

# Learning Objectives

- Recognize the benefits and requirements related to the management and sharing of research data
- Apply best practices for data planning and management
- Understand options for storing and preserving research data
- Identify repositories and determine best sharing option for data

# Why Data Management?

- ✓ Funding agency data management and sharing requirements
- ✓ Publisher data sharing policies
- ✓ NIH rigor and reproducibility



# Publisher requirements



*...**must specify that data are deposited publicly** and list the name(s) of repositories along with **digital object identifiers or accession numbers***”

nature.com

CellPress

Science

AAAS

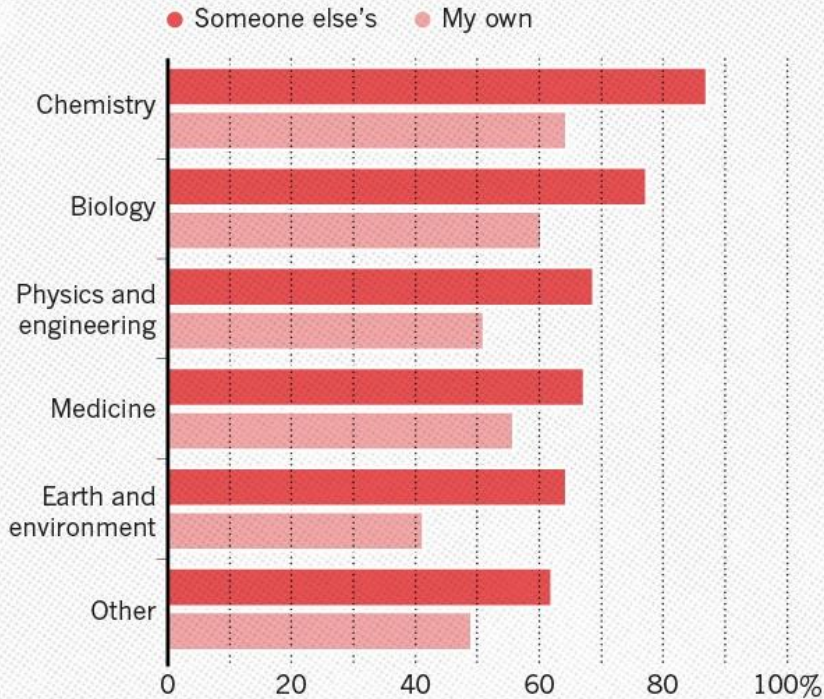
“All data necessary to **understand, assess, and extend** the conclusions of the manuscript must be available

# Why Data Management?

- Transparency
- Re-use and innovation
- Reproducibility and Replicability
- Open Science

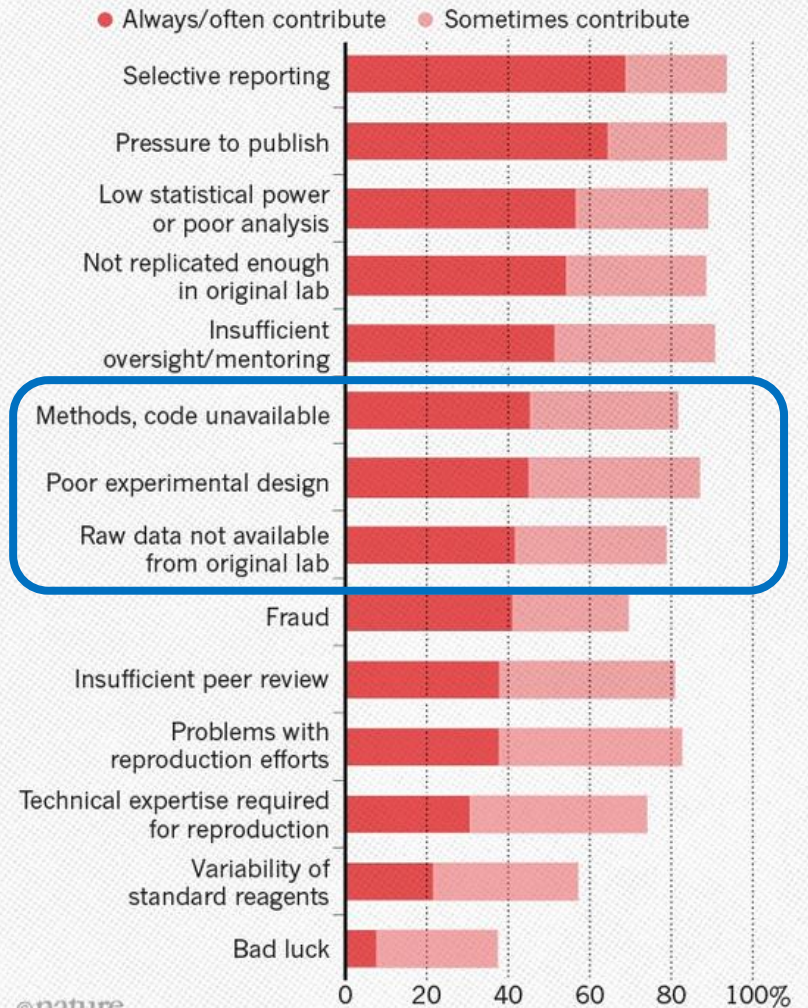
## HAVE YOU FAILED TO REPRODUCE AN EXPERIMENT?

Most scientists have experienced failure to reproduce results.



## WHAT FACTORS CONTRIBUTE TO IRREPRODUCIBLE RESEARCH?

Many top-rated factors relate to intense competition and time pressure.



<https://www.nature.com/news/1-500-scientists-lift-the-lid-on-reproducibility-1.19970>

# Why Data Management? – What's in it for me?

Have you ever. . . ?

- Conducted research with a team?
- Put data on a flash drive that got lost or broken?
- Collected data that you had trouble understanding later?

# Why Data Management?- What's in it for me?

- Organization
- Comprehensibility
- Efficiency
- Quality
- Access



# Don't end up here!

## Retraction Watch

**NEJM paper on sleep apnea retracted when original data can't be found**

with 4 comments

The authors of a paper in the *New England Journal of Medicine* are retracting it, after being unable to find data supporting a table that required corrections.



**Lost data!**

Multiple errors in table

Did not alter conclusions in article

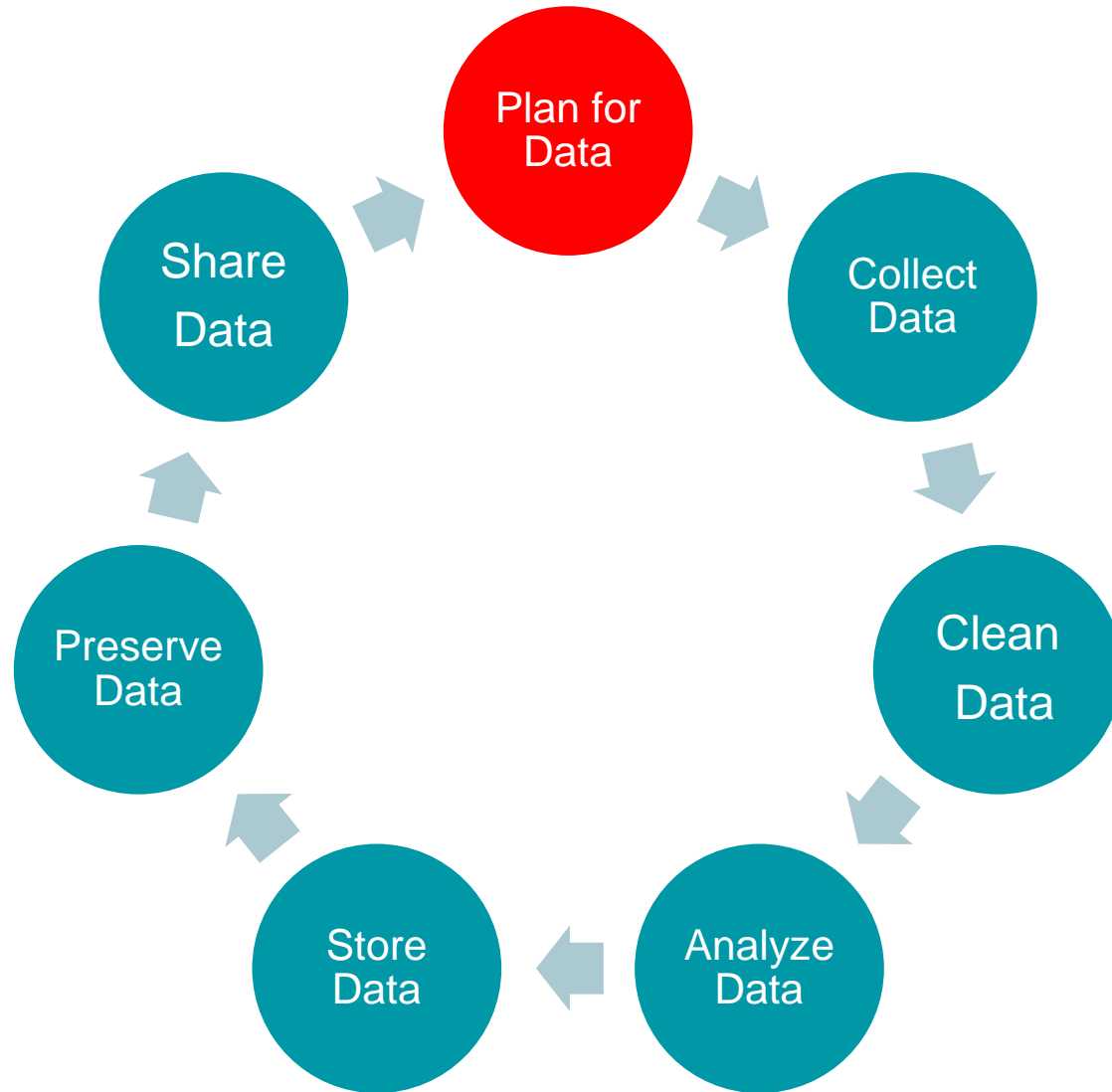
**BUT**, could not locate primary data

# Data management best practices



# Data Management Planning

# Data Lifecycle



# Planning!

Begin with a clear, well-thought out hypothesis. Your research question will guide your data collection plan.

What data will you need to collect?

What do you plan to do with the data? Why are you collecting it? What do you need to measure?

How will you collect the data? Who will enter the data?

Are there ethical considerations that will complicate data collection?



# Data Management Plans (DMPs)

## **A formal plan that:**

- describes the data your research will produce
- describes how your data will be handled during and after your project
- is being required by more and more funders
- is typically less than three pages

# Data Management Plans

<https://dmptool.org>



## Welcome to the DMPTool

Create data management plans that meet institutional and funder requirements.

[Get started](#)

### DMPTool by the Numbers



43,821  
Users



40,887  
Plans  
[More](#)



263  
Participating Institutions  
[More](#)

### Top Templates

Digital Curation Centre  
NIH-GEN: Generic  
NSF-SBE: Social, Behavioral, Economic Sciences  
NSF-CISE: Computer and Information Science and Engineering  
NSF-BIO: Biological Sciences  
[More](#)

[DMPTool News](#)

[DMP services unite!](#)

[Go to the blog](#)  
[RSS](#)

# Data Management Plans

<https://dmptool.org>

Learn [Sign in](#) [Language](#)



## Welcome to the DMPTool

Create data management plans that meet institutional and funder requirements.

### Sign in options

Option 1: If your institution is affiliated with DMPTool.

Your institution

- or -

Option 2: If your institution is not affiliated with DMPTool.

Email address

- or -

Option 3: If not affiliated and you need an account.

Create an account

### DMPTool by the Numbers

ol.org/#



### Top Templates

Digital Curation Centre  
Template USP - Baseado no DCC  
Template USP - Minimal

# Data Management Plans

<https://dmptool.org>

Project Details | Plan overview | Write Plan | Share | Download

expand all | collapse all 0/2 answered

**— Data sharing plan (0 / 1)**

**Investigators seeking \$500,000 or more in direct costs in any year should include a description of how final research data will be shared, or explain why data sharing is not possible.**

**B I** [List Icon] [List Icon] [Link Icon] [Table Icon]

|

Save

Guidance | Comments

NIH | DMPTool

expand all | collapse all

**Data format** —

- Clearly note what format(s) your data will be in, e.g., plain text (.txt), comma-separated values (.csv), geo-referenced TIFF (.tif, .tiff).
- Explain why you have chosen certain formats. Decisions may be based on staff expertise, a preference for open formats, the standards accepted by data centers, or widespread usage within a given community.
- Using standardized, interchangeable, or open formats ensures the long-term usability of data; these are recommended for sharing and archiving.
- See DataONE Best Practices for file formats.

**Metadata & documentation** +

# Data Management Workflows

Who is responsible for data management?

**Everyone!**

(but everyone means **no one**  
without assigning responsibility )

# Data Management Workflows

**Assign a person to be responsible for ensuring quality control:**

- ✓ File naming conventions adhered to
- ✓ Minimum documentation
- ✓ Version controls followed
- ✓ Data backed up



# Data Collection

# Your variables

	A	B	C	D	E
1	SID	wgt	smoking	name	sam
2	1	49	Y	Smith	13
3	2	252	2 packs	Sam Jones	37
4	3	28	N	Read, Kevin	A21
5	4	157	Never	Emma Banks	January
6					

# Variables – Best Practices

*Coding data will reduce inconsistency in data entry*

0 = no high school

1 = some high school

2 = graduated high school

3 = some college

4 = graduated college

*Code missing data! Participants might not remember exact dates or might not want to disclose information.*

8888 = participant cannot remember (date of appendectomy)

9999 = participant will not disclose (past drug use)

# Variables – Best Practices

## *Do not calculate variables*

USE THESE	NOT THIS
Systolic BP, Diastolic BP	Hypertension – yes/no
Height, weight	BMI
Temperature	Fever – yes/no

## *Avoid oversimplification*

Medication – yes/no; dose; duration of treatment

# Data Dictionaries

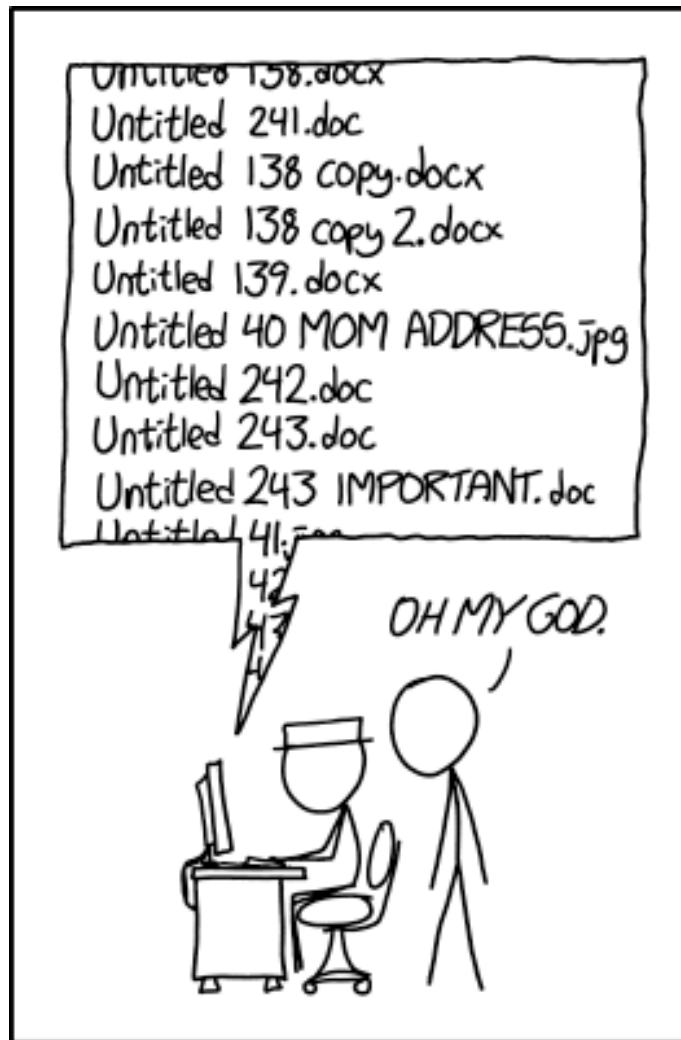
	A	B	C	D	E	F	G
1	Variable / Field Name	Form Name	Field Type	Field Label	Choices, Calculations, OR Slider Labels	Text Validation Min	Text Validation Max
2	record_id	demographics	text	Record ID			
3	mrn	demographics	text	MRN			
4	last_name	demographics	text	Last name			
5	first_name	demographics	text	First name			
6	age	demographics	text	Age	1, <55   2, between 55 and 75   3, >75	21	105
7	gender	demographics	radio	Gender	1, Male   2, Female		
8	race	demographics	radio	Race/Ethnicity	1, White   2, Black   3, Asian   4, Hispanic/Latino   5, Other		
9	describe_other	demographics	text	Describe			
10	education	demographics	radio	Highest Level of Education Completed	1, < highschool diploma   2, highschool diploma   3, associate degree   4, bachelors degree   5, masters degree   6, graduate school or advanced degree		
11	yes	demographics	radio	Working	1, Yes   2, No		
12	occupation	demographics	text	Occupation			
13	income	demographics	radio	Household Income	1, Household Income <30,000/year   2, Household income between 30-50,000/year   3, Household income 50-75,000/year   4, Household income 75-100,000/year   5, Household income 100-150,000/year   6, Household income 150-250,000/year   7, Household income >250,000/year		
14	htn	medical_history	radio	Hypertension	1, Yes   2, No   3, Unkown		
15	hld	medical_history	radio	Hyperlipidemia	1, Yes   2, No   3, Unkown		
16	dm	medical_history	radio	Diabetes	1, Yes   2, No   3, Unkown		
17	current_smoker	medical_history	radio	Current Smoker	1, Yes   2, No   3, Unkown		
18	former_smoker	medical_history	radio	Former Smoker	1, Yes   2, No   3, Unkown		
19	smoking_start_date	medical_history	text	Smoking start date			
20	smoking_quit_date	medical_history	text	Smoking Quit Date			
21	depression	medical_history	radio	Depression	1, Yes   2, No   3, Unknown		
22	anxiety	medical_history	radio	Anxiety	1, Yes   2, No   3, Unknown		
23	stress_cardiomyopathy	medical_history	radio	Stress Cardiomyopathy ( TakoTsubo)	1, Yes   2, No   3, Unknown		
24	prior_mi	medical_history	radio	Prior MI	1, Yes   2, No   3, Unknown		
25	prior_stroke	medical_history	radio	Prior Stroke	1, Yes   2, No   3, Unknown		
26	prior_tia	medical_history	radio	Prior TIA	1, Yes   2, No   3, Unknown		
27	prior_hf	medical_history	radio	Prior HF	1, Yes   2, No   3, Unknown		
28	etoh_use	medical_history	radio	Alcohol Use	1, Yes   2, No   3, Unknown		
29	etoh_use_quantity	medical_history	radio	How much alcohol do you drink in a t	1, 1-3 drinks   2, 4-7 drinks   3, 7-15 drinks   4, greater than 15 drinks		
30	mj_use	medical_history	radio	Marijuana Use	1, Yes   2, No   3, Unknown		
31	age_at_menopause	medical_history	text	Age at Menopause			

# Document your variables

- Intuitive / meaningful variable names e.g. study\_id
- What do variable names mean?
- What does each variable contain?
- Are there a limited set of possible values?

Name	Field Type	Description	Possible values	Units
study_id	text	Unique ID of study	8-digit number	
date_enrolled	date	Initial subject enrollment date	Date in format YYYY-MM-DD; All dates later than 2011-09-01	
weight	integer	Weight of subject		lbs

# File Organization



PROTIP: NEVER LOOK IN SOMEONE ELSE'S DOCUMENTS FOLDER.

# File Names

**sam\_1262011.tif**

# File Names

**sam\_1262011.tif**

12 June, 2011?

December 6, 2011?

January 26, 2011?

# File Names

**sam\_1262011.tif**

12 June, 2011?

December 6, 2011?

January 26, 2011?

Unambiguous dates, the **ISO standard**:

- YYYYMMDD *or* YYYY-MM-DD
  - *e.g. 20120612 = June 6, 2012*
- YYYYMMDDTHH:MM:SS
  - *e.g. 20120612T14-03-12 = June 6, 2012 2:03:12 pm*

# File Names

## **sam\_1262011.tif**

Scanning acoustic microscope?	12 June, 2011?
Systolic anterior motion?	December 6, 2011?
Sam the postdoc?	January 26, 2011?

### Unambiguous dates, the **ISO standard**:

- YYYYMMDD *or* YYYY-MM-DD
  - e.g. 20120612 = June 6, 2012
- YYYYMMDDTHH:MM:SS
  - e.g. 20120612T14-03-12 = June 6, 2012 2:03:12 pm

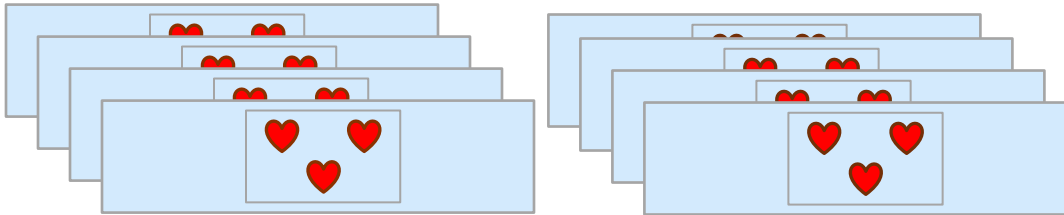
1 rat  
heart



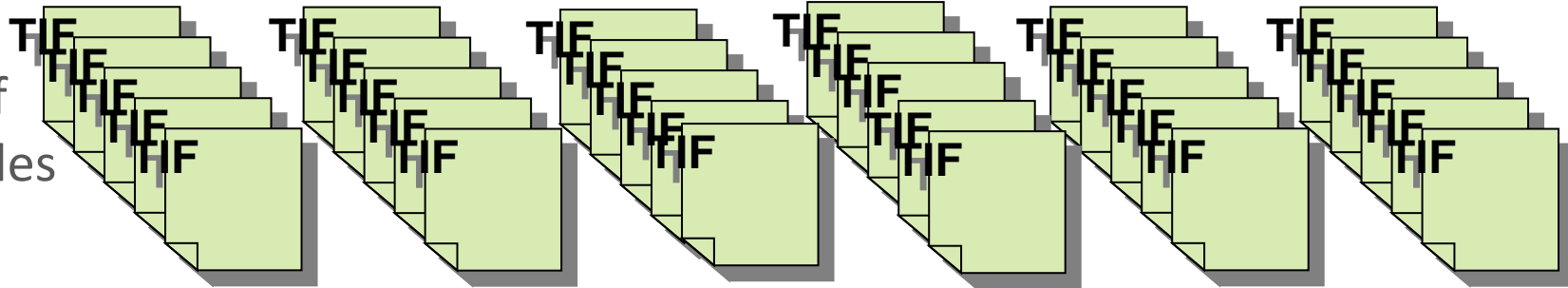
100s  
of slices



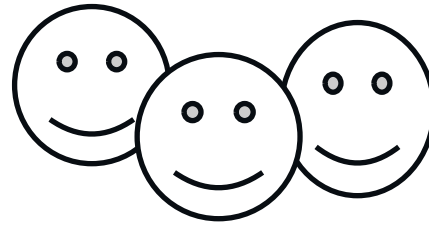
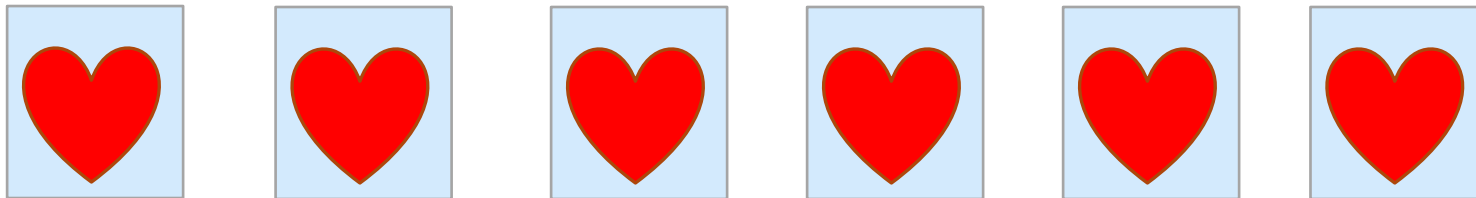
100s of  
slides



1000s of  
image files



100s of *huge*  
images



3 post docs

**5-7 experiments  
a week...**

# File names should...

1. Embody their content, including major parameters

AtherRat\_ex012\_ather\_lipitor\_128.tif

# File names should...

1. Embody their content, including major parameters

AtherRat\_ex012\_ather\_lipitor\_128.tif

2. Have non-cryptic/intuitive names where possible

AtherRat\_SOP\_DataValidation\_v01.docx

# File names should...

3. Be extensible. “ex001” not “ex1”



RawData1.xlsx  
RawData10.xlsx  
RawData2.xlsx  
\*  
\*  
\*

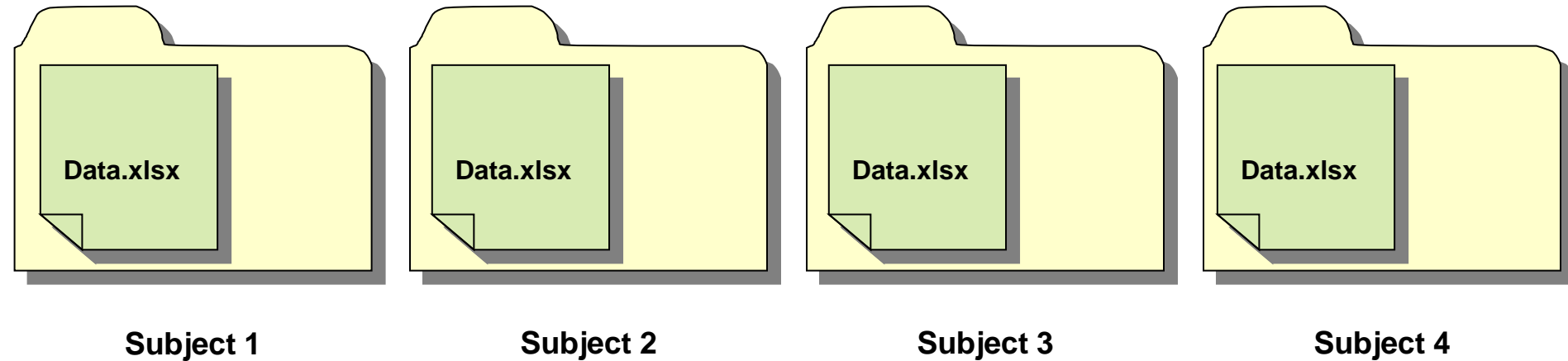


RawData01.xlsx  
RawData02.xlsx  
\*  
\*  
\*  
RawData10.xlsx

# File names should...

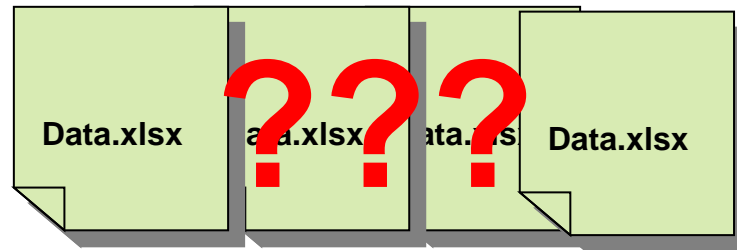
4. Be unique, where possible and practical.

Avoid 20 files named “data.xlsx” in different folders



# File names should...

4. Be unique, where possible and practical. Avoid 20 files called "data.xlsx" in different folders



Subject 1

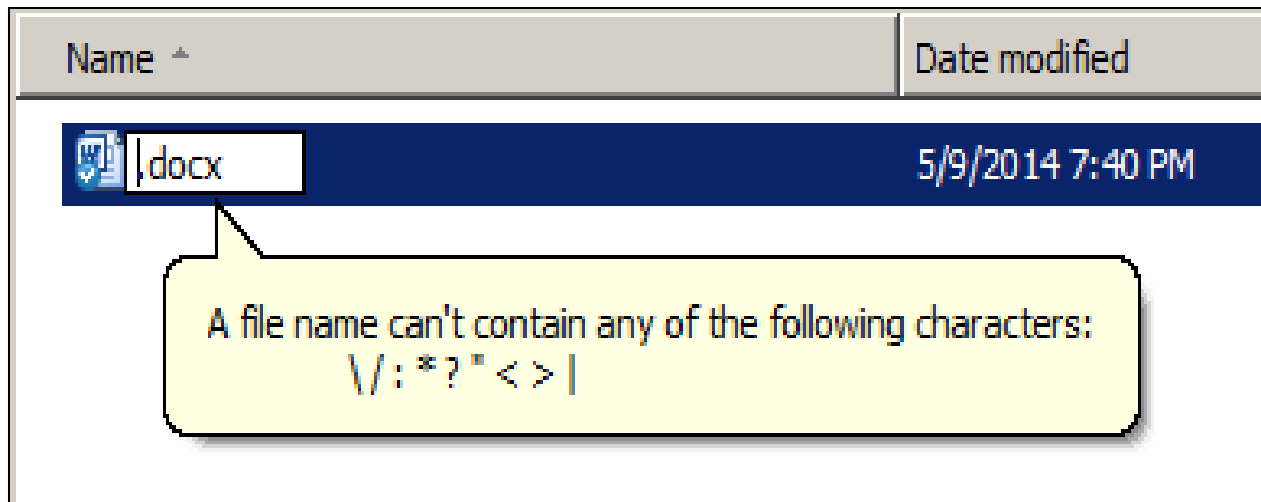
Subject 2

Subject 3

Subject 4

# File names should...

5. Do not use special characters – restrict file names to numbers, letters, and underscores



# File names should...

6. Use consistent, documentable rules for naming files

**AtherRat\_012\_056\_mb\_0423\_raw.csv**

**AtherRat** = experiment name

**012** = experiment number











**056** = sample number

**mb** = stain used, methylene blue











**0423** = 2-digit coordinates of image (4 across, 23 down)

**Raw** = data stage

# In the folder...

Name ^	Date modified	Type
 AtherRat_ex012_ather_lipitor_126.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_lipitor_127.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_lipitor_128.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_lipitor_129.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_notreat_001.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_notreat_002.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_notreat_003.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_notreat_004.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_notreat_005.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_notreat_006.tif	5/9/2014 7:55 PM	TIFF imag

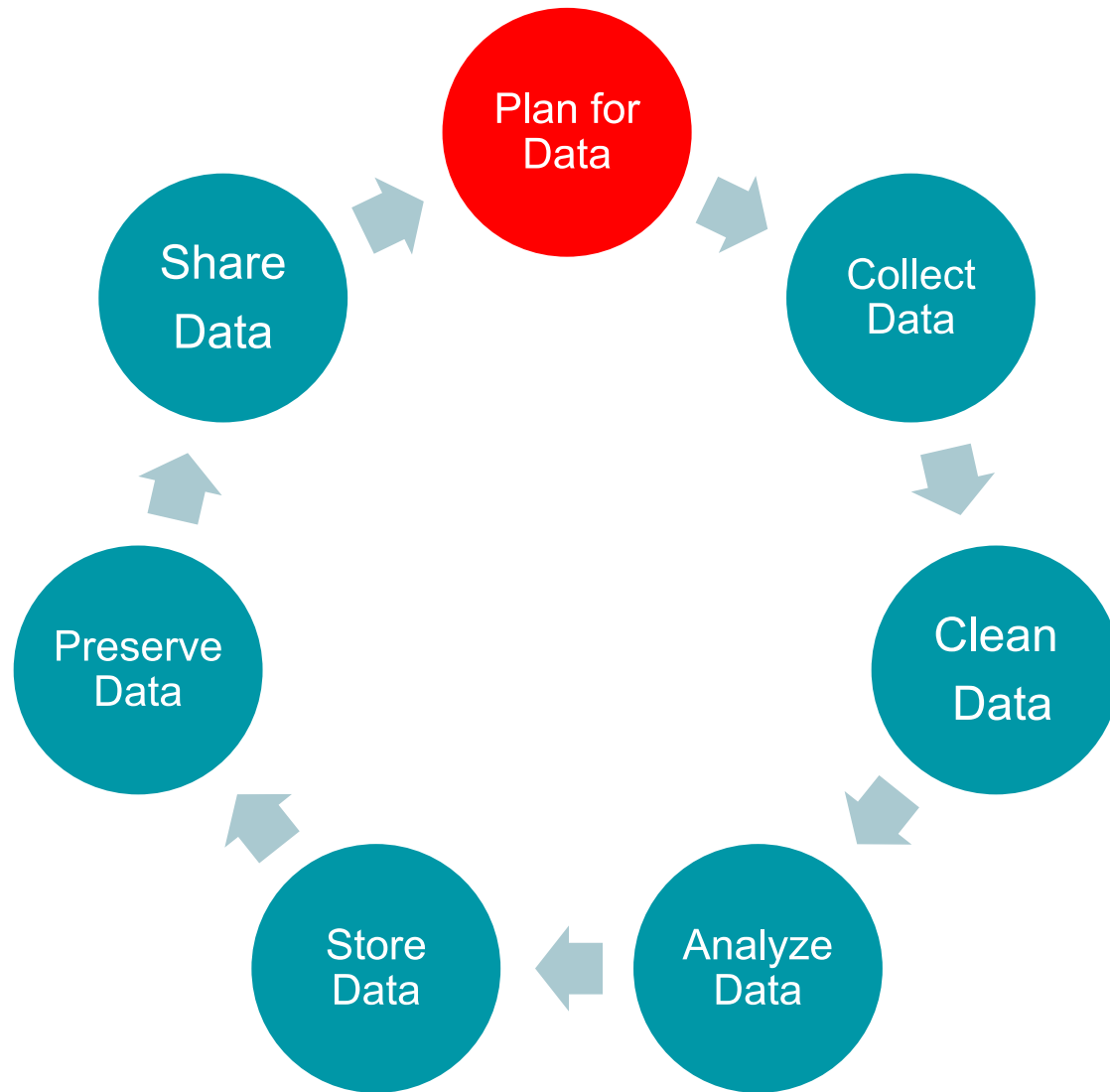
# In the folder...

Name ^	Date modified	Type
 AtherRat_ex012_ather_lipitor_126.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_lipitor_127.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_lipitor_128.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_lipitor_129.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_notreat_001.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_notreat_002.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_notreat_003.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_notreat_004.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_notreat_005.tif	5/9/2014 7:55 PM	TIFF imag
 AtherRat_ex012_ather_notreat_006.tif	5/9/2014 7:55 PM	TIFF imag

**DOCUMENT**

# Storage

# Data Lifecycle



# Storage Solutions at UMB

**Office 365 – One Drive**

**SOMFiles – Backup data storage for Pls**

**Discuss storage options** with IT at your school



# Storage Options

## If you are going to use cloud storage:

- Talk to IT at your school.
- On campus: SharePoint, OneDrive
- Others (not HIPAA compliant): Google Cloud Drive, Amazon, Box.

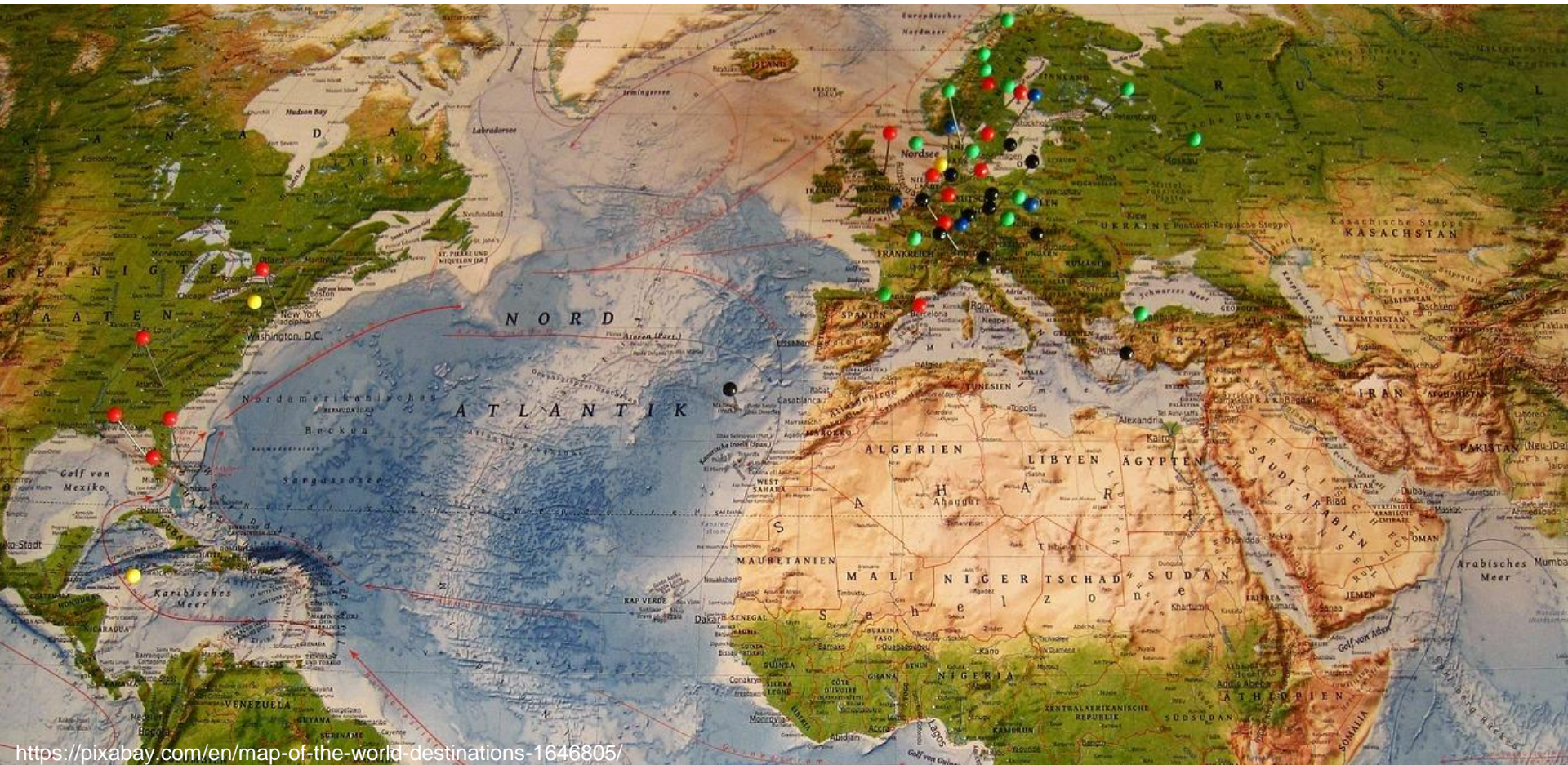


# Backup Considerations

- How will you back up your data?
- How frequently will data be backed up?
- How long will backups be stored?
- How much storage space will be needed?
- And how can you keep track of different versions of data, especially when backing up to multiple devices?

Save multiple copies...

...and disperse them geographically



# Security Considerations

Certain data requires special protection:

- **Protected Health Information**
- **Patents or commercial data**
- **Data as intellectual property**

# Security Extra Steps



- Password protect files or folders.
- Lock computers when not in use.
- Have others sign data use agreements.
- At UMB, use **SecureXfer** for transfer of secure files

# Preservation

**storage ≠ preservation**

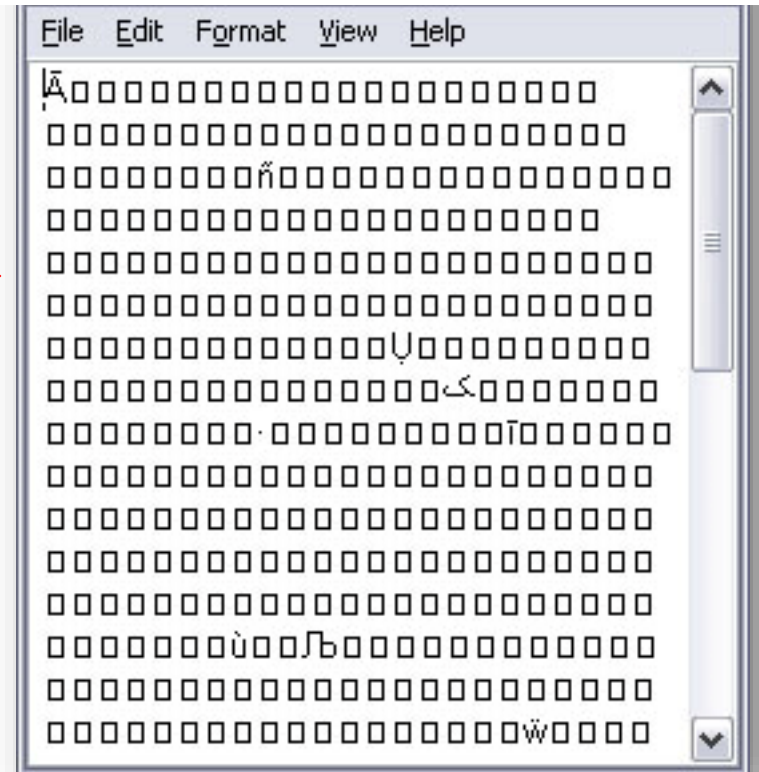
# Preservation

Protects from: **Hardware obsolescence**



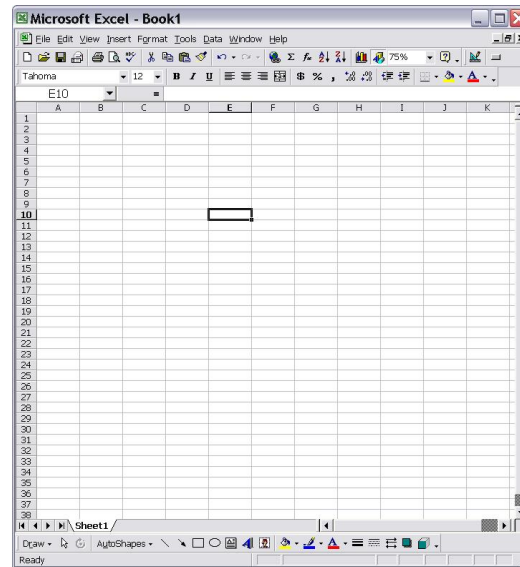
# Preservation

Protects from: **Software obsolescence**



# Preservation

*Collecting  
data*



*Disseminating  
data*

# Trusted Open Formats





# Data Formats

## Encryption and Compression



# Data Formats

You can't assume you own your data  
Check for:

- Funder policies on data ownership
- Institution policies on data ownership



# Providing Access

# Why share data?



# Data sharing challenges



Time and effort

Fear of losing control of data

Confidential and sensitive information

Ownership of data

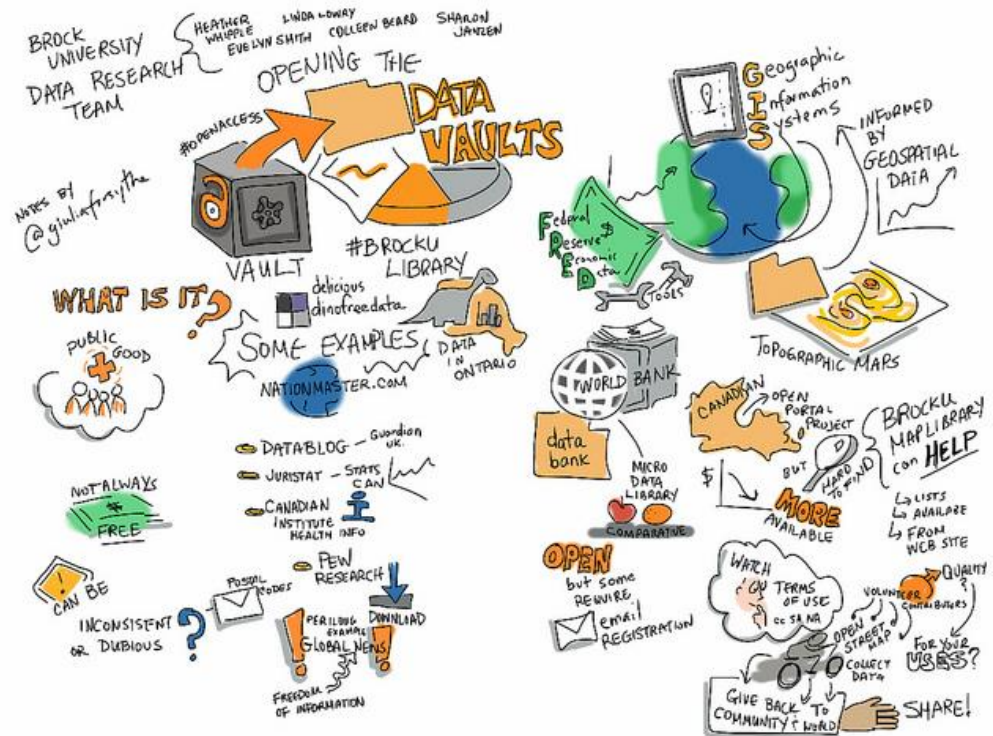
Lack of incentives

Inexperience with data management



# Providing access to your data

- Access vs. **meaningful** access
- Well-documented data



# Repository Types



UMB DIGITAL ARCHIVE

Institutional



zenodo

Cross-disciplinary



GEO  
Gene Expression Omnibus

Domain-specific

# Research Data Repositories

The screenshot shows the re3data.org website. At the top is the logo "re3data.org" with the tagline "REGISTRY OF RESEARCH DATA REPOSITORIES". Below the logo is a navigation bar with links: Home, Search, Browse, Suggest, FAQ, About, Schema, Contact, and Imprint. The main content area is titled "Search for Repositories (1132 Reviewed Repositories)". It features a search bar with a blue "Search" button. Below the search bar are three dropdown menus for "Subject", "Content Type", and "Country (of the responsible institutions)". The "Subject" dropdown is open, showing "Basic Biological and Medical Rese...". Below the dropdowns are three checkboxes: "Certificates" (checked), "Open Access" (unchecked), and "Persistent Identifier" (unchecked). A red "Clear" button is located at the bottom right of the filter section.

# UMB Data Catalog

## Dataset of an Exploratory Review of Clinical Study Reports of Randomised Controlled Trials Internal Dataset [unpublished]

UID: 7

Author(s): Peter Doshi\*

\* Corresponding Author

### Description

This dataset is associated with an exploratory evaluation of pharmaceutical industry clinical study reports (CSR) for possible use in evidence synthesis and systematic reviews. 78 CSRs from public sources were selected for data extraction. The report dates ranged from 1991 through 2011, inclusive, and represented 90 randomized controlled trials of 14 pharmaceuticals. The primary outcome measures included presence and length of essential elements of trial design and reporting and compression factor (ratio of page length for CSRs compared to its published counterpart in a scientific journal). The dataset is comprised of an audited table of extracted and derived variables. Data were extracted on MS Word extraction tables, migrated to MS Excel, and audited (double-checked). The Excel file contains multiple "sheets" (worksheets) the contents of which are described in an accompanying readme file. The uncorrected (original) and corrected extraction sheets as well as audit records are available upon request from Peter Doshi, corresponding author (pdoshi@rx.umaryland.edu).

### Subject Domain

[Drug Industry](#)

[Randomized Controlled Clinical Trials as Topic](#)

### Keywords

[clinical study reports/evaluation](#)

[Access via Dryad](#)

Dataset and readme file

### Access Restrictions

Free to All

### Access Instructions

Available to download from the Dryad site

### Associated Publications

Doshi P, Jefferson T (2013) Clinical study reports of randomised controlled trials: an exploratory review of previously confidential industry reports. *BMJ Open* 3(2): e002496. <http://dx.doi.org/10.1136/bmjopen-2012-002496>

### Data Type

Administrative

### Dataset Format(s)

Microsoft Excel

### Dataset Size



95.98Kb



# Data Publishing

## SCIENTIFIC DATA

Home | About | For Authors | For Referees | Advisory and Editorial Board | Open Access | FAQ

✉ Sign up for Scientific Date e-alert  Facebook  Twitter

**Submit to *Scientific Data* in three simple steps:**

- 1. DESCRIBE**  
Write a detailed description of your dataset. We have templates to help you and a detailed guide to authors.
- 2. DEPOSIT**  
See our list of recommended repositories. We will help you find the right place for your data.
- 3. SUBMIT**  
Submit online and get the credit you deserve for your data!

**Get credit where credit's due and share your data.**

### Sample Data De



Proteomic p  
embryonic s  
pluripotent s  
resources f

Log on 

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# Conclusion

# How is the library supporting data management?

- Workshops, consultations, and assistance
  - Data management plan guidance
  - Storage and preservation recommendations
  - File naming and organization advice
  - Data citation
  - Locating secondary data for reuse
  - Recommending technology for specific needs
- Data catalog
- Referrals to other UMB experts

# Center for Data and Bioinformation Services

- Home
- About Us ▾
- Guides
- Resources
- Services
- Workshops & Tutorials ▾
- Communications & Contributions

The Center for Data and Bioinformation Services (CDABS) is the hub for data and bioinformation learning, services, resources, and communication at the Health Sciences & Human Services Library of the University of Maryland, Baltimore.



[Request a Consultation](#)



[Attend a Workshop](#)



[View the UMB Data Catalog](#)

## Expertise

 [Research Data Management](#)

 [Bioinformation](#)

 [Data Visualization](#)

 [High Performance Computing](#)

 [Data Sharing](#)

 [Genomic Data Science](#)

# Questions?

# Workshop Attribution

Thanks to the NYU Health Sciences Library's Data Services Team for developing the template for this workshop



Kevin Read  
*Data Services Librarian and  
Lead, Data Discovery*



Alisa Surkis  
Assistant Director, Research  
Data and Metrics

# Photo references

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- Pixabay. “Research” 2012 [http://pixabay.com/p-66365/?no\\_redirect](http://pixabay.com/p-66365/?no_redirect)
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