



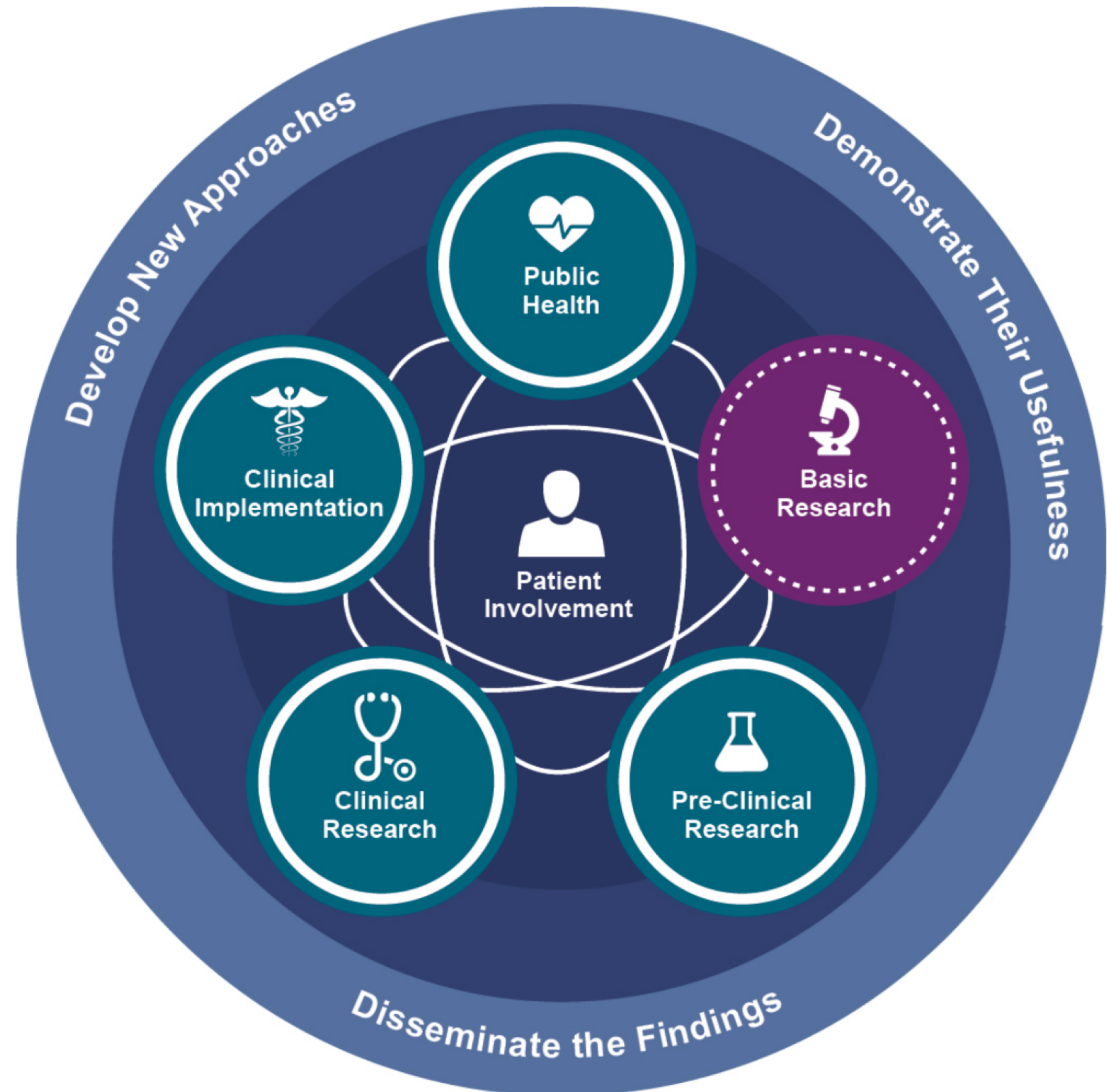
Team Scientists: how do we enable everyone to get credit for their work?

ORCID Person Citation WG

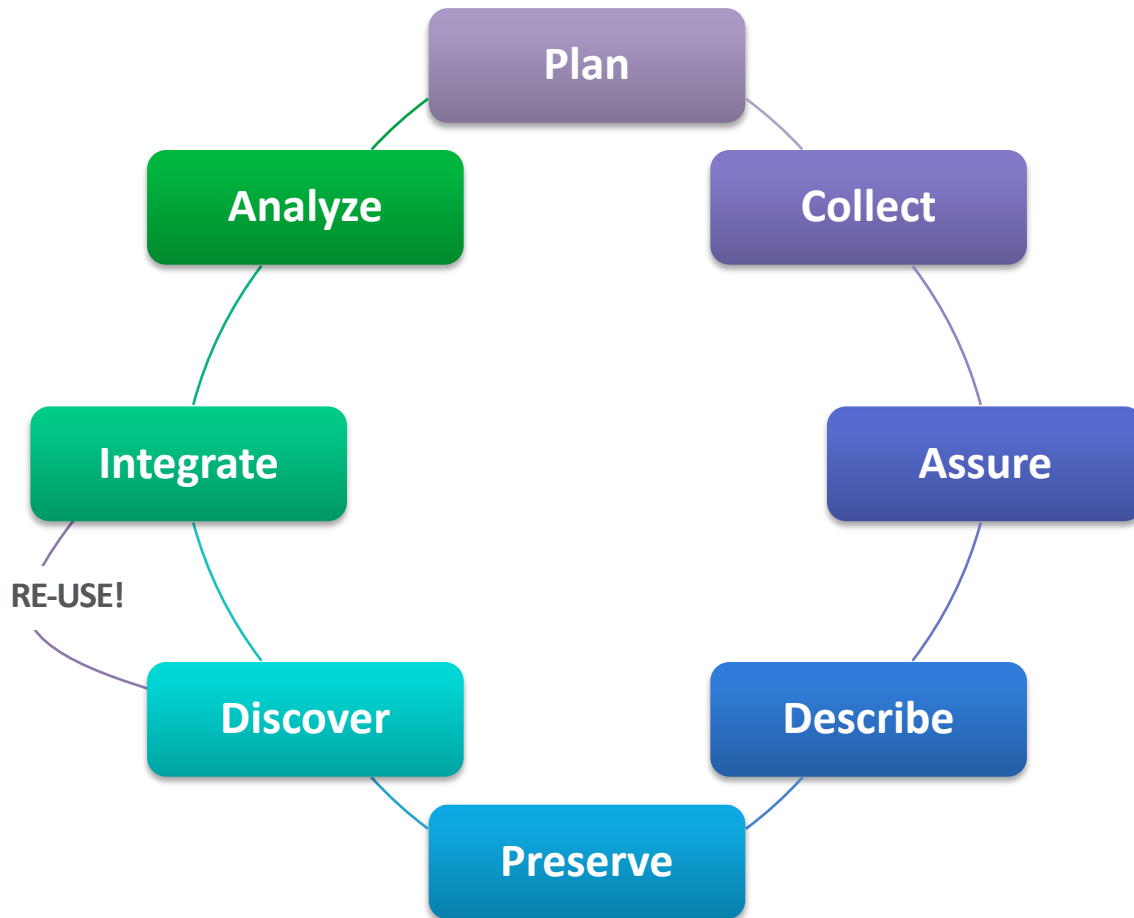
Kristi Holmes, Northwestern
kristi.holmes@northwestern.edu
[@kristiholmes](https://twitter.com/kristiholmes)
April 17, 2019

Biomedical research evolves: Accelerating discovery & implementation

- TEAM SCIENCE
- WORKFORCE DEVELOPMENT
- IDEATION & INNOVATION
- COMMUNICATION
- ASSESSMENT & IMPROVEMENT
- MATURATION OF THE ENVIRONMENT



Biomedical research evolves and opens

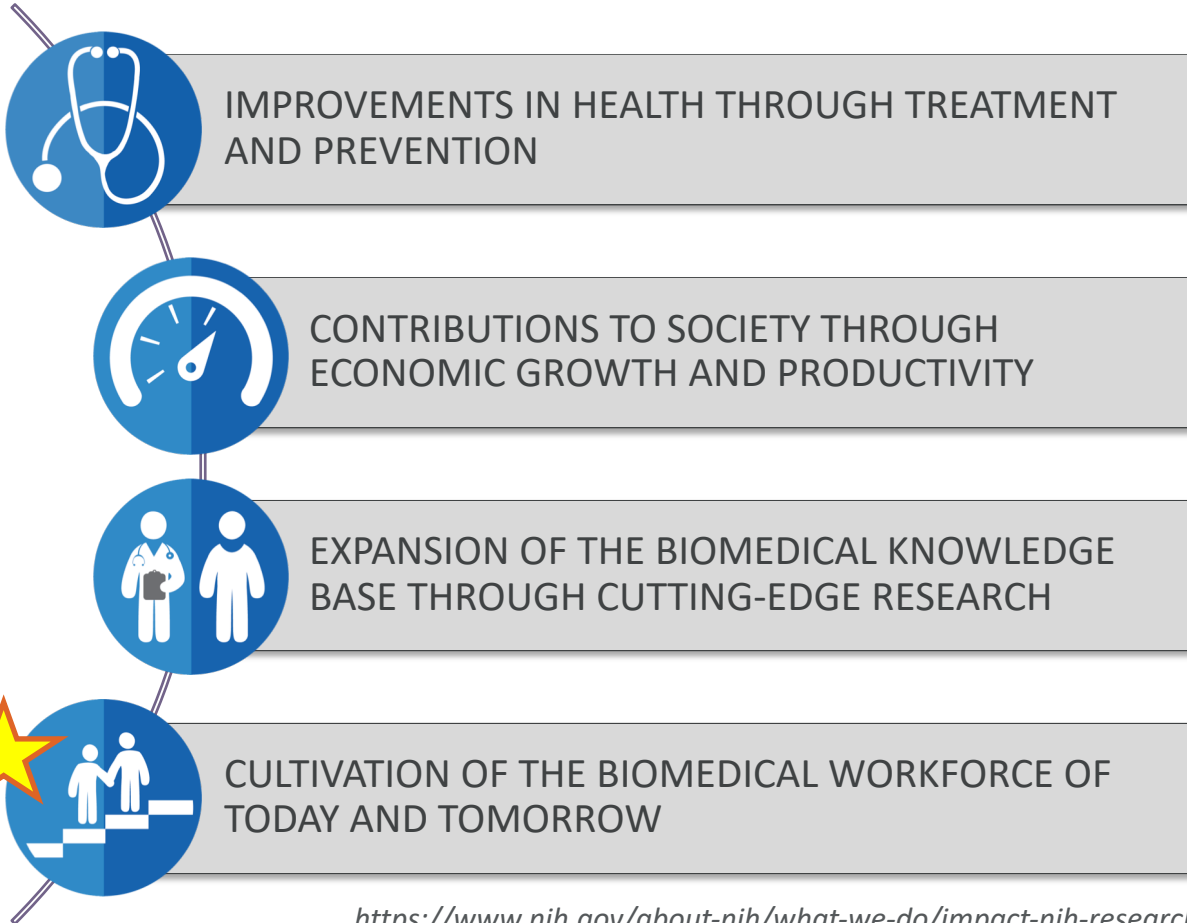


OPEN SCIENCE YIELDS:

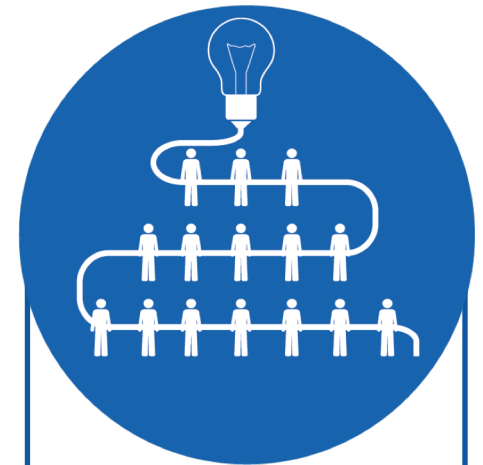
- **SPEED:** The research process becomes faster
- **EFFICIENCY:** Data collection can be funded once, and used many times for a variety of purposes
- **ACCESSIBILITY:** Anyone can access and build upon research resources with minimal barriers to access
- **IMPACT & LONGEVITY:** Open publications and data are more discoverable and receive more citations long-term
- **TRANSPARENCY & QUALITY:** The evidence that underpins research can be made open for anyone to scrutinize and replicate findings, leading to a more robust scholarly record

What is impact?

More than papers and grants – we are driving toward improved health and wellbeing



<https://www.nih.gov/about-nih/what-we-do/impact-nih-research>



For effective translation of knowledge and discoveries into the improved health of our communities, it is essential to incorporate evaluation strategies that enable investigators and teams to measure, monitor, and communicate the impact of their work

Biomedical research evolves

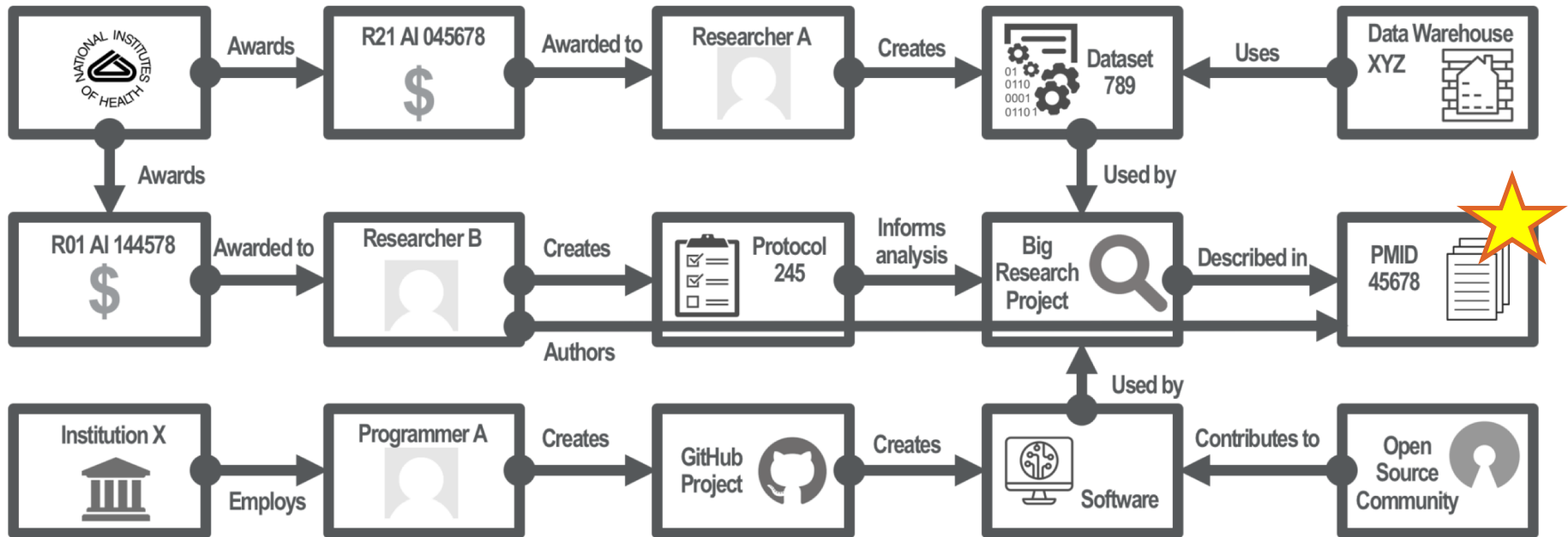
Consider the entire research workforce and all that they do



Diverse outputs
Diverse impacts
Diverse roles

Each a critical component of the
research process

- New experimental methods, data models, databases, or software tools
- New diagnostic criteria
- New standards of care
- Biological materials or animal models
- Consent documents
- Clinical/practice guidelines
- Quality measure guidelines
- Maps and visualizations
- Measurement instruments
- Continuing education materials
- Quality measure guidelines
- Cost-effective intervention
- Consensus development conferences
- American Medical Association Current Procedural Terminology (CPT) codes
- Change in delivery of healthcare services
- Gray literature



Adapted from original by @figgyjam

Institutional perspectives & new models

Faculty Affairs Office

Search Faculty Affairs Office 

About Us ▾ For Faculty ▾ For Administrators ▾ For Clinical Affiliates ▾ Career Development ▾ Wellness Resources ▾

Feinberg Home > Home > For Administrators > Team Scientists

For Administrators

Annual Processes

Clinician-Educators

Investigators

Team Scientists

Research Faculty

Undifferentiated Track

Adjunct Faculty

Contributed Services Faculty

Coterminous Faculty

Health System Clinicians

Team Scientists

The Team Scientist track is for non-clinical faculty who make substantial contributions to the research and/or educational missions of the medical school. Faculty members whose primary activity is in research will typically engage in team science. Their skills, expertise and/or effort play a vital role in obtaining, sustaining and implementing programmatic research.

Faculty on this track often have expertise in epidemiology, clinical trials, biostatistics, biomedical informatics, outcomes research or other qualitative and quantitative research methodologies and generally contribute to clinical studies, patient-oriented clinical outcomes research, community-engaged research, population-based studies and/or basic science research. Typically, such faculty provide critical expertise to a program or group of research teams as a co-investigator with contributions that do not necessarily require or result in independent grant funding, but some faculty on this track may serve as principal investigator on related research. Faculty on this track do not perform clinical work but do contribute to the education and service missions of the medical school.

While most members of this track make research the major focus of their activity, for some members of this track education may be the major focus of their activity. Faculty focusing on education are typically recognized as outstanding educators and contribute to course development, degree program leadership and other innovative educational products.

For more information, view the  [Information Guide for Appointments, Promotion and Tenure \(PDF\)](#).

Team Scientist Ranks

➤ **Team Scientist Track (variable amounts of effort distributed between research and education depending upon domain of activity)**

This track is for non-clinical faculty who make substantial contributions to the research and/or educational missions of the medical school. Faculty members whose primary activity is in research will typically engage in team science. Their skills, expertise and/or effort play a vital role in obtaining, sustaining and implementing programmatic research. Faculty on this track often have expertise in epidemiology, clinical trials, biostatistics, biomedical informatics, outcomes research or other qualitative and quantitative research methodologies and generally contribute to clinical studies, patient-oriented clinical outcomes research, community-engaged research, population-based studies and/or basic science research. Typically such faculty provide critical expertise to a program or group of research teams as a co-investigator with contributions that do not necessarily require or result in independent grant funding, but some faculty on this track may serve as principal investigator on related research.

Faculty on this track do not perform clinical work but do contribute to the education and service missions of the medical school. While most members of this track make research the major focus of their activity, for some members of this track education may be the major focus of their activity. Faculty focusing on education are typically recognized as outstanding educators and contribute to course development, degree program leadership, and other innovative educational products. Faculty rank in this track will be titled Assistant Professor, Associate Professor, or Professor. This is a non-tenure-eligible regular faculty track.

Prepare your packet (clusters of work):

<https://www.feinberg.northwestern.edu/fao/for-faculty/promo-tenure/prepare-your-packet.html>

Institutional perspectives & new models

Northwestern's Team Scientist Faculty Track

- 2015: a new “Team Scientist” track was established within our regular faculty lines to better value such scientists’ contributions.
- Collaborative effort between NUCATS (Lloyd-Jones), Vice Dean for Faculty Affairs at Feinberg (Lowe), and relevant stakeholders.
- Enthusiasm on campus by collaborative scientists, successful promotion pathway
- Collaborative scientists who span content disciplines at NU now have several distinct pathways for promotion with clear metrics through our tenure-eligible, non-tenure-eligible, and research faculty lines.

Team Scientist Faculty Track Survey Results	
	SATISFIED
Overall satisfaction with current position	74%
Opportunity to collaborate with other faculty	90%
Sense of contributing to important research	83%
Contributions are acknowledged via co-authorships	80%
Promotion process is clear and transparent	68%
Fall, 2017 survey response rate: 81%	
Herzog, Holmes, Lloyd-Jones	

It takes technology + culture.

COMMENT

Writing

Study conception

Credit where credit is due

Liz Allen, Amy Brand, Jo Scott, Micah Altman and Marjorie Hlava are trialling digital taxonomies to help researchers to identify their contributions to collaborative projects.

Investigation

Formal analysis

Through the endorsement of individuals'

journal articles could be classified using a 14-role taxonomy (see "Who did what?").

Game changer: Perhaps one of the biggest shifts in "culture" was the development, release, and implementation of the CRediT taxonomy, making it easier to give people credit for 14 specific contributions in a published work.

CRT

CRediT

CRediT is high-level taxonomy, including 14 roles, that can be used to represent the roles typically played by contributors to scientific scholarly output. The roles describe each contributor's specific contribution to the scholarly output.

<https://casrai.org/credit/>

OpenVIVO

Implementation of a community-driven concept of credit, based on input from community workshops

The screenshot shows the OpenVIVO user profile for Sören Auer. The profile includes a header with the OpenVIVO logo and a search bar. Below the header is a navigation menu with links for Home, People, Organizations, Research, Events, and Capability Map. The main content area features a profile picture of Sören Auer, his name, and a 'Person' label. To the right, there is a 'Publications in VIVO' section with a line graph showing 20 publications in the last 10 full years. Below the profile picture, there are sections for 'Positions', 'Contact Info', 'Research Areas', and 'Websites'. The 'Positions' section lists his roles at the University of Bonn and Fraunhofer Society. 'Contact Info' includes email addresses and a QR code. 'Research Areas' lists various FAST categories like Automation, Database management, and Information technology. 'Websites' includes links to his professional homepage and workgroup page. At the bottom, there are tabs for 'Publications', 'Contact', 'Identity', and 'View All'. The 'Publications' tab is active, showing a list of selected publications, including an academic article 'Linked Data in Business' and a book 'Linked Enterprise Data'.

1. Provide a VIVO experience for everyone, a demonstration of VIVO, a platform for experimentation, and an ownership experience for the VIVO team
2. Use persistent identifiers for all entities – people (ORCID), works (DOI and PMID), organizations (GRID), journals (ISSN), concepts (FAST)
3. Automatic, real-time ingest of metadata from identifiers via public APIs
4. Publication of data
5. Consumption and reuse of data
6. Attribution of works by scholars to indicate roles in works

Around the same time we were hosting workshops to ask attendees – what do you want credit for?



< Articles

THIS ARTICLE IS PART OF THE RESEARCH TOPIC
Evaluating Research: Acquiring, Integrating, and Analyzing Heterogeneous Data

TECHNOLOGY REPORT ARTICLE

Front. Res. Metr. Anal., 01 March 2018 | <https://doi.org/10.3389/frma.2017.00012>



OpenVIVO: Transparency in Scholarship

Violeta Ilik^{1*}, Michael Conlon², Graham Triggs³, Marijane White⁴, Muhammad Javed⁵, Matthew Brush⁴, Karen Gutzman⁶, Shahim Essaid⁴, Paul Friedman⁶, Simon Porter⁷, Martin Szomszor⁷, Melissa Anne Haendel⁴, David Eichmann⁸ and Kristi L. Holmes⁶

¹Stony Brook University, Stony Brook, NY, United States

²University of Florida, Gainesville, FL, United States

Front. Res. Metr. Anal. **2**, (01 March 2018)
doi:10.3389/frma.2017.00012

Driven by community input

OpenVIVO is a free and open-hosted semantic web platform that anyone can join and that gathers and shares open data about scholarship in the world. OpenVIVO, based on the VIVO open-source platform, provides transparent access to data about the scholarly work of its participants. OpenVIVO demonstrates the use of persistent identifiers, the automatic real-time ingest of scholarly ecosystem metadata, the use of VIVO-ISF and related ontologies, the attribution of work, and the publication and reuse of data—all critical components of presenting, preserving, and tracking scholarship. The system was created by a cross-institutional team over the course of 3 months. The team created and used RDF models for research organizations in the world based on Digital Science GRID data, for academic journals based on data from CrossRef and the US National Library of Medicine, and created a new model for attribution of scholarly work. All models, data, and software are available in open repositories.

Transparency in Scholarship

Scholarship requires knowledge of previous work. The growth of scholarship worldwide and the proliferation of scholarly output types—from papers and monographs to preprints, conference papers, datasets, posters, and presentation slides—have fundamentally changed the scholarly ecosystem from an environment dependent on libraries to one that is dependent on the electronic resources made available by libraries to support discovery and knowledge transfer. This shift clearly drives a need for the representation of scholarly works using standard metadata formats to facilitate indexing and discovery.

For scholars to have knowledge of previous work, the work must be indexed and discoverable via electronic systems. Metadata regarding the

Download Article Export citation

2,258
TOTAL VIEWS

Am score 27

View Article Impact

SHARE ON

f 0, 0, 0, 0, New

PEOPLE ALSO LOOKED AT

Eugene Garfield's Influences upon the Future of Evaluative Informetrics
Henk F. Moed

Openness and Impact of Leading Scientific Countries
Caroline S. Wagner, Travis Whetsell, Jeroen Baas and Koen Jonkers

Active Role of the Necrotic Zone in Desensitization of Hypoxic Macrophages and Regulation of CSC-Fate: A hypothesis
Maryam Mehrabi, Fatemeh Amini and Shima Mehrabi

Predictive Effects of Novelty Measured by Temporal Embeddings on the Growth of Scientific Literature
Jiangen He and Chaomei Chen

Interdependent Followers Prefer Avoidant Leaders: Followers' Cultural Orientation Moderates Leaders' Avoidance Relationships

OpenVIVO

Implementation of a community-driven concept of credit, based on input from community workshops

The screenshot displays the OpenVIVO website interface. At the top, there is a search bar and navigation links for 'Index' and 'Log in'. Below the header, a menu includes 'Home', 'People', 'Organizations', 'Research', 'Events', and 'Capability Map'. The main content area shows a profile for a contributor, categorized by roles:

- contributor to**
 - background and literature search role
 - [Dealing with Data: A Case Study on Information and Data Management Literacy.](#) *PLoS Biology*. e1001339. 2012
 - [Lost and Found in Behavioral Informatics.](#) *International Review of Neurobiology*. 1–18. 2012
 - [Preface.](#) *International Review of Neurobiology*. xi–xii. 2012
 - [Uberon, an integrative multi-species anatomy ontology.](#) *Genome Biology / Adv Genome Biol*. R5. 2012
 - [Integrating phenotype ontologies across multiple species.](#) *Genome Biology / Adv Genome Biol*. R2. 2010
 - [... more](#)
 - conceptualization role
 - [Dealing with Data: A Case Study on Information and Data Management Literacy.](#) *PLoS Biology*. e1001339. 2012
 - [Lost and Found in Behavioral Informatics.](#) *International Review of Neurobiology*. 1–18. 2012
 - [Preface.](#) *International Review of Neurobiology*. xi–xii. 2012
 - [Research resources: curating the new eagle-i discovery system.](#) *Database*. bar067–bar067. 2012
 - [eagle-i: An Ontology-Driven Framework For Biomedical Resource Curation And Discovery.](#) *Nature Precedings*. 2010
 - [... more](#)
 - data aggregation role
 - [Linking Human Diseases to Animal Models Using Ontology-Based Phenotype Annotation.](#) *PLoS Biology*. e1000247. 2009
 - data analysis role
 - [Research resources: curating the new eagle-i discovery system.](#) *Database*. bar067–bar067. 2012
 - [Linking Human Diseases to Animal Models Using Ontology-Based Phenotype Annotation.](#) *PLoS Biology*. e1000247. 2009

1. Provide a VIVO experience for everyone, a demonstration of VIVO, a platform for experimentation, and an ownership experience for the VIVO team
2. Use persistent identifiers for all entities – people (ORCID), works (DOI and PMID), organizations (GRID), journals (ISSN), concepts (FAST)
3. Automatic, real-time ingest of metadata from identifiers via public APIs
4. Publication of data
5. Consumption and reuse of data
6. Attribution of works by scholars to indicate roles in works

Next step: map community workshop input on top of a sturdy foundation of CREDIT

COMMENT

Writing

Study conception

Credit where credit is due

Liz Allen, Amy Brand, Jo Scott, Micah Altman and Marjorie Hlava are trialling digital taxonomies to help researchers to identify their contributions to collaborative projects.

Investigation

Formal analysis

Through the endorsement of individuals'

journal articles could be classified using a 14-role taxonomy (see "Who did what?").

Game changer: Perhaps one of the biggest shifts in "culture" was the development, release, and implementation of the CRedit taxonomy, making it easier to give people credit for their specific contribution in a published work.

CRedit

CRedit ontology in OWL:

<https://github.com/data2health/credit-ontology>

CRT

CRedit is high-level taxonomy, including 14 roles, that can be used to represent the roles typically played by contributors to scientific scholarly output. The roles describe each contributor's specific contribution to the scholarly output.

<https://casrai.org/credit/>

Contribution Role Ontology

The Contribution Role Ontology (CRO) contains classes representing scholarly contributions. The CRO imports classes from the CRediT ontology¹ (computational version of the CRediT taxonomy²), in **bold**.

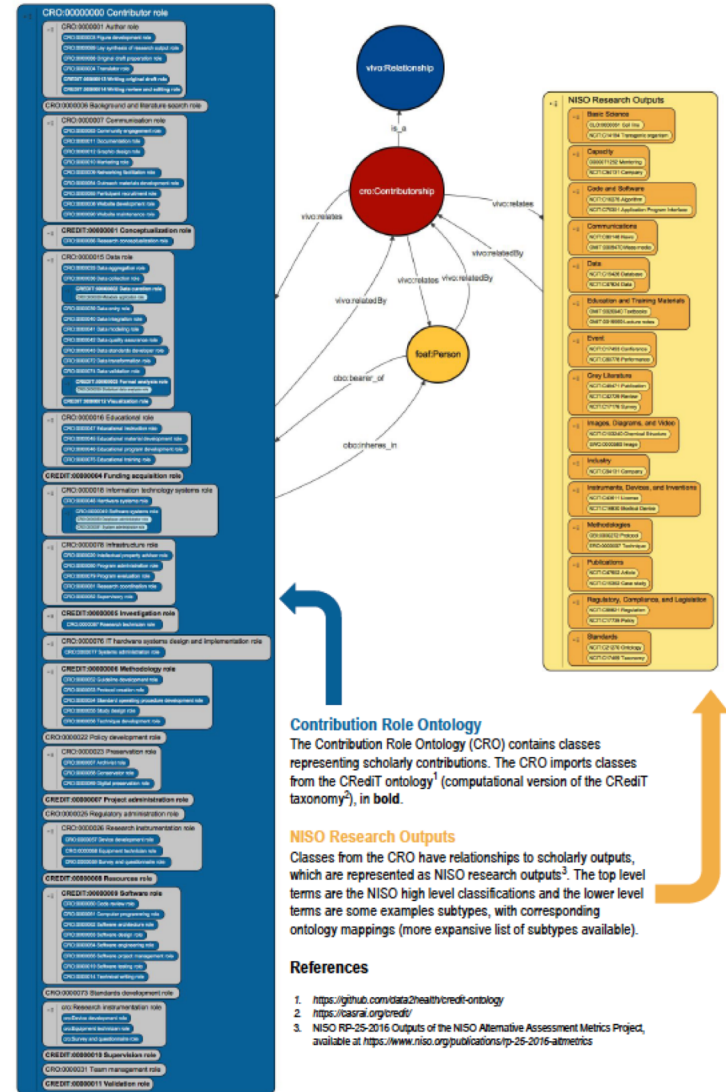
NISO Research Outputs

Classes from the CRO have relationships to scholarly outputs, which are represented as NISO research outputs³. The top level terms are the NISO high level classifications and the lower level terms are some examples subtypes, with corresponding ontology mappings (more expansive list of subtypes available).

References

1. <https://github.com/data2health/credit-ontology>
2. <https://casrai.org/credit/>
3. NISO RP-25-2016 Outputs of the NISO Alternative Assessment Metrics Project, available at <https://www.niso.org/publications/rp-25-2016-altmetrics>

Details at <http://bit.ly/PID19attribution>



CRO:0000015 Data role

- CRO:0000033 Data aggregation role
- CRO:0000036 Data collection role
- CREDIT:00000002 Data curation role**
 - CRO:0000038 Metadata application role
- CRO:0000039 Data entry role
- CRO:0000040 Data integration role
- CRO:0000041 Data modeling role
- CRO:0000042 Data quality assurance role
- CRO:0000043 Data standards developer role
- CRO:0000072 Data transformation role
- CRO:0000074 Data validation role
- CREDIT:00000003 Formal analysis role**
 - CRO:0000035 Statistical data analysis role
- CREDIT:00000012 Visualization role**

CRO:0000000 Contributor role

- CRO:0000001 Author role
- CRO:0000002 Data aggregation role
- CRO:0000003 Data collection role
- CRO:0000004 Data curation role
- CRO:0000005 Data entry role
- CRO:0000006 Data integration role
- CRO:0000007 Data modeling role
- CRO:0000008 Data quality assurance role
- CRO:0000009 Data standards developer role
- CRO:0000010 Data transformation role
- CRO:0000011 Data validation role
- CRO:0000012 Data visualization role
- CRO:0000013 Data aggregation role
- CRO:0000014 Data collection role
- CRO:0000015 Data curation role
- CRO:0000016 Data entry role
- CRO:0000017 Data integration role
- CRO:0000018 Data modeling role
- CRO:0000019 Data quality assurance role
- CRO:0000020 Data standards developer role
- CRO:0000021 Data transformation role
- CRO:0000022 Data validation role
- CRO:0000023 Data visualization role
- CRO:0000024 Data aggregation role
- CRO:0000025 Data collection role
- CRO:0000026 Data curation role
- CRO:0000027 Data entry role
- CRO:0000028 Data integration role
- CRO:0000029 Data modeling role
- CRO:0000030 Data quality assurance role
- CRO:0000031 Data standards developer role
- CRO:0000032 Data transformation role
- CRO:0000033 Data validation role
- CRO:0000034 Data visualization role
- CRO:0000035 Data aggregation role
- CRO:0000036 Data collection role
- CRO:0000037 Data curation role
- CRO:0000038 Data entry role
- CRO:0000039 Data integration role
- CRO:0000040 Data modeling role
- CRO:0000041 Data quality assurance role
- CRO:0000042 Data standards developer role
- CRO:0000043 Data transformation role
- CRO:0000044 Data validation role
- CRO:0000045 Data visualization role
- CRO:0000046 Data aggregation role
- CRO:0000047 Data collection role
- CRO:0000048 Data curation role
- CRO:0000049 Data entry role
- CRO:0000050 Data integration role
- CRO:0000051 Data modeling role
- CRO:0000052 Data quality assurance role
- CRO:0000053 Data standards developer role
- CRO:0000054 Data transformation role
- CRO:0000055 Data validation role
- CRO:0000056 Data visualization role
- CRO:0000057 Data aggregation role
- CRO:0000058 Data collection role
- CRO:0000059 Data curation role
- CRO:0000060 Data entry role
- CRO:0000061 Data integration role
- CRO:0000062 Data modeling role
- CRO:0000063 Data quality assurance role
- CRO:0000064 Data standards developer role
- CRO:0000065 Data transformation role
- CRO:0000066 Data validation role
- CRO:0000067 Data visualization role
- CRO:0000068 Data aggregation role
- CRO:0000069 Data collection role
- CRO:0000070 Data curation role
- CRO:0000071 Data entry role
- CRO:0000072 Data integration role
- CRO:0000073 Data modeling role
- CRO:0000074 Data quality assurance role
- CRO:0000075 Data standards developer role
- CRO:0000076 Data transformation role
- CRO:0000077 Data validation role
- CRO:0000078 Data visualization role
- CRO:0000079 Data aggregation role
- CRO:0000080 Data collection role
- CRO:0000081 Data curation role
- CRO:0000082 Data entry role
- CRO:0000083 Data integration role
- CRO:0000084 Data modeling role
- CRO:0000085 Data quality assurance role
- CRO:0000086 Data standards developer role
- CRO:0000087 Data transformation role
- CRO:0000088 Data validation role
- CRO:0000089 Data visualization role
- CRO:0000090 Data aggregation role
- CRO:0000091 Data collection role
- CRO:0000092 Data curation role
- CRO:0000093 Data entry role
- CRO:0000094 Data integration role
- CRO:0000095 Data modeling role
- CRO:0000096 Data quality assurance role
- CRO:0000097 Data standards developer role
- CRO:0000098 Data transformation role
- CRO:0000099 Data validation role
- CRO:0000100 Data visualization role



NISO Research Outputs

- Basic Science**
 - CLO:0000031 Cell line
 - NCIT:C14184 Transgenic organism
- Capacity**
 - D000071252 Mentoring
 - NCIT:C54131 Company
- Code and Software**
 - NCIT:C16275 Algorithm
 - NCIT:C75301 Application Program Interface
- Communications**
 - NCIT:C80148 News
 - OMIT:0009470 Mass media
- Data**
 - NCIT:C15426 Database
 - NCIT:C47824 Data
- Education and Training Materials**
 - NCIT:C15426 Database
 - NCIT:C47824 Data
- Event**
 - NCIT:C15426 Database
 - NCIT:C47824 Data
- File**
 - NCIT:C15426 Database
 - NCIT:C47824 Data
- Image, Diagram, and Video**
 - NCIT:C15426 Database
 - NCIT:C47824 Data
- Industry**
 - NCIT:C15426 Database
 - NCIT:C47824 Data
- Instruments, Devices, and Inventories**
 - NCIT:C15426 Database
 - NCIT:C47824 Data
- Methodologies**
 - NCIT:C15426 Database
 - NCIT:C47824 Data
- Publications**
 - NCIT:C15426 Database
 - NCIT:C47824 Data
- Regulatory, Compliance, and Legislation**
 - NCIT:C15426 Database
 - NCIT:C47824 Data
- Standards**
 - NCIT:C15426 Database
 - NCIT:C47824 Data

Contribution Role Ontology

NISO Research Outputs

- Basic Science**
 - CLO:0000031 Cell line
 - NCIT:C14184 Transgenic organism
- Capacity**
 - D000071252 Mentoring
 - NCIT:C54131 Company
- Code and Software**
 - NCIT:C16275 Algorithm
 - NCIT:C75301 Application Program Interface
- Communications**
 - NCIT:C80148 News
 - OMIT:0009470 Mass media
- Data**
 - NCIT:C15426 Database
 - NCIT:C47824 Data
- Education and Training Materials**

Contribution Role Ontology (CRO) contains classes and relationships. The CRO imports classes and relationships from the NISO Research Outputs (NISO RO) computational version of the CREDIT

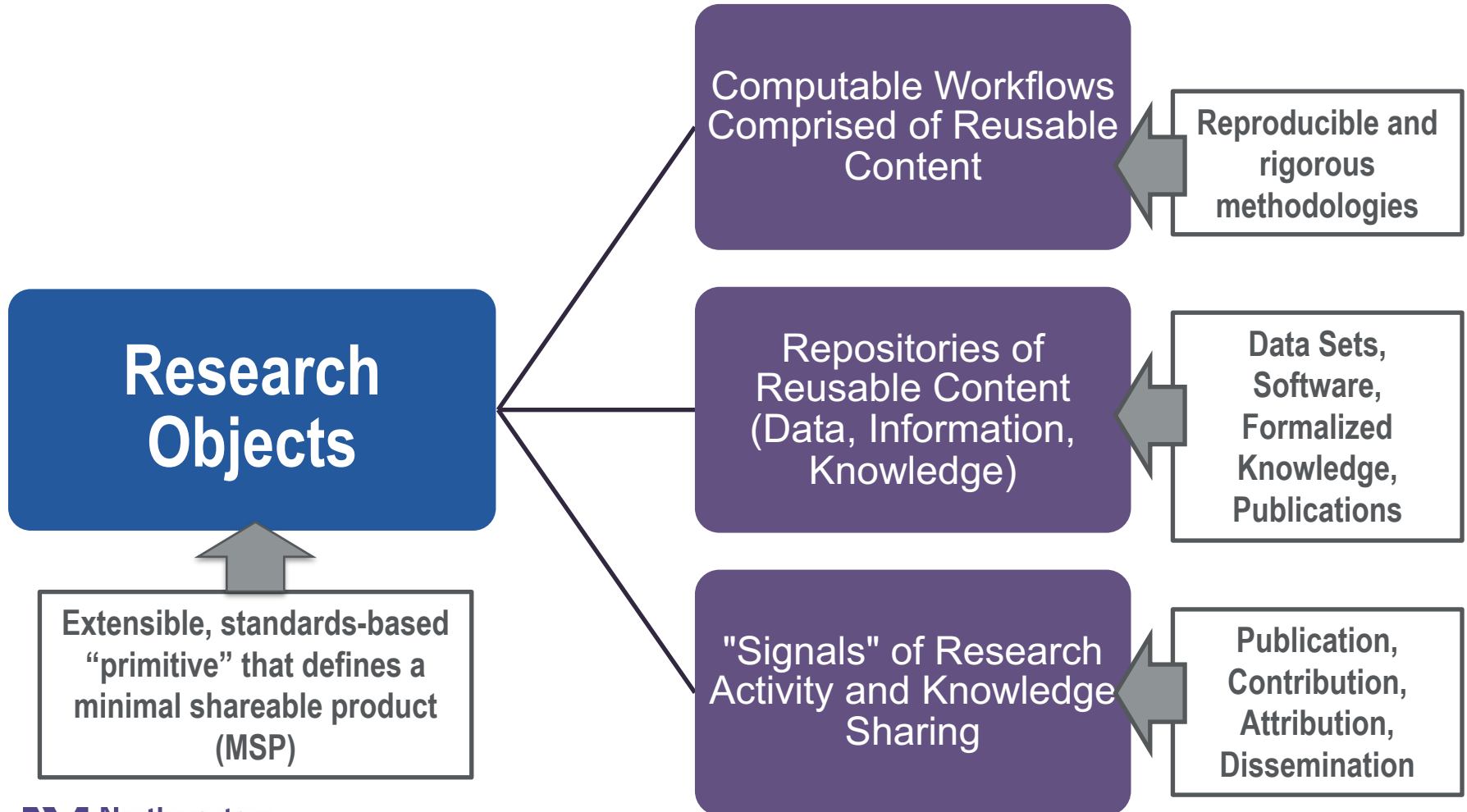
relationships to scholarly outputs, and NISO research outputs³. The top level classifications and the lower level subtypes, with corresponding descriptive list of subtypes available).

NISO Alternative Assessment Metrics Project, publications/tp-25-2016-atmetrics

Join us! Submit tickets! ☺
<https://github.com/data2health/contributor-role-ontology> or
https://github.com/data2health/architecting_attribution

Research Objects: A Common Unit of Sharing Across Use Cases

with @prpayne5



Architecting Attribution

https://github.com/data2health/architecting_attribution

(sign-up at the bottom of the page)

Products to be delivered:

- Contribution Role Ontology
- Digital research object taxonomy
- Annotation file format
- Attribution workflow for research information systems and other use cases
- Local guide to support attribution in CTS at the person-level
- Demonstrator for the individual

Milestones with Dates

April: enhanced contribution role ontology

May: finalize strategy for digital object types

May: finalize annotation file format

August: demonstrator for the individual

Fall: Credit, Attribution, and Incentives workshop

What will be delivered by fall:

- CRedIT Ontology, Contribution Role Ontology, digital research object taxonomy, translational research object taxonomy, & annotation file format
- Local guide to support attribution in CTS at the hub level
- Demonstrator for the individual to generate content for CVs, biosketches, etc.

Thank you!

Teams

- Northwestern University Clinical and Translational Sciences Institute
- Office of Faculty Affairs at Feinberg School of Medicine
- CD2H
 - NU team: Karen Gutzman, Sara Gonzales, Lisa O'Keefe*
 - OHSU team: Marijane White, Nicole Vasilevsky, Melissa Haendel*
- OpenVIVO collaborators, Force11 Attribution WG, NISO, Cathy Sarli & Becker Library
- Galter Library, NUCATS, ChicagoCHEC, FIRST DailyLife, Health for All

NIH Support

- U24TR002306 (NCATS)
- UL1TR001422 (NCATS)
- U54CA202995, U54CA202997, U54CA203000 (NCI)
- P30AR072579 (NIAMS)
- G08LM012688 (NLM)