

Curriculum Units by
Fellows of the
Yale-New Haven Teachers Institute
Guide
2015

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Preface

In March 2015, thirty-eight teachers from fifteen New Haven Public Schools became Fellows of the Yale-New Haven Teachers Institute® to deepen their knowledge of the subjects they teach and to develop new curricular material to engage and educate their students in their school courses. Founded in 1978, the Institute is a partnership of Yale University and the New Haven Public Schools, designed to strengthen teaching and improve learning of the humanities and STEM fields in our community's schools. Through the Institute, Yale faculty members and Public Schools teachers join in a collegial relationship. The Institute is also an interschool and interdisciplinary forum for teachers to work together.

The Teachers Institute has repeatedly received recognition as a pioneering model of university-school collaboration that integrates curriculum development with intellectual renewal for teachers. Between 1998 and 2003 it conducted a National Demonstration Project that showed the approach the Institute had taken for twenty years in New Haven could be tailored to establish similar university-school partnerships under different circumstances in other cities. Based on the success of that Project, in 2004 the Institute announced the Yale National Initiative to strengthen teaching in public schools®, a long-term endeavor to influence public policy on teacher professional development, in part by establishing in states around the country exemplary Teachers Institutes following the approach developed in New Haven and implemented elsewhere. Evaluations have shown that the Institute approach exemplifies the characteristics of high-quality teacher professional development, enhances teacher quality in the ways known to improve student achievement, and encourages participants to remain in teaching in their schools.

Teachers had primary responsibility for identifying the subjects on which the Institute would offer seminars in 2015. Between October and December 2014, teachers who served as Institute Representatives canvassed their colleagues in each New Haven public school to determine the subjects they wanted the Institute to address. The Institute then circulated descriptions of seminars that encompassed most teachers' interests. In applying to the Institute, teachers described unit topics on which they proposed to work and the relationship of those topics both to Institute seminars and to courses they teach. Their principals verified that their unit topics were consistent with district academic standards and significant for school curricula and plans, and that they would be assigned courses in which to teach their units during the following school year.

Through this process four seminars were organized, corresponding to the principal themes of that emerged during the canvassing. The seminars were:

- “American Indian History, 1492 to the Present,” led by Ned Blackhawk, Professor of History and of American Studies;
- “American Culture in the Long 20th Century,” led by Matthew Frye Jacobson, William Robertson Coe Professor of American Studies and History;
- “Physics and Chemistry of the Earth’s Atmosphere and Climate,” led by Steve K. Lamoreaux, Professor of Physics; and
- “Big Molecules, Big Problems,” led by Andrew D. Miranker, Professor of Molecular Biophysics and Biochemistry and of Chemical and Environmental Engineering.

Between March and July, Fellows participated in seminar meetings, studied the seminar subject and their unit topics, and attended a series of talks by Yale faculty members.

The curriculum units Fellows wrote are their own; they are presented in four volumes, one for each seminar. The units, which were written in stages over time, contain five elements: content objectives, teaching strategies, examples of classroom activities, lists of resources for teachers and students, and an appendix on the academic standards the unit implements. They are intended primarily for use by Institute Fellows and their colleagues who teach in New Haven. They are disseminated on Web sites at yale.edu/ynhti and teachers.yale.edu. We encourage teachers who use the units to submit comments at teachers.yale.edu.

This *Guide* to the 2015 units contains introductions by the Yale faculty members who led the seminars, followed by synopses written by the authors of the individual units. The Fellows indicate the courses and grade levels for which they developed their units and other places in the school curriculum where the units may be applicable. Copies of the units are deposited in all New Haven schools and are online at yale.edu/ynhti. A list of the 216 volumes of units the Institute has published between 1978 and 2015 appears in the back of this *Guide*. *Guides* to the units written each year, a topical *Index* of all 1,968 units written between 1978 and 2015, and reference lists showing the relation of numerous units to school curricula and academic standards are also online.

The Yale-New Haven Teachers Institute is a permanently endowed academic unit of Yale University. The New Haven Public Schools, Yale's partner in the Institute, has supported the program annually since its inception.

James R. Vivian

New Haven
August 2015

I. Teaching Native American Studies

Introduction

The eight curriculum units that comprise this volume – the product of a seminar on “American Indian History, 1492 to the Present” – explore varying approaches to the study of Native America. Several examine contemporary Native American literature, using a range of fictional and theatrical accounts. Others probe the limits of current pedagogical approaches to U.S. history and provide ways of incorporating Native American history into the classroom. Generally, they are all animated by a deep sense of concern about the lack of existing curricular materials available for public education. Nearly all attempt to incorporate the voices, texts, and experiences of Native Americans within contemporary American society in their unit, deploying Native voices to fill the long-standing voids and silences that have historically framed curricular approaches to the continent’s Indigenous peoples.

Using a range of secondary scholarly texts, films, documentaries, and fictional accounts, this Institute seminar explored the history of American Indians. Fellows developed broad overviews of the historical development of Indian law, policy, and contemporary affairs. A recurring theme throughout the seminar emerged within each session: namely, the profound dissonance between the experiential nature of Native American life and history and the familiarity of one-dimensional and often simplistic portrayals of Native people in popular culture. Indeed, within nearly each of our readings, Fellows were able to identify popular stereotypes that either emerged from such subjects or, more commonly, obscured the nature of these subjects. For example, the mythology of early New England history with stories of Native peoples welcoming Puritan settlers starkly contrasted with our readings about the Puritan conquest of Connecticut, the Pequot War, and Mystic River Massacre. Similarly, discussions of the post-World War II Federal Indian policy efforts known as Termination placed the presence of the Cold War Hollywood western genre into sharp relief.

Such analyses ultimately brought focused and sustained attention to the narratives of Native people, which Fellows came to see as the most powerful countermeasure for challenging such one-dimensional portraits. Sherman Alexie’s *The Absolutely True Diary of a Part-Time Indian*, Chris Eyre’s *Smoke Signals* and *Skins*, Mary Kathryn Nagle’s *Sliver of a Full Moon*, the photography of Horace Poolaw, and the twelve short films made about Great Lakes Indian life and culture, *The Ways*, provided alternative visions of the experiences and challenges of contemporary Native Americans in modern U.S. society. Coupled with visits to the Yale University Art Gallery, Peabody Museum, and Native American Cultural Center, these narratives enriched the seminar and provided what one Fellow termed ‘insider-outsider’ narratives of Indian experiences geared towards fostering greater understanding. Many Fellows attended the Yale Law School performance of Nagle’s *Sliver of a Full Moon*, met with her subsequently, and incorporated aspects of her play about the 2013 reauthorization of the Violence Against Women Act into their units.

The diverse classroom settings of these New Haven teachers amplified the need for accessible and approachable ways for introducing Native American Studies to area students. Several units are geared towards elementary-school children. Most are for high-school students. The power of Native voices to de-mystify Indian history and complicate familiar images and understandings became the most commonly utilized methodology developed within this Institute program.

Carol Boynton’s “A Year in the Life of an Algonquian Family” aims to give her second-grade classes opportunities to explore the pre-contact histories of the region’s Algonquian-speaking Pequot and Quinnipiac nations. Her unit plan traces the seasonal economies of these Northeastern communities and attempts to provide her young students with visions of alternative lifestyles and cultures that pre-dated Euro-American settlement.

James Brochin’s “Memoir, Identity and History in the Words of Sherman Alexie” provides high-school students multiple entryways into contemporary Native American film and literature. Using extended selections from several prominent films, his unit assesses Alexie’s work in extended dialogue with contemporary representations of Native people. He also provides visual representations of Native peoples drawn from photographic collections, identifying another realm in which Native peoples have been both immortalized but also often frozen in time.

Christine Elmore’s “Teaching Young Children about the Cherokee Trail of Tears” explores one of the most chronicled chapters of Indian history within the realm of children’s literature and history. Aimed at getting first-graders to recognize the deadly injustices that characterized Cherokee removal, her unit offers multiple approaches to elementary-school pedagogy.

Vancardi Foster’s “Now Let Me Tell My Story” explores the ongoing struggles for justice of Native American communities in contemporary America. It uses examples drawn from historical overviews to highlight the inequitable standing between Indian and non-Indian communities, exposing in particular the often arbitrary rulings of the federal government that have had severe environmental, human, and economic consequences for Indian communities.

Jessy Griswold’s “A Study of American Indian History” explores the subject from an artistic and social justice perspective. Employing artistic representations produced by American Indian artists, this unit considers commonalities and differences across cultural backgrounds. It offers students visual and artistic entryways into the comparative forms of cultural analysis.

Mark Osenko’s “Overcoming the Absence of Native Americans in the History Curriculum” attempts to counteract the ongoing erasure of American Indians from commonplace textbooks in U.S. history. Applying a regional analysis that highlights the diversity and complexity of pre-Columbian Native North America, this unit offers models for integrating Native histories into high-school U.S. history curricula.

Robert Schwartz’s “The Surviving and Thriving of Cultures” links Native American struggles for justice with other injustices in U.S. history. Using literary expressions as windows into the larger themes of survival and adaptation, this unit introduces contemporary Native American voices into English and language arts course materials, drawing upon plays, memoirs, and creative works to highlight the ongoing resiliency of Native communities.

Marialuisa Sapienza’s “Contemporary Native American Fictional Accounts of Hope and Fear” investigates short stories and autobiography to challenge the absence of Native Americans from contemporary English and literature pedagogies. Using stories by Louise Erdrich and Sherman Alexie, this unit probes the multiplicity of meanings and insights found within these complex forms of Native American literary production.

Ned Blackhawk

Curriculum Units

15.01.01

A Year in the Life of an Algonquian Family, by Carol Boynton

Using local history as an entry point into American and world history motivates students to learn about and to become more engaged in their smaller world. Learning resonates with students when they become part of the timeline of their own area and community, an approach known as place-based education. This model creates a pathway to understanding our current time in the places that we live. Through this close-reading curriculum unit designed for second-graders, history will become accessible to the young students as they explore, investigate, and discover how the Algonquian families lived on the same land that the students now call home.

With the long, rich history of American Indians here in New Haven, students will work with informational text on American Indians in general and the Quinnipiac and Pequot tribes specifically to practice close reading. A social studies component includes research projects developed from authentic questions generated during close reading experiences and collaborative discussions.

(Developed for Literacy and Social Studies, grade 2; recommended for Literacy – Reading and Writing, and Social Studies, grades K-4)

15.01.02

Memoir, Identity and History in the Works of Sherman Alexie: An Insider's Outsider Perspective, by James P. Brochin

Designed for urban high-school students in U.S. History II, Civics, or Journalism, the unit's central thematic focus is Sherman Alexie's writing. Alexie is one of very few writers capable of making students laugh, cry, get angry, and gain a deeply personalized understanding of American Indian history and identity. How did he develop his identity? By choosing to leave the reservation, he became an insider's outsider. Teenagers are by nature insider outsiders, with powerful antennae capable of figuring things out. Combining a close study of his writing with at least two films, *Little Big Man* and *Smoke Signals*, along with words and images from *Strong Hearts: Native American Visions and Voices* and other texts, students will develop some of the following skills: journalistic writing, memoir analysis and writing, film review writing, and a critical analysis of American Indian history. Students will also gain some appreciation of the varied experiences of Native communities, and will contribute to podcast recordings of class presentations and discussions.

(Developed for Journalism, grades 9-12, and Civics, grades 11-12; recommended for AP Literature and English 3 and 4, grades 11-12)

15.01.03

Teaching Young Children about the Cherokee Trail of Tears, by Christine A. Elmore

Indian Removal remains a defining component within contemporary Native American history. This unit explores this historical trauma within the Cherokee communities in order to highlight the relationship between injustice and American democracy.

Through an analysis of historical documents, eyewitness accounts, Cherokee family stories, paintings, poetry, songs, online videos as well as children’s historical fiction books and informational texts, students will gain a familiarity with the Trail of Tears event – the forced removal of sixteen thousand Cherokee Indians from their homes in Georgia to Indian Territory (now Oklahoma) in 1838.

This unit, divided into four sections, is interdisciplinary in scope and incorporates reading, writing, art, history and social studies:

- 1: Examine a Myth and Begin to Get to Know a People
- 2: Two Influential Figures in Cherokee History
- 3: Three Events Shaping the Destiny of the Cherokee Nation
- 4: The Trail of Tears: Voices from the Past and Present

Designed with first-graders in mind, this unit could easily be adapted for use in other primary and intermediate grades.

(Developed for Language Arts, Reading, Writing, History, and Social Studies, grade 1; recommended for History, Social Studies, and Language Arts, grades 1-5)

15.01.04

Now Let Me Tell My Story: American Indian Community Struggles in Contemporary U.S. History, by Vancardi Foster

Curriculum on Native Americans in high-school classrooms has been very thin at best, and this is to the detriment of teaching justice within our nation. This unit explores the human experience of Native Americans through works of fiction, art and theater while also examining primary and secondary historical sources relating to the issues of native communities living in the legal and culturally harsh environment of the 21st century. Many contemporary teachers and students of the subject fail to realize how underappreciated Native American history is and miss an opportunity to unlock the real visions of our forefathers. The unit helps students to understand why Indian nation sovereignty is important for the reversal of an attempted cultural genocide and how it can apply to their own communities. The unit concludes with students developing an advertising campaign and/or proposal for a tribe of their choice on how to solve an issue of that particular tribe, using the previously examined sources with the aim of allowing Native Americans finally to tell their story.

(Developed for U. S. History I, grade 10)

15.01.05

A Study of American Indian History: Cultural Identity and Artistic Expression, by Jessy Griswold

Art is and has been a fundamental expression of American Indian culture as it appears in many media, including clothing, dance, poetry, photography and painting, to name a few. Students will look to representations of these characteristics to explore the cultural identity of the modern American Indian. Students will analyze artistic representations to detect biases or expressions that limit viewers' understanding of certain cultures, and use these analytical skills to evaluate their own artwork as well. There will be a visit to the Yale Art Gallery to continue this analysis. Students will read history, through prose and drama, in order to discover the journey of American Indian culture from settlement until now and the political injustices that prevail to this day. Students will also take a look into their own culture to find elements that express their cultural identity. There will be connections made between modern American Indian life and the lives of the students. In making such connections, students will create art that speaks a message of awareness, empathy and common ground. They will do this by implementing new art techniques of typography and symbolism to create a piece that represents two cultures and their commonality in America.

(Developed for Visual Arts, grades 5-8, and Photo I: Emphasis, grades 6-8; recommended for Visual Arts, Creative Writing, Visual Storytelling, and Photography, grades 6-12)

15.01.06

Overcoming the Absence of Native Americans in the History Curriculum, by Mark Osenko

In many educational settings around the United States there are classes where Native American histories are overlooked or under-taught for various reasons. My curriculum unit tries to combat the absence of these histories within the classroom, and to bring to life the various tribes in this country whose histories have been omitted or underappreciated. The main objective of this unit is to allow students an opportunity to examine various tribes' cultures, languages, societies, interactions with settlers, and advances made over the years. The purpose of this analysis will be to show students that even though many textbooks and curricula across the nation may have exchanged native history with other topics in the curriculum, there is still a rich history and continuing legacy. The unit consists of primary and secondary source analysis along with class discussions and group assignments. The unit will culminate with the students working in small groups in order to create their own textbook entry on a Native American tribe or region of their choice. My overall goal will be to open students' minds to the fact that even though Native American histories may be too often missing, they are not forgotten.

(Developed for U. S. History I, grade 10; recommended for History, grade 6, and English, grade 10)

15.01.07

Contemporary Native American Fictional Accounts of Hope and Fear, by Marialuisa Sapienza

This unit studies the themes of hope and fear in a rich selection of contemporary Native American writings. It starts with a close analysis and discussion of what causes fear and how the characters in a novel, a short story, a play, and poems struggle, fight and react to societal injustices with hope. The unit takes into consideration other causes for fear like poverty, alcohol, isolation, loneliness, and sometimes the feeling(s) of desperation. The students read the novel, *The Absolutely True Diary of a Part-Time Indian* by Sherman Alexie (Spokane/Coeur d'Alene), the short story *The Red Convertible* by Louise Erdrich (Turtle Mountain/Ojibwe), the play *Sliver of a Full Moon* by Mary Kathryn Nagle (Cherokee), a rich selection of poems such as "Homeland" by Jayne Fawcett (Mohegan), "I Found Him on a Hill Top" by Ella Wilcox Sekatau (Narragansett), and "Sad Country Song" by John Christian Hopkins (Narragansett), as well as some paintings and photographs that represent Native American cultures. The goal is to read, analyze, reflect, research, discuss, and write about the reactions to hardships. The unit also aims to teach students to appreciate and understand American Indian arts while addressing Common Core Standards.

(Developed for AP English Literature and Composition, grades 11-12, and English 10, grade 10)

15.01.08

The Surviving and Thriving of Cultures: Foundational Study of American Indian History for Literature, by Robert M. Schwartz

Modern students face struggles, as have people throughout history. Students struggle to compete in high school, the practice arena for an increasingly globalized society and, therefore, can benefit from a more foundational study of American experience. The original Americans – the Native people of this continent – have an amazingly rich history. From their ancient beginnings to their modern challenges, the tragedy and resiliency of American Indians can make for similarly rich study within an English classroom. This unit explores the cultures and experiences of the original American survivors – American Indians – juxtaposed with both advanced literary study and foundational reading skills across two classes. Compared with commonly utilized American drama, students will study a play by a modern American Indian playwright in order to synthesize the meaning of the "American Dream." In a different classroom, struggling readers will read survivor stories in order to enhance their interest in reading, the reading skills themselves, and students' socio-emotional understanding of a society that has endured much persecution. This is a study of a society that continues to both survive and thrive today.

(Developed for English 3, grade 11, and Read 180, grades 9 and 12; recommended for English, grades 9-12)

II. American Culture in the Long 20th Century

Introduction

Beginning in about the 1990s, the discipline of History took what has come to be known as “the cultural turn.” Scholars began to see the value of approaching “culture” itself as an object of historical study, tracing and contextualizing the development of various cultural forms and institutions: World’s Fairs, the vaudeville stage, cinema and the broadcast media, jazz, the roadhouse, the motor hotel, amusement or theme parks, or the Internet. Other historians, taking their cue from cultural theorists like Antonio Gramsci and Stuart Hall, began to find recourse in “cultural” sources (films, plays, advertisements) to answer broader historical questions in the realm of politics and society. For example, one cannot fully understand class-based identities and relations in the United States without reckoning with the powerful narratives, myths, and icons of American mobility, from the Horatio Alger rags-to-riches stories of the nineteenth century to the “hoop dreams” of spectacular wealth through sport in the twentieth. The political behavior of social “classes” as “classes,” in other words, is informed not only by the facts on the ground, but also by the stories we tell ourselves about what is possible. Or again, a nation does not travel from Richard Nixon’s “southern strategy” in 1968 to the election of an African American president in 2008 without the important political work that *culture* accomplishes: the ground for Barack Obama was prepared not only by political figures like Jesse Jackson and Colin Powell, but also by culture workers like Diahann Carroll, Aretha Franklin, Harry Belafonte, Spike Lee, Michael Jordan, and Toni Morrison.

“American Culture in the Long Twentieth Century” examined these interpretive threads in the period from the 1890s to the present. After an introductory segment devoted to the broad, theoretical questions – “What is culture?” “Why study it?” – we surveyed the contours of U.S. history across the many decades separating Stephen Crane’s novella of urbanization, *Maggie: A Girl of the Streets*, and Phil Klay’s recent short story cycle on the Iraq and Afghanistan Wars, *Redeployment*. Along the way we considered a wide array of cultural forms, including fiction, poetry, drama, music, film, photography, the graphic and visual arts, television and radio, advertising, and journalism. Above and beyond a basic historical understanding of the period under investigation, this seminar sought to outfit Fellows with a range of approaches and methods for the task of assessing and assigning historical meaning, and with practical ideas for engaging their own students in the hands-on work of historical interpretation. Topics included the Great African American Migration and the Harlem Renaissance; the culture of the Great Depression; cultures of war and Cold War; the counterculture and the social movements of the 1960s; U.S. popular culture and the Vietnam War; multiculturalism and the “culture wars”; and the culture of insecurity in the wake of 9/11.

We began our investigation with historian Jim Cullen’s survey of cultural materials and interpretive approaches, *Popular Culture in American History*. Other signature readings by U.S. cultural historians included John Kasson’s treatment of Coney Island at the turn of the century, *Amusing the Million*; Michael Denning’s analysis of progressive and radical culture during the Great Depression, *The Cultural Front*; Donna Knaff’s investigation of visual culture and gender relations during World War II, *Beyond Rosie the Riveter*; H. Bruce Franklin’s interpretation of the nation’s perpetual refighting of the Vietnam War in popular culture, *Vietnam and Other American Fantasies*; Alice Echols’ rendering of the 1960s counterculture through the lens of biography, *Scars of Sweet Paradise: The Life and Times of Janis Joplin*; and Jeff Chang’s

account of the emergence of new cultural forms in the context of deindustrialization, *Can't Stop Won't Stop: A History of the Hip Hop Generation*.

While scholarly readings like these framed our approach and discussion, the real heart of the enterprise was in our collective encounter with the myriad primary sources of U.S. cultural history. Both in assigned readings and in our in-class PowerPoint “archive,” we spent a great deal of time developing interpretations of primary materials: paintings by Aaron Douglas or Norman Rockwell; music by Louis Armstrong, Woody Guthrie, The Byrds, or Nina Simone; photographs by Dorothea Lange; dance pieces by Martha Graham or hip hop artist Storyboard P; fiction by Pietro Di Donato or Sandra Cisneros; poetry by Langston Hughes, Erika Vazquez-Aguilar, Allen Ginsberg, Maria Mazziotti Gillan, or Claudia Rankine; films by Albert Maltz, Irving Berlin, or Spike Lee; drama by Lorraine Hansberry; social commentary by Betty Friedan, Tom Hayden, Audre Lorde, or Gloria Anzaldua; as well as more ephemeral forms such as poster art, TV advertisements, Hollywood B-movies, and children’s toys. These secondary and primary readings provided a good overview of the major themes and trends in this period in U.S. history, and also gave us many opportunities to examine how *meaning* is made, and how it comes to be both broadly shared and roundly contested in a complex society encompassing over three hundred million people.

The ten Fellows who participated in this seminar teach in a diverse range of New Haven schools, and by level and discipline they spanned grades three to twelve in Humanities, Language Arts, English, Social Studies, Music, Visual Art, and Spanish. They developed ten highly innovative curriculum units, each in its way reflecting the group’s ongoing discussion of “culture” as an object of historical inquiry and as a force in American political and social life. Though united in their basic approach to culture and history, and also in their general attention to questions of social justice, the ten units differ quite widely in the array of topics and subject areas they treat. Some center upon a small number of cultural artifacts – or even just one text – to illuminate a period or to examine a broader set of social questions. Others canvass a much wider body of texts or artifacts in order to trace a particular historical phenomenon across time. But as a group, these curriculum units offer superb insight and guidelines when it comes to teaching critical thinking, historical interpretation, and imaginative habits of inquiry, as well as teaching history itself, not as some distant, dead thing, but as the very stuff that the present is made of.

Matthew Frye Jacobson

Curriculum Units

15.02.01

History of a Social Construction: How Racism Created Race in America, by Nataliya Braginsky

This unit offers teachers a history of the social construction of race, as well as activities to teach this concept through a number of different lenses. Relying heavily on primary source material, including quotes and images, music and art, laws and other government documents, this unit will expose students to the historical evidence that created and maintained the concept of race. Activities in this unit are experiential, multi-modal, collaborative, and discussion-based.

Beginning with foundational lessons that can be used independent of the greater unit, themes of power and hegemony are explored. Approaching the question of race from a theoretical perspective, the unit begins with students working together to discuss the factors that determine one's race. Is it appearance, ancestry, lived experience, culture, or some combination? The complexity of this issue will provide the necessary backdrop for learning its history. The historical dimension will be explored through four different reference points: the scientific rise and fall of biologically determined racism; the history of Colonial America; the laws, codes, acts, and other legal discourses about race; and finally, the U.S. Census. With this historical background, students will come to understand the basis of this social phenomenon that plays such a huge role in our society and lives. Though contemporary controversies are not included in the unit, this history is ripe for connections to current social realities of racism in our country. Finally, utilizing the musical, literary, and artistic resources in the appendix, it is critical to conclude with how people resist racism through self-expression around themes of race. That is, it is necessary to explore how race – and ethnicity – despite its social construction and its racist history, can still be a source of identity and pride.

(Developed for Humanities - ALIVE, grade 9; recommended for Social Studies/History, grades 9-12)

15.02.02

Energizing Creative Processes through Art Appreciation: The Influences American Culture Had on Modern Art, by Claudine Renee Davis

This unit teaches art appreciation by taking a deeper look into art history, focusing on modern art of the 20th century and influences that American culture had on art and the artists who were creating it. Aims for the lessons include being able to form objective opinions about modern art, making connections to contemporary culture discovered within art subjects, creating a painting project where students apply critical thinking, and exploring and collecting various forms of media to learn from and then utilize in student research. The unit aligns with the National Arts Education Standards and achieves all eleven Anchor Standards. The influences of Technology, Mass Media and Industry on artists George Bellows, Joseph Stella, Aaron Douglas, Norman Rockwell, Jackson Pollock and Andy Warhol are bridged together to teach students understanding of modern art as well as lessons on processes and techniques for a painting assessment.

(Developed for Exploring Visual Design, grades 9-12; Recommended for U.S. History and Civics, grades 9-12)

15.02.03

Women, War and Propaganda: Cultural Connections in the Long 20th Century, by Mary-Doris Devlin

This unit examines women of the 20th century and the use of their images in war propaganda. The unit begins by exploring women soldiers of the Civil War, who disguised themselves as male soldiers. What inspired them to do this?

We will also analyze the roles of the women of World War II. The women of the home front took over men's jobs and helped with the all-encompassing war effort. When students study the visual wartime propaganda, including images of women and appeals to women, they will be able to gain appreciation for the enormity of the war campaign.

Next, we study the "Be All That You Can Be" campaign of the 1980s. This campaign sparked the largest influx of women in military history, in an effort to reshape and change the image of the military. The campaign focused on what the Army could do for you during peacetime.

The unit concludes by examining the "Army Strong" campaign (2006), the first interactive, multi-media advertising campaign with women as a target audience.

(Developed for Photoshop and Graphic Design, grades 11-12; recommended for Graphic Design, Visual Arts, and American History/Women's Studies, Secondary grades)

15.02.04

Popular Music Diversity from 1965-1969, by Gillian Greco

This unit provides students the opportunity to create, perform, and respond to music, all within the context of America from 1965-1969. General Music is a class that is open to all experience levels, and those students will inevitably have many different tastes in music. This unit is designed with those students in mind.

The unit will explore the beginnings of rock and roll and move on to the British Invasion, the Civil Rights Movement, the counterculture, and the Vietnam War. This unit and its lesson plans are not intended primarily for history or social studies instruction, but they do offer students a chance to explore the deeper cultural connections of the music during this era. Students will be asked to put themselves in the performers' shoes, think critically, and perform to the best of their ability.

(Developed for General Music, grades 5-8; recommended for Choral Music and General Music, grades 5-8)

15.02.05

Understanding Ourselves from the Past, by Susan Hansen

As children learn and grow in elementary school, goals mainly relate to the future. Unfortunately, history may be viewed merely as facts to memorize and only discussed during special anniversaries or monthly commemorations. Social studies is an often neglected subject due to our needed focus on the development of literacy skills. Most of my students come from Latin and Hispanic cultures from around the world and bring a rich background of diversity to the classroom, as well as great curiosity. Yet many lack historical knowledge. Students will examine our present culture as it relates to the 1930s by comparing and contrasting in order to analyze “who” we are now as a result of “who” we were in the past. Students will also analyze patterns and changes over time. The goal of this unit is to expose students to the 1930s in order to engage student historical curiosity, discourse, reading and writing.

(Developed for Literacy/Social Studies, grade 3; recommended for Literacy/Social Studies, grades 3-5)

15.02.06

Latino Identity in the Civil Rights Movement, by Valbona Karanxha

This curriculum unit focuses on the Civil Rights Movement from the Latino perspective. Its conceptual framework revolves around the Chicano Movement in the southwestern United States. The unit is a combination of standards for teaching a foreign language, research on the Chicano Movement as a power effort, a political and a social quest for justice for migrant farm workers, and a historical entryway for Latino students. The research part of the unit starts with a historical perspective focused on a few dynamics of Mexican American heritage, including phases of Mexican immigration and the Treaty of Guadalupe Hidalgo, as a promise to take care of Mexican nationals in the lands of Arizona, California, New Mexico, and Colorado after the end of the Mexican-American War. The unit discusses problems and disputes that arose over the lands, associated with practices of discrimination. These practices, according to the research, were the foundations of the Chicano Movement, along with political developments at the time. Lastly, the unit offers two lesson plans and appropriate Web sites to develop a well-rounded lesson, so our heritage student population is able to learn about the history of some of their ancestors.

(Developed for Spanish, grades 7-8; recommended for Spanish, grades 7-12)

15.02.07

A Turn of the Century Reading of Yellow Death: A Story of Medical Sleuthing, by Medea E. Lamberti-Sanchez

This is a marking-period-long, reading and writing unit designed for middle-school students, primarily in the sixth grade, but can be modified and adapted to fit high-school curriculum, grades nine through twelve. Students will be challenged to research, read, and write about yellow fever and its origins at the turn of the century, using a wide array of multimedia resources that will include literature, music, visual arts, and technology to help enhance students’ background knowledge of what the world was like in the 1900s. It is the intent of the unit for students to gain background knowledge of the culture of this period in order to better understand and make connections with the text. The unit will engage all the readers, writers, and thinkers in your classroom who are willing to be transported to circa 1900 and explore Cuba, old-fashioned

scientific laboratories, and most importantly, witness transformation of women. Would you be willing to risk your life for science?

(Developed for Language Arts, grade 6; recommended for Language Arts, grades 6-8)

15.02.08

Placing Literature in a Cultural Studies Framework: *The Color Purple*, by Eric W. Maroney

This unit layers New Criticism with a cultural studies framework to approach the novel, *The Color Purple*. Throughout the unit students define, analyze and compare cultural artifacts that emerge from the period in which Alice Walker is writing. By framing the novel, itself, as a cultural artifact, students are able to apply a critical lens to the text and probe the social and political context of the work, which arises out of a rich political history, caught within the intersection of race, gender and class. Students will consider the social and material conditions of the period Walker is writing in and consider how those realities may have impacted her choices as a writer.

(Developed for English 4, grade 12; Recommended for English 3, grade 11, and African American History Elective)

15.02.09

Film as Representations of American Democracy and Oppression in the Long 20th Century, by Matthew S. Monahan

During the past three years at Metropolitan Business Academy High School, I have developed an introductory film course that I continue to teach. Introduction to Film is an elective that is open only to juniors and seniors. I also teach senior-level English. It is my aim that students who complete this unit through either of my courses, although my primary purpose and method of delivery will be Introduction to Film, will have a deeper understanding of American democracy and the struggles that different groups have endured in their attempts to attain power and voice in the face of oppression throughout the “long 20th century” – a term I shall attribute to seminar leader Matthew Frye Jacobson to mean the late 1800s to present. Students will critically assess three major movements in which “Americans” have both struggled against and acted as forces of oppression: the early labor movement beginning roughly in the 1920s, the Civil Rights era of the 1960s, and present day post-9/11, post-Hurricane Katrina America.

The anchor texts included in this unit are seminal works of American independent cinema: John Sayles’ *Matewan* and Spike Lee’s biopics *Malcolm X* and *A Huey P. Newton Story*. Also, although it is not available at the time of this writing, it is recommended that teachers consulting this unit seek out the forthcoming feature film *Zeitoun*, based on Dave Eggers’ non-fiction book of the same name, due out later this year.

(Developed for Intro to Film, grades 11-12; recommended for English and Film Studies, grades 11-12)

15.02.10

Code Switching: Celebrating Cultural Dialects in American Speech,

by Barbara A. Sasso

As teachers it is our responsibility to educate young people so they can build a better society, and that includes working towards changing biased and racist attitudes. To strive towards this end, this unit on dialect will examine bias in language, and how cultural stereotypes for many Americans, particularly African Americans, have been negatively portrayed. It will include discussions of language as power, discussions of stereotypical images from the minstrel era to rap music, and an examination of dialect in literature as a powerful and creative tool. The unit requires a synthesis paper and an original work that uses dialect creatively and celebrates the linguistic richness that many cultures have added to the English language. Works suggested include *The Adventures of Huckleberry Finn*, *Their Eyes Were Watching God*, *Under the Feet of Jesus*, and *The Sound and the Fury*.

(Recommended for English 2: Individual and Society, grade 10; recommended for English 2, English 3, and AP Literature and Composition, grades 10-12)

III. Physics and Chemistry of the Earth's Atmosphere and Climate

Introduction

I was invited to lead this seminar apparently due to my teaching of “Introduction to Earth and Environmental Physics” (Physics 342), which is offered, every other year, by the Department of Physics at Yale. In the off-years for Physics, it is sometimes offered by the Geology and Geophysics Department. Indeed, many similar courses exist at Yale, and although there are parallels and similarities among these courses, each reflects the specific interests and proclivities of the instructor. My own professional interest lies in fundamental physics – in particular experimental tests of the so-called standard model of particle physics by use of precision techniques. In 2008, I was recruited by Professor Meg Urry, then chair of the Physics Department, to teach Physics 342, the motivation being a departmental colloquium I gave on a prehistoric natural nuclear reactor, a geological phenomenon that occurred approximately two billion years ago (the Oklo phenomenon) which has a deep connection to fundamental physics. Because a discussion of this phenomenon consists of just one class lecture, I was faced with developing a curriculum on a broad subject for which I had no obvious professional experience. Also, at the time, no satisfactory elementary books on the principal subject of concern (global warming) existed. Fortunately, my unusual background (undergraduate study in chemical engineering, a ten-year stint at the Los Alamos National Laboratory where I ended up being a weapons physics team leader) is such that I was able, after some panicked efforts, to develop an elementary model of the atmosphere that jibes well with the standard treatments.

The goal of my seminar was to motivate and present this model to the Fellows, along with discussions of human impacts on the climate and environment, in broad terms, due to the principal industrial and military activities that occur worldwide.

It is increasingly assumed that climate change, due to carbon dioxide release associated with human activity, is occurring, and that this is a fact to be taught. Teachers need the background and some basic understanding of the scientific evidence behind global warming and climate change, in order to form their own informed opinion on the subject if they are to be truly effective teachers. I will perhaps be labeled as a pariah in that my stance, in leading this seminar, is that we don't know if the climate is changing due to human activities. My goal was to lead the Fellows to make their own informed decisions. Certainly the predicted “hockey stick” runaway global warming did not come to pass, and the term global warming has been replaced, in the popular press, with the term “climate change.” In any case, amid the ever-increasing rate of release of carbon dioxide into the atmosphere, we are conducting a global experiment that has potential to end badly. Or have no effect at all. Or perhaps stave off an ice age, or possibly start one. The problem is that we would like the Earth to remain exactly as it is now. That isn't going to happen, irrespective of human activity; the evidence in the Earth's geological record proves with 100% reliability that things will change. We don't, however, want to make things worse.

A main theme of this seminar was to point out that the scientific community is not anywhere near 100% agreement on issues of global warming and climate change; it is unfortunate that the issues have become polemical and politically polarizing. On the other hand, when solid scientific evidence of environmental harm from human activity has been presented in the past, for example in the case of ozone-depleting CFCs, the world has worked together to come up with a workable

solution – in that case the Montreal Protocol of 1987 and the phase-out of CFCs. This Protocol proved feasible; in particular it made allowances for developing countries to delay the phase-out of CFCs, essential for refrigeration. However, even today after that delay, we can still wonder about how many deaths occur due to lack of, for example, access to refrigeration for medical supplies like antibiotics because of the increased cost and energy use that comes with the replacements for CFCs. There is a balancing act: Does the excess suffering due to lack of technological resources outweigh the worldwide risk associated with ozone depletion, and who decides? I am not offering an answer or an opinion; these are questions that we, as members of a modern society, should, and perhaps must, ask ourselves.

The foundation of this seminar was built on two books, *The Alchemy of Air*, by Thomas Hager, and *The Two Mile Time Machine*, by Richard B. Alley. These books are both historical, but in different ways. The first describes the scientific and engineering history of the rise of artificially produced fertilizer that relies on the “fixation” of atmospheric nitrogen by the Haber-Bosch process. Indeed, this process is what allows the current level of world population without mass starvation; the flip side is that many current global problems can be traced to overpopulation, and we should also be concerned that artificial fixation of nitrogen is equal to all natural processes, leading to over-fertilization of aquatic systems in particular. The second book describes the history of the Earth’s climate and atmosphere as determined through the study of the Greenland and Antarctic ice sheet cores. This book paints a picture of a historically widely variable climate, with huge changes in temperature and weather patterns that occur frequently (10,000 year time scale, therefore short on a geological time scale) and progress quickly when they happen. One point in the book is that the Earth, at present, is too cold to have an ice age in that there is not enough moisture transported to the northern latitudes where snow and ice can accumulate – so perhaps global warming’s climate change will be a new ice age. The overall message from this book is that the Earth’s climate has varied widely in the past, and will likely do so in the future. Human-induced climate change has to be identified in this context. These two books were supplemented by newspaper articles, *National Geographic* and *Scientific American* articles, and various online resources including *Wikipedia*, which tends to be accurate and useful as an entry point to a subject.

The seminar also included four field trips. The first was to Kroon Hall, which is the Yale School of Forestry’s LEED-certified building located next door to Sloane Physics Laboratory, where the seminar was held. The Fellows were able to see first-hand how an energy-efficient large building is constructed and operated. The second field trip was to my two laboratories, one where we are operating a detector to search for dark matter, the mysterious material that makes up much of the mass of the Universe, and one where we are studying quantum zero-point forces that are responsible for many natural biological phenomena. The third field trip was to the Yale Central Power Plant, where the Fellows were able to see what’s behind the light switch that many people take for granted, and witness the tremendous technology and infrastructure behind modern society, as well as the dedicated effort and commitment to keep it all running. The fourth field trip was to the Peabody Museum Mineral Hall, where the effects of the climate and the development of life are evident in the mineralogical history of the Earth presented there.

A number of demonstrations were performed for the seminar, including ones addressing black body radiation, carbon dioxide and its properties, oxygen and its properties, fixation of nitrogen and catalysis, adiabatic processes, and the nature of light and artificial illumination.

The Fellows' units represent thoughtful analyses of the subjects and issues that were discussed in the seminar; Fellows have tied their particular units into the Connecticut curricular expectations and academic standards. Terry Bella addresses the carbon cycle, and presents calculations on carbon storage in different environmental and geological reservoirs, and the transport of carbon between those reservoirs. Jon Cap's unit presents a study of robotics as relating to manufacturing efficiency and uses in environmental studies. In particular, artificial satellites, including Earth-observing satellites for weather and environmental studies, can be considered as special types of robots. Alva Hanson, Jr. and Patricia Sorrentino worked together on complementary units that address their unique and challenging teaching needs at an alternative high school for students at risk of dropping out. The goal of their team-taught units is to give their students the background to have a debate on the reality of human-induced climate change. Mr. Hanson will provide the scientific background for this debate, while Ms. Sorrentino will provide the framework under which an effective debate can take place. An important point that is addressed by her unit is that the "winner" of a debate isn't necessarily correct. Deborah Johnson's unit addresses the effects of human activity on Long Island Sound, which receives much excess, for example, soluble nitrogen due to runoff water from Connecticut and from Long Island. Alexandra Novak's unit presents a study of solar energy culminating in a project where students build their own solar oven. Finally, Larissa Spreng's unit provides a detailed study of the structure of the Earth's atmosphere and solar energy, and similarly culminates in having the students build their own solar oven.

Steve K. Lamoreaux

Curriculum Units

15.03.01

The Carbon Cycle and the Connection to Human Activity, by Terry M. Bella

This unit can be used to cover the Connecticut high school science content requirements concerning: human energy use; chemical reactions; carbon chemistry; element cycling on Earth; resource use and the effect on the environment; and recycling of materials. Carbon is of integral importance today and will be for the life of our students because of its likely impact on climate and the finite nature of the carbon resources we rely upon.

This unit provides up-to-date information about the volume of the Earth's carbon stores and the amount of carbon that is moving among stores annually. The unit also frames the scientific material to facilitate organized instruction. Carbon stores are defined and divided into two categories, long term and short term.

Lastly, some easy-to-do classroom activities are provided to help deliver the content and apply the concepts to the real world.

(Developed for Phy-Chem, grade 9; recommended for General Science, grade 9)

15.03.02

The Physics of Robotic Construction and Operation, by Jonathan Cap

In this unit we will discuss and learn about the physics and chemistry that go into robotic construction and operations. We will also see how robots are used in the Earth's atmosphere and how they can help us understand the climate. We will consider the design process that is used to robotically manufacture items that are better for the environment and climate. Students will research different human activities that are affecting the climate and atmosphere and come up with hypothetical solutions using our design process. This will be tied into students' math courses, strengthening the use of physics by taking their formulas from paper to the construction of robots in school. Students' participation will increase as they will be working together to build robots, and working on the mathematics relating to physics problems that must be solved.

(Developed for Robotics, grades 11-12; recommended for Robotics and Engineering, grades 11-12)

15.03.03

Potential Causes of Climate Change, by Alva Roy Hanson Jr.

This curriculum unit was prepared in collaboration with another program participant, with the net goal to provide students in our co-taught course with the scientific and other skills needed to hold a debate on whether global warming and climate change are real. Students will consider potential main causes of climate change and how we, as humans on earth, can help prevent negative effects of climate change in the future. For the scientific basis of this debate, my unit covers the foundational knowledge our students need to understand climate change and its many complexities. Thomas Hager's *The Alchemy of Air* will be the first text we examine. To follow this text, we will focus on James Hansen's TED talk "Why I must speak out about climate

change,” *Scientific American’s* “Behind the Hockey Stick,” “The Nitrogen Cycle,” and “What Do Farmers Think about Climate Change?” In conjunction with the readings, I will perform a series of experiments with our students, show them a variety of videos, take them on field trips, and have them be in control of their own learning by performing tasks around our school.

(Developed for Science through Literature, grades 9-12; recommended for Weather and Climate, and Non-Fiction Science, grades 9-12)

15.03.04

How Humans Impact the Long Island Sound, by Deborah A. Johnson

In this curriculum unit, teachers and students will learn about the history of how the Long Island Sound was formed through glaciation, look at how humans impacted the area, and explore how the Sound is one of the most heavily used estuaries in the United States due to its location between the states of New York and Connecticut. This unit considers physical, chemical, and biological impacts on this ecosystem and how agriculture has adversely affected the Sound.

Inspired by the book *The Alchemy of Air*, by Thomas Hager, there is a discussion of the history of the worldwide search for the richest fertilizer, a quest that has led to many conflicts among nations as they seek to produce the most profitable crop yields to feed their people. The discovery of fertilizers contributed, also, to the discovery of gunpowder, which changed the course of wars. The connection of fertilizers to wealth and slavery is touched upon, along with Germany’s development of a synthetic fertilizer that played a role in that nation’s confidence to engage in the world wars of the 20th century.

Through the invention of this new synthetic fertilizer, converting atmospheric nitrogen into fixed nitrogen, world hunger should no longer exist. But progress came at a deadly cost of greed and power, as industrialization has harmed ecosystems and had mixed effects on human health.

(Developed for General Science, grade 6; recommended for General Science, Ecology, and Environmental Science, grades 4-8)

15.03.05

How Does A Solar Oven Work? by Alexandra Novak

At Conte West Hills School of Exploration and Innovation, our students learn through doing, seeing, questioning, and experiencing. As a sixth-grade science teacher, it is my job to inspire my students about the scientific and biological world that surrounds them, and about how they can influence their planet as they grow older. This unit focuses on Earth's position in the Solar System and how that position affects how the planet moves and revolves, with subsequent effects on climate and weather. In order for students to gain a solid understanding of these concepts, we must not only analyze how Earth's location in the universe affects climate and weather, but also analyze the Sun's role in life on Earth and how we can harness this to improve energy options in the United States.

The students will explore the Sun's power by creating a solar oven, and will also consider climate change. Students will come to appreciate the complexity of this subject, for example the roles of both natural and manmade interactions and factors. The students will learn about how

scientists analyze past climates, and how they make predictions for Earth's climate in the near future. We will of course touch upon the natural cycles such as the Greenhouse Effect, as well as the carbon and water cycles, and how humans interact with and disrupt these natural processes. The culmination of the unit will call upon the students to identify human error and negative interactions with our environment and work together to create plans for local and community action to help lessen their own and their families' carbon footprints. This unit fits perfectly with New Haven's mandated grade-six science unit, analyzing weather in Connecticut and our interactions with it.

(Developed for Science, grade 6; recommended for Science, grade 6)

15.03.06

Political Debates over Climate Change, by Patricia Marie Sorrentino

This curriculum unit was prepared in collaboration with another program participant, with the net goal to provide students in our co-taught course with the scientific and other skills needed to hold a debate on whether global warming and climate change are real. Students will consider potential main causes of climate change and how we, as humans on earth, can help prevent negative effects of climate change in the future. Working closely with the scientific content provider, my unit describes the philosophy and structure of effective debate strategies. Mastering these skills will allow our students to become better citizens by allowing them to understand what actually is happening in a civil debate. Thomas Hager's *The Alchemy of Air* will be the first text we examine. Then we will focus on James Hansen's TED talk "Why I must speak out about climate change," *Scientific American's* "Behind the Hockey Stick," "The Nitrogen Cycle," and "What Do Farmers Think about Climate Change?" In conjunction with the readings, I will ask our students to keep a journal of vocabulary words and facts, so they will be well prepared for their debate.

(Developed for Science through Literature, grades 9-12; recommended for Non-Fiction Science - Weather and Climate, grades 9-12)

15.03.07

Planet Protectors, by Larissa Spreng

This curriculum unit, focused on the physics and chemistry of the Earth's atmosphere and climate, will foster the creation of more global students and citizens capable of making informed decisions about our planet. This unit envisions transformational change by impacting all areas of my students' lives, from academic growth to problem-solving and career development. Academically, students will gain exposure to real-world scientific connections. They will engage in cutting-edge work of the discipline, through topics such as the balance of thermal energy from the sun, the ozone layer, and the effects of increasing carbon dioxide levels. The problem-solving aspect will see my students, like scientists, practice thinking critically and creatively about problems that relate to the world around them and other fields of science and mathematics. Finally, this unit will provide students with a deeper understanding of STEM careers and hopefully spark their interest in pursuing a degree in science, technology, engineering, or mathematics to show others the importance of protecting Earth so it can continue to protect us.

(Developed for General Science, grade 8; recommended for General Science, grade 8)

IV. Big Molecules, Big Problems

Introduction

Explaining the unseen. This is what lies at the root of teaching students about the molecules of life. Skin is elastic at birth, wrinkled and inflexible when we are old. The collagen that is responsible for this is a big molecule, yet still too small to see. Insulin made by the pancreas in your abdomen finds its way to your arm, signaling the tissue to take up any sugar that comes its way. Insulin is also big, yet too small to see. The approach of the “Big Molecules, Big Problems” seminar was to visit one after another amazing molecular machine and break it down into a discussion about the same small set of simple parts and the same small set of simple forces that govern them.

From the top of a mountain looking to a village below, students can't see a brick. But they can see a house made of brick, a bridge, a garden path or a bridge. Bridges are not houses, but students can study all these different structures and eventually see how they might be all be made from these invisible bricks. They can understand bricks even if they never come down from the mountain.

Participants began the seminar by learning the computer skills necessary for looking at the known atomic structures of proteins and DNA. Thousands of such structures have been solved by scientists. For the seminar, we came back to this visualization tool at almost every session regardless of what we were talking about that week. Our first set of big molecules was antibodies. We looked at atomic structures where two different antibodies attached to different sides of one protein target. We also looked at the atomic structures of two antibodies that were different, and you could attach to the same location on the same protein. Just imagine having two different keys for the same lock! These and other features had to be understood at the molecular scale to discuss how a home pregnancy test works. The seminar explored many other problems and challenges that big molecules have solved – for example, a protein that makes a pore that allows water and not hydrogen through it. Then we looked at a protein that makes a pore that lets hydrogen through but not water. Anyone can make a hole for a tennis ball that will keep a basketball out. Big molecules can make holes for a basketball and that keeps tennis balls out. Try that with plywood and a hole cutter!

As the seminar evolved we took some excursions to some big molecules making big news: Alzheimer's, cancer, sequencing all of your DNA and CRISPR/Cas9. We discussed how the coming CRISPR/Cas9 revolution might save us all. Perhaps instead it will kill us all. The seminar started with the basics: Scientists motivated only by curiosity were studying what many thought was just an unused area of a bacterium's DNA. Turns out, the DNA was part of a big molecular machine the bacterium used to ward off infections from viruses, but only if it or its parents had encountered it before . . . and survived. It seems that even bacteria have an immune system and can be immunized. One step at a time, we discussed how this machine could be taken from bacteria and put into most any organism to change its DNA code. One day it will save millions of lives and improve the quality of life for countless others. Or one day it could be used to make genetically modified children, just the way you want them. Or one day, it will allow a government to create diseases that only infect and kill its enemies. These grand hopes and fears litter the popular press, and we discussed how the CRISPR/Cas9 machine might actually be able or not be able to do these things. Finally, we ended our seminar with a field trip to the Yale

Medical School to visit the laboratory of Professor Chuck Sindelar. Professor Sindelar is one of the scientists who has the tools and expertise to look at and solve the atomic structures of these big molecules.

The seminar was informed by resources including popular articles (from the *Atlantic* and *BBC News* to the *New York Times*, *Huffington Post*, and *Wired*), online videos, and peer-maintained *Wikipedia* entries on very current scientific and technological developments. For example, selections from the latter considered such matters as Aquaporin, Oncogene, Polymerase Chain Reaction, Protein Folding, and Sanger Sequencing.

The discussions produced a very diverse set of units. Rebekah Laudermilch has put together a unit with focus on the forces that attract and repel and bond molecules together. A series of progressively more challenging activities culminate in an individualized big molecule project focused on the natural and synthetic polymers that are used to make textiles. Andrea Zullo developed a unit on non-infectious diseases. After studying infectious disease, the concept that disease could be something caused by the body's own failings is a challenging one for students. Her unit breaks down diverse diseases, into different classes of error in surveillance. The body has many large molecule tools that keep a watchful eye on problems. They don't always work, and they don't work forever. Amanda Weires' unit breaks down large molecules into the constituent parts that attract or repel one another. As she is a teacher in an arts-focused high school, she developed her unit around plant oils which get used as binder in oil-based paint. The chemistry of making soap from plant oils versus making paint are put side by side to give a rounded understanding. John Adamovich's unit compares sugar and artificial sweeteners. Students learn to meaningfully assess the nutritional content of food as it relates to sugar. Matthew Eveleth's unit takes on complex ideas in chemical reaction kinetics including enzyme kinetics. Embracing his role as a chemistry teacher at a health and sports-medicine-oriented high school, he uses a creative mix of baseball analogies to keep this challenging material lively. Sheila Martin-Corbin developed a unit to teach aspects of infectious disease. Her class activities place particular emphasis on the spread of disease, and a demonstration of how the herding effect in vaccination works.

Andrew D. Miranker

Curriculum Units

15.04.01

Molecular Structures and Chemical Forces in Textiles, by Rebekah Bentle Laudermilch

The world of textiles is endless in its applications, not only in its timeless use in clothing and household fabrics but in today's ever-expanding synthetic textiles, from fire-retardant space suits to bullet-resistant Kevlar used in armor. This unit explores the chemistry behind the unique properties of different textiles by looking at the structure of each textile's most prominent molecule, identifying the type of bonds and intermolecular forces present in and between the fibers. The unit provides a foundation in coulombic attraction, intermolecular forces, and hydrophilic and hydrophobic interactions before moving on to exploring both natural and synthetic textiles. The types of textiles included in unit are cotton, wool, silk, nylon, polyester, and spandex. The unit culminates in a molecular modeling project in which students have an opportunity to choose a textile to research and model using their own materials, showcasing their ability to connect structure and function to their peers.

(Developed for College Chemistry and Honors Chemistry, grade 11; recommended for Chemistry, grade 11)

15.04.02

Surveillance Errors and Disease, by Andrea Zullo

Ask any student to name diseases that affect the human body and they can probably develop a pretty lengthy list of infectious and chronic conditions. The factors that can lead to disease are constantly working in our body – from exposure to microbes to simple DNA mutations. However, the body is able to stave off many diseases through surveillance mechanisms like the immune system, DNA replication self-editing, DNA double strand break repair, and misfolded protein degradation. It is when these surveillance mechanisms fail that catastrophe happens. Errors in surveillance can be classified into four major groups: surveillance is turned off, surveillance is overwhelmed, surveillance makes a mistake, or surveillance is overexcited. Students will have the opportunity to explore these various errors and diseases that happen as a result. This unit is aimed at students who are in high-school biology, anatomy and physiology, or molecular biology.

(Developed for Human Body Systems, grades 10-12; recommended for Biology, grade 10, and Anatomy and Physiology Elective)

15.04.03

Problem-Based Chemistry: How Do I Make a Lake Paint? by Amanda Weires

This unit encompasses all the content involved in making oil-based lake paints. Lake pigments are usually organic molecules that are soluble in water, and thus not soluble in oil. They are bonded to an ionic salt then dispersed in a drying oil, like linseed oil. The non-polar nature of the oil will provide an overlapping network of cross-linking large molecules, one end of which will bond to the ionic salt, and the ionic salt will also stick to the polar lake pigment. The small pockets of color will disperse in the oil, and as the oil dries and crosslinks, it traps the pigment pockets in its web. The layer of individual molecules fuse together to make one thin layer of a

single network. The basic chemistry content is miscibility of compounds, polarity of molecules, and molecular interactions based on relative polarity. The unit is designed for a high-school chemistry class, specifically for 11th-graders enrolled in an arts magnet high school.

(Developed for College Chemistry and Honors Chemistry, grade 11; recommended for College Chemistry and Honors Chemistry, grade 11, and Studio Art, grades 9-12)

15.04.04

Sugar versus Artificial Sweeteners, by John M. Adamovich

This unit will teach students the molecular difference between natural sugar and artificial sweeteners. Students throughout the unit will be able to explore and evaluate the effects each of these has on the human body. Students will be able to compare and contrast the substances' chemical make-up. Students will be able to build structural models of their chosen sweeteners in order to give others the opportunity to see their results.

Currently students enter the class with a basic understanding of the digestive system as well as the six basic nutrients and how they assist in our everyday bodily functions. It is my hope within this unit to teach students to delve more deeply into analyzing what we are placing into our bodies. We will research the questions: Is it safe to eat? How much should we be eating? And, of course, which should we consume to maximize our health?

(Developed for Health Education, grades 9-10; recommended for Science, Chemistry, and Biology, grades 9-12)

15.04.05

Biochemistry and Baseball, by Matthew Eveleth

My unit strays from the typical chemistry curriculum and into biochemistry with analogies to baseball. The purpose behind this is to engage students with concepts that reach into their lives with enzymes – those little machines in our bodies – and analogies to sports to capture their imaginations. Throughout this unit, students will encounter a number of challenging concepts related to reactions: how they occur, the math behind them, and how they are mediated biologically. Students will learn about reaction collision theory through an analogy to baseball. They will engage mole ratios and grapple with the concept of the limiting reagent by making s'mores and mixing chemicals. Finally, they will discover the power of enzymes and their kinetics by encountering the Michaelis-Menten equation, enzyme saturation, and the importance of the K_m constant. In all, students will be challenged and stimulated by the analogies and activities that will bring to life products, reactants, reactions, stoichiometry, enzymes and kinetics.

(Developed for Chemistry, grade 11; recommended for Chemistry, grades 10-12)

15.04.06

Battling with Infectious Diseases, by Sheila Martin-Corbin

This unit is designed for high-school biology students enrolled in grade 10 and can be adapted and implemented in grades 11-12, in the anatomy and physiology curriculum. The focus of the

unit is to engage students in the inquiry-based scientific process through laboratory investigations and content knowledge as outlined in the curriculum with an emphasis on Connecticut standards. In accordance with Standard D32, students will be able to describe how bacterial and viral infectious diseases are transmitted and will also become informed about and able to explain the roles of sanitation, vaccination and antibiotic medication in the prevention and treatment of infectious diseases. The duration of the full unit will be about two weeks.

To accommodate the many different learning styles in my classes, my goal is to incorporate a variety of teaching strategies encompassing laboratory activities, class discussions, research work, and class presentations. The unit also offers students the choice of integrating the arts in their unit assessments. STEM learning, as well as English, will be highlighted throughout this unit enforcing critical-thinking skills, argumentation, scientific literacy, interpretation of data and formulating conclusions based on scientific evidence.

Students will explore scientific investigations that model transmission and spread of an infectious disease, gain an understanding of how disease is transmitted into their bodies and hopefully become advocates of the importance of good hygiene, living a healthy lifestyle, and avoiding harmful pathogens and microorganisms.

(Developed for Biology, grade 10; recommended for Life Science, grade 7, and Health, grades 7-12)

**Curriculum Units by Fellows of the
Yale-New Haven Teachers Institute
1978-2015**

2015

Volume I	Teaching Native American Studies
Volume II	American Culture in the Long 20th Century
Volume III	Physics and Chemistry of the Earth's Atmosphere and Climate
Volume IV	Big Molecules, Big Problems

2014

Volume I	Picture Writing
Volume II	Exploring Community through Ethnographic Nonfiction, Fiction, and Film
Volume III	Race and American Law, 1850-Present
Volume IV	Engineering in Biology, Health and Medicine

2013

Volume I	Literature and Information
Volume II	Immigration and Migration and the Making of a Modern American City
Volume III	Sustainability: Means or Ends?
Volume IV	Asking Questions in Biology: Discovery versus Knowledge

2012

Volume I	Understanding History and Society through Visual Art, 1776 to 1914
Volume II	The Art of Biography
Volume III	Anatomy, Health, and Disease: From the Skeletal System to Cardiovascular Fitness
Volume IV	Engineering in the K-12 Classroom: Math and Science Education for the 21st-Century Workforce

2011

Volume I	Writing with Words and Images
Volume II	What History Teaches
Volume III	The Sound of Words: An Introduction to Poetry
Volume IV	Energy, Environment, and Health

2010

Volume I	Interdisciplinary Approaches to Consumer Culture
Volume II	The Art of Reading People: Character, Expression, Interpretation
Volume III	Geomicrobiology: How Microbes Shape Our Planet
Volume IV	Renewable Energy

2009

Volume I	Writing, Knowing, Seeing
Volume II	The Modern World in Literature and the Arts
Volume III	Science and Engineering in the Kitchen
Volume IV	How We Learn about the Brain
Volume V	Evolutionary Medicine

Curriculum Units by Fellows (continued)

2008

Volume I	Controlling War by Law
Volume II	Storytelling: Fictional Narratives, Imaginary People, and the Reader's Real Life
Volume III	Pride of Place: New Haven Material and Visual Culture
Volume IV	Representations of Democracy in Literature, History and Film
Volume V	Forces of Nature: Using Earth and Planetary Science for Teaching Physical Science
Volume VI	Depicting and Analyzing Data: Enriching Science and Math Curricula through Graphical Displays and Mapping

2007

Volume I	American Voices: Listening to Fiction, Poetry, and Prose
Volume II	Voyages in World History before 1500
Volume III	The Physics, Astronomy and Mathematics of the Solar System
Volume IV	The Science of Natural Disasters
Volume V	Health and the Human Machine

2006

Volume I	Photographing America: A Cultural History, 1840-1970
Volume II	Latino Cultures and Communities
Volume III	Postwar America: 1945-1963
Volume IV	Math in the Beauty and Realization of Architecture
Volume V	Engineering in Modern Medicine
Volume VI	Anatomy and Art: How We See and Understand

2005

Volume I	Stories around the World in Film and Literature
Volume II	The Challenge of Intersecting Identities in American Society: Race/Ethnicity, Gender and Nation
Volume III	History in the American Landscape: Place, Memory, Poetry
Volume IV	The Sun and Its Effects on Earth
Volume V	Ecology and Biodiversity Conservation

2004

Volume I	The Supreme Court in American Political History
Volume II	Children's Literature in the Classroom
Volume III	Representations of American Culture, 1760-1960: Art and Literature
Volume IV	Energy, Engines, and the Environment
Volume V	The Craft of Word Problems

Curriculum Units by Fellows (continued)

2003

Volume I	Geography through Film and Literature
Volume II	Everyday Life in Early America
Volume III	Teaching Poetry in the Primary and Secondary Schools
Volume IV	Physics in Everyday Life
Volume V	Water in the 21st Century

2002

Volume I	Survival Stories
Volume II	Exploring the Middle East: Hands-On Approaches
Volume III	War and Peace in the Twentieth Century and Beyond
Volume IV	The Craft of Writing
Volume V	Food, Environmental Quality and Health
Volume VI	Biology and History of Ethnic Violence and Sexual Oppression

2001

Volume I	Medicine, Ethics and Law
Volume II	Art as Evidence: The Interpretation of Objects
Volume III	Reading and Writing Poetry
Volume IV	Race and Ethnicity in Contemporary American Art and Literature
Volume V	Bridges: Human Links and Innovations
Volume VI	Intelligence: Theories and Developmental Origins

2000

Volume I	Women Writers in Latin America
Volume II	Crime and Punishment
Volume III	Constitutional and Statutory Privacy Protections in the 21 st Century
Volume IV	Ethnicity and Dissent in American Literature and Art
Volume V	Sound and Sensibility: Acoustics in Architecture, Music, and the Environment
Volume VI	The Chemistry of Photosynthesis
Volume VII	Bioethics

1999

Volume I	Women's Voices in Fiction
Volume II	Art and Identity in Mexico, from the Olmec to Modern Times
Volume III	Immigration and American Life
Volume IV	Detective Fiction: Its Use as Literature and as History
Volume V	How Do You Know? The Experimental Basis of Chemical Knowledge
Volume VI	Human-Environment Relations: International Perspectives from History, Science, Politics, and Ethics
Volume VII	Electronics in the 20th Century: Nature, Technology, People, Companies, and the Marketplace

Curriculum Units by Fellows (continued)

1998

Volume I	The Use and Abuse of History in Film and Video
Volume II	Cultures and Their Myths
Volume III	Art and Artifacts: The Cultural Meaning of Objects
Volume IV	American Political Thought
Volume V	Reading Across the Cultures
Volume VI	Selected Topics in Contemporary Astronomy and Space Science
Volume VII	The Population Explosion

1997

Volume I	Twentieth Century Latin American Writing
Volume II	American Children's Literature
Volume III	American Maid: Growing Up Female in Life and Literature
Volume IV	Student Diversity and Its Contribution to Their Learning
Volume V	The Blues Impulse
Volume VI	Global Change, Humans and the Coastal Ocean
Volume VII	Environmental Quality in the 21st Century

1996

Volume I	Multiculturalism and the Law
Volume II	Environmental and Occupational Health: What We Know; How We Know; What We Can Do
Volume III	Race and Representation in American Cinema
Volume IV	Remaking America: Contemporary U.S. Immigration
Volume V	Genetics in the 21st Century: Destiny, Chance or Choice
Volume VI	Selected Topics in Astronomy and Space Studies

1995

Volume I	Gender, Race, and Milieu in Detective Fiction
Volume II	Film and Literature
Volume III	The Constitution and Criminal Justice
Volume IV	Coming of Age in Ethnic America
Volume V	The Geological Environment of Connecticut

1994

Volume I	Family Law, Family Lives: New View of Parents, Children and the State
Volume II	Poetry in the Classroom: Incentive and Dramatization
Volume III	Understanding the Ancient Americas: Foundation, Flourishing, and Survival
Volume IV	Racism and Nativism in American Political Culture
Volume V	The Atmosphere and the Ocean

Curriculum Units by Fellows (continued)

1993

Volume I	The Symbolic Language of Architecture and Public Monuments
Volume II	Folktales
Volume III	Twentieth-Century Multicultural Theater
Volume IV	The Minority Artist in America
Volume V	Environmental Science

1992

Volume I	The Constitution, Courts and Public Schools
Volume II	Writing and Re-writings of the Discovery and Conquest of America
Volume III	Reading and Writing the City
Volume IV	The National Experience: American Art and Culture
Volume V	Ecosystems: Tools for Science and Math Teachers

1991

Volume I	Regions and Regionalism in the United States: Studies in the History and Cultures of the South, The Northeast and the American Southwest
Volume II	The Family in Art and Material Culture
Volume III	Afro-American Autobiography
Volume IV	Recent American Poetry: Expanding the Canon
Volume V	Adolescence/Adolescents' Health
Volume VI	Global Change

1990

Volume I	The Autobiographical Mode in Latin American Literature
Volume II	Contemporary American Drama: Scripts and Performance
Volume III	The U.S. National Parks Movement
Volume IV	American Family Portraits (Section I)
Volume V	American Family Portraits (Section II)
Volume VI	Genetics
Volume VII	What Makes Airplanes Fly? History, Science and Applications of Aerodynamics

1989

Volume I	American Communities, 1880-1980
Volume II	Poetry
Volume III	Family Ties in Latin American Fiction
Volume IV	Detective Fiction: Its Use as Literature and History
Volume V	America as Myth
Volume VI	Crystals in Science, Math, and Technology
Volume VII	Electricity

Curriculum Units by Fellows (continued)

1988

Volume I	The Constitution in Public Schools
Volume II	Immigrants and American Identity
Volume III	Autobiography in America
Volume IV	Responding to American Words and Images
Volume V	Hormones and Reproduction
Volume VI	An Introduction to Aerodynamics

1987

Volume I	The Modern Short Story in Latin America
Volume II	Epic, Romance and the American Dream
Volume III	Writing About American Culture
Volume IV	The Writing of History: History as Literature
Volume V	Human Nature, Biology, and Social Structure: A Critical Look at What Science Can Tell Us About Society
Volume VI	Science, Technology, and Society

1986

Volume I	The Family in Literature
Volume II	Writings and Re-Writings of the Discovery and Conquest of America
Volume III	Topics in Western Civilization: Ideals of Community and the Development of Urban Life, 1250-1700
Volume IV	The Process of Writing
Volume V	The Measurement of Adolescents, II
Volume VI	Fossil Fuels: Occurrence; Production; Use; Impacts on Air Quality

1985

Volume I	Poetry
Volume II	American Musical Theater
Volume III	Twentieth Century American Fiction, Biography, and Autobiography
Volume IV	History as Fiction in Central and South America
Volume V	Odysseys: Nineteenth and Twentieth-Century African-American History Through Personal Narrative
Volume VI	Time Machines: Artifacts and Culture
Volume VII	Skeletal Materials-Biomineralization
Volume VIII	The Measurement of Adolescents

1984

Volume I	Elements of Architecture, Part II
Volume II	Greek Civilization
Volume III	Hispanic Minorities in the United States
Volume IV	The Oral Tradition
Volume V	American Adolescents in the Public Eye
Volume VI	Geology and the Industrial History of Connecticut

Curriculum Units by Fellows (continued)

1983

Volume I	Elements of Architecture
Volume II	Greek and Roman Mythology
Volume III	Reading the Twentieth Century Short Story
Volume IV	America in the Sixties: Culture and Counter-Culture
Volume V	Drama
Volume VI	Cross-Cultural Variation in Children and Families
Volume VII	Medical Imaging

1982

Volume I	Society and the Detective Novel
Volume II	Autobiography
Volume III	The Constitution in American History
Volume IV	An Unstable World: The West in Decline?
Volume V	Society and Literature in Latin America
Volume VI	The Changing American Family: Historical and Comparative Perspectives
Volume VII	Human Fetal Development

1981

Volume I	The “City” in American Literature and Culture
Volume II	An Interdisciplinary Approach to British Studies
Volume III	Human Sexuality and Human Society
Volume IV	Writing Across the Curriculum
Volume V	The Human Environment: Energy
Volume VI	Computing

1980

Volume I	Adolescence and Narrative: Strategies for Teaching Fiction
Volume II	Art, Artifacts, and Material Culture
Volume III	Drama
Volume IV	Language and Writing
Volume V	Man and the Environment
Volume VI	The Present as History
Volume VII	Problem Solving

1979

Volume I	The Stranger and Modern Fiction: A Portrait in Black and White
Volume II	Themes in Twentieth Century American Culture
Volume III	Remarkable City: Industrial New Haven and the Nation, 1800-1900
Volume IV	Language and Writing
Volume V	Strategies for Teaching Literature
Volume VI	Natural History and Biology

Curriculum Units by Fellows (continued)

1978

Volume I	Language and Writing
Volume II	20th Century Afro-American Culture
Volume III	20th Century American History and Literature
Volume IV	Colonial American History and Material Culture