

The Science of Aldous Huxley's *Brave New World*

Erin M. Counihan
Lee High School

INTRODUCTION

Seniors in high school face many challenges after Spring Break: they begin to feel the pressure of leaving home to go to college, they begin to question their capabilities and their decisions, and they begin to experience the dreaded “senioritis.” Because of these factors, they find it difficult to focus on – or find interest in – what their teachers are presenting. In this curriculum unit, senior Advanced Placement English students will read Aldous Huxley’s *Brave New World*, a high-interest novel that encourages conversation and contains provocative subject matter. They will address the novel not as a piece of fiction, but as a vehicle through which to view our world and what it may still become. By studying Huxley himself and some of the current science that parallels the novel, students will become engaged and active and remain involved in learning even at the end of their high school career.

The school in which this unit will be taught is an inner-city high school in Houston, Texas. Many of the students in the school do not speak English as a first language and, therefore, have not had consistent training in English language and literature. This interdisciplinary curriculum unit is designed for an Advanced Placement English Literature and Composition class, but it can easily be modified for other high school English courses. The unit will be taught over a span of approximately four weeks. Courses meet three times a week, once for 40 minutes and twice for 95 minutes; therefore, each lesson plan is designed for a 40 or a 95 minute class period.

OBJECTIVES

The objectives for this interdisciplinary unit are based on the Texas Essential Knowledge and Skills (TEKS) for 12th grade Language Arts (see Appendix A for appropriate numeration) and on the College Board’s Advanced Placement expectations for English Literature and Biology.

Writing

Primary writing skills expect students to be able to write an organized, coherent piece that progresses logically, provides clear support, and uses vocabulary and rhetorical devices appropriate to the audience and purpose. Students will also be expected to use the Modern Language Association (MLA) manual as they format their research papers.

Reading

Though there are many objectives involved in studying a novel, only three primary reading objectives will be stressed continuously throughout the unit. Students will be expected to draw inferences and then support and clarify them. They will also be expected to connect the fiction and non-fiction they will be reading with historical contexts, current events (specifically in science), and their own lives.

Research

Students will be researching throughout this unit and will primarily be expected to evaluate the sources they use for appropriateness to the topic and to the audience. They will produce their

own research projects for diverse audiences, and they will be able to draw relevant questions from their research, as well.

Advanced Placement

English Literature

This curriculum unit is designed to support the objectives of the College Board Advanced Placement Literature and Composition course. One of the purposes of this course and of this unit is to have a student “read deliberately and thoroughly, taking time to understand a work’s complexity, to absorb its richness of meaning, and to analyze how that meaning is embodied in literary form” (*English Literature Course Description* 45).

Biology

Secondary biology learning objectives will be interspersed throughout this unit. The student will understand and intelligently discuss the fact that “Scientific research often leads to technological advances that can have positive and/or negative impacts upon society as a whole” (*Biology Course Description* 6).

RATIONALE

The seminar “One Cell to Many: The Dynamics of Life” may seem a strange choice for an English teacher, but I am hoping to use the experience to broaden my own knowledge of science to relate to science fiction and to develop a strong, cross-disciplinary unit to pique my students’ interests. I always discuss the historical context of any work before teaching it, but in some cases I don’t have the scientific knowledge to explore the aspects of science fiction within a work. When reading Aldous Huxley’s novel *Brave New World* in my Advanced Placement English Literature course, for example, my students sometimes ask questions that I cannot answer – and the questions begin on page 4.

We begin learning about the Central London Hatchery and Conditioning Centre from the beginning of the novel. Students are always intrigued by the “Fertilizing Room,” where eggs taken from surgically removed ovaries are “immersed in a warm bouillon containing free-swimming spermatozoa,” fertilized, and sent to incubators (Huxley *Brave New World* 4). Depending on the caste that has been predestined, the ova are either “bottled” (in the case of the upper caste Alphas and Betas) or brought out for further adjustments (in the case of the lower caste Gammas, Deltas, and Epsilons). This seems, to my students and to me, a straightforward and believable process – until we get to the details of “Bokanovsky’s Process,” through which the lower caste ova will have their development arrested (Huxley *BNW* 4). A “bokanovskified egg will bud, will proliferate, will divide....every bud will grow into a perfectly formed embryo, and every embryo into a full-sized adult. Making ninety-six human beings grow where only one grew before” (Huxley *BNW* 4). It is at this point where my students begin to ask if this is possible now or will be soon, and where my students who are taking Advanced Placement Biology begin to discuss cloning, “in vitro” fertilization, stem cells, and other topics about which I know very little; it is at this point when I tell myself I should take a course in cell biology.

In this unit, I will explore the science behind Aldous Huxley’s *Brave New World* – the author’s early influences and passions – as well as address some of the science that permeates Huxley’s novel. Students will debate as to whether or not *Brave New World* was (or will become) a dire predictor for our society. Topics such as “in vitro” fertilization, “designer babies,” stem cell research, and cloning are very visible now, and students love to debate the science and ethics connected to these issues. Because there is such a high interest level, I am creating this unit to address these issues, broaden the appeal of *Brave New World*, design an environment where all

students are actively writing, speaking, and defending well-researched arguments, and encourage my students to become strong, well-rounded thinkers.

UNIT BACKGROUND

Author Background – Some of Aldous Huxley’s Early Influences

Because the heart of this unit revolves around whether or not the science in the novel is legitimate, students must discern if Aldous Huxley had the scientific knowledge to make his book realistic. In Lesson Plan One below, students will research Huxley’s life in order to form an opinion about his qualifications and then present their results to their classmates. Most will likely determine that his experiences are worthy enough to tag the science in *Brave New World* as probable or even possible; his ancestry and his interests certainly lead to this conclusion.

Aldous Huxley was born to a very intellectual and scientific family. His paternal grandfather, Thomas Henry Huxley, was a supporter and contemporary of Charles Darwin and wrote his own book, *Evidence on Man’s Place in Nature*, which presented evidence for human evolution, a topic Darwin had avoided. Thomas Huxley surrounded himself with other famous men of science and philosophy, studied broadly, and founded a formidable dynasty of intellectually and scientifically minded descendants (“Thomas Henry Huxley”).

Aldous’s father, Leonard Huxley, was not an established scientist, but he understood the concepts enough to be a recognized biographer of his father and of Charles Darwin. Leonard married Julia Arnold, who came from an intellectual family herself; she was the sister of a novelist, niece of the poet Matthew Arnold, and granddaughter of a famous educator, Thomas Arnold (“Aldous Huxley: The Author and his Times”). It would seem inevitable that such a learned couple would have children who pursued great ideas.

Leonard and Julia’s oldest son, Julian, became a prominent scientist in the 20th century, following in his grandfather’s footsteps. While Aldous was penning *Brave New World*, his treatise on how science may affect human life, Julian was similarly studying “concepts of evolution and growth, dealing with them in the light of the philosophic problems generated by contemporary scientific developments;” he also made important connections between genetics and evolution (“Sir Julian Huxley”).

Meanwhile, after the death of his first wife, Julia, Leonard Huxley remarried; his first son by this new marriage was Andrew F. Huxley, the 1963 Nobel Laureate in Physiology or Medicine. In 1932, the year that Aldous’s *Brave New World* was published, Andrew went to Cambridge planning to major in the physical sciences; an “extra” course in physiology started him on the professional path that was to lead to the collaborations that would, in turn, lead to his Nobel Prize (“Andrew F. Huxley”).

Aldous Huxley himself obviously grew up in a family of the intellectual elite in England, and this likely affected his own life and his writing. Huxley had avidly studied science as a child, though he was prevented from becoming a surgeon by an eye illness that left him nearly blind. Eventually, his family history and scientific interests, as well as some moral obligations to fight the “class-instituted slavery” he saw around him, were evidenced in his writing, especially in *Brave New World* (“Aldous Huxley: The Author and his Times”).

As an adult, Aldous also had some very impressive friends, including the early 20th century geneticist J.B.S. Haldane. Haldane was an “innovative pioneer” in population genetics whose “brilliance” helped define the field, which “reshaped modern evolutionary biology” (Milner). He also published a work of fiction, *Dædalus*, which discussed the scientific possibility of “test tube” or “ectogenic” babies; this “shocking science fiction” was a commercial success and may have inspired Huxley’s “decanted” babies in *Brave New World* (Milner).

Aldous Huxley certainly belonged to a world in which thoughts and conversations of science and its potential effects on mankind were prevalent. In the paper written in Lesson Plan One, students will determine whether Huxley's presence in this world qualified him as a believable scientist and thus whether or not we can think of *Brave New World* as a prediction or a legitimate warning. The parallels between *Brave New World's* "World State" and today are such that the novel will likely be approached as "probable," by most students, though some may feel, at this point, that his credentials are lacking. If this is the case, the teacher can return to the "What Makes a Believable Scientist" chart periodically throughout the novel and continue to debate Huxley's qualifications.

Science in *Brave New World*

For a teacher wishing to develop an interdisciplinary unit with *Brave New World*, there are many topics in biology and psychology that can be addressed. Huxley was obviously very well-versed in science, and, therefore, much of the "progress" in his novel can be compared to scientific advances made since 1932, with the exception of physical sciences; Huxley does not address nuclear fission or some other ideas that were known at the time, as they did not apply to *society* directly. Science is a "sustained presence in Huxley's texts or has a crucial impact on the plot... [In *Brave New World*] scientific ideas, method and practitioners are [featured prominently] and Huxley sets out to predict what would happen if the scientific method were applied to an entire culture" (Deery 30).

Huxley himself stated that the theme of *Brave New World* is "the advancement of science as it affects human individuals...scientific advances [that are] specifically described are those involving the application to human beings of the results of future research in biology, physiology and psychology" (Huxley, Foreword xi). In *Brave New World*, the World Controller tells us that their society advanced only when "the Controllers realized that [brute] force was no good;" ectogenesis, neo-Pavlovian conditioning and hypnopædia, combined with the wonder drug soma ("all the advantages of Christianity and alcohol; none of their defects;" "a holiday from reality") create a perfect, scientifically regulated, peaceful, and happy World State (Huxley 50, 54).

Teachers can choose to delve into any or all of the scientific topics described below, dependent upon time and teacher/student interest. As this seminar is entitled "One Cell to Many," I will be focusing primarily on "in vitro" fertilization, cloning, and the basics of stem cell potential. These topics are discussed in more detail below and in Lesson Plans Two, Three, and Four.

"In vitro" Fertilization / Assisted Reproduction

Huxley had obviously been thinking about ectogenesis (a creation of mammalian life outside the womb) long before he wrote *Brave New World*. In his 1922 novel *Crome Yellow*, the philosophic Mr. Scogan grabs the attention of the young people in the room by discussing where the world may be heading:

An impersonal generation will take the place of Nature's hideous system. In vast state incubators, rows upon rows of gravid bottles will supply the world with the population it requires. The family system will disappear; society, sapped at its very base, will have to find new foundations; and Eros, beautifully and irresponsibly free, will flit like a gay butterfly from flower to flower through a sunlit world. (50)

In *Brave New World*, Huxley creates this world in which ectogenesis and "test tube babies" are taken for granted – and have been for hundreds of years "after Ford."

In our society, "in vitro" fertilization was developed not to be able to mass produce children as in Huxley's world, but to assist women whose oviducts are blocked in being able to have

children. Female reproductive cells are “surgically removed following hormonal stimulation of the follicles,” then fertilized in a laboratory before being placed back in the uterus and allowed to implant (Campbell and Reese 995). This procedure has a high rate of success, and embryos can be frozen for later use if the first attempt is not successful (Campbell and Reese 995).

Students may be intrigued by the details of “in vitro” fertilization, especially since there may be stigma involved in having been a “test tube baby” or having to “resort” to a procedure that some see as unnatural. Also, this topic can lead to heated discussions about ethics: some couples choose to use oocytes [cells that, after fertilization by sperm, become ova (Campbell and Reese 984)] donated by another woman to be fertilized by the male partner’s sperm, some couples fight custody battles over embryos that were frozen but not used (Lemonick 3), and some face the dilemma of what to do with the embryos left over after a successful pregnancy (Lemonick 3). There are also religious implications; Huxley himself hints in *Brave New World* at the ethics surrounding these topics: the World Controller mentions that scientists “had got the whole technique [of ectogenesis] worked out. But would the Governments look at it? No. There was something called Christianity. Women were forced to go on being viviparous [having children develop within their bodies]” (46).

Students do not need to know the particulars of the science behind “in vitro” fertilization or other methods of assisted reproduction in order to understand this novel or to succeed in this unit. However, the topic is an interesting and debatable one; it can keep students interested and encourage them to form educated arguments about a topic that is popular in the news today. For details on how to further incorporate this topic into the unit, see Lesson Plan Two below. Discovery Education also has a clear lesson plan for teaching “in vitro” fertilization; though it is designed for a high school science class, the material can be grasped in an English classroom as well (Clem). Students may also find it interesting to read “The Curious Lives of Surrogates,” a popular media article about women (mostly military) who give birth to other people’s babies, and discuss additional ethics involved in this procedure (Ali and Kelley).

Bokanovskification and Cloning

Even more controversial than “in vitro” fertilization is the idea of cloning (similar to Huxley’s “Bokanovskification”), especially since it is often a word that is used loosely in debates and about which the public knows little. Though our world does not mass-produce children as does the World State in *Brave New World*, there are aspects of current research where parallels can be seen. Reproductive and therapeutic cloning can both be linked to *Brave New World*, since the World State creates beings and has practically eliminated dying from disease. Scientists have been discussing the potential of cloning for years: decades ago, “Prof. James Bonner (California Institute of Technology) told a seminar of science writers that it would be possible, in the not-too-distant future, to produce a master race of super-babies, called clones, by growing them in labs” (Ramamurty 91). Though most scientists would agree that these “super-babies” are not an impending threat, the media and politicians generalize and exaggerate enough that our students are not sure what is or is not possible when it comes to cloning. Therefore, the topic is a valuable one for students to grasp; cloning has many ethical and moral debates around which students could rally, as well.

The “cloning” most people think of when they hear the word is reproductive cloning, which is used to “generate an animal that has the same nuclear DNA as another currently or previously existing animal,” but it is expensive and highly ineffective (*Human Genome Project*). The animals that donated adult cells are only mostly replicated:

Only the clone's chromosomal or nuclear DNA is the same as the donor. Some of the clone's genetic materials come from the mitochondria in the cytoplasm of the enucleated

egg. Mitochondria, which are organelles that serve as power sources to the cell, contain their own short segments of DNA. (*Human Genome Project*)

This, on the surface, appears similar to the Bokanovsky process, but the mitochondrial DNA and their mutations would appear to disallow the Bokanovsky process from actually occurring today. However, if the rates of success can be improved, “(Dolly was only one success out of 276 tries), reproductive cloning can be used to develop efficient ways to reliably reproduce animals with special qualities. For example, drug-producing animals or animals that have been genetically altered to serve as models for studying human disease could be mass-produced” (*Human Genome Project*), which does suggest that our world may be able to replicate Huxley’s factory-created Deltas and Epsilons eventually.

Another kind of cloning, therapeutic cloning, produces human embryos for use in research, not to create cloned human beings, but “to harvest stem cells that can be used to study human development and to treat disease” (*Human Genome Project*). Unlike Huxley’s Bokanovskified embryos, the embryos used in therapeutic cloning are destroyed when stem cells are extracted from the egg after it has divided (*Human Genome Project*). “Therapeutic cloning technology may some day be used in humans to produce whole organs from single cells or to produce healthy cells that can replace damaged cells in degenerative diseases such as Alzheimer’s or Parkinson’s” (*Human Genome Project*), which suggests that Bokanovskification may be out of reach, but that science may create Huxley’s “social stability” artificially – where the upper echelons of society will be able to afford to rid their offspring of diseases (creating healthy and more worry-free Alphas and Betas), but the less fortunate will be relegated to lives of poverty and loss (though not likely as content as Huxley’s conditioned Gammas, Deltas, and Epsilons). This cloning is likely to be less controversial in the classroom, but it may also raise questions among the students about the role that socio-economics play in medical care: who will be able to receive these organs and/or cells? What will it do to a society already divided by wealth?

Because cloning with its moral, ethical, and socio-economical issues is another high-interest topic, students will do a collection of readings about cloning (see Lesson Plan Three below for more detail) in order to form educated opinions about the topics so that they can discuss pros and cons of both reproductive and therapeutic cloning in both our world and in the *Brave New World*’s World State. They will be able to learn enough of the processes to educate others in the reality of cloning and to argue their opinions using sources as support. This can also develop into an interdisciplinary activity with a Biology or Economics teacher, dependent upon time and teacher and student interest.

An Introduction to Stem Cells

Stem cells have been popular in the news, especially with the controversy surrounding President George W. Bush’s refusal to use federal funds for stem cell research. This is a very important topic, and one that will likely dominate science headlines for years to come. Stem cells themselves are not mentioned in *Brave New World*, but some of what stem cells may be able to do for humans today is implied to have happened in the years “After Ford” in the novel. This lesson will be taught toward the end of the *Brave New World* unit, since the topic is merely hinted at in the novel; this is a case where the science was not in Huxley’s book, so the students will be using the novel as a starting point for their further study. The teacher will teach an introduction to stem cells – what they are and what their potential may be – so that students can become educated members of society and can make choices about this divisive topic without relying on media, which may skew the issue (See Lesson Plan Four below for details).

Stem cells, simply, are cells that have the potential to develop into multiple cell types in the human body; they can theoretically divide an unlimited amount of times to replenish other cells in the body (*Stem Cell Information*). What is so amazing to the general public is that when a stem

cell divides, each new cell has the “potential to either remain a stem cell or become another type of cell with a more specialized function,” anything from a muscle cell to a red blood cell (*Stem Cell Information*).

The controversy around stem cells comes primarily from a lack of understanding of the facts. The general public hears the words “embryonic stem cells” and can picture “mad scientists” like something out of a B-movie version of *Frankenstein*, “stealing” cells from babies or aborting babies on purpose to harvest their cells. In fact, embryonic stem cells come from “embryos that develop from eggs that have been fertilized *in vitro*—in an *in vitro* fertilization clinic—and then donated for research purposes with informed consent of the donors. They are *not* derived from eggs fertilized in a woman's body” (*Stem Cell Information*). Studying these cells “may yield information about the complex events that occur during human development;” this, in turn, may help scientists determine how diseases like cancer arise and may suggest ideas for therapy (*Stem Cell Information*).

The characters in *Brave New World* live in a society where debilitating disease has been wiped out and where death primarily is caused by old age – and high school students should have no difficulty seeing a resemblance between where our stem cell research can take us and where the advanced technology in the novel did take them. Upon completing their study of *Brave New World*, students will likely see Huxley’s “world state” as a dystopian society, and that will pose questions about where our stem cell research may take us.

Eugenics and “Designer Babies”: Creating “better” beings?

Though not a modern scientific concern, eugenics might be an interesting topic for students to consider. Students will likely be quite interested to know more about the idea of creating a stronger human race by various means, including killing the weak and mentally handicapped and/or not allowing them to reproduce. (See *Image Archive on the American Eugenics Movement* for details and ideas for lesson plans). (See also discussion of population control below). What was surprisingly popular in the early 20th century could be compared to the more modern idea of “designer babies,” where it is predicted that parents will one day be able to have the genes of their unborn children “adjusted” in order to “create” a human being with certain desired qualities.

Parents and doctors can now screen embryos for genetic disorders, but, according to “Design a Baby,” the fear is that “in the future we may be able to use [these same technologies] to modify embryos and choose desirable or cosmetic characteristics.” [It should also be noted that the term “designer babies” is one used by journalists, not scientists (“Design a Baby”). There is a fear that:

If gene therapy leads up to its promise, parents may someday be able to go beyond weeding out undesirable traits and start actually inserting the genes they want....Before [this] millennium is many years old, parents may be going to fertility clinics and picking from a list of options the way car buyers order air conditioning. (Lemonick 1)

For my students in their relatively poor urban setting, the idea of “designer babies” also can lead to animated discussions about the possibility that society will clearly split into two camps, those with and without designer genomes (Lemonick 4); students can research pros and cons of gene therapy and initiate debates on the topic as well, which links into a discussion of stem cell research (see above and Lesson Plan Four below). Of course, upon researching, students will find that the science behind creating “designer babies” is not sufficiently understood to make this reality in the near future. But because the topic is a popular one in the media, it is still valuable for students to be educated and to be able to have informed discussions.

Population Control

Though the topic may be a controversial one, some students may benefit from a learned discussion on the methods of population control in *Brave New World*. Its World State controls whose genes are used to “create” babies and who is “born” sterile, since they deem fertility a “nuisance” (Huxley *BNW* 11). Approximately 70% of the female embryos receive male sex hormones periodically so that they are “decanted as freemartins – structurally quite normal...but sterile. Guaranteed sterile. [This brings the World State] out of the realm of mere slavish imitation of nature into the much more interesting world of human invention” (Huxley *BNW* 12). In this manner, the government completely controls the population of the entire world because the government decides which ovaries are “allowed” to be used for reproduction – always in the factories.

Huxley hinted at beneficial methods of population control in *Crome Yellow* when the aforementioned Mr. Scogan stated that:

...the goddess of Applied Science has presented the world with another gift, more precious even than [cinema and pistols] – the means of dissociating love from propagation. Eros, for those who wish it, is now an entirely free god; his deplorable associations with Lucina [Roman goddess of childbirth] may be broken at will. In the course of the next few centuries, who knows? The world may see a more complete severance. (50)

Similarly, while the fertile women in *Brave New World* must follow a strict regimen of birth control medications called a Malthusian drill, Mary, a progressive young woman in *Crome Yellow*, tries to talk to a woman who had “three children in thirty-one months” and tell her about the “Malthusian League” (281). Students maybe have studied Thomas Malthus’s concerns about population growth in their Economics class and can read more about his philosophies as an extension to this topic.

Aldous Huxley, like Malthus, was concerned about the effects of overpopulation on a society. Though *Crome Yellow* and *Brave New World* address methods of “Malthusian” birth control, in reality, “birth control depends on the co-operation of an entire people...it demands [more] than most of the world’s teeming [masses] can now afford” (Huxley, *Brave New World Revisited* 5). Their population then grows at a faster rate than others, and their children in many cases cannot be “adequately housed, educated or fed,” so their lives are ruled by undernourishment and overcrowding (Huxley, *BNWR* 15). This is an idea that will resonate with my urban students, who live in neighborhoods where much of these statements by Huxley are visible on a daily basis, though they will likely find that Huxley’s statement (*BNWR* 5, above) reflects a stance that comes off as bigoted by current standards; this might also lead to fruitful discussions regarding imperialist attitudes toward Third World countries, or conversely, of the positive effects on a country’s standard of living when women are allowed to control their own fertility. These ideas may be deemed contentious, but students are likely to be very interested in debating the pros and cons of these methods of controlling population; they can research this in conjunction with climate change, famine, economics, or any other topics that are of interest in the news today.

The Overuse of Legal Drugs in Society

While Aldous Huxley created soma, the “perfect drug” with no negative ramifications, Western society is on a seemingly endless quest to create its own “perfect drugs.” Any student who watches television has likely been inundated with advertisements for various medications that claim to improve the quality of human life somehow, and many will be familiar (if only through movies) with the quests of many in the 1960s (including Aldous Huxley, as can be seen in his essays “The Doors of Perception” and “Heaven and Hell”) to find happiness of any kind, even pharmacological. In *Brave New World*, “Science...believes that happiness consists in catering to the physical and physiological needs, and the only psychological need it recognizes is the need to

fill up leisure and avoid boredom. This is fulfilled through games, the ‘feelies’ and the ‘soma’ ration” (Ramamurty 94).

Lessons on this topic could include researching drugs like Ritalin and Adderall, which are used to treat ADD and ADHD and often overused to calm immature students (at the suggestion of parents and/or teachers) or to improve concentration and thus academic performance (see Foer). Students interested in history or music could also study Grace Slick’s song “White Rabbit” and its veiled criticism of parents in a society where “One pill makes you larger, and one pill makes you small,” but the lyrics caustically suggest that “the [pills] that mother gives you don’t do anything at all” (Jefferson Airplane). Students who are athletes may be interested in researching addictions to pain killers or “nutrition” shakes that are so often used and discussed in high school locker rooms. Finally, any student can study the science behind addiction, as is mentioned in “The New Science of Addiction.”

Students and teachers can use any of the topics in this section to conduct research and complete an informational pamphlet that students can distribute to their peers or to local health agencies.

Social Behavior in Animals

One of the main tenets of *Brave New World*’s World State is social stability: “No civilization without social stability. No social stability without individual stability” (Huxley 42). Bokanovsky groups in the novel behave like some altruistic animals do: the animals “behave in ways that reduce their individual [possibilities for reproduction] and increase [those possibilities in] the recipient of the behavior,” whereas the lower-caste Bokanovsky groups toil for the good of the overall society (Campbell and Reese 1145). In fact, even the upper castes in *Brave New World* are not all that different from the image of a worker bee returning to the hive, dancing, and exciting the rest of the bees and motivating them to leave the hive, in a group, and search for nearby food (Campbell and Reese 1143): “Buzz, buzz! the hive was humming, busily, joyfully. Blithe was the singing of the young girls over their test-tubes, the Predestinators whistled as they worked, and in the Decanting Room what glorious jokes were cracked above the empty bottles!” (Huxley, BNW 149). Just as many animals, including ground squirrels and naked mole rats, engage in social behaviors that are altruistic, the citizens of the World State are not encouraged to “indulge” in solitary amusements (Huxley 166).

Students may be interested in the idea of either altruistic behavior of animals or in the idea of humans acting like social insects; anyone who spends time around large groups of humans (especially high school students) has likely seen such behavior. This can also be a place for an extension project on anything from how advertising controls the masses to peer pressure and fitting in at school.

Behavioral Conditioning

For students and teachers who are interested in psychology, there is a great deal of social conditioning in Huxley’s *Brave New World*; in fact, its sleep teaching, “hypnopædia,” is called “the greatest moralizing and socializing force of all time” (28). All caste members in the World State experience years of conditioning to “train” them as society wants them to be trained; “books and loud noises, flowers and electric shocks – already in the infant mind these couples were compromisingly linked; and after two hundred repetitions of the same or a similar lesson would be wedded indissolubly” (Huxley, BNW 21). Students may argue that they, to some extent, are similarly conditioned by parents, teachers, politicians, or religious leaders.

Teachers and students interested in this topic can bring the practices of B.F. Skinner and/or Ivan Pavlov into the classroom, and can maybe have some fun in designing small and harmless

experiments around making their classmates behave a certain way in order to get some kind of reward.

Conclusion

There are so many topics of relevance from which teachers can choose that this unit has a great deal of flexibility. Teachers can use any or all of these subjects and intersperse them throughout the novel; some, like the background on Aldous Huxley, will serve well as introductions to the unit, and others may serve as final research papers or projects. All will involve at least minimal research on the part of the students, and many can conclude with debates or formal research papers. No matter the order in which they are taught – all of these will link to the main objectives of the unit and will keep students engaged and interested throughout their study of Aldous Huxley’s *Brave New World*.

LESSON PLANS

Lesson Plan One: Introductory Biographical Research / Persuasive Paper: Is Huxley a Scientist?

Objectives

The students will be expected to meet the following objectives, based on the Texas Essential Knowledge and Skills for 12th grade Language Arts (see Appendix A): 3e, 8g, 14d and 14f.

Materials and Resources

Teachers will need a pad of large sticky notes and some markers for students to use when brainstorming what it means to be a “legitimate scientist.” Students will need access to reference books and Internet research tools, and they will also need a resource to remind them how to document their research properly using Modern Language Association (MLA) formatting (see suggestions in “Student Resources” section of Works Cited).

Procedures and Activities

Before beginning research on Aldous Huxley, students will first brainstorm to determine what it means to be a “credible” scientist. The teacher will introduce the subject by mentioning popular science topics in the news today, like global warming / climate change or stem cell research. Who do we, as the lay public, trust to tell us about these topics in an unbiased and knowledgeable way? Do these people need to be educated? Trained? Conducting research in the field? Well spoken? Evaluated by their peers? Students will gather in small groups of 3 or 4 and list the qualifications they feel are necessary to make a “trusted” scientist. After a few minutes of brainstorming, the class will come together and create a chart titled “What makes a ‘believable’ scientist?” Groups must agree with everything that will go on this chart, as it will remain up during our study of *Brave New World*, and we will constantly refer to it as we try and determine whether or not Aldous Huxley meets our qualifications. This can likely be done within one 45-minute class period.

The major task that students will complete during this lesson is a brief research paper on Aldous Huxley. They will research biographical information as well as some critical resources in order to answer the question: Is Aldous Huxley a scientist, or does he have enough scientific knowledge to make the science in his novel *Brave New World* believable? This question is important to answer before students begin reading *Brave New World* because the purpose of this unit is to consider this novel almost a prophecy and to compare it to our own society, and this can’t be done without some evaluation of Huxley’s capabilities. The teacher can reserve a few periods of library time for students to begin their research, but much of the work will be done at home.

Assessment

Students will compile their research into a brief (approximately three to five page) persuasive paper which will be graded on a rubric that contains content (did they answer the question and support it well; did they use appropriate sources) as well as format (did they use proper parenthetical documentation and a Works Cited Page), and grammar, spelling, and related usage.

They will also present their arguments to the class, one at a time (to be graded on a brief rubric that assesses their clarity as well as their support for their arguments). Students who are arguing that Huxley *is not* a qualified scientist will present their evidence first, and this evidence will be charted on a large piece of sticky paper. Those who support Huxley as a scientist will respond, also having their evidence charted. The students will then use the documented evidence to determine if they, as a class, should read *Brave New World* with the confidence that Huxley's science is believable – and we will return to these charts throughout our study of the novel.

Lesson Plan Two: “In vitro” Fertilization and Assisted Reproduction

Objectives

The students will be expected to meet the following objectives, based on the Texas Essential Knowledge and Skills for 12th grade Language Arts (see Appendix A): 2c, 8g, 11b.

Materials and Resources

Students will need copies of at least two basic informational articles that will teach them what “in vitro” fertilization is and what some of its risks are. Jairo Garcia’s “In Vitro-Fertilization” or one of the “In Vitro Fertilization” introduction websites is a great place to start for a non-biased introduction. Teachers may also want to provide sets of articles from alternative sources, such as a piece from a religious organization (see “Pope Speaks Again”) paired with one from a facility that makes money by completing the procedure.

Procedures and Activities

In one 95-minute class period, students will read and annotate the given articles on “in vitro” fertilization (IVF). Within small groups, they will discuss and/or write what they have learned with guided questions from the teacher. (What is IVF? Who undergoes the procedure? How often is it done? What are the risks involved with IVF? What are some of the pros and cons of the procedure? Who might support it, and who might not?)

Once students have a clear idea of what IVF is and they understand its pros and cons, they will be assigned a persuasive writing paper: *Do you support IVF and why?* They will write it in the form of a letter to the editor of a major national newspaper or magazine, and each student will be asked to write from a specific point of view. The teacher can assign specific points of view to individual students if the desired outcome is to have students argue specifically with (or against) their own views, or “characters” can be drawn from the proverbial hat. Points of view can include (but should not be limited to) the following: a 40-year-old childless married woman who has always wanted children, a 25-year-old single man who can’t stand his nieces and nephews, Thomas Malthus, Lenina Crowne or John “the Savage” (from *Brave New World*), a teenaged Catholic girl, the President, or a rabbi. This point of view paper should include as many facts as possible from the primary sources the students read, and thus will need to contain MLA formatted citations as well.

Teachers can also assign students to prepare sides of a debate in addition to or in place of the position paper.

Assessment

The students' position paper can easily be graded with a rubric. Texas has a 4-point rubric for its standardized TAKS test, and this can be modified to contain relevant sections like proper use of MLA formatting.

This assessment will be a formative one, as it is a good opportunity to determine how much of the science the students understand. From here in the unit, they will continue to study biology (cloning and stem cells), and the teacher may need to do some recursive teaching of the basics behind some of these methods. Also, students can have an opportunity to rewrite drafts of the paper in order to better master the lesson objectives.

Lesson Plan Three: Teaching the Basics of Cloning

Objectives

The students will be expected to meet the following objectives, based on the Texas Essential Knowledge and Skills for 12th grade Language Arts (see Appendix A): 2c, 8g, 11b.

Materials and Resources

Teacher will need to create a PowerPoint presentation presenting the general information that students need to know about cloning. (If the teacher does not feel comfortable presenting this material, there are plenty of "student-friendly" articles that can be read so that students can discover the material themselves). This presentation (or these articles) should define reproductive and therapeutic cloning (as described in "Bokanovskification and Cloning" above), outline the fundamentals of how each procedure works (and how well), and discuss possible benefits of the research that is being done. (See also teacher resources below for other articles that can be of benefit).

Students will need either access to computers and publishing software or arts and crafts materials with which to make brochures. Teachers may also want to provide pamphlets from clinics or from drug companies so that students have a model from which to draw.

Procedures and Activities

After the PowerPoint or introductory reading, students will be asked to create an informational brochure that teaches the general public about cloning. This is a popular term in the media, one about which people make decisions without really knowing the facts. Students will need to use terminology that will be familiar to the average citizen and should strive to remain neutral in their descriptions.

Pamphlets can be used as a teaching tool; students can visit middle school classrooms or give presentations with non-profit groups and bring their knowledge into the public's eye. Bilingual students can also translate their material into their native language(s) in order to make the message even easier to understand across our diverse population.

Assessment

Student pamphlets will be graded using a rubric that assesses the following topics: Has the student understood cloning? Has the student kept a neutral tone throughout the pamphlet? Has the student presented information clearly and concisely? Has the student created a neat and usable product? Has the student used language appropriate for the audience? Has the student followed the rules of Standard English grammar, usage, etc.?

Lesson Plan Four: Introduction to the Potential of Stem Cell Research

Objectives

The students will be expected to meet the following objectives, based on the Texas Essential Knowledge and Skills for 12th grade Language Arts (see Appendix A): 1f, 8g, 14g.

Materials and Resources

Teachers will need to provide introductory information on stem cell potentials, in the form of a PowerPoint presentation or student-friendly reading (see details in “An Introduction to Stem Cells” above).

Procedures and Activities

Because stem cells are so often in the news and are so controversial with the American public, it is important that students thoroughly understand the big picture of what is meant by “stem cell research.” Students need not understand the specifics or mechanisms involved, as those are very technical and constantly changing, but they should have a passing knowledge so that they can make informed decisions when this topic is involved. Huxley said that “literary artists were under an intellectual and moral obligation to engage with science and explicitly refer to [it] in their writing in order to heal the division between what later became known as the ‘two cultures’” (Deery 2). In other words, we, the general public, know so little about science that a gulf has developed between scientists and the rest of us. How can we make informed decisions about health care, about politics, about donating money to causes, if we know so relatively little?

After the introductory lesson, teachers can provide questions for students to answer: *What is a stem cell? What are embryonic and adult stem cells, and what is the difference? What are scientists hoping stem cells can do for them / us? What makes these procedures so controversial? How much of this information is known by the general public (i.e. not students who have recently taken or are currently taking a biology course), and why might this add to the controversy?*

Students will explore the disconnect that our society seems to have with science, and what it might mean for where our society is headed. Details of the assignment are below.

Assessment

This assignment will bring us full circle; we began this unit by researching Aldous Huxley’s background to determine whether or not his qualifications would allow us to read *Brave New World* as science. We will end it by answering a similar question: *Based on all that you have learned about Aldous Huxley and about stem cell research, how would Huxley feel about the fact that the general public is so removed from what is really happening with stem cells today? Would he be alarmed, would he not be concerned, or would he just tell us that we are on our way to his “Brave New World”? Explain.*

Students’ essays will be graded on a standard Advanced Placement English Literature or similar rubric addressing organization, development, grammar/usage/etc., and support of arguments. This assignment can be used as a summative assessment to the unit.

APPENDIX A

Unit Objectives

From the Texas Essential Knowledge and Skills for 12th grade Language Arts (“Texas Essential Knowledge and Skills for Language Arts and Reading”):

Writing

The student is expected to:

- 1f – organize ideas in writing to ensure coherence, logical progression, and support for ideas.

- 2c – use vocabulary, organization, and rhetorical devices appropriate to audience and purpose.
- 3e – use a manual of style such as Modern Language Association (MLA).

Reading

The student is expected to:

- 8g – draw inferences and support them with textual evidence and experience.
- 11b - use elements of text to defend, clarify, and negotiate responses and interpretations.
- 12f - connect literature to historical contexts, current events, and his/her own experiences.

Research

The student is expected to:

- 14d - evaluate the credibility of information sources and their appropriateness for varied needs.
- 14f - produce research projects and reports in varying forms for audiences.
- 14g - draw relevant questions for further study from the research findings or conclusions.

ANNOTATED BIBLIOGRAPHY

Works Cited

"Aldous Huxley: the Author and His Times." *Somaweb.Org*. 2008. 9 Feb. 2008.
<<http://somaweb.org/w/huxbio.html>>.

Biography of the author.

Ali, Lorraine and Raina Kelley. "The Curious Lives of Surrogates." *Newsweek*. (7 Apr. 2008): 45-51.
Popular media article about the women who choose to become surrogate mothers.

"Andrew F. Huxley: the Nobel Prize in Physiology or Medicine, 1963." NobelPrize.Org. 2008. 19 Feb. 2008 (from *Nobel Lectures, Physiology or Medicine 1963-1970*. Amsterdam, Elsevier Publishing Company: 1972). <http://nobelprize.org/nobel_prizes/medicine/laureates/1963/huxley-bio.html>.

Biology Course Description. AP Central. 2008. College Board. 8 March 2008.
<<http://apcentral.collegeboard.com>>

Includes course objectives for AP Biology course discussed in objectives section.

Campbell, Neil A. and Jane B. Reese. *Biology*. 6th ed. New York: Pearson Education, Inc. 2002.
Textbook commonly used in high school AP Biology classes and in early college level classes. Good resource for definitions, clarification of concepts for English teachers using this unit.

Clem, Donna. "In Vitro Fertilization." *Discovery Education*. 2008. 12 Apr. 2008
<<http://school.discoveryeducation.com/lessonplans/programs/invitro/>>.
Two-day lesson plan to help students understand “in vitro” fertilization and to encourage them to discuss the ethical questions behind the procedure.

Deery, June. *Aldous Huxley and the Mysticism of Science*. New York: St. Martin’s Press, 1996.
A thesis that discusses some of the scientific topics in Huxley’s novels.

"Design a Baby?" *BIONET*. 2002. 8 Mar. 2008.
<http://www.bionetonline.org/English/Content/db_cont1.htm>.

Description of techniques that allow doctors and parents to help prevent babies from being born with genetic disorders. Can be used in a discussion of eugenics and/or “designer babies.”

- English Literature Course Description. AP Central.* 2007. College Board. 8 March 2008.
<http://apcentral.collegeboard.com>
 Includes objectives for AP English Literature course discussed in curriculum unit.
- Foer, Joshua. "The Adderall Me: My Romance with ADHD Meds." *Slate*. 10 May 2005. 22 Apr. 2008.
 <<http://www.slate.com/id/2118315/>>.
 A vignette in which a man discusses what happened to him when he took unprescribed ADHD medications.
- Garcia, Jairo. "In Vitro Fertilization." *EMedicine Health*. 10 Aug. 2005. WebMD. 12 Apr. 2008.
 <http://www.emedicinehealth.com/in_vitro_fertilization/article_em.htm>.
 Introductory information to be used in Lesson Plan Two.
- Human Genome Project Information.* 29 Aug. 2006. Human Genome Project. 9 Feb. 2008.
 <http://www.ornl.gov/sci/techresources/Human_Genome/elsi/cloning.shtml>.
 Cloning Fact Sheet.
- Huxley, Aldous. *Brave New World*. 1932. New York: Harper Perennial, 1989.
 Huxley's dystopian novel that prompts questions about the reality of "Bokanovskification," the arrested development of an egg that leads to budding and, essentially, cloning.
- . Foreword. *Brave New World*. By Aldous Huxley. 1932. New York: Harper Perennial, 1989. vii-xviii.
 This foreword written by the author contains his retrospection on the novel and its reception; also explains some of his motivation.
- . *Brave New World Revisited*. 1958. New York: Bantam, 1960.
 Huxley's nonfiction commentary on some of the topics he had discussed in *Brave New World*. Contains his reflections and his considerations as to how science and society had, indeed, caught up to the World State in his original novel.
- . *Crome Yellow*. New York: Harper and Brothers, 1922.
 An earlier novel of Huxley's where one of the characters proposes in conversation many of the ideas that come to light in *Brave New World*.
- Image Archive on the American Eugenics Movement.* Cold Spring Harbor Laboratory. 8 Mar. 2008.
 <<http://www.eugenicsarchive.org/eugenics/>>.
 Very detailed resource on eugenics from the laboratory where much of the American research was conducted. Includes pictures, histories, and other sources. Can be used in conjunction with "designer baby" material.
- "In Vitro Fertilization: IVF." *American Pregnancy Association*. May 2007. 13 Apr. 2008.
 <<http://www.americanpregnancy.org/infertility/ivf.html>>.
 General information about the process. Can be used as a source in Lesson Plan Two.
- "In Vitro Fertilization (IVF-ET)." *IVF.Com*. 2005. Georgia Reproductive Specialists. 12 Apr. 2008.
 <<http://www.ivf.com/ivffaq.html>>.
 General information about the process. Can be used as a source in Lesson Plan Two.
- Jefferson Airplane. "White Rabbit." Perf. by Grace Slick. *Surrealistic Pillow*. RCA Victor, February 1967.
 Song that poses the question that hints at overt drug use in society, not unlike the preponderance of soma in *Brave New World*.
- Lemonick, Michael D. "Designer Baby." *Time*. 11 Jan. 1999. 8 Mar. 2008.
 <<http://www.time.com/time/magazine/article/0,9171,989987,00.html>>.
 Popular press article that discusses gene therapy and what it could lead to. Can be used in section on "designer babies."
- Milner, Richard. *The Encyclopedia of Evolution*, NY: Facts on File, 1990: 207-08. *Unofficial Stephen Jay Gould Archive*. 19 Feb. 2008. <http://www.stephenjaygould.org/people/john_haldane.html>.
 Biographical information on J.B.S. Haldane, famous geneticist and friend of Aldous Huxley.

"The New Science of Addiction: Genetics and the Brain." *Learn.Genetics*. 2008. The University of Utah. 12 Apr. 2008. <<http://learn.genetics.utah.edu/units/addiction/index.cfm>>.

Great resource with many links about addictions to drugs as well as the genetics behind addictions. Can be used by teachers or students in a lesson on drug addiction.

"Pope Speaks Against In Vitro Fertilization On Italy's 'Day of Life'." *LifeSiteNews.Com*. 3 Feb. 2003. 13 Apr. 2008. <<http://www.lifesitenews.com/ldn/2003/feb/03020301.html>>.

Can be used in "in vitro" fertilization lesson as an example of a non-science point of view.

Ramamurty, K. Bhaskara. *Aldous Huxley: A Study of His Novels*. New York: Asia Publishing House, 1974.

A thesis which discusses many topics about Huxley's novel, including how Huxley's science in *Brave New World* is similar to what scientists have discovered since he wrote.

"Sir Julian Huxley." *Encarta*. 2007. Microsoft. 9 Feb. 2008.

<http://encarta.msn.com/encyclopedia_761576201/Julian_Huxley.html>.

Biography of Aldous's older brother, a prominent evolutionary scientist.

"Texas Essential Knowledge and Skills for Language Arts and Reading." *Texas Education Agency*. 29

March 2007. TEA. 8 March 2008. <http://www.tea.state.tx.us/teks>

A listing of all of the required skills for 12th grade English.

"Thomas Henry Huxley (1825-1895)." University of California Museum of Paleontology. 9 Feb. 2008

<<http://www.ucmp.berkeley.edu/history/thuxley.html>>.

Biography of Aldous Huxley's grandfather, the supporter of Charles Darwin.

United States. National Institute of Health. *Stem Cell Information*. 21 Nov. 2007. 12 Apr. 2008.

<<http://stemcells.nih.gov/>>.

Great information and links for all teachers who teach an introduction to stem cells.

Supplemental Sources

For Teachers

Bedford Stem Cell Research Foundation. 9 Feb. 2008.

<http://www.bedfordresearch.org/aboutus/aboutus.php?item=about_stemcellresearch>.

Details about their Stem Cell Research Fund / Human Egg Donor Program.

Bonner, John Tyler. *First Signals: The Evolution of Multicellular Development*. Princeton: Princeton UP, 2000.

Discussion of origins of multicellular development, and thus biological complexity. Lay terminology or well defined. Good background reading for teachers who may want to expand knowledge.

"*Brave New World* - Monarch Notes." *Somaweb.Org*. 1993. Bureau of Electronic Publishing, Inc. 9 Feb.

2008. <http://somaweb.org/w/sub/BNW_MonarchNotes.html>.

Analysis of the entire work, primarily to be used for author biography and influences.

Brownlee, C. "Cloning Milestone." *Science News* 166 (2004): 371-372. JSTOR. University of Houston Library, Houston. 12 Apr. 2008.

Discusses progress made towards cloning and using stem cells for research in non-human primates.

Can be used as introductory information in Lesson Plan Three or Four.

Fackelmann, Kathy. "Cloning Human Embryos." *Science News*. 145 (1994): 92-95. JSTOR. University of Houston Library, Houston. 12 April 2008.

General information about the first human embryo cloned. Good resource for background information on teaching cloning (Lesson Plan Three).

Highfield, Roger. "Scientists Can Make Human Eggs From Male Embryos." *Telegraph* 5 Feb. 2003. 9 Feb.

2008 <<http://www.thenewatlantis.com/archive/16/nicolprint.htm>>.

A report on the *Science* publication by University of Pennsylvania's Hans Scholer discussing mass-producing eggs from embryos.

Huxley, Aldous. *Doors of Perception and Heaven and Hell*. 1954, 1956. New York: Harper Perennial, 2004.

Huxley's treatises on topics including social and spiritual drug use.

Jaenisch, Rudolf and Ian Wilmut. "Don't Clone Humans." *Science*. 30 March 2001: 2552. JSTOR. University of Houston Library, Houston. 12 April 2008. <<http://www.jstor.org/stable/3082819>>. The science behind why reproductive cloning won't work in humans. Good teacher resource for background information on assuaging the fears of cloned people.

Love, Jamie. "The Cloning of Dolly." *Science Explained*. 27 Nov. 1997. 8 Mar. 2008. <<http://www.synapses.co.uk/science/clone.html>>.

Very clear explanation of how Dolly was cloned. Good teaching resource. Includes diagrams.

"Sorry, but Your Soul just Died." *The Guardian*. 13 Mar. 2002. 9 Feb. 2008.

<<http://education.guardian.co.uk>>

Edited excerpts from Francis Fukuyama's work, *Our Posthuman Future*, in which he argues that Huxley was right and that biotechnology will alter human nature in a potentially negative way.

For Students

Boeree, George C. "B.F. Skinner." *Personality Theories*. 2006. Shippensburg University. 12 Apr. 2008. <<http://webpace.ship.edu/cgboer/skinner.html>>.

Description of Skinner and his practices of "behavior modification." Can be used by students researching behavioral conditioning.

"Easy Bib." 2008. ImagineEasy. 12 Apr. 2008. <www.easybib.com>.

A "cheat sheet" to help students take the information they have gathered from a site while researching and put it into proper MLA format.

Fredholm, Lotta. "Ivan Petrovich Pavlov (1849-1936)." *NobelPrize.Org*. 2008. 12 Apr. 2008.

<http://nobelprize.org/educational_games/medicine/pavlov/readmore.html>.

Summary of Pavlov's Nobel Prize winning studies on conditioned reflexes. Students can also play "Pavlov's Dog's" game to see if they, too, can condition the dog to drool.

Gibaldi, Joseph and Phyllis Franklin. *MLA Handbook for Writers of Research Papers*. 6th ed. New York: Modern Language Association of America, 2003.

The official book for students to use when researching. Teaches how to format parenthetical documentation and Works Cited Pages.

Kunka, Jennifer L. and Joe Barbato. "MLA Formatting and Style Guide." *The Owl At Purdue*. 2008. Purdue University. 12 Apr. 2008. <<http://owl.english.purdue.edu/owl/resource/557/01/>>.

A shorthand version for students to use for help in formatting while researching.

Malthus, Thomas R. *An Essay on the Principle of Population*. London, 1798. *Western Washington University*. 12 Apr. 2008. <<http://www.ac.wvu.edu/~stephan/malthus/malthus.0.html>>.

A copy of the famous essay. Students can use this in an argument on population control.

Przykuta, Eric. "CASE TEACHING NOTES for Cloning Man's Best Friend." *Sciencecases.Org*. 03 Feb. 2003. 8 Mar 2008. <http://www.sciencecases.org/dog_cloning/dog_cloning_notes.asp>.

A website with clear and simple diagram.

"Thomas Malthus (1766-1834)." *The Evolution Pages*. 4 Oct. 1995. University of California Museum of Paleontology. 12 Apr. 2008. <<http://www.ucmp.berkeley.edu/history/malthus.html>>.

Biographical information and general information about Malthus and his population control ideas.