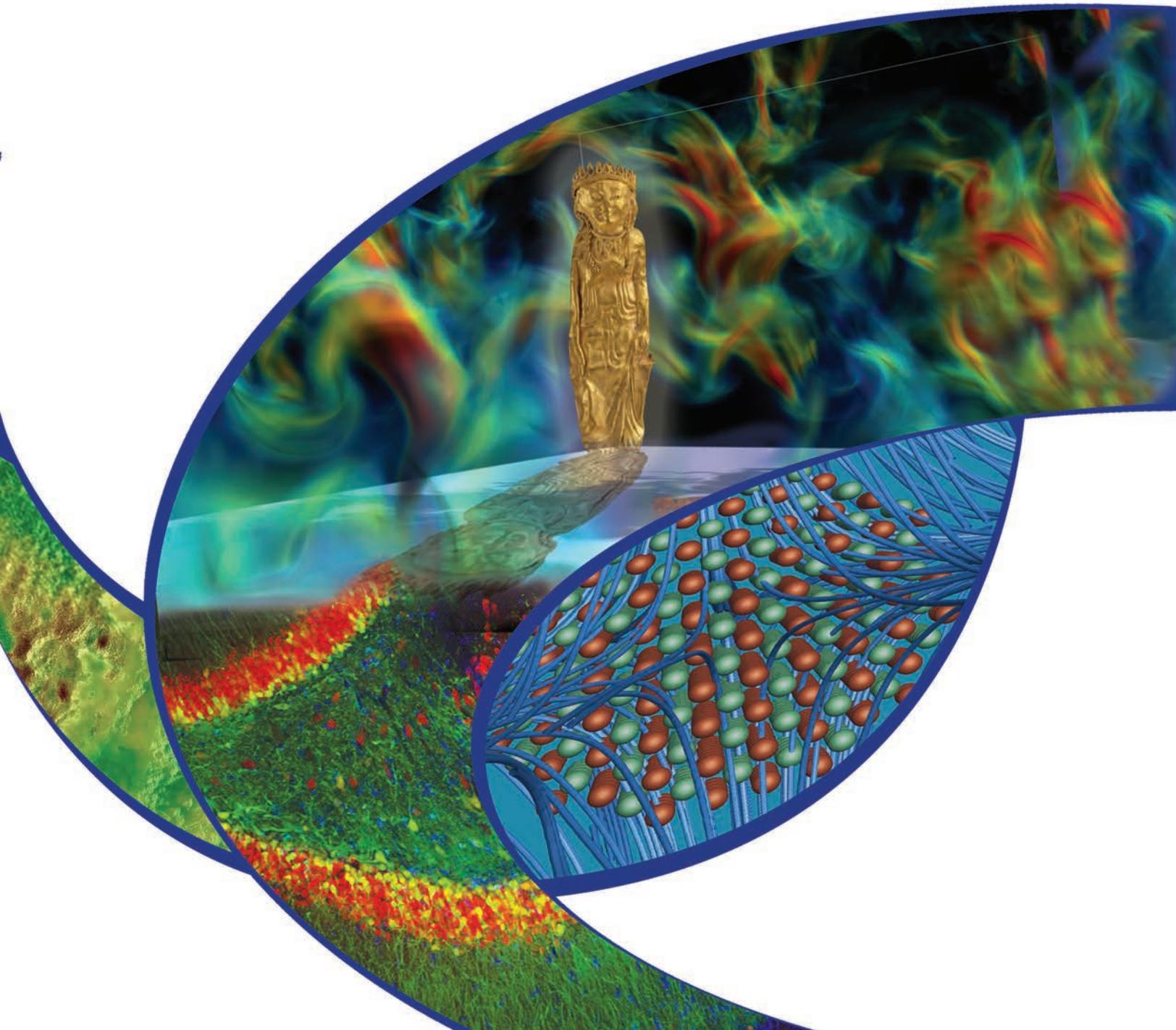




Coalition for Networked Information

Introduction &  
Program Plan  
2016-2017



## CNI STEERING COMMITTEE, 2016-2017

**John P. Barden**, University of Rochester, representing EDUCAUSE, 2016-2019  
**Daniel Cohen**, Digital Public Library of America, at large member, 2016-2017  
**Joseph D. Combs**, Vanderbilt University, representing EDUCAUSE, 2014-2017  
**Harriette Hemmasi**, Brown University, representing ARL, 2015-2018  
**Geneva L. Henry**, George Washington University, representing ARL, 2014-2017  
**Clifford A. Lynch**, Coalition for Networked Information, *ex officio* member  
**John O'Brien**, EDUCAUSE, *ex officio* member  
**Elliott Shore**, ARL, *ex officio* member  
**Oren Sreebny**, University of Chicago, representing EDUCAUSE, 2015-18  
**Edward Van Gemert**, University of Wisconsin at Madison, representing ARL, 2016-19  
**Donald J. Waters**, The Andrew W. Mellon Foundation, at large member, 2016-2017

## CALENDAR OF KEY MEETINGS

**Designing Libraries IV**, Raleigh, North Carolina – September 18-20, 2016  
**2016 Fall Membership Meeting**, Washington, DC – December 12-13, 2016  
**12th International Digital Curation Conference**, Edinburgh, Scotland – February 20-23, 2017  
**2017 Spring Membership Meeting**, Albuquerque, NM – April 3-4, 2017  
**2017 Fall Membership Meeting, Washington, DC** – December 11-12, 2017  
**2018 Spring Membership Meeting**, San Diego, CA – April 12-13, 2018  
**2018 Fall Membership Meeting**, Washington, DC – December 10-11, 2018

## CNI STAFF

**Clifford A. Lynch**, Executive Director ([cliff@cni.org](mailto:cliff@cni.org))  
**Sharon Adams**, Administrative Assistant ([sharon@cni.org](mailto:sharon@cni.org))  
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## Coalition for Networked Information

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# Coalition for Networked Information

## An Introduction & Program Plan 2016-2017

### Mission

The Coalition for Networked Information (CNI) promotes the transformative promise of networked information technology for the advancement of scholarly communication and the enrichment of intellectual productivity.

# ABOUT CNI

The Coalition for Networked Information (CNI), a joint initiative of the Association of Research Libraries (ARL) and EDUCAUSE, promotes the use of digital information technology to advance scholarship and education. In establishing the Coalition under the leadership of founding Executive Director Paul Evan Peters, our sponsor organizations recognized the need to broaden the community's thinking beyond issues of network connectivity and bandwidth to encompass digital content and advanced applications to create, share, disseminate, and analyze such content in the service of research and education. Reaping the benefits of the Internet for scholarship, research, and education demanded, and continues to demand, new partnerships, new institutional roles, and new technologies and infrastructure. CNI seeks to advance these collaborations, to explore these new roles, and to catalyze the development and deployment of the necessary technology base.

Since its founding in 1990, CNI has addressed a broad and diverse array of issues related to the development and use of digital information in research and education environments. As the premier organization fostering connections and collaboration between library and information technology communities, we represent the interests of a wide range of member organizations from higher education, publishing, networking and telecommunications, information technology, government agencies, foundations, museums, libraries, and library organizations.

CNI is supported entirely from dues paid by its roughly 230 member institutions. We do not seek or accept grants, and all content produced by the Coalition is openly accessible. Membership in the Coalition is open to all organizations, both for-profit and not-for-profit, that share CNI's commitment to furthering the development of digital information in the networked environment. We view our members as partners in advancing the Coalition's mission. Fall and spring membership meetings are CNI's flagship events, bringing together hundreds of representatives for a comprehensive update on critical issues; attendance at CNI's meetings is included in membership dues.

## Governance and Leadership

CNI's program is guided by a Steering Committee to which sponsor organizations ARL and EDUCAUSE each appoint three representatives drawn from their member leadership; the current roster of Steering Committee members appears on the inside front cover of the printed Program Plan and on our website. Three "at large" representatives on the Steering Committee contribute additional perspectives. The chief executives of ARL, EDUCAUSE, and CNI serve as *ex officio* members of the committee.

CNI Executive Director Clifford Lynch has led the organization since 1997. Joan Lippincott, CNI's Associate Executive Director, has served since fall 1990. For more information about the Coalition's history and contributions, see the CNI website, [www.cni.org](http://www.cni.org).

## Program Themes

CNI's work is structured around three central themes that we believe are the essential foundations of the vision of advancing scholarship and intellectual productivity:

### Developing and Managing Networked Information Content

The Coalition has played a central role in ensuring that the network richly engages the needs of scholarship, teaching and learning. We bring together many diverse groups that create and manage content, and work with these communities to advance the deployment and stewardship of digital information resources. Changes in scholarly practices (particularly those shorthanded by "e-science" or "e-research") and the development of large-scale digitized collections require a close and continuing examination of information creation, aggregation, exchange, reuse, and preservation throughout the research and education community and society broadly; these developments, and the evolving roles of higher education institutions and cultural memory organizations in facilitating and supporting them, are a central part of the CNI agenda. Working within these contexts and others, CNI furthers the development

of economic, policy, social and legal frameworks to sustain the creation and management of digital information and to facilitate its access.

## Transforming Organizations, Professions, and Individuals

The pervasiveness of ubiquitously accessible digital information is transforming institutions, professions, and the practices of learning and scholarship. CNI focuses on the unprecedented need for collaboration among libraries, information technology and instructional technology groups, faculty, museums, archives, university presses, and other units in order to achieve success in this environment. In addition, we promote new alliances and partnerships with publishers, information technology and network service providers, scholarly societies, government, and other sectors. Organizations must understand their constituencies and adapt their services and facilities to current needs; they must develop and share new strategies, policies, and best practices. Professions need to develop new competencies and enter into new dialogues that cross traditional disciplinary boundaries. CNI seeks to facilitate these collaborations and dialogues and to help professions and institutions work together in program strategy formulation.

## Building Technology, Standards, and Infrastructure

The networked information environment relies on the development and deployment of standards and infrastructure components in order to enable the creation, discovery, use, and management of digital information on the Internet. The ability to use collections of resources in a unified, consistent fashion is essential and requires a continuing focus on interoperability of services. At the same time, promising new technologies need to be explored, assessed and tested, and sometimes adapted to the needs of the CNI community. No one institution acting alone can build the needed infrastructure or explore the full range of new technologies as they become available; it requires a coordinated, community-wide effort that also reaches out to other communities, such as the world of e-research. CNI seeks to highlight links between technology and policies at all levels, to offer a context for collaborative experiments and test beds, and to serve as a focal point for sharing knowledge about new technologies.

The specific program initiatives that further CNI's themes evolve from year to year. The initiatives and strategies planned for 2016-2017 are described in the Program Plan portion of this publication; most build upon and continue efforts already underway. Many of the initiatives seek to make strategic progress relevant to more than one theme.

It is important to recognize that the digital information environment is still changing rapidly. CNI is continually adapting its activities in response to new developments and opportunities. Indeed, CNI believes agility is essential in the current environment and invites a continuous dialogue with its members on the need for additional program initiatives. Because of this, the 2016-2017 Program Plan should be viewed as a snapshot of our thinking about priorities and opportunities as of late 2016 that will inevitably develop further during the coming program year.

## Policy & Consultative Activities

CNI acts as an important and respected voice on behalf of our community in a wide range of national and international policy venues. This is accomplished through our participation in the ongoing scholarly dialogue; through collaboration with key funding agencies, such as the National Science Foundation (NSF), the Institute of Museum and Library Services, the National Endowment for the Humanities, The Andrew W. Mellon Foundation, the Alfred P. Sloan Foundation, and Jisc in the United Kingdom (UK); through work on advisory groups of organizations such as ITHAKA, OCLC, and the American Library Association (ALA); through service on numerous visiting and advisory committees for our member institutions; through contributions to standards efforts and standards organizations such as the National Information Standards Organization (NISO); and through participation in organizations such as the Networked Digital Library of Theses and Dissertations (NDLTD) and the Library Publishing Coalition.

Of particular note in this area are our recent contributions to various studies and programs conducted by the U.S. National Research Council, particularly in conjunction with the Board on Research Data and Information (BRDI), the National Academies *Developing a 21st Century Global Library for Mathematics Research* study, the Committee on Coherence at Scale, the New Media Consortium's *Horizon Report*, and the ALA Working Group on Libraries and Digital Content.

As a contributor and participant within a complex and dynamic ecosystem of organizations that share common interests, CNI works with Internet2 on advanced networking applications and standards; with the Council on Library and Information Resources (CLIR) on scholarly communication, cyberinfrastructure, and preservation issues; with the New Media Consortium on the exploration and use of new media and new technologies in higher education; with the Learning Spaces Collaboratory on development of principles for technology-enabled spaces that enhance learning; with the National Institute for Learning Outcomes Assessment (NILOA) Assignment Library; and with ALA on policy and professional development activities. We are deeply involved with some of the programs of our sponsor organizations, notably the EDUCAUSE Learning Initiative (ELI), the ECAR/CNI Working Group on Supporting Digital Humanities, the EDUCAUSE Campus Cyberinfrastructure Initiative, and the recent SHared Access Research Ecosystem (SHARE) effort that ARL is leading in partnership with the Association of American Universities (AAU) and the Association of Public and Land-grant Universities (APLU).

In addition to specific initiatives to address CNI's overarching program themes, the Coalition actively conducts an ongoing program of collaboration and advocacy to advance the development of digital information and its role in transforming organizations and scholarly activities. To this end, CNI works with scholarly societies, government agencies, publishers, and others. CNI is also committed to leadership development within the community and contributes regularly to the CLIR Postdoctoral Fellows program and the ARL Leadership Fellows program.

On an international level, we collaborate with other organizations concerned with networked information, including the Digital Curation Centre (DCC) and Jisc in the UK, the German Initiative for Networked Information (DINI), the German Research Foundation (DFG), Denmark's Electronic Research Library (DEFF), SURF (the collaborative information and communications technology organization for Dutch education and research), and the Confederation of Open Access Repositories (COAR).

CNI works to provide our community with frameworks for understanding key networked information issues so that institutions can develop strategies to address these issues on the local, regional, or national level. We write white papers, reports, and articles, we present talks at conferences, and we make institutional visits that may involve meetings with campus leaders and presentations at public events and seminars.

CNI alerts its community to our organizational activities, significant new publications, and important developments in the field via the CNI website, the CNI-ANNOUNCE e-mail list, and the CNI News RSS. Additional information about CNI's activities and interests is available through social media channels. We also make video of selected sessions from our membership meetings publicly available from our YouTube and Vimeo channels.

## Meetings

The Coalition's semiannual membership meetings, scheduled for December 12-13, 2016, in Washington, DC, and April 3-4, 2017, in Albuquerque, NM, highlight activities related to CNI's program themes, focus attention on significant new thinking and technology developments, and provide opportunities for members to showcase and discuss a wide range of emerging issues and developments in networked information. Some participants have developed knowledge communities within CNI and use the meetings as an opportunity to share ideas on a particular aspect of networked information and to incubate new initiatives. Each member organization is invited to send two delegates, typically a senior information technologist and a senior librarian. Meeting participants are introduced to new developments that may reshape institutional plans in a forum that encourages collaborations and dialogues with others who share common interests.

CNI has a long history of being the first to offer discussion of major networked information developments, including the early web browser Mosaic, the National Science Foundation's (NSF) Digital Libraries Program, the Google Books Scanning program, and NSF's DataNet initiative. CNI regularly co-sponsors an event in partnership with Jisc as part of our ongoing collaboration with our

UK colleagues; the most recent event, the conference *International Advances in Digital Scholarship*, took place in Oxford, England in July 2016. CNI occasionally convenes invitational or public workshops to advance specific elements of its program plan, most recently *Planning a Digital Scholarship Center*, sponsored jointly with ARL and held May 17-18, 2016, in Washington, DC, and the *Security & Privacy Workshop* held March 2015 in Washington, DC.

We also serve as an active co-sponsor for other meetings relevant to the CNI agenda. This year these events include the North Carolina State University (NCSU) Libraries, CNI, and University of Calgary co-sponsored conference “Designing Libraries for the 21st Century V,” on September 18-20, 2016 in Calgary, Alberta, the next conference in the series, to be held at the NCSU Hunt Library in September 2017, and the 12th International Digital Curation Conference, “Upstream, Downstream: Embedding Digital Curation Workflows for Data Science, Scholarship and Society,” to be held February 20-23, 2017 in Edinburgh, Scotland.

Additionally, CNI is serving as a cooperating organization for several other conferences, including: Theory & Practice of Digital Libraries Conference (TPDL) 2017, in Thessaloniki, Greece, September 17-21, 2017; Archiving 2017 in Riga, Latvia, May 18, 2017; the Joint Conference on Digital Libraries (JCDL) 2017 on June 19-23, 2017, in Toronto, Canada; and the Open Repositories 2017 meeting in Queensland, Australia, June 26-30, 2017.

## PROGRAM PLAN 2016-2017

### Developing & Managing Networked Information Content

The Coalition has broad interests across all forms of digital content that can be used to support research and education. We provide a forum for information on leading projects in this arena, including a showcase at CNI membership meetings for innovative faculty projects from our member institutions. In addition, we track developments and promote strategies for the creation, management, and preservation of digital collections, digital libraries, and federated services in support of digital content. Further, because digital content cannot be divorced from the processes of teaching, learning, and scholarship that both create and rely upon that content, CNI is deeply involved in issues related to the changing practices of scholarship, the restructuring of scholarly publishing, the increasing focus on the value of data underlying research, and the broader transformation of scholarly communication, as well as innovation in teaching and learning. Through our membership meetings, specialized conferences and workshops, collaborative initiatives with other organizations, and publications, we provide leadership on digital content policy and new directions in scholarly communication.

### Institutional and Disciplinary Implications of E-Research

The Coalition has long led programs to chart, understand, and facilitate the transformation of scholarly practice through the use of digital content and advanced information technology. These endeavors have come to be shorthand as *e-research* (or, in the sciences, *e-science*, and in the humanities, *digital humanities*). In the sciences and engineering, CNI has been heavily involved in helping the higher education and library communities understand and frame emerging issues in cyberinfrastructure and e-science, with a primary focus on data sharing and data curation issues, and the interrelationships between data, software and more traditional publications. In the arts and humanities, CNI, working with a wide range of partners, has a long record of leadership in computing and the humanities, and in efforts to build collaborations that span the museum, archival and library communities. The need to continue to understand evolving scholarly practice in the sciences, social sciences, and humanities is vital in informing future planning by CNI’s members. We will continue to feature innovative and creative data and technology intensive scholarship across all disciplines, both within the US and internationally.

In the 2016-2017 program year, CNI will continue to engage in data-related e-research developments in both the sciences and the humanities, but more selectively than in past years. A wide range of organizations, including EDUCAUSE and the Association of Research Libraries (ARL), now have aspects of data stewardship issues prominently on their agendas; there are immediate challenges for

higher education institutions driven by funder mandates for data management plans, data sharing policies, and public access to research outcomes. It is our intention to support and collaborate with these efforts but not to duplicate them. For example, CNI is substantially involved in supporting the effort led by ARL, the Association of American Universities (AAU), and the Association of Public and Land-grant Universities (APLU) called SHARE (SHared Access Research Ecosystem), which among other things should result in a system to track and facilitate the management of research outcomes (publications, software and data) across US higher education. Faculty investigators need guidance from their funders and their home institutions on how best to meet these requirements, and they will be demanding new services at both disciplinary and institutional levels; CNI member institutions are leading the development of a wide variety of such services. We have seen the launch of other potentially important community based efforts like the Digital Preservation Network (DPN) and the Research Data Alliance (RDA); we will be highlighting developments from these programs in our membership meetings, and seeking to facilitate coordination among these developments.

Many of the key developments here are international as well as national. Scholarship is a global enterprise. This year, we issued the report *International Advances in Digital Scholarship*, from a July 2016 conference co-sponsored with our UK colleagues at Jisc, in which we examined trends and challenges for new modes of research dissemination and re-use as well as scholarly record curation in a multi-national context.

There are specific challenging frontier areas in research data management where CNI expects to continue to provide direct leadership, including efforts to understand criteria for retention and re-assessment, re-use practices, issues related to data involving human subjects, aspects of large-scale infrastructure, reproducibility of results, long-term sustainability and the evaluation of the effectiveness of funder and institutional policies. We also hope to help clarify some of the tangled issues of software sustainability and software preservation, and the relation of both of these to data stewardship, reproducibility of results, and other challenges.

Beyond developments driven by funder mandates, CNI also continues to be concerned with the question of the availability of data related to scholarly work, and we have engaged in a number of discussions around open access, open science, and open data as they relate to this question, as well as discussions about disciplinary norms for data sharing, practices for data citation, and educating graduate students. We will continue to explore and document the ways in which data and computationally intensive scholarship are altering the nature of scholarly communication; the issues here include the legal and technical barriers to large-scale text and data mining; appropriate organizational, policy and technical strategies for linking articles and underlying data; and ways to construct scholarly works that are amenable to various combinations of human and machine use. Critical new developments here include the need to better understand the complex architectural questions about the relationships among repositories, operational storage systems, e-research workflows, high performance network connectivity and powerful computational resources.

Connecting our work in e-research directly to our program focus on institutional content resources, CNI will continue to examine institutional policy and planning implications of campus cyberinfrastructure initiatives in both the sciences and humanities, and consider how these can complement national or international cyberinfrastructure investments and strategies at disciplinary and cross-disciplinary levels.

## Digital Preservation

Closely related to, and supporting the programmatic focus on stewardship of institutional content resources, is the Coalition's ongoing work on preservation of a wide variety of digital content. This is a central issue not only in the shift to network-based scholarly communication, but also in ensuring the continuity of the broad cultural and intellectual record in the digital age and the continued availability of evidence to support future scholarly inquiry. CNI works closely with organizations such as ARL, the Council on Library and Information Resources (CLIR), The Andrew W. Mellon Foundation, the Library of Congress, the National Science Foundation (NSF), ITHAKA, Jisc, the UK Digital Curation Centre (DCC), and OCLC on the full range of technical, economic, and strategy issues surrounding digital preservation. Digital preservation progress will continue to receive extensive coverage at CNI membership meetings.

The issues here are not simply technical, but they represent a fundamental social and public policy challenge with wide-reaching implications; we are particularly interested in trying to define and

characterize the ever growing range of materials that should constitute parts of our cultural and intellectual record, including new areas such as social media in the broadest sense, and to find ways to measure progress in preserving them. In this connection, we have recently been engaged with the work of the Keepers Registry to understand the extent to which the journal record is being preserved, and were signatories of the call to action *Working Together to Ensure the Future of the Digital Scholarly Record*.

A particularly important development we are following closely is the emergence of genuinely viable virtual machine level emulation and containerization technology; this has implications not only for preservation but also for scholarly communication practices themselves.

We will once again collaborate with the DCC on the International Digital Curation Conference; IDCC 12 will take place in Edinburgh, Scotland on February 20-23, 2017.

The wide-scale adoption of networked information services and the shift to digital content raises a set of new questions about risk management and business continuity planning for libraries and higher education institutions. CNI continues to track these risk management issues, exploring developments and experiences with so-called “cloud” storage systems and their implications for robust storage and digital preservation, as well as some of the thinking emerging from the exascale computing and massive storage communities on the development of resilient systems, and the ways in which these ideas can be applied to very large scale digital preservation.

Another area in which CNI has maintained a strong interest is in the changing nature of personal information storage and personal archiving, and the social and scholarly implications of these developments. A specific case in point is the institutional response to the acquisition of large, personal digital archives from scholars and researchers, as well as the personal archives of prominent intellectual, artistic, literary, political and similar figures. CNI will be involved again in the Personal Digital Archiving Conference, which will take place in Palo Alto, CA, March 29-31, 2017.

The digital records of organizations are also poorly explored. A particular area of CNI interest is the changing nature of the academic record caused by the deployment of learning management systems, institutional repositories (IRs), large-scale lecture and event capture, and long-lived, collaborative resources jointly developed by faculty and students, including massive open online courses (MOOCs). These emerging methods and systems will have lasting policy implications for special collections and institutional archives.

CNI has long championed those inside and outside of government working to provide a record of government information on the web, and we are participating in the Digital Preservation of Federal Information Summits hosted by the University of North Texas.

A new area of investigation is the character and structure of stewardship transitions, where responsibility for preserving and managing collections of content needs to migrate from one organization to another. Issues in this area are emerging in a wide range of contexts: escrow agreements for commercial digital content; the disposition of research data after some initial funder-underwritten retention period; organizational failures; succession rights in the context of efforts like DPN.

## Institutional Content Resources and Repositories

A centerpiece of CNI’s work on networked information is built around the broad theme of the stewardship of institutional content resources: materials created by members of the institutional community, or that document the work, processes, or intellectual and cultural life of an institution. The practice of such stewardship, which includes management, preservation, and access, is a central role for higher education and cultural memory organizations in the digital age. Our work here has two major components. One is to advance and structure the wealth of new digital content. The program includes our continuing efforts to understand and highlight experiments in the creation of new types of scholarly works for the digital medium, such as successors to the scholarly print monograph or the development of electronic theses and dissertations; the disposition of materials collected through lecture capture systems; the implications of mass digitization of materials to support scholarship; and the availability of digital representations for existing collections of physical materials held in libraries, archives, museums, and audio/visual and public broadcasting groups. The second major effort focuses on approaches to managing the wealth of new content through the development of strategies such

as the deployment of IRs. Here CNI is addressing the full range of issues, from policy and strategic planning through system architecture and standards for the management of complex digital objects.

We will continue to explore ways in which institutional strategies and systems need to connect to national and disciplinary-level data management and curation activities (such as those developing through the e-research initiatives described above), and some of the inter-institutional issues that arise from large-scale research collaborations and virtual organizations.

A continuing priority is a focused, ongoing re-examination and re-assessment of IR services. The concept of the IR is in its second decade; CNI was deeply involved in the initial conceptualization of IR services and in the development of implementation strategies for them. Platform alternatives have multiplied and matured, and understandings about costs, as well as barriers to successful deployment, have become much clearer. Indeed, we are seeing significantly different deployment trajectories in different nations, particularly in the context of subject repositories and other disciplinary or funder-defined data management frameworks, and these are leading to new policy issues and requirements for various kinds of interoperability standards. The SHARE program (and parallel developments in other nations), relying heavily on repositories of all types as infrastructure, is creating a new set of demands for various forms of interoperability. It is an appropriate time to document these developments and examine their implications: we will focus the Spring 2017 Executive Roundtable on this area.

We are particularly interested in ways in which the impact of IRs might be measured, and the ways in which IRs interact with virtual organizations, faculty movement from one institution to another, and with stewardship of scholarly work associated with faculty retirements.

## Transforming Organizations, Professions, & Individuals

The ubiquitous nature of digital content and networks has led to transformations in the way the research and education community does its work. In this program area, we focus on the impact of changing technologies, new modes of communication and content creation, and the pervasiveness of digital content on organizations, including the changing nature of teaching and learning, the need for new services and expertise in professions, the importance of partnerships, and the pressure on physical facilities to accommodate the changing needs of user communities.

CNI has a longstanding commitment to highlighting and advancing organizational initiatives that facilitate cooperation across institutional units and professional cultures, with particular emphasis on collaboration between librarians and information technologists. We have also tried to extend the core library-information technology collaboration to encompass instructional technologists, faculty, publishers, electronic records managers, archivists, data managers and data scientists, research managers and others. Our work on organizational and institutional issues includes a focus on evaluation and assessment strategies, recognizing the continuing need to understand the effects and contributions of advanced information technology and digital content.

We are monitoring a number of developments in this area, including innovations in online learning, new models for e-book development and acquisition, multi-pronged institutional publishing and dissemination programs that strategically span and coordinate activities involving the libraries and university presses, and sometimes other units, and the growing importance of building and maintaining high-quality institutional databases of geo-referencing information.

There is a developing recognition that institutions need more coherent strategies for disseminating scholarship, and that this entails much more than just operating a university press. Just as research libraries and presses jointly enabled humanities monograph publishing to work in print, new partnerships will be needed to support digital humanities at scale. Several years ago we held an executive roundtable to look at these trends. In spring 2016 we partnered with ARL and the Association of American University Presses to convene library and press directors from the growing number of research institutions where the press reports to the library in order to better understand the implications of this organizational restructuring on mission alignment and scope. As we prepare the report for release this program year, we are looking carefully at next steps for this work.

Many institutions are integrating the use of mobile devices in teaching and learning, and researchers use mobile devices for data collection and communication in the field. New applications involve sophisticated geo-tagged information and augmented reality, or the use of portable devices as distributed “sensors.” Institutions continue to grapple with developing policies, services, and

strategies for mobile devices as the number of devices deployed by the campus community continues to increase. In the last few years our Executive Roundtable program has been a particularly useful vehicle for mapping emerging thinking in these areas.

## Today's Learners and Digital Environments

Digital technologies and the global nature of higher education today are accelerating changes in colleges and universities in a variety of ways. There are increasing calls to make higher education more affordable and more accountable for student outcomes. One response has been the growing use of analytics software to track student behavior related to learning; this is used to improve student performance and outcomes, and to inform faculty members. We are following some new technologies that enable universities to reach new and huge audiences (e.g. MOOCs), and how some result in significant gains in learning (e.g. the “flipped classroom”). We help institutions understand the need to reconfigure some of their services and their physical and virtual spaces to reflect the ways in which our students work with technology and information today. Another programmatic emphasis is to assist our members in thinking about the content issues related to the use of educational resources in this environment, whether making digital content available in MOOCs, instituting a campus e-textbook pilot program, or working with faculty to produce open educational resources.

As both students and faculty increasingly produce new digital information, sometimes incorporating parts of others' work, and often in complex social software contexts, they have a pressing need to understand a wide range of issues including intellectual property, privacy, preservation, format standards, and metadata creation. A variety of literacies (information, technology, and visual) are converging as students, faculty, and others produce innovative digital content.

## Spaces and Services that Support Technology-Enhanced Research and Learning

Campuses are building or renovating physical, technology-enabled spaces to support research and learning. CNI continues to have a strong focus on spaces that enhance new modes of teaching and learning; for example, spaces configured to support collaborative student projects employing technology and a range of information resources. Our interest stresses aligning new services and new technologies within the spaces that have been built to enhance the teaching and learning mission of the institution. Spaces that promote the integration of content and technologies into student-produced work in a way that engages students in the academic enterprise (whether media labs, studios, information/learning commons, or specialized classrooms) are a particular focus, highlighting the innovative ways that library spaces, technologies, and services are enabling pedagogical and curricular change. We are following developments in the emergence of makerspaces, which often offer capabilities such as 3-D printing to support individuals and classes working in a wide variety of disciplines.

Our work also emphasizes how these spaces can provide mechanisms for various professional collaborations to offer student-centered services. Librarians, instructional technologists, multi-media specialists, information technologists, and writing center staff are some of the partners who may work together to offer joint services in these types of spaces. CNI co-sponsored a major conference, *Designing Libraries for the 21st Century V*, at the University of Calgary's Taylor Family Digital Library in September 2016, and the next conference in the series will be held at the NCSU Hunt Library in September, 2017. We are working to take some lessons learned to a broader community through webinars and sessions at conferences.

Many institutions are interested in understanding the learning spaces of other campuses when they are planning renovations or new buildings. They seek data, photos, floor plans, and service models for new learning spaces, including classrooms, media studios, learning or information commons, and small group collaborative spaces. We are working with the ARL Assessment Committee on analyzing data collected through the ARL Facilities Inventory, developed by their Task Force on Facilities, and we will present some findings at the Library Assessment Conference in November 2016. In addition, we work to highlight the FLEXSpace project and the NCSU Learning Space Toolkit's Space Browser, and the Learning Space Rating System, all of which provide useful information about campus spaces.

The assessment of learning spaces has garnered increasing attention; we will continue to work with our partners, such as the Learning Spaces Collaboratory, to explore principles and practices in this area, and we will co-facilitate a workshop on learning space assessment at the Library Assessment Conference in 2016.

## Supporting Emerging Scholarly Research Practices at Scale

Changes in research practices and scholarly communication are creating new faculty needs for expert consultation and training in technologies such as visualization and research data management, the best use of new publication and dissemination venues for scholarship, and intellectual property issues. The source of these demands is shifting from early adopters to the faculty at large. Libraries and IT organizations are hiring or training new types of staff with the skills to support faculty in their digital scholarship and e-research activities. Many institutional programs are still in early or pilot stages and may reach a limited number of faculty and departments. Institutions are experimenting with new organizational structures as well. Assisting institutions in understanding how to develop services at scale will continue to be a programmatic focus in the coming year. Humanities faculty, who often receive much less grant support than their counterparts in the sciences, have a particular need for institutional services to support their digital scholarship. We are working in partnership with the EDUCAUSE Center for Analysis and Research (ECAR) to develop a paper on supporting digital humanities; EDUCAUSE and CNI have assembled a working group of individuals with a variety of roles on campus to inform the scope and content of the paper. We are also a partner in the NCSU Data Science and Visualization Institute for Librarians, which will be held April 24-28, 2017.

For several years we have been highlighting digital scholarship centers as an emerging area of interest in both research and college libraries. These centers typically provide high-end technologies, in-depth consultation for faculty, graduate students, and upper-level undergraduates working on capstone projects, and a suite of spaces. They represent an institutional response to the need for services to support new kinds of scholarship. In spring 2014 we hosted a specialized workshop that explored digital scholarship centers in the humanities and other disciplinary areas. CNI issued a report encouraging better understanding of the rationale and mission for a center, suggestions for good practice, and models of staffing, funding, and provision of services and supplemented the report with related materials on our website.

One of the topics that engendered the most spirited discussion during the workshop was drawing distinctions between centers supporting digital scholarship in libraries (or other units serving the entire campus) versus centers that are faculty-sponsored and limited to specific digital scholarship research activities. In spring 2015 we convened a workshop to further discuss the continuum of organizational models that support digital scholarship in order to provide clarity on the purposes of various types of centers and their diverse programmatic and support configurations. In spring 2016 we offered a conference, co-sponsored by ARL, to help institutions plan for a digital scholarship center. We issued a report in summer 2016 summarizing the event and including information on such topics as staff expertise, physical space and technologies, funding models, and research, teaching, and learning faculty partnerships. We are planning another conference or workshop on digital scholarship centers in 2017.

## Museums, Libraries and Scholarship

Museums are not simply stewards of content; they are organizations with deep expertise and important learning spaces in their own right. Yet at too many institutions our university museums struggle to achieve the breadth and depth of engagement appropriate to their potential contributions. In January 2016, CNI, working together with the Kress and Mellon Foundations, the Association of Art Museums and Galleries and ARL, co-convened a meeting, hosted by the University of Miami, of library and art museum directors for a discussion of cooperation and collaboration within the broader institutional missions of teaching and learning, research and public service. This is the beginning of an extended dialog and collaboration. A report of the meeting is available, and we will be convening an executive roundtable to advance the discussions.

## Executive Roundtable

CNI's Executive Roundtable series assembles executive teams (usually the chief librarian and chief information technology officer, but varying depending on the topic) from about 10 member organizations for a focused discussion on a topic of interest on the morning of the first day of each membership meeting. Launched in 2003, the Executive Roundtables build on the theme of collaboration between librarians and information technologists that has been at CNI's foundation. Past topics have included IRs, campus open access policies, learning management system strategies, identity management, learning spaces, funding innovation, the university's role in the dissemination of research and scholarship, lecture and performance capture, infrastructure to support research,

risk management and disaster planning, institutional strategies for multiple devices and platforms, institutional publishing strategies, scholarly identity management, institutional e-book strategies, software as a service and cloud-based applications, supporting digital humanities, privacy in the age of analytics, funder mandates, compliance and access to research results, and institutional strategies for open educational resources (OERs). Reports of selected roundtables are available on the CNI website.

The Fall 2016 Executive Roundtable will address library and IT partnerships with campus museums and archives, and the Spring 2017 Roundtable is currently planned to focus on rethinking institutional repository strategies.

## Building Technology, Standards, & Infrastructure

CNI continues to be engaged in key areas of standards and infrastructure development. The Coalition is particularly concerned with facilitating the difficult and delicate transition of standards and technologies into operational infrastructure for the research, higher education and library communities. For example, federated identity management is becoming a key infrastructure component to support research using resources beyond a single campus. Another example: while there has been good work recently on linked data and on annotation, there are practical deployment questions, regarding where data is actually hosted and where computation occurs, that still need to be fully explored.

In addition to the specific program initiatives described here, CNI participates in and tracks a wide range of developments in areas as diverse as identifiers, digital books, metadata standards, distributed and federated network services, harvesting technologies, recommender systems, and personalization technologies. As we look at an evolving landscape that includes commercial web search engines, traditional library automation tools such as online catalogs, stand-alone abstracting and indexing databases, systems deployed by scholarly publishers, museums, and other content providers, and learning management systems, the Coalition is concerned with architectural and standards frameworks that can facilitate integration and interoperation. This perspective has motivated much of our work over the last few years on cyberinfrastructure, IRs, the various components of the Open Archives Initiative (including the protocol for metadata harvesting, the object reuse and exchange protocol, and, most recently, the Open Annotation work), and learning management systems. One of our most important contributions is the ability to promote discussions across project and technology silos that help to reduce redundancy, increase coherence, and facilitate scalability.

Currently, we see a number of trends that we believe will drive a renewed focus on standards and infrastructure, including the proliferation of mobile devices (smart phones, tablets, e-book readers, etc.), the move towards data resources as part of the infrastructure (changes in identity management, bibliographic control, etc.), and the move towards cross-institutional systems (web-scale discovery and resource sharing, cloud computing, and distributed storage). Many of the latest developments couple technical issues with policy challenges in novel ways.

We also continue to track and inform our members about developments in technologies that promise to change the way we can capture or document objects and events digitally (for example, through developments in computational digital photography and image capture), and the way we can share or reproduce them (for example, through 3-D printing technologies).

### Institutional Infrastructure to Support Research

There is a renewed focus on campus infrastructure to support research programs. Developments include: policy, technical, and economic influences that are leading to a partial re-centralization of computing functions; radically new high performance network and distributed computing technologies; a rethinking of storage functionality and economics; requirements for long-term data management, curation and preservation; and growing faculty demands for informatics support services. An additional dimension of these needs involves information and technology intensive collaborations among groups at multiple campuses (sometimes characterized as collaboratories or virtual organizations) and virtual research environments that enable such collaborations. Complementing the organizationally oriented work on e-research already described, CNI is also concerned with the institutional and cross-institutional development of technical infrastructure, with a particular focus on large-scale storage and data management (discussed in more detail earlier), and

on collaboration tools and environments. Of particular concern is the persistently difficult integration of investment in national level research infrastructure and campus-level investments and approaches. We continue to participate in efforts such as the ECAR working group on campus cyberinfrastructure and relevant work within the Common Solutions Group. These issues are also central to strategies for research data management stewardship discussed earlier.

## Security, Privacy, Identity and Access Management

CNI takes a broad view of security, integrity, privacy and access management issues as they relate to the management of licensed resources and the stewardship and preservation of digital content. New technological capabilities (notably the ability for users to amass and maintain massive personal digital libraries which include large amounts of copyrighted material drawn from licensed databases or large collections of digital books on proprietary reading platforms) continue to raise complex questions with both technological and policy dimensions. CNI believes that we must continue to explore new behaviors and practices such as the building of workgroup or personal collections combining public and private materials, or large-scale text or data mining that spans published literature and databases and unreleased research results, or the emerging commerce in information about reader behaviors in various contexts.

We conducted an executive roundtable at the spring 2015 meeting that broadly explored privacy in an age of analytics. A specific area on which we continue to focus is so-called “reading analytics,” including their interactions with learning analytics in e-textbooks. An article exploring aspects of such analytics is also scheduled to appear this program year.

Authentication and authorization are now established as essential infrastructure components for network-based services and have become a particularly critical need as institutions increasingly rely on site license agreements with information providers, implement online and distance education initiatives, and form consortia for resource sharing or educational initiatives. They are an essential underpinning for data sharing and data reuse. The Coalition has been supporting partners such as Internet2, EDUCAUSE, and InCommon in pursuing a program to define technology approaches, standards, best practices, and policy and business issues for such inter-organizational authentication and authorization infrastructures. Our March 2015 workshop on privacy highlighted the need for further work in extending these technologies so that they are easily used in systems deployed by researchers as well as institutional systems. In August 2016 we released the results of a member survey we conducted on privacy practices surrounding both technical and contractual practices related to licensed external content resources; as a follow-on to this report we will be looking further at the interactions among attribute based authorization and attribute policies, privacy, and usage data that can be gathered to help in resource allocation decisions.

## The Coming Convergence Of Identity Management, Biography, Bibliography and Social Discovery

We will continue the exploration of the potential future convergence, or at least linkage, between identities as established by campus-based identity management systems on one hand, and personal names as used in the context of scholarly communication, citation, and bibliographic control name authority on the other. Historically, these worlds have been almost completely separate and highly insular, but the emergence of sophisticated author rights retention strategies, institutional and disciplinary repositories, advanced bibliometrics and webmetrics, faculty activity tracking and research management systems, and directories and social discovery systems in academic settings, are clearly bringing them into closer alignment. Connections to public history, genealogy, and prosopography or large-scale biography are also fast emerging, essentially recognizing potential continuity between forward-looking infrastructure and historical documentation. We are also seeing bridges being established between resources of a primarily academic nature and tools used by the broad public (including Wikipedia). A very important development that CNI is helping to advance is the work towards a National (and ultimately international) Archival Authorities Infrastructure.

Numerous systems, databases, and initiatives that are relevant to parts of this program, such as the Open Researcher and Contributor ID (ORCID), the International Standard Name Identifier (ISNI), the Virtual International Authority File (VIAF), VIVO, and new developments within Web of Science, Microsoft Academic Search, Google Scholar, and other platforms, are making this an extraordinarily dynamic and exciting area.

# Selected Recent Publications by CNI Staff

## Reports

*Funders, Compliance, and Access to Research Results*. Report of a CNI Executive Roundtable held Dec. 13-14, 2015 (Sept. 2016).

*Privacy in the Age of Analytics*. Report of a CNI Executive Roundtable held April 13, 2015 (Aug. 2016).

*Institutional Strategies for Open Educational Resources (OERs)*. Report of a CNI Executive Roundtable held April 3 & 4, 2016 (Aug. 2016).

*Report on the CNI Authentication and Authorization Survey 2016*. (Aug. 2016).

*Planning a Digital Scholarship Center 2016*. Report of the CNI-ARL workshop held May 17-18, 2016 (Aug. 2016).

*Supporting Digital Humanities*. Report of a CNI Executive Roundtable held Dec. 7 & 8 (May 2016).

## Interviews

Richard Poynder, "Q&A with CNI's Clifford Lynch: Time to Rethink the Institutional Repository?" *Open and Shut?* Sept. 22, 2016.

Alison J. Head. "Joan Lippincott: Libraries as the Intellectual Crossroads of a Campus." *Smart Talks* (Project Information Literacy). Oct. 5, 2016.

## Articles

Clifford A. Lynch. "The Rise of Reading Analytics and the Emerging Calculus of Reader Privacy in the Digital World" (forthcoming).

Sarah K. Lippincott and Joan K. Lippincott. "Faculty Research and Scholarly Communication." *Academic Librarianship Today*, edited by Todd Gilman. Rowman & Littlefield Publishing Group (forthcoming, Jan. 2017).

Joan K. Lippincott. "Libraries and the Digital University." *College & Research Libraries* 76, no. 3 (March 2015): 283-295.

Keith Kintigh, et al. "Cultural Dynamics, Deep Time, and Data: Planning Cyberinfrastructure Investments for Archaeology." *Advances in Archaeological Practice* 3, no. 1 (Feb. 2015): 1-15.

Joan K. Lippincott. "The Future for Teaching and Learning." *American Libraries* (online), Feb. 26, 2015.

## CNI Staff Contributed to these Selected Recent Reports:

*International Advances in Digital Scholarship*. Conference report, Jisc/CNI meeting 2016 (forthcoming).

"DH Capacity Building Framework: A Joint ECAR/CNI Working Group Paper." *Research Bulletin*. Louisville, CO: ECAR (forthcoming).

Clifford A. Lynch et al. "Curation." *Big Data in the Campus Landscape* (series). EDUCAUSE Center for Analysis and Research Campus Cyberinfrastructure (ECAR-CCI) Working Group (Nov. 2015).

*Scholarly Communication: The Journey Towards Openness*. Conference report, Jisc/CNI meeting 2014: Opening Up Scholarly Communications. July 10-11, 2014, Bristol, UK (October 2015).

L. Johnson, S. Adams Becker, et al. *NMC Horizon Report: 2015 Library Edition*. Austin, Texas: The New Media Consortium (2015).

L. Johnson, S. Adams Becker, et al. *NMC Horizon Report: 2015 Higher Education Edition*. Austin, Texas: The New Media Consortium (2015).

William Barnett, Curtis W. Hillegas et al. "Security and Privacy." *Big Data in the Campus Landscape* (series). EDUCAUSE Center for Analysis and Research Campus Cyberinfrastructure (ECAR-CCI) Working Group (July 2, 2015).

CNI reports, most articles, and selected presentations, interviews, and third party reports are linked to from [www.cni.org/publications](http://www.cni.org/publications).

# Membership List

(As of November 2016)

Alfred P. Sloan Foundation  
American Library Association  
American Theological Library Association  
American University\*  
Andrew W. Mellon Foundation  
Appalachian State University  
Arizona State University\*  
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\* Denotes charter members

## IMAGE CREDITS

Front (left to right; top to bottom):

### *Ice Volcanoes and Topography*

Scientists using New Horizons images of Pluto's surface to make 3-D topographic maps have discovered that two of Pluto's mountains, informally named Wright Mons and Piccard Mons, could possibly be ice volcanoes. The color is shown to depict changes in elevation, with blue indicating lower terrain and brown showing higher elevation; green terrains are at intermediate heights.

Courtesy: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

### *Rat Hippocampus With Injected Virus*

This image shows a rat hippocampus, a region of the brain critical for learning, memory and emotion. The green cells show where researchers used an injected virus to block production of a protein called fibroblast growth factor 9 in rat brains and reduce anxiety-like behavior.

Credit: Elyse L. Aurbach, Molecular and Behavioral Neuroscience Institute, University of Michigan

Courtesy: National Science Foundation

### *Supercomputer Simulation of Magnetic Field Loops on the Sun*

Magnetic fields emerging from below the surface of the sun influence the solar wind—a stream of particles that blows continuously from the sun's atmosphere through the solar system. Researchers at NASA and its university partners are using high-fidelity computer simulations to learn how these magnetic fields emerge, heat the sun's outer atmosphere and produce sunspots and flares.

Image Credit: Robert Stein, Michigan State University; Timothy Sandstrom, NASA/Ames

Courtesy: NASA

### *Applique (about 510 B.C.)*

Artist: Unknown (Etruscan)

The J. Paul Getty Museum, <http://www.getty.edu/museum/>

Object Number: 83.AM.4

Courtesy: Getty's Open Content Program

### *Hydrodynamic and DNA-linked Crystals*

By attaching short sequences of single-stranded DNA to nanoscale building blocks, researchers can design structures that can effectively build themselves. A Pennsylvania State University research team has shown that fluid dynamics plays a critical role for crystals that self-assemble without the pattern defects seen here.

Credit: Ian Jenkins, University of Pennsylvania

Courtesy: National Science Foundation

Back (left to right):

### *Engraved Gem (30-20 B.C.)*

Artist: Attributed to Solon (Roman, Modern)

The J. Paul Getty Museum, <http://www.getty.edu/museum/>

Object Number: 96.AN.290

Courtesy: Getty's Open Content Program

### *A Caladrius Bird (Late 13th century, after 1277)*

Artist: Unknown

Franco-Flemish manuscript; tempera colors, pen and ink, gold leaf, and gold paint on parchment.

The J. Paul Getty Museum, <http://www.getty.edu/museum/>

Object Number: Ms. Ludwig XV 4, fol. 74

Courtesy: Getty's Open Content Program

Descriptions are from image sources unless otherwise noted.

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