

**Kingsborough Community College
The City University of New York**

College Now - Syllabus

SCI 1: Issues and Adventures in Science - 3 credits, 3 hours

Course Coordinator: Dr. Mary Ortiz

Course Description: Science 1 explores scientific issues through integration of concepts and techniques from the biological, physical and health sciences. Issues examined include humankind's place in the universe, in which the structure and origin of the universe, solar system, Earth and life are considered; humankind's attempts at mastery of the world, which focuses on space and undersea exploration, genetics research and engineering, bio/computer technology and energy/pollution challenges; and humankind's development of self-knowledge as studied through research on aging, the human mind, fertility, immunity, nutrition and alternative medicine.

Catalog Description: SCI 100 ISSUES AND ADVENTURES IN SCIENCE (3 crs. 3 hrs.)

The most recent and important discoveries in the biological and physical sciences are presented, observed, discussed, and experimented with, to acquaint students with the world around them. Brain research, studies of aging, disease, fertility, immunity, and the origin of life are explored. Studies emphasize relations to mankind's place in the universe, self-explorations and technological achievements.

Prerequisite: Enrollment in "College Now" Program

Flexible Core: Scientific World (Group E)

College Now Description: Students study concepts and methodologies used to investigate issues dominating current thought in physical, biological and health sciences. Topic examples include brain research, sleep, aging, fertility, immunity, extinction, pollution and disease.

Course Rationale: Most college-level science courses involve in-depth study of details of specific disciplines (e.g., genetics) within the biological and physical sciences. However, Science 1 is a multidisciplinary survey of modern science with a major goal being the exciting presentation of current areas of scientific research utilizing traditional and Internet-based approaches. Background theory is presented as needed, with the understanding that most students in the course have completed a year of both high school level earth science and biology and that many have completed a year of high school chemistry. The hope is that students will become better informed citizens in an ever-more technologically advancing civilization, and that they might see themselves as becoming part of the scientific effort through their eventual career choices.

Prerequisite/Co-requisite: Enrollment in the "College Now" Program.

Flexible Core: Scientific World (Group E) – SCI1 satisfies a CUNY Pathways Flexible Core: Scientific World (Group E) requirement.

Academic Integrity: Academic integrity means that all the work you do in this course (exams, quizzes, reports, papers, etc.) is your OWN work and no one else's. It includes not cheating on exams or quizzes in any way, as well as avoiding plagiarism in your writing. Plagiarism is using anyone else's work or ideas without proper attribution. This means that if you quote, paraphrase, or even describe in your own words, an idea that comes from someone else's writing, you MUST acknowledge that author in parentheses at the end of the sentence or sentences in which you have summarized his or her idea. Plagiarism, whether

intentional or not, is taken seriously and can result in a failing grade. It is almost always very obvious if you do it, so don't risk it. If you are not sure how to reference a source, ask the instructor for help. Your instructor adheres to CUNY policy on academic integrity, which can be found in your student handbook or online at: <http://www.kingsborough.edu/sub-administration/sco/Documents/CUNYAcademicIntegrityPolicy.pdf>. These sources explain the policy in detail and give examples. Please be aware that academic dishonesty may result in a failing grade on the exam or in the course, as well as dismissal from the college. Additional websites that may be of use include: turnitin.com, citationmachine.com and plagiarism.org. (Polizzotto, K., personal communication, 2008).

Attendance Policy: Attendance will be taken at the start of each class. Any student not present when attendance is taken will be marked absent. It is the responsibility of students arriving late to see the instructor at the end of class to have an "absent" changed to a "late". This mark will not be changed after the class has been dismissed.

Accessibility: Access-Ability Services (AAS) serves as a liaison and resource to the KCC community regarding disability issues, promotes equal access to all KCC programs and activities, and makes every reasonable effort to provide appropriate accommodations and assistance to students with disabilities. Please contact this office if you require such accommodations and assistance. Your instructor will be glad to make the accommodations you need, but you must have documentation from the Access-Ability office for any accommodations.

Civility Statement: As an institution of higher education, Kingsborough Community College and its faculty and staff are committed to its entire student body. As such, we strive to interact with each student equitably and professionally while providing an environment of mutual respect and civility. In the event a student has an allegation charge brought against him/her that is a breach of the Henderson Rules to Maintain Public Order or the Campus Code of Conduct, an immediate investigation will commence followed by a conciliation conference to determine the appropriate outcome within a thirty day period. The Judicial Affairs process at Kingsborough Community College is critical in providing an agenda for safety, yet simultaneously offering protection of the rights of students who may have been accused of being in violation of the Henderson Rules to Maintain Public Order and/or the Campus Code of Conduct. These rights have been afforded to each Kingsborough student under the bylaws that were established in 1969.

Course Outcomes: Upon completion of this course, the students will be able to:

1. Demonstrate scientific thinking by designing an experiment.
2. Identify the ways science affects everyday life.
3. Demonstrate understanding of the interdisciplinary dependence between scientific fields.
4. Develop an appreciation for science and its significance in the 21st century.

Topical Course Outline:

I. Humankind's place in the universe.

A. The origin of the universe.

1. The size and age of the universe.
2. The Big Bang and other theories of universal origins.
3. Astronomy: past and present; Hubble Space Telescope (HST), radio and X-ray astronomy.

B. Composition of the universe.

1. Sub-atomic physics - how small can matter be subdivided; are there ultimately small particles?
2. What is matter? Origin and evolution of the elements. What is dark matter?
3. What is energy? What is dark energy? Gravity vs. an expanding universe; What is Einstein's cosmological constant?
4. What's in space? Mysteries of deep space objects: black holes, quasars, pulsars, neutron stars.
5. Near-Earth objects and their implications for Earth and humankind's history and ultimate fate: comets, asteroids, meteors. Exploration of the planets and moons of the solar system.

C. What is the nature of our planet?

1. The age and theories of formation of Earth.
2. Shapes and position of continents: drift, plate tectonics.
3. Volcanoes, earthquakes, tsunamis, and weather - hurricanes, thunder, lightning, wind.

D. Life and its origins.

1. Defining life's characteristics - those unique to life and those shared by non-living things.
2. Life's diversity - the 6 kingdoms of life on Earth.
3. The interrelationships among all life on planet Earth.
4. Life and the oceans; our internal fluidic oceans as life colonizes the lands.
5. Life elsewhere in the universe - SETI, UFOs.

E. Evolutionary theory.

1. Explaining life's diversity.
2. Explaining fossils, extinctions, vestigial structures, embryology.
3. Darwinism, neo-Darwinism. Creationism and Lamarchism as belief, not science.
4. Evolution of populations, not individuals.

F. How we are formed: Developmental biology and genetics.

1. Development before birth and the mechanism of birth.
2. Genetics: classical concepts and recent research - the elucidation and implications of the human genome and the complete genomes of other organisms.
3. Genetic engineering - cloning any plant or animal, including humans; genetically altered foods and microorganisms.
4. Totipotent cells from embryos; stem cells from adult human and animal bodies as alternates to politically/ethically charged human embryo studies.

II. Our Attempts at Mastery of the Universe.

A. Flight.

1. Principles of flight - powered planes, gliders, birds.
2. Supersonic flight - advantages, hazards.
3. Space exploration - manned and unmanned rocket flight; space stations.

B. Computers.

1. At home and school - literacy and skills development for workplace advancement.
2. Miniaturization and nanotechnology.
3. Access to worldwide information through the Internet, and building and accessing Web sites.

C. Light.

1. The electromagnetic spectrum from cosmic rays to radio waves.
2. Lasers and their expanding role in medicine and industry.
3. Holography and holographic images.

D. Energy.

1. Sources - wood, coal, oil, gas, wind, solar, tidal, nuclear.
2. Problems and controversies concerning sources, especially nuclear.

E. Technology's price - human-made plagues and pollution.

1. Chernobyl, Three-Mile Island, Love Canal.
2. Are oceans an ultimate dumping ground for all types of waste?
3. Herbicides - defoliants, weed killers, lawn maintenance and their relationship to birth defects.
4. Pesticides and their relationship to endocrine disruption, biodegradability and animal extinctions.
5. Oil transport, spills and effects on the environment.
6. Powerful, antibiotic-resistant microorganisms and their relation to our human prophylactic use of antibiotics and their use in animal feed.
7. Do we need to worry about saving Earth? Should we be concerned about saving ourselves as Earth and the biosphere evolve without us?

III. Our Exploration of Ourselves.

A. Exploring the brain.

1. Neurotransmitters and drugs to prolong or terminate their effects (e.g., serotonin-uptake inhibitors like Prozac).
2. Control of neurological disorders: Parkinson's, Schizophrenia, Alzheimer's.
3. Recreational drugs - new drugs to meet steady demands.
4. Nerve and brain regeneration based on cell division of brain cells and stem cell research.

B. Healing - many paths.

1. Modern, western physician in a lab coat - allopathic medicine. The pervasive use of pharmaceuticals - drugs, vaccines, synthetic hormones; their uses and abuses.
2. Eastern medicine's style - acupuncture, herbs.
3. Other alternatives: homeopathic, naturopathic, chiropractic.
4. Medicine for the whole person - Holistic medicine.

C. Immunology.

1. Advances in organ transplants utilizing immunosuppression.
2. Understanding autoimmune disease: e.g., Type I Diabetes Mellitus, Multiple Sclerosis.

D. Fertility.

1. In vitro fertilization.
2. Laparoscopy and fiber optics.
3. In utero surgery for correction of some birth defects.
4. Cloning.

E. Nutrition.

1. Tailoring diet to individual metabolic patterns.
2. Supplements - their value and pitfalls.
3. Weight loss diets vs. fat loss diets; can weight loss be healthily maintained over the long run?

F. Maturity and aging.

1. Aging as an inevitability (for now) and theories of how we age: free radical theory, glucose and aging, mutational theory.
2. Aging and evolutionary theory - why mammals age whereas many other organisms do not.
3. Aging and disease - their relationship and influence on each other.
4. Role of nutrition, exercise and other lifestyle aspects on the aging body.
5. Transplanted, artificial, or cloned organs and other replacement parts.

G. Bioethics.

1. Science and politics - how they mix: war on cancer, AIDS and HIV, chemotherapy and tumor growth inhibition, pharmaceuticals and all aspects of the human life cycle.
2. Science and truth - changing paradigms. Science as a modern religion - dogmatic belief in one way of thinking.
3. Science and human values - does anything go, especially if you can make money? Human cloning and human and animal experimentation. Do animals have rights? Do newborn babies feel pain?
4. Science and scientific contribution of men and women, and all cultures, now and throughout history.

Methods of Teaching: This course emphasizes personal exploration. Teaching methods include:

1. Traditional class discussion and lectures where appropriate.
2. Carefully prepared in-class oral, individual and group reports on topics chosen by both the instructor and the students.
3. Student research through Internet access and traditional library research, resulting in a term paper and also an e-mailed topical report to the instructor.
4. Student dissections and other laboratory experimentation.
5. Guided trips to the American Museum of Natural History, Hayden Planetarium and other field sites.
6. Utilization of specialized instructional tools at the instructor's discretion and based on availability.

Assignments:

1. One written report based on traditional library research - to be graded and returned to the student.
2. One Internet-researched report e-mailed to the instructor; grades and comments transmitted to the student through e-mail.
3. One oral individual or group report based on a current controversial scientific topic researched by any means appropriate.
4. One laboratory report.
5. One report based on a field trip (e.g., AMNH, Planetarium).

Method of Evaluation - Although there is much leeway, the following is a typical grading pattern:

<u>Assignment</u>	<u>Percentage of Grade</u>
2 or 3 examinations at 15% or 10% each	30
1 library research paper	10
1 Internet research paper	10
1 oral presentation	10

1 laboratory report	10
1 report from field trip	10
Final examination, cumulative (KCC requirement)	20
Total	<u>100%</u>

Textbook Concept: Textbooks are out-of-date at their moment of publication. Consequently, since 1984, when the College Now program began, hardbound textbooks have been optional for this course. However, each instructor is required to put together readings based on current materials from newspapers (e.g., *Tuesday Science Times*), and scientific periodicals (e.g., *Discover*, *Scientific American*, *Natural History*). These sources may vary as the instructor's interests and focus change from semester to semester. The constant is that the course syllabus is the ultimate reference for content, sequence and continuity in the course.

Teacher Resource Materials: College Now instructors, as adjuncts in the KCC Department of Biological Sciences, have access to materials and supplies used by the Department of Biological Sciences of Kingsborough Community College. This includes use of dissecting supplies (e.g., brains, hearts, eyes), multimedia supplies and duplicating and library services. Special requests may be honored and should be addressed to the Science I Course Coordinator: Dr. Mary Ortiz (718-368-5724, or MOrtiz@kbcc.cuny.edu).

Selected Bibliography: Newer references are available through any current book providers and ISBN numbers are provided. Older references are excellent also (many are classics) and are available through libraries or, possibly, on loan from the Science I Course Coordinator.

Humankind's Place in the Universe

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 Consolmagno, G., and Davis, D., *Turn Left at Orion*, Cambridge University Press, NY 1995.
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 Farrington, B., *What Darwin Really Said*, Schocken Books, NY 1966
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 Fraser, G., Lillestal, E., and Sellvag, I., *The Search for Infinity*, Reed International Books, Ltd., 1995.
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Our Attempts at Mastery of the Universe

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Our Exploration of Ourselves

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 Ross, I., Aging of Cells, Humans and Societies, Wm. C. Brown, Publishers, 1995.
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DVD/VHS - The following films are available through the College Now office:

October Sky
 The Andromeda Strain
 The Perfect Storm
 The Day After Tomorrow

Course Objectives for College Now SCII

I. Humankind's place in the universe.

A. The origin of the universe.

- State the size and age of the universe.
- Demonstrate understanding of the theories of the universe's creation and destruction, i.e. Big Bang Theory, The Big Crunch.
- Discuss solar system formation.
- Discuss the Hubble Space Telescope (HST).
- Distinguish between radio and X-ray astronomy.

B. Composition of the universe.

- Define matter, element, energy, dark matter, dark energy, gravity and Einstein's cosmological constant.
- State and define the sub-atomic particles.
- Demonstrate understanding of the vastness of space, i.e. light year, distance -time relationships, bending of space, and worm holes.
- Explain man's affinity for space and survival.
- Discuss human capabilities to explore our celestial neighborhood, i.e. Mars exploration, return to the Moon, visiting an asteroid, and the Cassini Mission to Saturn.
- Identify technologies that will give humans the ability to live on other worlds.

C. What is the nature of our planet?

- State the age of the Earth and discuss theories of its formation.
- Discuss how tsunamis, earthquakes and tornados have lead to devastation in parts of the world.
- Explain how human actions may have contributed to the formation of earthquakes, tsunamis, and tornados.

D. Life and its origin.

- Define life and discuss its' diversity on Earth.
- Compare and contrast historical views of life origins.
- Describe the experimental results of Stanley Miller and discuss their significance to origin of life theories.
- Describe alternative theories to origin of building blocks of life. (astrobiological concept and synthesis at hydrothermal vents).
- Compare the concepts of an RNA world vs. a DNA world as the basis for origin of life theories.
- Discuss evolutionary models of the origins of cellularity.

E. Evolutionary theory.

- Define: organic evolution, species, adaptation, speciation, extinction.
- Discuss the history of evolutionary thought. Include Lamarck's Theory of Acquired Characteristics.
- Identify the role of the environment as a selective agent for evolution.
- List biological and physical isolating mechanisms that affect evolution.
- Describe evidence that supports the theory of evolution, including comparative anatomy, embryology, biochemistry, biogeography and molecular biology.
- Identify relationships between structure & function among related organisms.
- Differentiate between and provide examples of vestigial, homologous and analogous structures.
- Infer evolutionary relationships by analyzing protein amino acid sequences and/or sequences of nucleotides of genes in organisms.
- List the four premises of natural selection as outlined by Darwin.

- Discuss the theory of Natural Selection.

F. How we are formed: Developmental Biology and Genetics

- Compare and contrast the stages of development in various species.
- Explain the stages of human childbirth.
- State and explain the basic principles of classical (Mendelian) genetics.
- State and explain the basic principles of modern (molecular) genetics.
- Discuss the Human Genome Project & its implications for the future of humankind.
- Discuss the genomes of other organisms.
- Discuss genetic engineering; include cloning & genetically altered organisms.

II. Humankind's place in the universe.

A. Flight.

- List the forces that act on a plane, glider, or bird in flight.
- Explain how a plane gets off the ground and remains in flight.
- Discuss the advantages and hazards of supersonic flight.
- Discuss the history and challenges of space exploration.

B. Computers.

- Discuss the major events in the development of the PC and the Internet.
- Explain how Web 2.0 is useful and how Web 3.0 is expected to modify our digital experience.
- Describe three Internet based applications that have changed healthcare.

C. Light.

- Describe the electromagnetic spectrum from cosmic rays to radio waves.
- Explain the role of lasers in medicine and industry.
- Discuss the methodology of holography and holographic images.

D. Energy

- Discuss five alternative forms of energy that do not rely on fossil fuels.
- Explain two tradeoffs society must accept to fully utilize these alternate energy resources.

E. Technology's price - human-made plagues & pollution.

- Demonstrate understanding of the history and progression of modern technology 1900 - present/future.
- Describe 3 technological advances that will likely occur in the next 50 years.
- Demonstrate an understanding of the limitations of technology.
- Create ways to use technology to become better stewards of our planet.
- Explain how technology is capable of becoming a burden.

III. Our Exploration of Ourselves.

A. Exploring the brain.

- Describe the etiology and treatments for three neurological disorders.

- Explain the mechanism of action of three classes of recreational drugs and their impact on society (both positive and negative).
- Describe how stem cells may be the basis for treatment of several neurological disorders.

B. Healing - many paths.

- Discuss the western view of viewing the body as a machine.
- Discuss surgery and medication - compare to a mechanic.
- Discuss issues that arise from this western view - antibiotic resistant bacteria.
- Discuss the flow of energy - Acupuncture/Medicinal Herbs, and link these to scientific studies and the role of the FDA.
- Explain chiropractic adjustments and the endorphin release. Compare and contrast the current roles of these in American society.

C. Immunology.

- Create a timeline of the milestones in the field of Immunology.
- Describe methodologies that are used to treat and control diseases.
- Define the significance of the immune system, including non-specific, humoral and cell mediated immunity.
- Explain virulence and describe factors that will increase virulence.
- Distinguish among disease spread, prevention and treatment.
- Distinguish between HIV and AIDS.
- Explain the goals of Immunological research in the 21st century.

D. Fertility.

- Define in vitro fertilization & explain its indications in infertile women.
- Describe the process and stages involved in in vitro fertilization.
- Describe what a fiber optic cable is and how it works.
- Discuss the indications and usage of a laparoscope in surgery.
- Discuss advances and techniques that have arose in the past 20 years involving in utero surgery in which birth defects are corrected.
- Identify the signs of various birth defects such as Spina bifida & acardiac twin.
- Define cloning.
- Identify the different types of cloning.
- Describe how cloning techniques can be used.
- List what animals have been cloned.
- Discuss the future of cloning.
- State the risks of cloning.
- Discuss the ethics of cloning humans.

E. Nutrition.

- List and describe the basic food components: proteins, carbohydrates, fiber, lipids, vitamins, minerals, and water.
- Distinguish between a nutritional claim and a health claim on a food product label.
- Describe how individual health is affected by nutritional status.
- List and describe the types of disorders associated with altered nutritional status.
- List at least four healthful strategies for eating at "fast food" establishments.
- Explain how the media (TV, newspapers, magazines) influences food choices.
- Explain the differences between hunger and appetite.
- Explain how the Food Guide Pyramid is used for healthy meal planning.

- Describe the *Dietary Guidelines for Americans*, and explain their purpose.
- Recognize that fats and refined sugars can be obtained from almost any food group and that both the types and amounts of fats should be carefully controlled in order to eat a healthful diet.
- Explain how you would determine the percent daily value for carbohydrates, fats and protein for a person on a 2000-calories-a-day diet.
- Use the food composition tables on the website (www.mypyramid.gov) to determine: calories, grams of carbohydrates, fats and protein for a serving of a particular meal.

F. Maturity and aging.

- Identify five sensory changes that occur as we age.
- Identify five systemic changes that occur as we age.
- Compare and contrast three of the following theories of aging: free radicals, Hayflick, protein cross linking and glycosylation.
- Discuss 3 ways that our understanding of aging can lead to a longer lifespan.
- Identify one benefit of the aging process.

G. Bioethics

- Compare ethics and morals.
- Discuss the ethics surrounding the Willowbrook and Tuskegee scandals.
- Discuss the changing paradigms of science and truth.