Placement, notes that the changes mark a new direction for the board, which has focused on the tests more than the courses. The rollout of "the New A.P.," as the board describes it, will actually start this year with a new curriculum taking effect in two smaller programs, German and French language. Major revisions to physics, chemistry, European history, world history and art history will follow, with the hope of being ready for exams in 2014 or 2015.

“We really believe that the New A.P. needs to be anchored in a curriculum that focuses on what students need to be able to do with their knowledge,” Mr. Packer says. A.P. teachers made clear that such a shift was impossible unless the breadth of material covered was pared down. Courses in English and math are manageable, Mr. Packer says, and will not be revised until later.

The new approach is important because critical thinking skills are considered essential for advanced college courses and jobs in today’s information-based economy. College administrators and veteran A.P. teachers familiar with the new biology curriculum believe the changes could have significant reverberations for how science is taught in introductory college classes and even elementary school classrooms, and might bring some of the excitement back to science learning.

“I really think this is a game-changer,” says Gordon E. Uno, a botany professor at the [University of Oklahoma](#) who has helped plan the biology changes.

And here is one indication of how pumped up the College Board is about the revitalization: If Mr. Packer were a high school junior next year, would he take the old A.P. biology or wait till his senior year for the new one?

“I would absolutely wait,” he says.

WHEN A.P. testing began in 1956, memorization was not yet a dirty word, and it was O.K. if history classes ran out of time just after they finished World War II.

The College Board created the first exams at the behest of elite preparatory schools, which wanted to convince colleges that their best students could dart right into advanced work. The board based the exams on what colleges taught in freshman survey courses. As the testing expanded over the next several decades, the board began providing a brief description of college-course themes and breaking down the percentage of those courses — and thus the A.P. exam — devoted to each topic. But it was up to each high school to flesh out its own curriculum.

And it did not take long for instructors to start teaching to the test, treating the board’s outline as the holy grail for helping students achieve the scores of 3 or higher, out of 5, that might earn credit from a college.

That obviously became harder to do as breakthroughs in genetic research and cellular organization, and momentous events like the cold war, the civil rights movement, Watergate and the war on terror, began to elbow their way onto the lists. College professors could pick and choose what to cover in their introductory survey classes. But because the A.P. test can touch on almost anything, high school juniors and seniors must now absorb more material than most college freshmen.

So perhaps it is no surprise that while the number of students taking the A.P. biology test has more than doubled since 1997, the median score has dropped to 2.63, from 3.18. On the exam last May, slightly fewer than half of the test-takers scored a 3, which equates to a C in a college course. And while 19 percent of students earned 5’s, almost twice that many got 1’s, which could be a failing grade in college.

A committee of the [National Research Council](#), a part of the [National Academy of Sciences](#), called attention to these problems in 2002. It criticized A.P. science courses for cramming in too much material and failing to let students design their own lab experiments. It also said the courses had failed to keep pace with research on how people learn: instead of listening to lectures, “more real learning takes place if students spend more time going into greater depth on fewer topics, allowing them to experience problem solving, controversies and the subtleties of scholarly investigation.”

A few top universities have become more choosy about giving credit. In 2007, the [Massachusetts Institute of Technology](#), for instance, stopped giving credit for A.P. biology, and developed its own placement exam. Stuart Schmill, M.I.T.'s dean of admissions, says the biology department found that even some of the students who scored 5's did not have the problem-solving skills needed for higher-level courses. The [University of Texas](#) has also tightened its rules for biology placement, giving credit for 5's only, though many large universities still accept 4's or 3's.

Several elite private high schools have also dropped A.P. courses. In defiance, the public school district in Scarsdale, N.Y., created its own in-depth courses called Advanced Topics. (For college credit, students still have to do well on the A.P. or another placement exam.)

The College Board took the criticisms to heart, and has been working with hundreds of college professors and high school teachers to develop the new approach.

For biology, the change means paring down the entire field to four big ideas. The first is a simple statement that evolution "drives the diversity and unity of life." The others emphasize the systematic nature of all living things: that they use energy and molecular building blocks to grow; respond to information essential to life processes; and interact in complex ways. Under each of these thoughts, a 61-page course framework lays out the most crucial knowledge students need to absorb.

And to the delight of teachers who have gotten an early peek at the plans, the board also makes clear what will not be on the exam. Part or all of at least 20 of the 56 chapters in the A.P. biology book that Mrs. Carlson's class uses will no longer need to be covered. (One PowerPoint slide explaining the changes notes sardonically that teachers can retire their swift marches through the "Organ of the Day.")

Similarly, the new plans divide United States history into nine time periods and seven overarching themes. But instead of requiring students to memorize the dates of the Pequot War — which, for those of you who forgot, occurred from 1634 to 1638 and eliminated the Pequot tribe in what is now Connecticut — teachers will have more leeway to focus on different events in teaching students how to craft historical arguments.

Scarsdale High School sees some synchronicity. "It appears to be clearly much more in line with what we are trying to emphasize this year," says Beth Schoenbrun, the school's co-director of Science Research. "It certainly seems to allow for a good deal more flexibility in terms of what is covered in the classroom."

William Wood, who teaches biology at the [University of Colorado](#), Boulder, was a key member of the National Research Council panel that criticized A.P. science. He says now: "I like the way they've tried to make it clear what the boundaries are, what they want students to actually remember and what can be left out." He says he's "pretty impressed" with what he's seen so far.

MRS. CARLSON, who teaches A.P. bio at the Bancroft School, an affluent, private academy in central Massachusetts, has always made her lab an inviting place. A chalk-white skeleton watches over the students. So does Al, a rare clear gummy bear, in a paper-clip chair, surrounded by presents from students who view his lack of color as analogous to genetic mutations. He has a bag of mud from the Dead Sea, trinkets from Mount Fuji and a model of a fish from Bermuda.

Mrs. Carlson knows she is fortunate to have a board of directors that will buy whatever equipment she needs for the lab and a generous nine class periods a week for her A.P. course. Many teachers have to cover all the material in just five or six periods, and some must hold their labs after school or on holidays, if they have them at all — thanks to insufficient slots during the school day, and too many after-school activities.

Mrs. Carlson says several students drop her class each year after they realize how hard it will be. She is also frustrated by the predictable nature of many of the “dirty dozen,” the teachers’ nickname for the basic lab exercises now recommended by the College Board. In one that her class did last fall, the students looked at pre-stained slides of onion root tips to identify the stages of cell division and calculate the duration of the phases.

She and her students, who historically score 4’s and 5’s on the exam, were one of several schools asked by the College Board to road test one of the proposed new labs to see if it brought back the “Oh, wow!” factor.

The basic question: What factors affect the rate of photosynthesis in living plants? The new twist: Instead of being guided through the process, groups of two or three students had to dream up their own hypotheses and figure out how to test them.

Caroline Brown, a senior who stages the school’s plays, connected the lab to her passion for theater. She borrowed green, sky blue and “Broadway pink” filters from the playhouse to test how different shades of light affected photosynthesis in sunken spinach leaves. The pink surprised her by narrowly edging out the blue in triggering photosynthesis.

Ms. Brown had started to take both A.P. biology and A.P. United States history as a junior, but says she quickly realized that school counselors were right in warning “that’s one combination that will just about kill you.” So she stuck with history and went back to biology this year.

Robert Turley, a junior, created little disks of spinach with a hole puncher and dropped them into two beakers. He and his partner thought photosynthesis would occur more quickly in a slightly acidic solution, prompting those disks to shoot to the surface. But as they watched through safety goggles, all 10 of the disks in the basic solution rose, while none of disks in the more acidic solution budged.

“So for this lab, our hypothesis was actually wrong,” he says. “But it definitely felt more like a lab that would be done like a scientist in the real world than the other labs we’ve done.”

Even though Alyssa Kotin’s experiment was inconclusive, she and her partner presented a colorful poster with a graph of their findings to the class, just as the other groups did, to stimulate more discussion.

College Board officials say the new labs should help students learn how to frame scientific questions and assemble data, and the exam will measure how well they can apply those skills. When the new test is unveiled in 2013, biology students will need, for the first time, to use calculators, just as A.P. chemistry and physics students do. The board plans to cut the number of multiple-choice questions nearly in half on the new test, to 55. It will add five questions based on math calculations, and it will more than double the number of free-response questions, to nine.

“There won’t be any more questions like: here is a plant, and what is this tissue?” says Professor Uno of the University of Oklahoma, who is helping to decide what will be asked. Instead, early samples show that the multiple-choice questions will be more complex. They will require students to read short passages, or look at graphs, and pick the answers that explain why something happened or that predict what will occur next.

One sample essay question provides a chart with the heights of plants growing in either sunlight or shade and a graph that misinterprets the results. Students must decipher what went wrong, re-plot the data and design a better experiment to determine which grew faster.

WHILE many educators agree with the tack A.P. is taking, they also recognize that the change is going to be difficult for many teachers and schools.

Athena Vangos, who teaches A.P. biology at a public high school in Leicester, Mass., a blue-collar town where many students have part-time jobs, loves the idea of less memorization and more conceptual thinking. As is the case with many public schools, hers does not limit A.P. courses to only the top students. So while six of her students earned 4's or 5's on the exam last May, six others "just throw up their hands" at the amount of work and settled for 1's.

While Ms. Vangos believes the program could inspire students who "like to think outside the box," she worries that the new math requirements will discourage others. And with so many cutbacks these days in education budgets, she says, the need to improve lab facilities at many public schools "is absolutely going to pose a big problem." Labs in resource-strapped urban schools often don't have enough of even basic tools, like dissecting microscopes, for their students.

Studies indicate that relatively few high schools have laboratories equivalent to those used in first-year college courses. Professor Uno says that the new A.P. lab experiments will rely mostly on the same equipment as the old ones, and that program designers will provide "some low-cost alternatives where we can."

Another concern is how well teachers — across the full range of A.P. subjects — will adjust to an approach that will require them to give up some control and let the students dictate more about where the class discussions go. Mr. Packer says the College Board is investing substantial resources in creating professional-development programs and online tools to help teachers make that transition.

In many ways, the changes will complete a broad turn for the College Board, from its origins as a purveyor of tests to a much more deliberate arbiter of what the nation's top students will study. Its exams had already set that agenda indirectly, of course, and turned A.P. classes into a way of life for top students.

Yet as the board trumpets its new plans, it is also acknowledging how much the process had gotten out of hand. Students will still have to put in long hours, and there is no sign that the arms race will slow among students trying to pile up as many A.P. classes as they can to impress college admissions offices.

But, Mr. Packer says, the College Board supports the idea of schools' placing limits on the number of A.P. classes students can take. And, he says, it sees the new courses as a step toward relieving some of the burdens.