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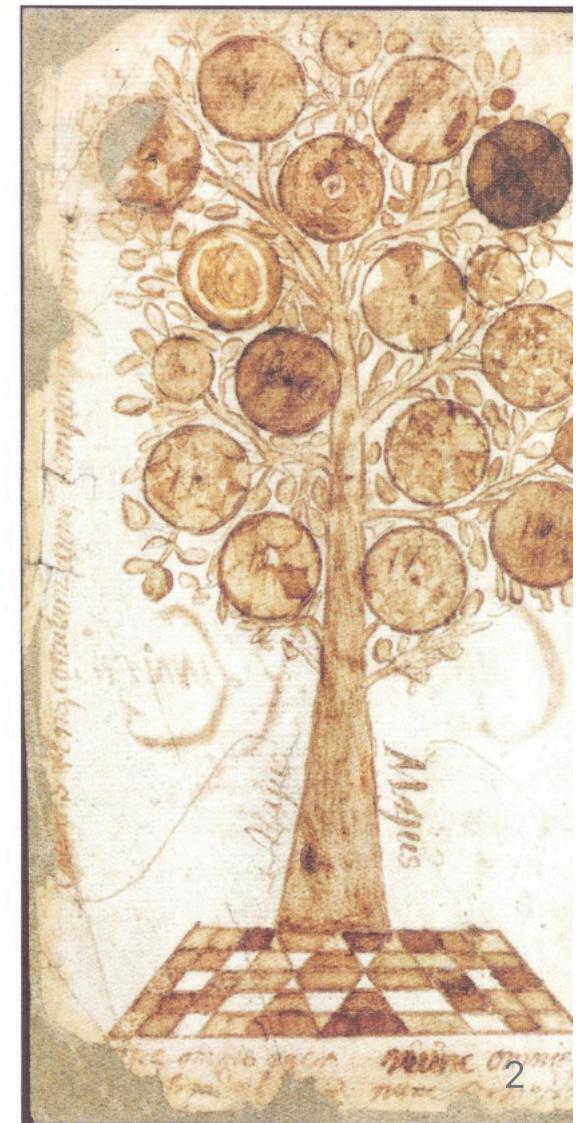
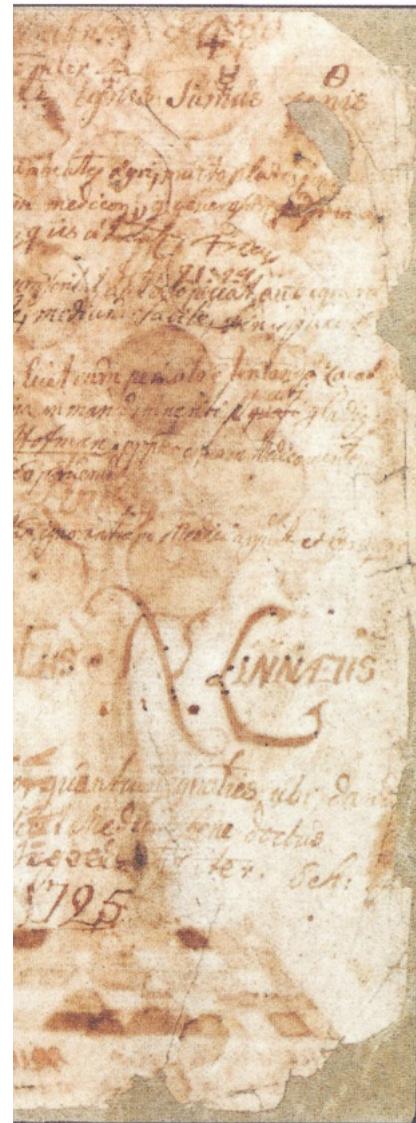
Leon Han

Streets Lab, Computational Biology Graduate Group

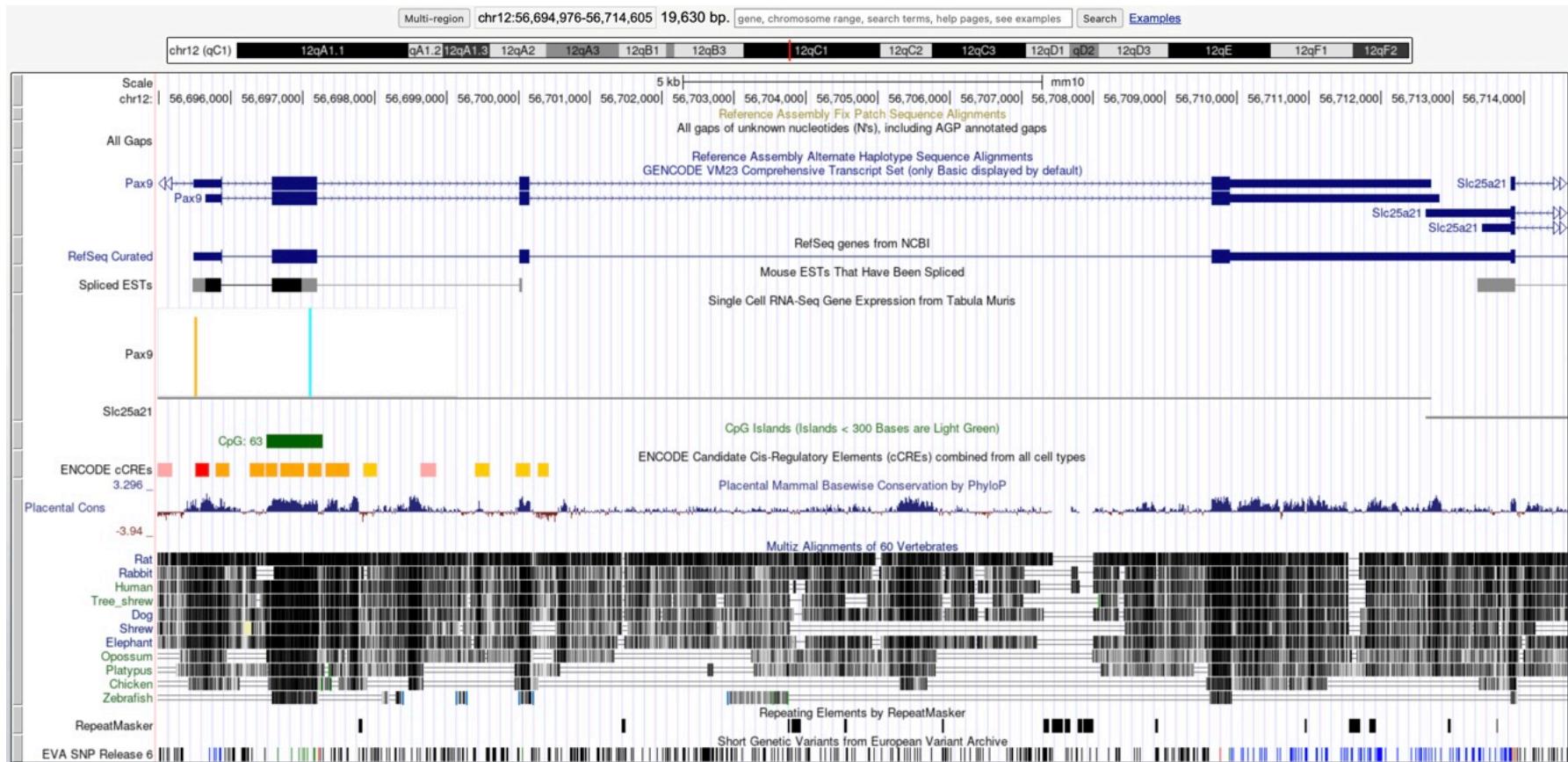
May 1st, 2025

Örtaboken (Herb book), an early
Linnaeus manuscript, 1725

5268x3717, 7.6MB



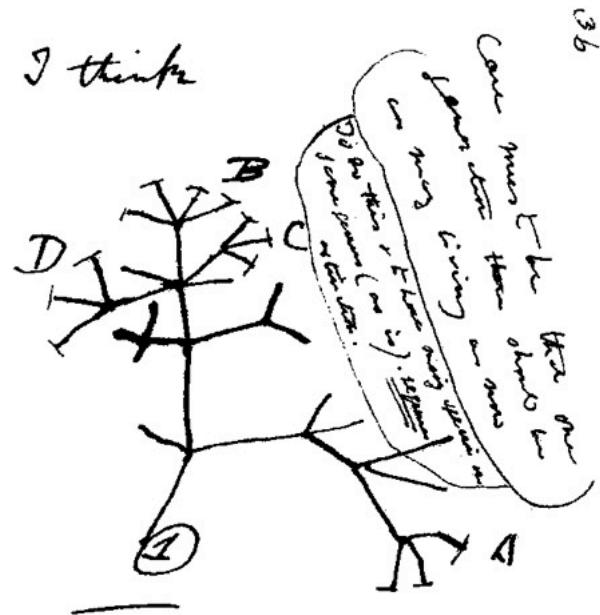
A World Flooded with Data



UCSC Genome Browser, genome of *Mus musculus*, 6.3GB, 2.7 billion base pairs

Downloads

Name	Size	Kind	Date Added	Date Modified
0100.tif	1 MB	TIFF image	Jan 2, 2025 at 8:32 PM	Oct 3, 2024 at 2:28 PM
0100_signal.tif	1 MB	TIFF image	Jan 2, 2025 at 8:32 PM	Sep 30, 2024 at 6:42 PM
cat_avatar.jpeg	76 KB	JPEG image	Jan 2, 2025 at 8:32 PM	Sep 30, 2024 at 12:00 PM
IMG_1116.HEIC	3.7 MB	HEIF Image	Feb 8, 2025 at 2:26 PM	Sep 29, 2024 at 4:36 PM
C0017.MP4	3.56 GB	MPEG-4 movie	Jan 2, 2025 at 8:32 PM	Sep 27, 2024 at 9:06 PM
full_stats.csv	8.8 MB	comma-separated values	Jan 2, 2025 at 8:32 PM	Sep 27, 2024 at 12:55 PM
Screenshot 2024-09-26 at 18.52.24	169 KB	JPEG image	Jan 2, 2025 at 8:32 PM	Sep 26, 2024 at 6:52 PM
sample_gblur_spots_2color.tif	2.1 MB	TIFF image	Jan 2, 2025 at 8:32 PM	Sep 26, 2024 at 6:16 PM
0060.tif	1 MB	TIFF image	Jan 2, 2025 at 8:32 PM	Sep 25, 2024 at 6:16 PM
0165.tif	1 MB	TIFF image	Jan 2, 2025 at 8:32 PM	Sep 25, 2024 at 5:36 PM
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img_stack.tif	264.3 MB	TIFF image	Jan 2, 2025 at 8:32 PM	Sep 25, 2024 at 5:31 PM
manifold2021.pdf	4.7 MB	PDF Document	Jan 2, 2025 at 8:32 PM	Sep 25, 2024 at 11:04 AM
requirements_20240925.txt	3 KB	Plain Text	Jan 2, 2025 at 8:32 PM	Sep 25, 2024 at 10:42 AM
test_tiles.tif	2.4 MB	TIFF image	Jan 2, 2025 at 8:32 PM	Sep 24, 2024 at 5:05 PM
ipgt1.tif	363 KB	TIFF image	Jan 2, 2025 at 8:32 PM	Sep 24, 2024 at 5:03 PM
test_tile.tif	2.4 MB	TIFF image	Jan 2, 2025 at 8:32 PM	Sep 24, 2024 at 4:56 PM
fnet_nn_2d.py	3 KB	Python script	Jan 2, 2025 at 8:32 PM	Sep 24, 2024 at 4:21 PM
s41592-020-01050-x.pdf	16.8 MB	PDF Document	Jan 2, 2025 at 8:32 PM	Sep 23, 2024 at 4:19 PM
HDR CONVERSION LUT.cube	115 KB	LutFileType	Jan 2, 2025 at 8:32 PM	Sep 19, 2024 at 11:57 AM
s41467-022-33850-4.pdf	4.9 MB	PDF Document	Jan 2, 2025 at 8:32 PM	Sep 18, 2024 at 4:49 PM
Screenshot 2024-09-17 at 15.09.10	1.9 MB	JPEG image	Jan 2, 2025 at 8:32 PM	Sep 17, 2024 at 3:09 PM
Screenshot 2024-09-17 at 15.08.44 (2)	1.9 MB	JPEG image	Jan 2, 2025 at 8:32 PM	Sep 17, 2024 at 3:08 PM
Screenshot 2024-09-17 at 15.08.44	451 KB	JPEG image	Jan 2, 2025 at 8:32 PM	Sep 17, 2024 at 3:08 PM



Then between A & B. various
sorts of relation. C & B. the
finer gradation, B & D
rather greater distinction
These genera would be
formed. - binary relation

Not All Data Speaks the Same Language

Tree of Life, Charles Darwin, 1837
695x1181, 15KB



Then between A & B. various
sorts of selection. C & B. the
first gradation, B & D
rather greater distinction
Then genera would be
formed. - binary selection

Not All Data Speaks the Same Language

I think ... Case must be that one generation then should be as many living as now. To do this & to have many species in same genus (as is) requires extinction.

Thus between A & B ... Thus genera would be formed.

On the Origin of Species has approximately 893,878 characters, or 150,144 words.

CAROLI LINNÆI

I. QUADRUPEDA.		II. AVES.		III. AMPHIBIA.	
Cerop. tauricus. Podo. quatuor. Fossa. unipora. Infusaria.		Cerop. plumosa. Ali. dura. Podo. das. Fossa. expansa.		Cerop. rotundata. vel. fuscocaudata. Dextra. mader. nill. - repletus tempore.	
Nom.	Nodo. ali. pectoral.	Pithecus. schiz.	Pithecus. schiz.	Triturus. ciliatus.	Triturus. ciliatus.
Sin.		Ali. dentata. Pectenata.	Ali. dentata. Pectenata.	Ali. dentata. Ciliata.	Ali. dentata. Ciliata.
Brevitars.		Ali. pulcherrima. dentata.	Ali. pulcherrima. dentata.	Ali. dentata. Ciliata.	Ali. dentata. Ciliata.
	sp. 3. 4. 5. 6. 7. 8.				
Urs.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Cervus. belli. Pelle. cor. palma.	Cervus. belli. Pelle. cor. palma.	Uro. taurica.	Uro. taurica.
Lou.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Canis. lupus.	Canis. lupus.	Ore. canis.	Ore. canis.
Tigri.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Leopardus. pardalis.	Leopardus. pardalis.	Gloss. taurica.	Gloss. taurica.
Felis.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Leopardus. pardalis.	Leopardus. pardalis.	Gloss. taurica.	Gloss. taurica.
Meph.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Smilis. leucurus.	Smilis. leucurus.	Gloss. taurica.	Gloss. taurica.
Didelph.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Thylax. vulpes.	Thylax. vulpes.	Gloss. taurica.	Gloss. taurica.
Lou. Odontoma.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Thylax. vulpes.	Thylax. vulpes.	Gloss. taurica.	Gloss. taurica.
Phoca.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Uro. thomasi.	Uro. thomasi.	Gloss. taurica.	Gloss. taurica.
Hyena.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Uro. thomasi.	Uro. thomasi.	Gloss. taurica.	Gloss. taurica.
Canis.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Uro. thomasi.	Uro. thomasi.	Gloss. taurica.	Gloss. taurica.
Meph.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Uro. thomasi.	Uro. thomasi.	Gloss. taurica.	Gloss. taurica.
Tata.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Uro. thomasi.	Uro. thomasi.	Gloss. taurica.	Gloss. taurica.
Erethizon.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Uro. thomasi.	Uro. thomasi.	Gloss. taurica.	Gloss. taurica.
Vulp.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Uro. thomasi.	Uro. thomasi.	Gloss. taurica.	Gloss. taurica.
Hydro.		Asio. scandens.	Asio. scandens.	Amietia. ciliata.	Amietia. ciliata.
Scorpa.		Asio. scandens.	Asio. scandens.	Amietia. ciliata.	Amietia. ciliata.
Cafon.		Asio. scandens.	Asio. scandens.	Amietia. ciliata.	Amietia. ciliata.
Mat.		Asio. scandens.	Asio. scandens.	Amietia. ciliata.	Amietia. ciliata.
Lepus.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Ali. borealis. Vulpes. vulpes.	Ali. borealis. Vulpes. vulpes.	Amietia. ciliata.	Amietia. ciliata.
Sorex.	Dip. 1. 2. 3. 4. 5. 6. 7. 8.	Ali. borealis. Vulpes. vulpes.	Ali. borealis. Vulpes. vulpes.	Amietia. ciliata.	Amietia. ciliata.
Epon.		Ali. borealis. Vulpes. vulpes.	Ali. borealis. Vulpes. vulpes.	Amietia. ciliata.	Amietia. ciliata.
Hippopot.		Ali. borealis. Vulpes. vulpes.	Ali. borealis. Vulpes. vulpes.	Amietia. ciliata.	Amietia. ciliata.
Elephas.		Ali. borealis. Vulpes. vulpes.	Ali. borealis. Vulpes. vulpes.	Amietia. ciliata.	Amietia. ciliata.
Sit.		Ali. borealis. Vulpes. vulpes.	Ali. borealis. Vulpes. vulpes.	Amietia. ciliata.	Amietia. ciliata.
Cavia.		Uro. cavia.	Uro. cavia.	Colostethus. ciliatus.	Colostethus. ciliatus.
Cervus.		Uro. cavia. primata. ciliata.	Uro. cavia. primata. ciliata.	Colostethus. ciliatus.	Colostethus. ciliatus.
Capa.		Uro. cavia. primata. ciliata.	Uro. cavia. primata. ciliata.	Colostethus. ciliatus.	Colostethus. ciliatus.
Oris.		Uro. cavia. primata. ciliata.	Uro. cavia. primata. ciliata.	Colostethus. ciliatus.	Colostethus. ciliatus.
Bos.		Uro. cavia. primata. ciliata.	Uro. cavia. primata. ciliata.	Colostethus. ciliatus.	Colostethus. ciliatus.
Cavia.		Uro. cavia.	Uro. cavia.	Colostethus. ciliatus.	Colostethus. ciliatus.
Cervus.		Uro. cavia. primata. ciliata.	Uro. cavia. primata. ciliata.	Colostethus. ciliatus.	Colostethus. ciliatus.
Capa.		Uro. cavia. primata. ciliata.	Uro. cavia. primata. ciliata.	Colostethus. ciliatus.	Colostethus. ciliatus.
Oris.		Uro. cavia. primata. ciliata.	Uro. cavia. primata. ciliata.	Colostethus. ciliatus.	Colostethus. ciliatus.
Bos.		Uro. cavia. primata. ciliata.	Uro. cavia. primata. ciliata.	Colostethus. ciliatus.	Colostethus. ciliatus.
Gloss.		Claudius. Gossneri.	Species. *		

REGNUM ANIMALE.

IV PISCES.	V. INSECTA.	VI VERMES.
Cypr. spadix; pisces, pluma vera infraorbitalis, senes, vid. spiculum.	Cypr. crella colla cosa loca velum. Cypr. antennae infraorbitalis.	Corpus Myofid a sua parte bid. caudae stellae affl.
Thrichodon. Carodon. Monodon. Belone.	Histio. F. pene. C. fida. D. crenata. E. crenata. F. crenata. G. crenata. H. crenata. I. crenata.	Gordia. Taxis. Luminaria. Hirundo. Linea.
Delphini.	P. crenata. Q. crenata. R. crenata. S. crenata. T. crenata. U. crenata. V. crenata. W. crenata.	Corpe filiforme, tenui, flexibili. Corpe filiforme, pluma, tenuissima. Corpe filiforme, densa, protracta, tenuissima.
Raja.	F. crenata deprimata. G. crenata deprimata. H. crenata deprimata. I. crenata deprimata. J. crenata deprimata. K. crenata deprimata. L. crenata deprimata.	Nigra ex arysta.
CHONDRICHTHENY.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Cochlea.
Squatina.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	TAXACEAL. sp. vel oblonga.
Acanthocephala.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Nasuta.
Pentamerida.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Cypraea.
Logognathus.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Habenaria.
Cyclopedes.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Palatula.
Balistes.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Dorsalium.
Zucronides.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Concha.
CEPHALOPODA.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Nudibranchia.
Nautilidae.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Nautilus.
C. CANTABRICA.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Calymene.
Amphibolites; concretiones calcareas.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Cypris.
Graptolites.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Habenaria.
Conularia.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Palatula.
Trilobites.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Dorsalium.
Trachinida.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Concha.
Pterea.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Nudibranchia.
Spirula.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Nautilus.
Larvula.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Calymene.
Mugil.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Cypris.
Scorpaen.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Habenaria.
Xiphias.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Palatula.
Gobius.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Dorsalium.
GYROPODIA.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Concha.
Marcusen.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Nudibranchia.
Paraceraspidea.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Nautilus.
Ammonoidea.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Calymene.
Coryphaenoides.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Cypris.
Echeneis.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Habenaria.
Echis.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Palatula.
Selene.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Dorsalium.
Ostrea.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Concha.
Cortezia.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Nudibranchia.
Cephaloscyllium.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Nautilus.
Cypris.	P. crenata deprimata. Q. crenata deprimata. R. crenata deprimata. S. crenata deprimata. T. crenata deprimata. U. crenata deprimata. V. crenata deprimata.	Calymene.
Cabrit.	C. pene. C. pene. C. pene. C. pene. C. pene. C. pene. C. pene.	Taxaceal.
Synaptida.	C. pene. C. pene. C. pene. C. pene. C. pene. C. pene. C. pene.	Taxaceal.
MATERIALIS, quae non ad aliud genus pertinet.		
AD INVERTEBRATOS.		
AD INSECTA.		
AD VERMES.		
AD MOLLUSCA.		
AD CONCHA.		
AD ECHINIDA.		
AD CEPHALOPODA.		
AD C. CANTABRICA.		
AD TRILOBITES.		
AD GYROPODIA.		
AD MARCUSEN.		
AD PARACERASPIDEA.		
AD AMMONOIDEA.		
AD CORYPHAOIDES.		
AD ECHENEIS.		
AD ECHIS.		
AD SELENE.		
AD OSTREA.		
AD CORTEZIA.		
AD CEPHALOSCYLLIUM.		
AD CYPRIS.		
AD CABRIT.		
AD SYNAPTIDA.		
AD MATERIALE, quae non ad aliud genus pertinet.		
AD INVERTEBRATOS.		
AD INSECTA.		
AD VERMES.		
AD MOLLUSCA.		
AD CONCHA.		
AD ECHINIDA.		
AD CEPHALOPODA.		
AD C. CANTABRICA.		
AD TRILOBITES.		
AD GYROPODIA.		
AD MARCUSEN.		
AD PARACERASPIDEA.		
AD AMMONOIDEA.		
AD CORYPHAOIDES.		
AD ECHENEIS.		
AD ECHIS.		
AD SELENE.		
AD OSTREA.		
AD CORTEZIA.		
AD CEPHALOSCYLLIUM.		
AD CYPRIS.		
AD CABRIT.		
AD SYNAPTIDA.		
AD MATERIALE, quae non ad aliud genus pertinet.		

Not All Data Speaks the Same Language

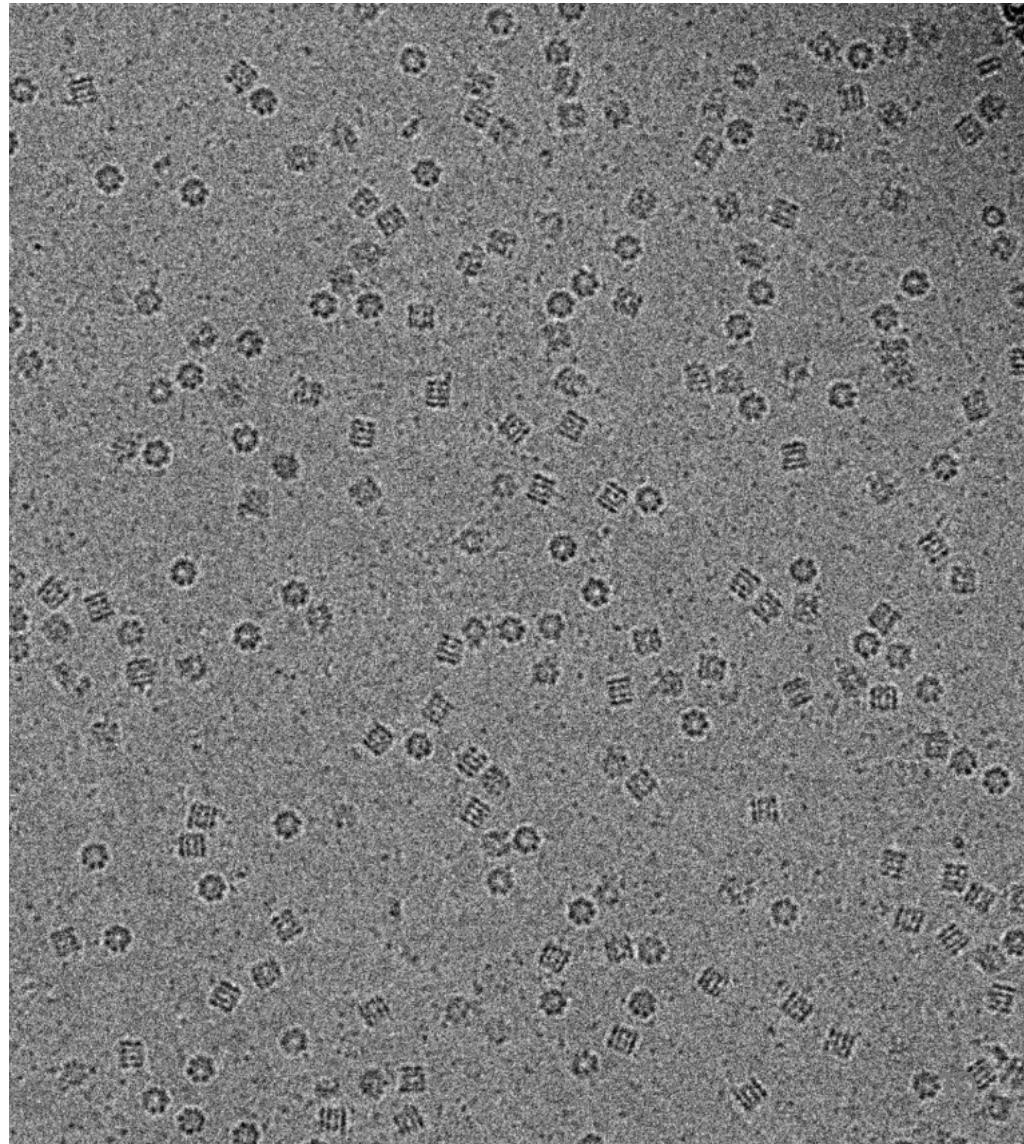
- Directly interpretable
 - Documents, slides, spreadsheets, figures
- Machine-oriented
 - cryoEM images, viral genome, RNA-seq, neural networks, ...



Not All Data Speaks the Same Language

- Directly interpretable
 - Documents, slides, spreadsheets, figures
- **Machine-oriented**
 - cryoEM images, viral genome, RNA-seq, neural networks, ...

Image By [Vossman](#) CC BY-SA 4.0,



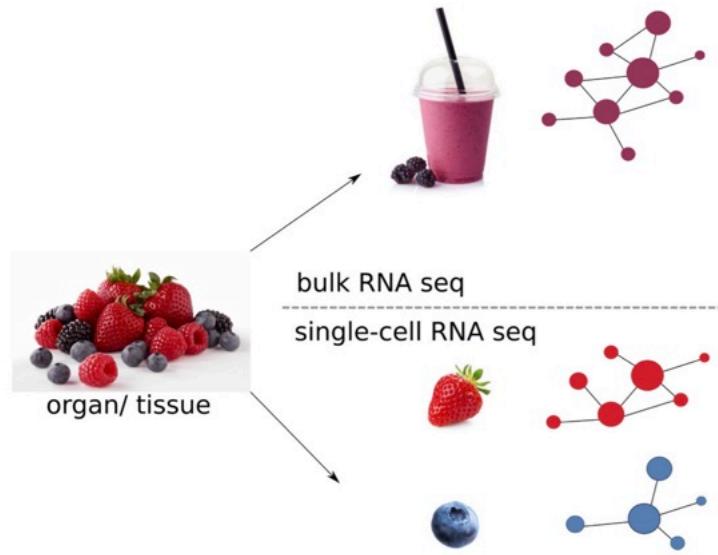
What Makes Data Readable?

Spatial Information

Microscopy v. Transcriptomics



<https://www.thepioneerwoman.com/food-cooking/recipes/a39752886/fresh-fruit-tart-recipe/>



The diagram illustrates the concept of spatial information in transcriptomics. It starts with a photograph of a fruit tart labeled "organ/ tissue". Two arrows point from this image to two different RNA sequencing paths. The top arrow leads to a smoothie cup labeled "bulk RNA seq", which is then connected by a dashed line to a network graph with purple nodes and connecting lines. The bottom arrow leads to a single strawberry labeled "single-cell RNA seq", which is then connected by a dashed line to a network graph with red nodes and connecting lines. Below the smoothie cup and the single-cell RNA seq are small images of a blueberry and a kiwi.

bulk RNA seq

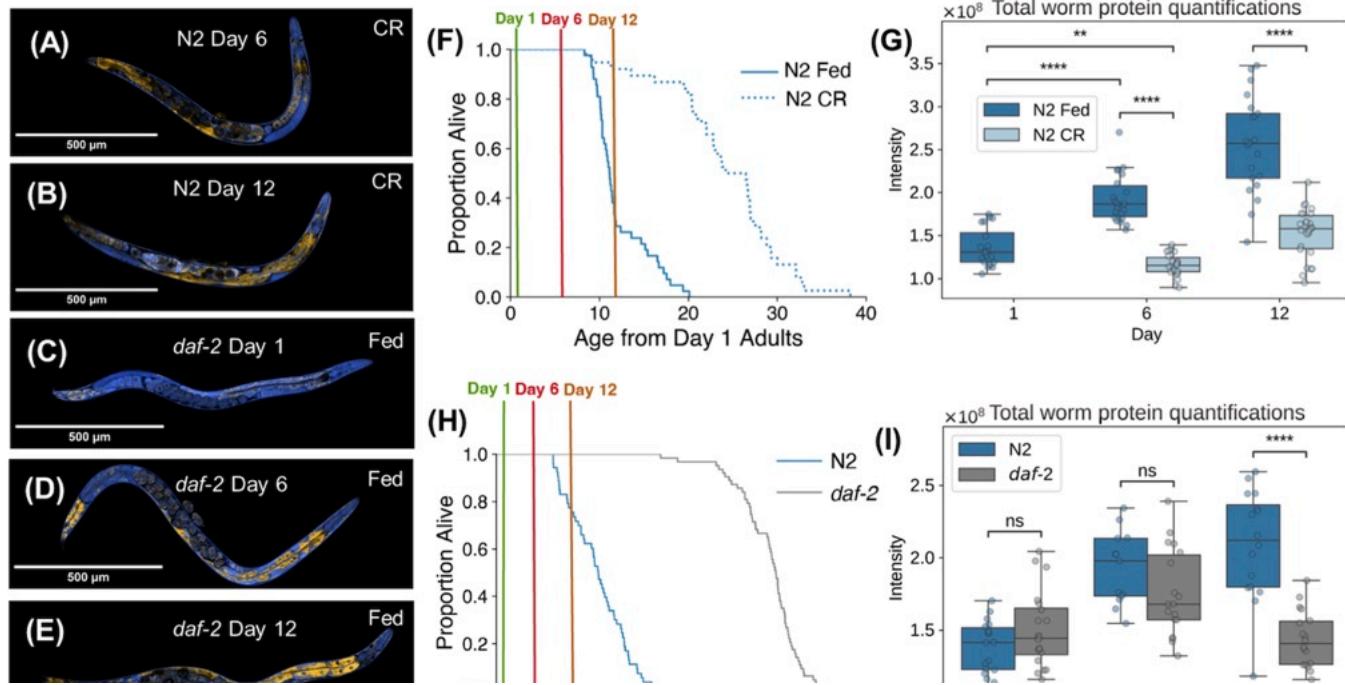
single-cell RNA seq

organ/ tissue

5

Steinheuer, Lisa Maria, Sebastian Canzler, and Jörg Hackermüller. "Benchmarking ScRNA-Seq Imputation Tools with Respect to Network Inference Highlights Deficits in Performance at High Levels of Sparsity." Preprint. (2021)

longer compared to their wildtype counterparts (Figure 3H). Then, using these same conditions, we performed SRS imaging at day 1, day 6, and day 12 of adulthood. Consistent with previous studies, *daf-2* mutant worms displayed increased lipid levels in their intestine by day 6 of adulthood (Figures 2B, 3D, and S1)^{21,36,39–42}. Importantly, similar to CR, *daf-2* worms showed significantly lower levels of protein buildup by day 12 of adulthood compared to their N2 counterparts (Figure 3D, 3E, and 3I).



Leon_20250412_ivt_rt_product_cleaned_alt_primers.xlsx - Re...

Comments Share

No.	Row	Col	Ct	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5
1	1 A		1 13.134179	0.167918	0.164805	0.169887	0.168644	
2	2 A		2 8.218045	0.125571	0.123348	0.127836	0.128208	
3	3 A		3 17.28804	0.064276	0.063157	0.063968	0.063576	
4	4 A		4 ∞	0.064299	0.063684	0.064047	0.063614	
5	5 A		5 42.065498	0.068588	0.067189	0.067641	0.067145	
6	6 A		6 42.065498	0.058859	0.057672	0.058108	0.057658	
7	7 A		7 42.065498	0.059493	0.058648	0.058873	0.058212	
8	8 A		8 42.065498	0.053278	0.052754	0.053068	0.05261	
9	9 A		9 42.065498	0.078624	0.078429	0.078388	0.077901	
10	10 A		10 42.065498	0.119215	0.118289	0.118262	0.117873	
11	11 A		11 42.065498	0.049732	0.049399	0.049167	0.048964	
12	12 A		12 42.065498	0.063243	0.062754	0.062575	0.061931	
13	13 B		1 15.867844	0.142543	0.13864	0.142594	0.14079	
14	14 B		2 9.51229	0.129615	0.127535	0.131953	0.131494	
15	15 B		3 17.574818	0.071034	0.070329	0.070555	0.070143	
16	16 B		4 42.065498	0.055049	0.054159	0.05444	0.053925	
17	17 B		5 42.065498	0.048744	0.047643	0.048089	0.047406	
18	18 B		6 ∞	0.050968	0.049742	0.050348	0.049841	
19	19 B		7 42.065498	0.068622	0.067672	0.068002	0.067276	

Text: The Universal Interface

- Document: **text**, images, links, tables, equations
- Slides: **text**, images, videos, tables, equations
- Figures: **text** + images (a specialized “document”)
- Spreadsheet: **text** + numbers

Behind the Scenes: It's Still Text!

Leon_20250412_ivt_rt_product_cleaned_alt_primers.xlsx - Re...

Comments Share

	A	B	C	D	E	F	G	H	Cy
1	No.	Row	Col	Ct	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cy
2	1	A		1 13.134179	0.167918	0.164805	0.169887	0.168644	
3	2	A		2 8.218045	0.125571	0.123348	0.127836	0.128208	
4	3	A		3 17.28804	0.064276	0.063157	0.063968	0.063576	
5	4	A		4 ∞	0.064299	0.063684	0.064047	0.063614	
6	5	A		5 42.065498	0.068588	0.067189	0.067641	0.067145	
7	6	A		6 42.065498	0.058859	0.057672	0.058108	0.057658	
8	7	A		7 42.065498	0.059493	0.058648	0.058873	0.058212	
9	8	A		8 42.065498	0.053278	0.052754	0.053068	0.05261	
10	9	A		9 42.065498	0.078624	0.078429	0.078388	0.077901	
11	10	A		10 42.065498	0.119215	0.118289	0.118262	0.117873	
12	11	A		11 42.065498	0.049732	0.049399	0.049167	0.048964	
13	12	A		12 42.065498	0.063243	0.062754	0.062575	0.061931	
14	13	B		1 15.867844	0.142543	0.13864	0.142594	0.14079	
15	14	B		2 9.51229	0.129615	0.127535	0.131953	0.131494	
16	15	B		3 17.574818	0.071034	0.070329	0.070555	0.070143	
17	16	B		4 42.065498	0.055049	0.054159	0.05444	0.053925	
18	17	B		5 42.065498	0.048744	0.047643	0.048089	0.047406	
19	18	B		6 ∞	0.050968	0.049742	0.050348	0.049841	
20	19	B		7 42.065498	0.068622	0.067672	0.068002	0.067276	

Profile Raw Data Result Summary +

```
<?xml version="1.0" ?>
<ns0:worksheet xmlns:ns0="http://schemas.openxmlformats.org/spreadsheetml/2006/main"
  (http://schemas.openxmlformats.org/spreadsheetml/2006/main)">
  <ns0:sheetData> <ns0:row r="1">
    <ns0:c r="A1" s="1" t="str">
      <ns0:v>No.</ns0:v> </ns0:c>
    <ns0:c r="B1" s="1" t="str">
      <ns0:v>Row</ns0:v> </ns0:c>
    <ns0:c r="C1" s="1" t="str">
      <ns0:v>Col</ns0:v> </ns0:c>
    <ns0:c r="D1" s="1" t="str">
      <ns0:v>Ct</ns0:v> </ns0:c>
    <ns0:c r="E1" s="1" t="str">
      <ns0:v>Cycle 1</ns0:v> </ns0:c>
    <ns0:c r="F1" s="1" t="str">
      <ns0:v>Cycle 2</ns0:v> </ns0:c>
    <ns0:c r="G1" s="1" t="str">
      <ns0:v>Cycle 3</ns0:v> </ns0:c>
    ...
  </ns0:row> </ns0:sheetData> </ns0:worksheet>
```



```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN"
"http://www.w3.org/Graphics/SVG/1.1/DTD/svg11.dtd">
<svg width="100%" height="100%" viewBox="0 0 365 292"
version="1.1" xmlns="http://www.w3.org/2000/svg"
xmlns:xlink="http://www.w3.org/1999/xlink"
xml:space="preserve" xmlns:serif="http://www.serif.com/"
style="fill-rule:evenodd;clip-rule:evenodd;
stroke-linejoin:round;stroke-miterlimit:2;">
  <g>
    <path d="M345.763,55.486C343.428,54.198 337.196,
58.793 337.196,58.793C325.262,68.27 316.292,80.
011 308.562,93.539C288.138,129.28 290.022,157.364
290.022,157.364C290.022,157.364 300.676,145.235
303.19,141.262C306.617,135.845 319.512,117.712
326.767,104.928C334.546,91.221 343.485,72.249 345.
701,65.679C345.701,65.679 349.289,57.431 345.763,
55.486ZM195.013,140.13C189.087,140.312 174.954,
147.607 163.653,168.51C161.016,173.388 152.84,193.
678 157.27,203.806C158.608,206.868 161.029,208.
968 164.086,209.714C164.876,209.909 165.691,210.
006 166.503,210.006C176.472,210.008 183.454,196.06
```

$$M = \begin{bmatrix} m_{11} & \cdots & m_{1g} \\ \vdots & \ddots & \vdots \\ m_{n1} & \cdots & m_{ng} \end{bmatrix}, \quad \Lambda = \underbrace{\begin{bmatrix} \lambda_{11} & \cdots & \lambda_{1g} \\ \vdots & \ddots & \vdots \\ \lambda_{n1} & \cdots & \lambda_{ng} \end{bmatrix}}_g \Big\} n,$$

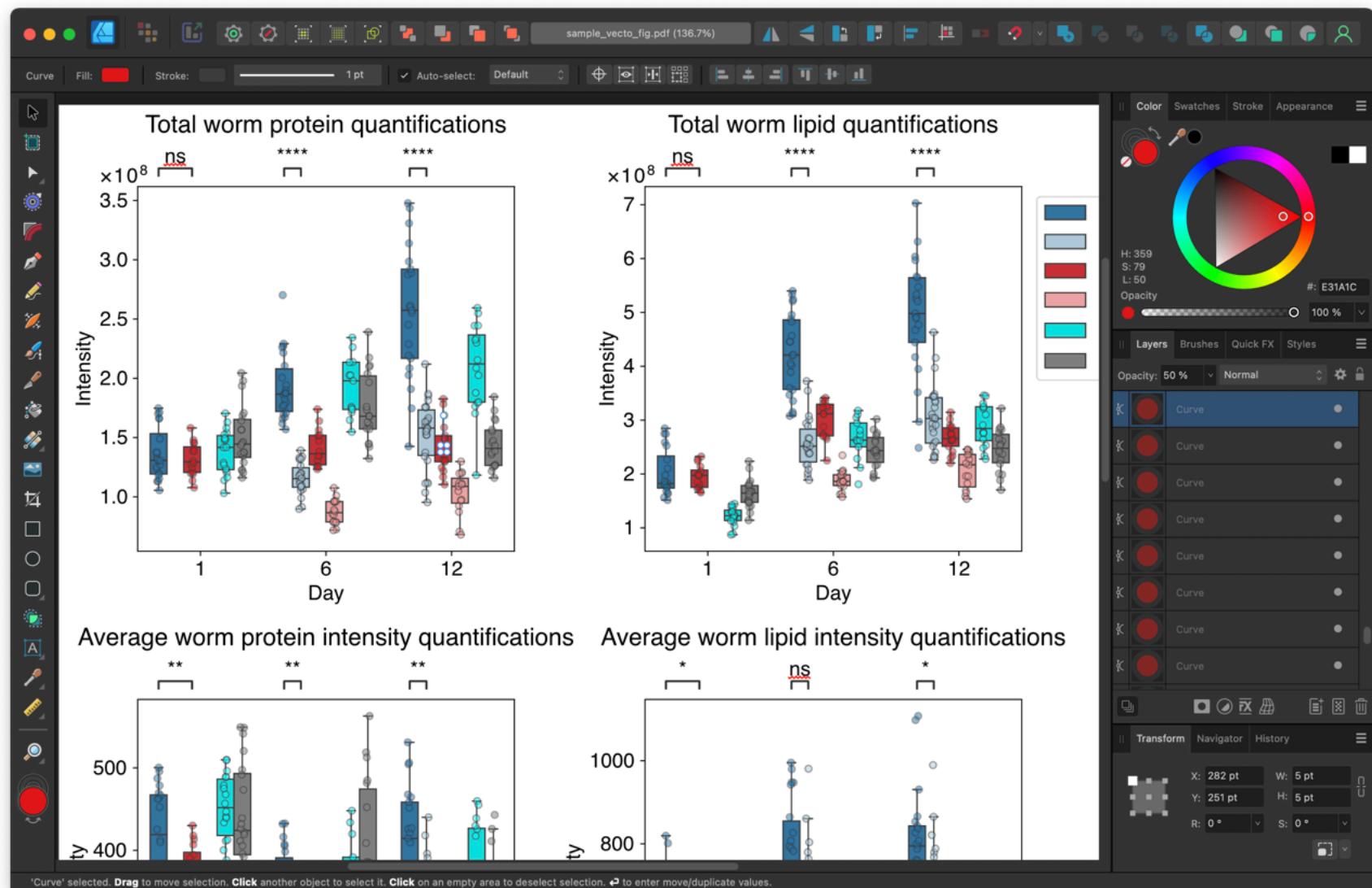
```
$$
M = \begin{bmatrix} m_{11} & \cdots & m_{1g} \\ \vdots & \ddots & \vdots \\ m_{n1} & \cdots & m_{ng} \end{bmatrix}, \quad \Lambda = \underbrace{\begin{bmatrix} \lambda_{11} & \cdots & \lambda_{1g} \\ \vdots & \ddots & \vdots \\ \lambda_{n1} & \cdots & \lambda_{ng} \end{bmatrix}}_g \Big\} n,
$$
```

Scientific Research is Both Dynamic and Scalable

Small Tasks, Big Headaches

Dilute the 100 μM stock to a concentration of 80 ng/ μL for each oligo. Label as probe, T7.

Oligo	Stock Conc.	Final Conc.	Volume of Stock	Volume of Water	Final Volume
T7 promoter	100.00 μM	12.89 μM	2.58 μL	17.42 μL	20.00 μL



AutoSave Document1

Home Insert Draw Design Layout References Mailings Review >> Comments Editing Share

Equation / Unicode {()} Bracket Limit and Log
{} Function Operator

$$(1 + x)^n = 1 + \frac{nx}{1!} + \frac{n(n - 1)x^2}{2!} + \dots$$

$$f(x) = a_0 + \sum_{n=1}^{\infty} \left(a_n \cos \frac{n\pi x}{L} + b_n \sin \frac{n\pi x}{L} \right)$$

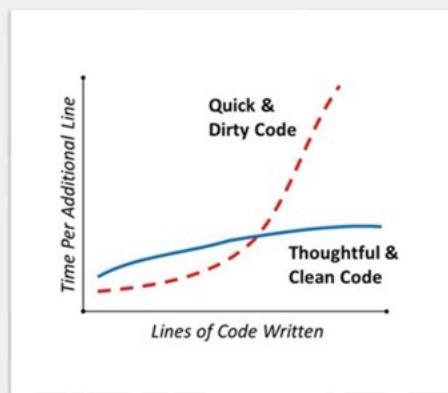
Page 1 of 1 2 words English (United States) 244%

When Effort Scales Poorly

BENEFITS OF FLEXIBLE CODE

- Update workflows as new methods arise
- Single-responsibility principle makes understanding code easier
- Increases longevity of codebase

CCB Skills Seminar Series



3/18/24

8

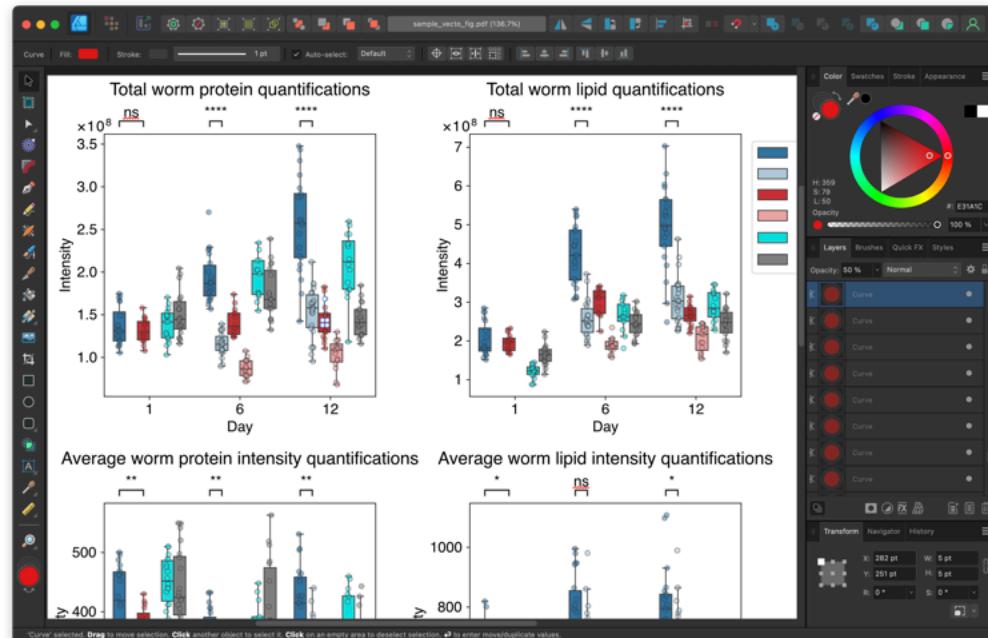
Credit: Matthew Giamar, CCB

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Text as a Tool for Automation and Reuse

```
def calculate_mw(sequence, is_duplex):
    ...
def convert_conc(conc, unit, mw):
    ...
def dilution_ratio(start_conc, target_conc):
    ...
def determine_dilution_steps(dil_ratio):
    steps = []
    while dil_ratio > 10:
        if dil_ratio >= 10:
            steps.append(10)
            dil_ratio /= 10
        elif dil_ratio >=5:
            steps.append(5)
            dil_ratio /=5
    steps.append(dil_ratio)
    return steps
```

Step	Oligo	Stock Conc.	Final Conc.	Volume of Stock	Volume of Water	Final Volume
1	T7 promoter	100.00 μM	12.89 μM	2.58 μL	17.42 μL	20.00 μL
1	Probe	100.00 μM	10.00 μM	1.00 μL	9.00 μL	10.00 μL
2	Probe	10.00 μM	1.91 μM	3.81 μL	16.19 μL	20.00 μL
1	Probe+T7	100.00 μM	10.00 μM	1.00 μL each	8.00 μL	10.00 μL
2	Probe+T7	10.00 μM	1.66 μM	8.31 μL	41.69 μL	50.00 μL
...						



```

hue_order = [
    'N2_Fed', 'N2_CR',
    'CEH60_Fed', 'CEH60_CR',
    'N2_(daf2_control)_Fed',
    'daf2_Fed',
]

my_colors = [
    '#1f78b4',
    '#a6cee3',
    '#e31a1c',
    '#fb9a99',
    '#00FFFF',
    '#808080',
]

hue_dict = dict(zip(
    hue_order,
    my_colors
))

```

```

\begin{frame}
\frametitle{From Discrete to Continuous}
\begin{bmatrix} N_k=N_0 \lambda^k, k \in \mathbb{N} \end{bmatrix}
\pause
\begin{description}
\item[Comparison] The geometric sequence
\pause
\item[Expansion] {What if the cells do not divide simultaneously?  
What about a non-integer time (e.g.  $0.7\tau$ )?}
\end{description}
\pause
\begin{align*}
& N_t = N_0 \lambda^t \\
& t = C\tau, C \in \mathbb{R}
\end{align*}
\end{frame}

```

QUANTITATIVE APPROACHES TO BIOLOGICAL PROBLEMS

LEON HAN

Math in Genetics

- Introduction
- Probability Theory Concepts
- Induction in Genetics

Math in Population Growth

- Introduction
- Modeling
- Continuous Analogy
- Different Perspective

Some Remarks

From Discrete to Continuous

$$N_k = N_0 \lambda^k, k \in \mathbb{N}$$

Comparison The geometric sequence

Expansion What if the cells do not divide simultaneously?
What about a non-integer time (e.g. 0.7τ)?

$$N_t = N_0 \lambda^t$$

$$t = C\tau, C \in \mathbb{R}$$

Key Takeaways

- 1. Text is the foundation of scientific data and communication**
- 2. A lot of digital content is text under the hood**
- 3. Using text early enables flexibility, scalability, and reproducibility**

Structured Text for Machines and Humans

JSON:

- Created in early 2000s for JavaScript-based data exchange
- Now a **universal format** for web APIs, cloud apps, scientific tools
- Simple key–value pairs, supports arrays and nesting
- **Readable by both humans and machines**

```
{  
  "name": "Taiyaki",  
  "age": 1,  
  "favoriteFood": "tuna"  
}
```

Structured Text for Machines and Humans

YAML:

- Introduced in 2001 as **YAML Ain't Markup Language**
- Prioritizes **human readability** over strict syntax
- Widely used in configuration files (Docker, GitHub Actions, CI/CD tools)
- Indentation defines structure (no braces or commas)

```
name: taiyaki
age: 1
favoriteFood: tuna
```

Text Formatting Tools

HTML5 - the Heart of Modern Internet

HTML5 (Hypertext Markup Language 5) is a markup language used for structuring and presenting hypertext documents on the World Wide Web. It was the fifth and final major HTML version that is now a retired World Wide Web Consortium (W3C) recommendation. The current specification is known as the HTML Living Standard.

— Wikipedia

Text Formatting Tools

HTML5 - the Heart of Modern Internet

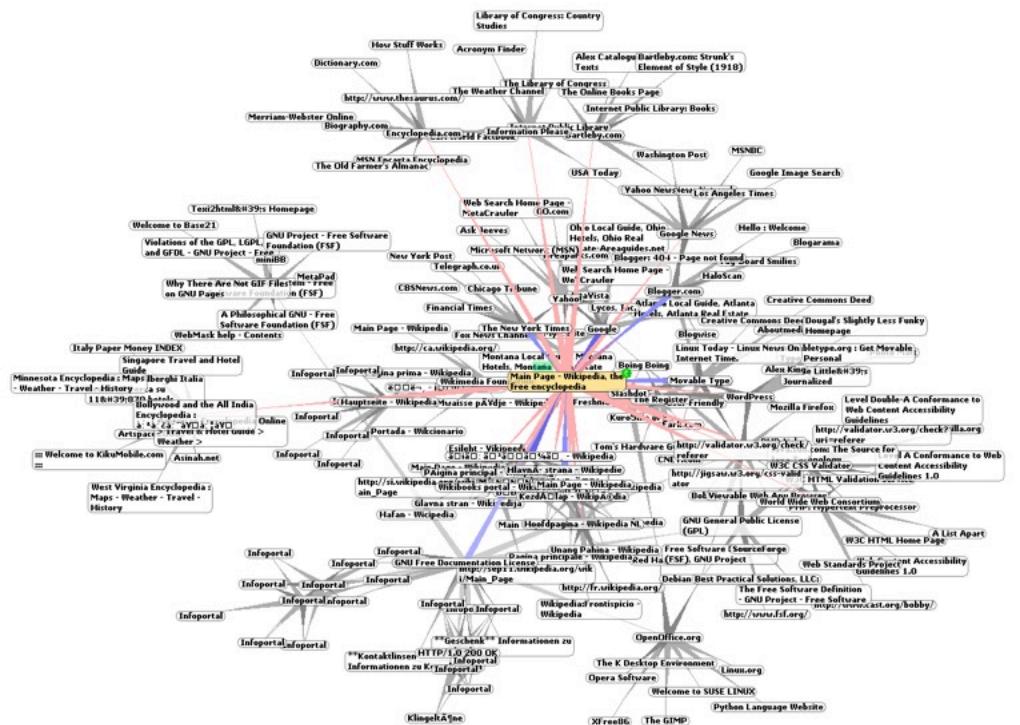
Structured:

- Separates content and style

Easy Navigation:

- Support interconnected links and embedded contents

Image credit: [Chris 73](#)



The screenshot shows a browser window with the address bar set to `ccbskillssem.github.io`. The main content area displays a paragraph about seminars taught by graduate students focusing on software tools, techniques, and libraries useful for researchers. Below this, a section titled "Spring 2025" is shown with a sub-section about "Storytelling in Scientific Talks". The browser's developer tools are open, specifically the Network and Sources tabs.

These seminars are taught by graduate students and focus on software tools, techniques, and libraries that are useful for researchers performing computation and data analysis. There is an emphasis on subjects related to the biological sciences, but many of the techniques are general and the seminar is open to researchers in all disciplines.

Spring 2025

Topic: Storytelling in Scientific Talks: crafting and refining a narrative for better communications

Details: Thursday, April 10, 12 - 1pm

Presenter: Chandler Sutherland, PMB, UC Berkeley

Sources Tab Content:

```
</nav>
</header>
<div class="franklin-content">
  <h1 id="overview">
    <a href="#overview" class="header-anchor">Overview</a>
  </h1>
  <p>These seminars are taught by graduate students and focus on software tools, techniques, and libraries that are useful for researchers performing computation and data analysis. There is an emphasis on subjects related to the biological sciences, but many of the techniques are general and the seminar is open to researchers in all disciplines.</p>
  <h2 id="spring_2025">
    <a href="#spring_2025" class="header-anchor">Spring 2025</a>
  </h2>
  <p>
    <span style="font-weight: 750"> Topic: Storytelling in Scientific Talks: crafting and refining a narrative for better communications</span>
  </p>

```

"Less is more."

Markdown Unifies Readability and Text Structuring

Markdown is a lightweight markup language for creating formatted text using a plain-text editor. Markdown is widely used for blogging and instant messaging, online forums, collaborative software, documentation pages, and readme files.



Heading

Sub-heading

Alternative heading

Alternative sub-heading

1. fruits

- *apple*
- **banana**

2. [link to vegetables](#)

Rabbits like carrots.

Heading

=====

Sub-heading

Alternative heading

Alternative sub-heading

1. fruits
 - * *apple*
 - * **banana**
2. [link to vegetables](<https://foo.bar>)
> Rabbits like carrots.

Honorable Mention: Obsidian

The image shows the Obsidian application running on a Mac and an iPhone. The Mac window has two tabs open: 'Writing is telepathy' and 'Graph of Writing is telepathy'. The left tab displays a note titled 'Writing is telepathy' with a heading 'Ideas can travel through time and space'. It contains text about the nature of ideas and a bulleted list: 'A sending place, a transmission place — where the writer sends ideas, such as a desk' and 'A receiving place — where the reader receives the ideas/imagery such as a couch, a comfortable chair, in bed'. The right tab shows a network graph with nodes like 'Books', 'On Writing', 'Calmness is a superpower', 'Writing is telepathy', 'Evergreen notes turn ideas into objects that you can manipulate', 'Everything is a remix', 'Charm', 'Evergreen notes', 'Creativity is combinatoric uniqueness', 'Company is a superorganism', and 'Imagination is your former self'. The iPhone screen shows a 'Japan Trip Planning' project with a 'To-do' list containing items like 'Schedule flights', 'Ask for recommendations', and names 'Keiko', 'Andrew', 'Garrett'. A keyboard is visible at the bottom of the iPhone screen.

Summary

- 1. You own the data as long as you know about it**
- 2. Text is not only the abstraction of data, but also the cohesive of your knowledge base**