

Science and the Liberal Arts

Veritas - Unitas - Caritas

What is the rationale for a College of Liberal Arts and Sciences? How can we unify the truths that are found within disciplines throughout our college in a way that serves passionate caring about learning and living together in community? What is the intellectual project that ties the parts of the college together into a whole?

How can the natural sciences, the social sciences, and the humanities be integrated to tell a coherent, evidence based narrative from the Big Bang 13.82 billion years ago through today and well into the future? An evidence based narrative about the common origins of all people and the entire universe? About the emergent complexity of sustained, structured relationships that begins with quarks and the strong force and leads eventually to the practice of sustainable, caring communities. The chapters of this story build on each other, incorporating what has happened before as it moves ahead. It is an uneven story, with many unforeseeable surprises that have been connected but were not inevitable. Much in the story stayed at earlier stages and often has become less complex. Only a small portion has continued to gain greater complexity. Can studying this story help provide the skills and insights that will aid in imagining, planning, and achieving a sustainable human community?

We will study how science has provided the evidence for periods of time since the Big Bang that have led to us now and to reasonable expectations for the future. This study



A Course for the College

will cover the major periods since the Big Bang from the Radiation Period and expansion, the formation of atoms, the development of stars and galaxies, second generation stars such as our own Sun, the accretion of our Earth about 4.5 billion years ago and its many changes since then, the origins and development of life over the past 4 billion years, the origins and development of human culture over the past 200,000 years, the increasing complexity of social relations (from kinship, to village, to city, nation, empire, and globalization), the emergence of self-consciousness and culture, the role of imagination in creating new types of relationships, and reasonable projections about what in the future might be expected.

Because we incorporate or inherit what originated millions and billions of years ago, we are investigating what has led to us now. The quarks and hydrogen of which we are made are 13.82 billion years old. (65% of the atoms out of which you are made today are hydrogen.) The carbon of which life on earth is made is at least 5 billion years old or more. Our ability to turn food into energy as we do is about 2 billion years old. Our eyesight, hearing, reproductive systems, wrists, and so on all have their own long histories of how our parts are structured within sustained relationships. How can we interpret a very long history that was originally written not in books, but in light, stones, bones, and blood? How do we understand the thread of continuity through the creative transitions that nature has taken over time? A history in which there are ever more complex units that are used in the formation of more complex units with new properties?

The journey that the universe has taken includes our own human journey. The 65 million year rise of mammals led to primates of various sorts and then to hominds some 8 million years ago, of which our own species is the last surviving one. Your brain now is the most complex matter of which we know anywhere in the universe. The relationships among the billions of people today are the most complex phenomena of which we are aware. Our relationships have been facilitated by our ability to speak a language, think in symbols, be creative and artistic, sing, dance, trade, form polities, develop ethics, be religious, fight wars, migrate, and build a digital structure than connects billions of people. How have we developed the complexity of our relations over time? What is necessary to create a human community in sustainable relationship with the nature from which we emerged? How can nature be imagined in ways that accounts for creativity and marvel?

Finally, what can we reasonably expect in the future? Can our social and political complexity continue to develop in ways that may be necessary to sustain human survival over the long term? What will happen to humanity, life, the earth, and the universe over the coming millions and billions of years? How do you understand your place in all of spacetime? What does this evidence based story mean to you?

To cover the material in this course, we will draw upon physics, astronomy, chemistry, geography, geology, biology, computing sciences, anthropology, linguistics, religious studies, art, music, philosophy, ethics, narrative and literary studies, sociology, psychology, economics, and political science. We will be reading material written by people from all of the fields covered and listening to lectures by many of them.

By unifying the truths established by the disciplines of the entire College of Liberal Arts and Sciences, one of humnaity's greatest achievements can be investigated: the integrated story of the stages and transitions that have occured from the beginning of our universe until now, the steps that have been taken to get to us and everything else, how each of these are embedded in us now, how imagination and learning have been a part of this creative process, and how passionately caring about learning can be part of passionately caring for the unity of all who have a common origin.

Course Assignments

- The first assignment is to listen to lectures and to participate in class discussions.
- The second is to read our text book (Fred Spier, *Big History and the Future of Humanity*) that summarizes the periods of time over the past 13.82 billion years and the next 14 billion years.
- The third is to have viewed videos before class and be prepared to discuss them.
- The fourth is to read two additional books that you will choose from those that are listed. These book will give you a deeper understanding of one of the topics that is introduced in our textbook. Please be prepared to briefly present an evaluation of that book in class. You will write a review of each of these two books.

Grading

Mid Term exam: 20%

Class Participation: 20%

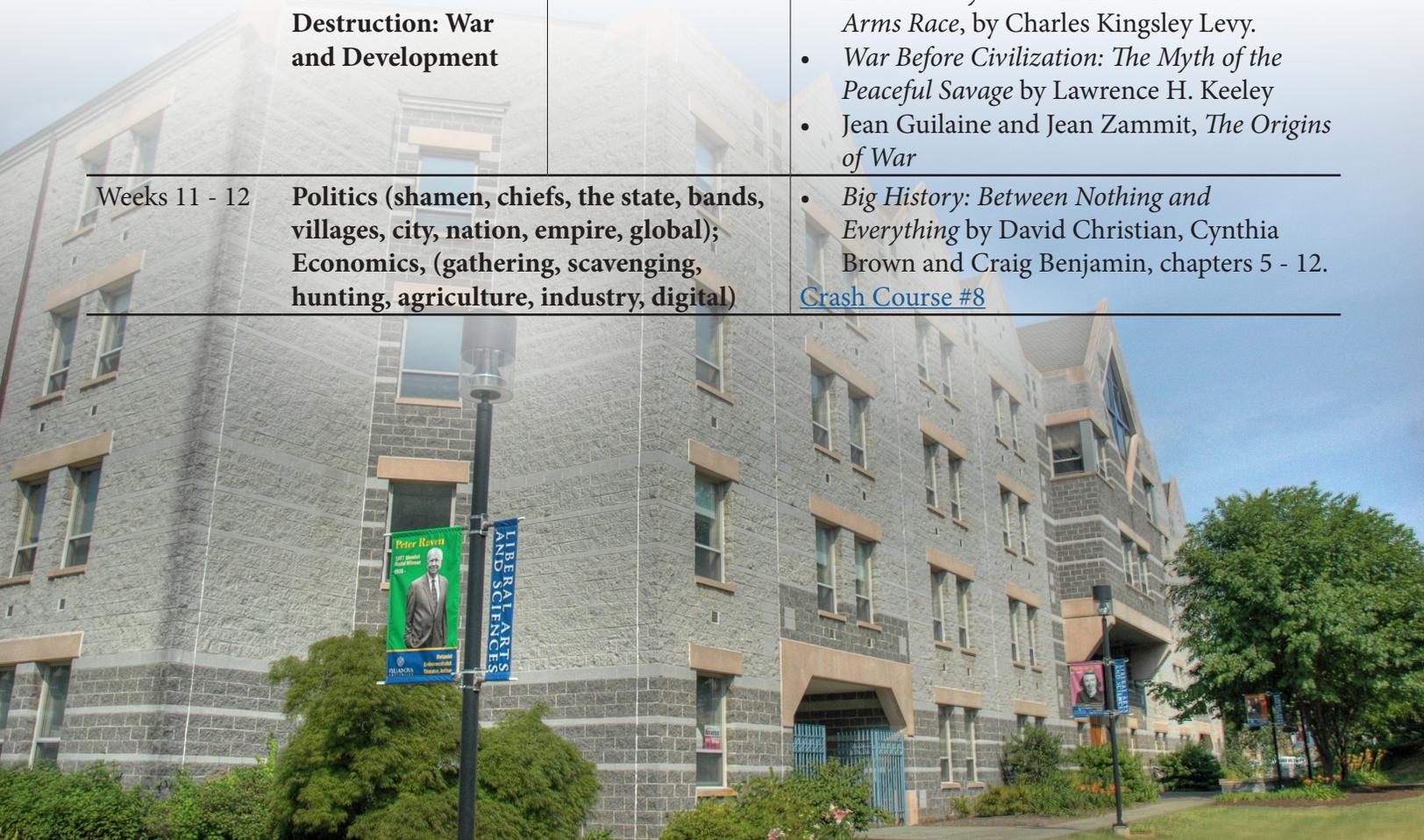
Two Book reviews: each worth 10%.

Final Exam: 40%

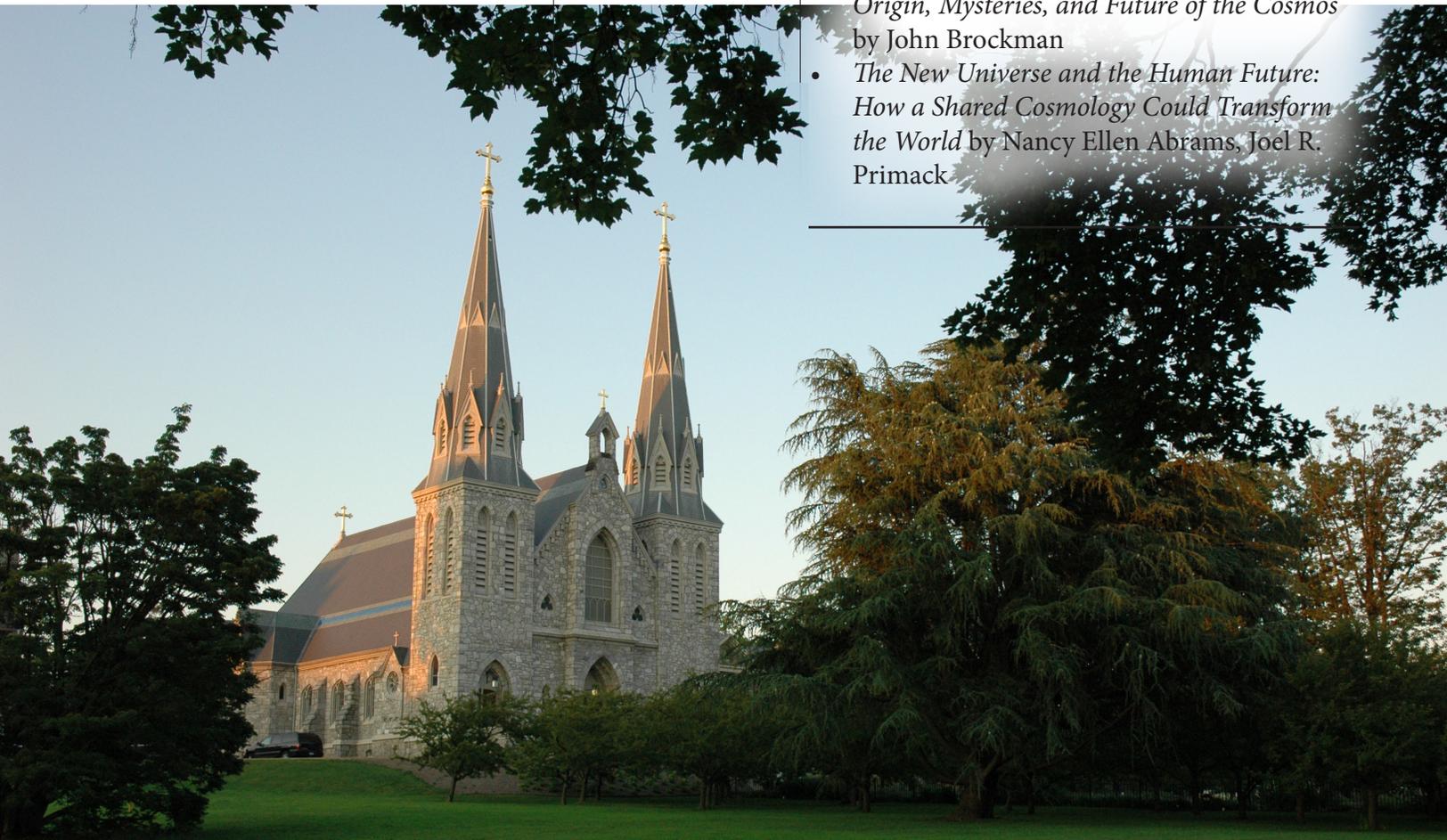


Date	Fields / Topics	Common Readings and Videos	Class presentation on your choice of one of these Books
Week 1	Introductions	Fred Spier, <i>Big History and the Future of Humanity</i> , Chapters 1 - 2. (Suggested) <i>Human Universe</i> by Brian Cox, Kahn Academy Course on Big History	
Week 2	Physics The Big Bang: Particles and Atoms (Physics)	Reading: Spier, Chapter 3. The Big Bang: Crash Course Big Bang, Atoms	<ul style="list-style-type: none"> • Lederman, Leon M., and C. T. Hill. 2011. <i>Quantum Physics for Poets</i> • Lederman, Leon M., and Dick Teresi. 2006. <i>The God Particle: If the Universe is the Answer, What is the Question?</i> • Lederman, <i>Beyond the God Particle</i>
Week 3	Astronomy, Chemistry Stars and galaxies, Molecules and Minerals in Space	Spier, Chapter 4. Crash Course 2 Stars	<ul style="list-style-type: none"> • <i>Big Bang: The Origin of the Universe</i> by Simon Singh
Week 4	Astronomy, Geology, Geography Planets and Earth	Crash Course 3	<ul style="list-style-type: none"> • Hazen, Robert M. 2012. <i>The Story of Earth: The First 4.5 Billion Years, From Stardust to Living Planet</i> • Neil Shubin, <i>The Universe Within: Discovering the Common History of Rocks, Planets, and People</i>
Week 5	Biology and Evolution Origins of Life and Evolution	Spier, Chapter 5 Crash Course 4 Life Crash Course 5	<ul style="list-style-type: none"> • Robert Hazen, <i>Genesis: The Scientific Quest for Life's Origins</i> • Pross, Addy. 2012. <i>What is Life?: How Chemistry Becomes Biology</i> • <i>In Search of Cell History</i> by Franklin M. Harold • <i>The Ancestor's Tale: A Pilgrimage to the Dawn of Evolution</i> by Richard Dawkins • <i>Life Ascending: The Ten Great Inventions of Evolution</i>, by Nick Lane • <i>Your Inner Fish: A Journey into the 3.5-Billion-Year History of the Human Body</i> by Neil Shubin
Week 6	Physical Anthropology Mammals, Hominins	Spier, Chapter 6 Evolution Mammals Hominins Crash Course #6	<ul style="list-style-type: none"> • <i>The Last Human: A Guide to Twenty-Two Species of Extinct Humans</i>, by Esteban Sarmiento et al • Daniel Lord Smail, <i>On Deep History and the Brain</i> • Johanson, Donald C., and Edgar Blake. 2006. <i>From Lucy to Language</i>
Week 7	Genetics and Archaeology Out of Africa and Global Migration	Spier, Chapter 7 Crash Course #7	<ul style="list-style-type: none"> • <i>The Real Eve: Modern Man's Journey Out of Africa</i>, Stephen Oppenheimer • <i>Before the Dawn</i>, Nicolas Wade • Tattersall, Ian. 2012. <i>Masters of the Planet: Seeking the Origins of Human Singularity</i>

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Weeks 8	Linguistics, Art, Music Society Mediated by Exchange of Symbols Language Art and Music	Speaking Up: The Origins of Language	<ul style="list-style-type: none"> • <i>Adam's Tongue: How Humans Made Language, How Language Made Humans</i> by Derek Bickerton • Christine Kenneally, <i>The First Word: The Search for the Origins of Language</i> • Norbert Aujoulat, <i>Prehistoric Art: the symbolic journey of humankind, Lascaux</i> by • Jean-Marie Chauvet, <i>Dawn of Art: The Chauvet Cave</i> • Lewis-Williams, David. <i>The Mind in the Cave: Consciousness and the Origins of Art.</i>
Week 9	Religion, Meaning, and Ethics		<ul style="list-style-type: none"> • Matt J. Rossano, <i>Supernatural Selection: How Religion Evolved.</i> • Nicholas Wade, <i>The Faith Instinct: How Religion Evolved and Why It Endures.</i> • Frans De Waal, <i>Our Inner Ape or Primates and Philosophers</i> • Frans De Waal, <i>The Bonobo and the Atheist</i> • <i>Big Gods: How Religion Transformed Cooperation and Conflict</i> by Ara Norenzayan • <i>The Meaning of Human Existence</i> by Edward O. Wilson
Week 10	Creative Destruction: War and Development		<ul style="list-style-type: none"> • <i>Evolutionary Wars: A Three Billion Year Arms Race</i>, by Charles Kingsley Levy. • <i>War Before Civilization: The Myth of the Peaceful Savage</i> by Lawrence H. Keeley • Jean Guilaine and Jean Zammit, <i>The Origins of War</i>
Weeks 11 - 12	Politics (shamen, chiefs, the state, bands, villages, city, nation, empire, global); Economics, (gathering, scavenging, hunting, agriculture, industry, digital)		<ul style="list-style-type: none"> • <i>Big History: Between Nothing and Everything</i> by David Christian, Cynthia Brown and Craig Benjamin, chapters 5 - 12. Crash Course #8



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Week 13	Future of Humans	Crash Course #9	<ul style="list-style-type: none"> • <i>Human Purpose and Transhuman Potential: A Cosmic Vision of Our Future Evolution</i> by Ted Chu • <i>The Future of the Mind: The Scientific Quest to Understand, Enhance, and Empower the Mind</i> by Michio Kaku • <i>Physics of the Future: How Science Will Shape Human Destiny and Our Daily Lives by the Year 2100</i> by Michio Kaku • <i>The Singularity Is Near: When Humans Transcend Biology</i> by Ray Kurzweil • <i>Abundance: The Future Is Better Than You Think</i> by Peter H. Diamandis and Steven Kotler • <i>The Island of Knowledge: The Limits of Science and the Search for Meaning</i> by Marcelo Gleiser
Week 14	Future of Nature	Spier, Chapter 8 Crash Course #10	<ul style="list-style-type: none"> • <i>The Sixth Extinction: An Unnatural History Hardcover</i> by Elizabeth Kolbert • <i>Sustainability or Collapse?: An Integrated History and Future of People on Earth (Dahlem Workshop Reports) Paperback</i> by Robert Costanza (Editor), Lisa J. Graumlich (Editor), Will Steffen (Editor) • <i>The Universe: Leading Scientists Explore the Origin, Mysteries, and Future of the Cosmos</i> by John Brockman • <i>The New Universe and the Human Future: How a Shared Cosmology Could Transform the World</i> by Nancy Ellen Abrams, Joel R. Primack





Suggested Texts

Berry, Thomas and Mary Evelyn Tucker. 2009. The Sacred Universe: Earth, Spirituality, and Religion in the Twenty-first Century. Columbia University Press.

Brown, C. S. 2007. Big History: From the Big Bang to the Present. New York, NY: New Press. Distributed by W.W. Norton.

Chaisson, E. 2006. Epic of Evolution: Seven Ages of the Cosmos. New York, NY: Columbia University Press.

Christian, D. 2004. Maps of Time: An Introduction to Big History. Berkeley, CA: University of California Press.

Christian, D., Cynthia Brown and Craig Benjamin. 2013. Big History: Between Nothing and Everything. New York, McGraw-Hill.

Grinin, Leonid, David Baker , Esther Quaedackers , Andrey Korotayev, editors. 2014. Teaching and Researching Big History: Exploring a New Scholarly Field. Uchitel Publishing House.

Simon, Richard B. , Editor. 2014. Teaching Big History, University of California Press.

Spier, Fred . 2015. Big History and the Future of Humanity. 2015 Wiley-Blackwell; 2 edition

Swimme, Brian Thomas and Mary Evelyn Tucker. 2011. Journey of the Universe. Yale University Press.

Yavelow, Jonathan, Star Gazing to Sustainability: Appreciating the Scientific Process, 2013, Dubuque, IA, Kendall-Hunt.