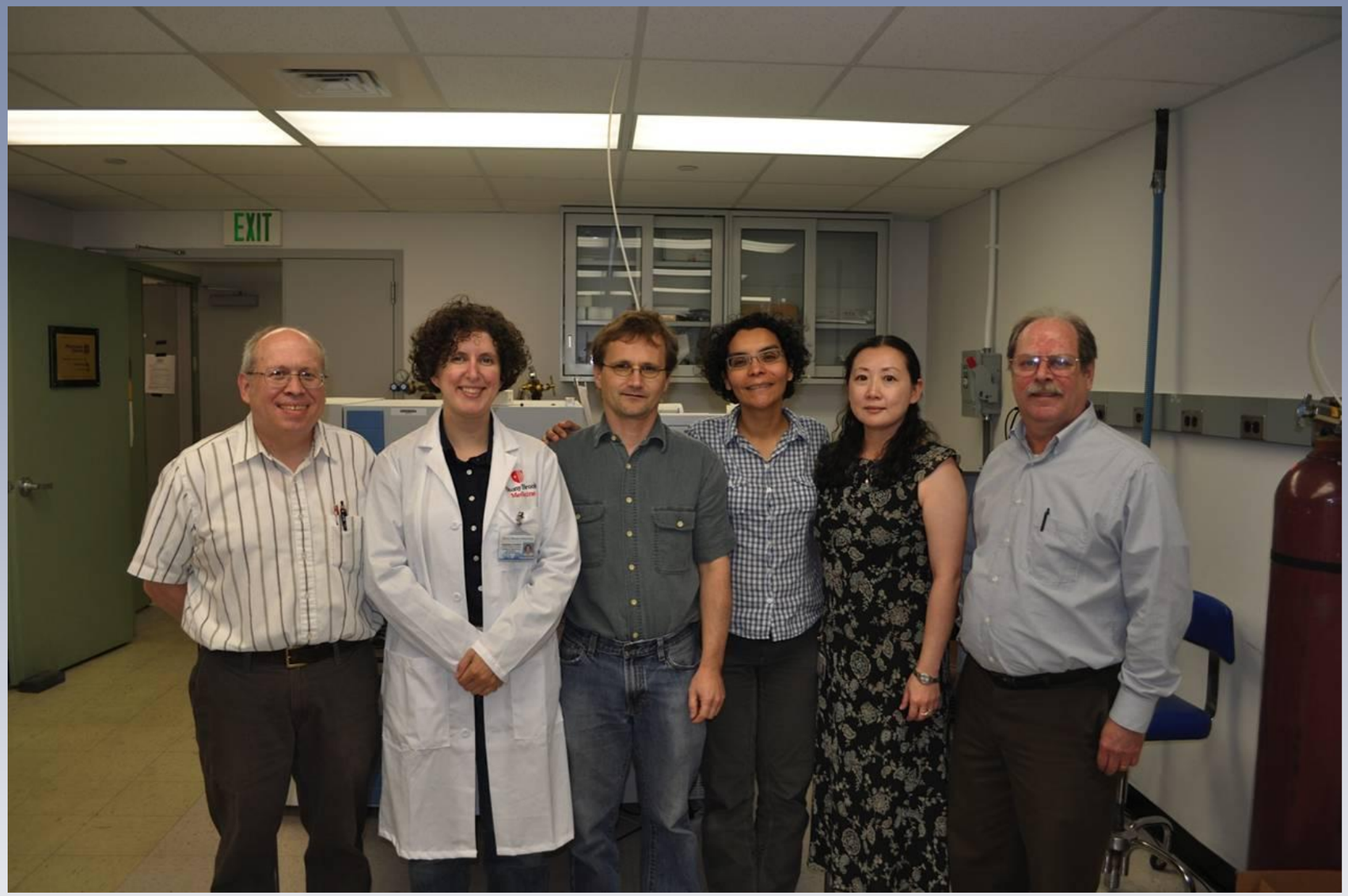
Configurable Software Advantage for Managing Today's Biobank

The Freezerworks Advantage



Stony Brook Medicine

Dr. Angelique Corthals

Scientific Director of the BioBank

Stony Brook University (SUNY) School of Medicine (Present)

American Museum of Natural History Tissue Bank (AMCC) 2000-2006

Biobanking: What?

- Document the sample's present

↓

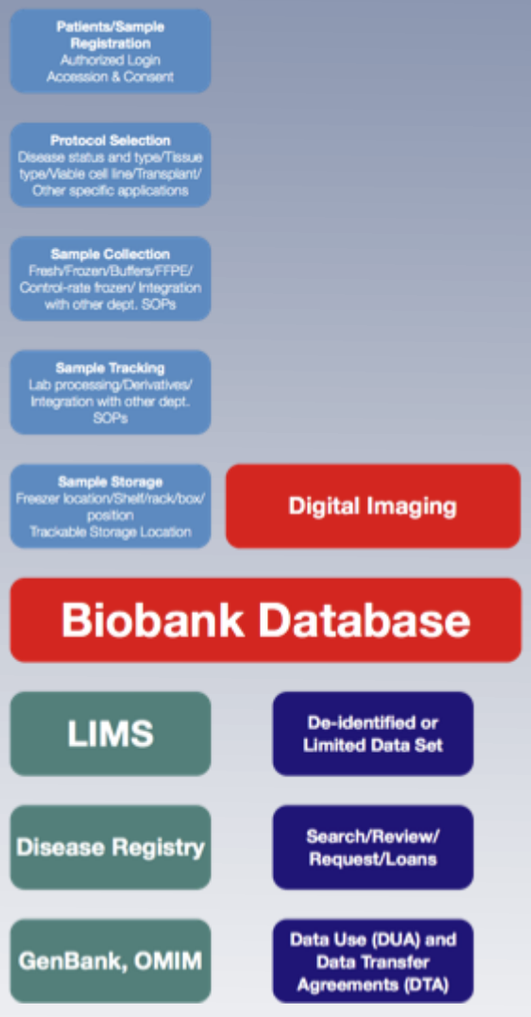
  - Validate its past

↓

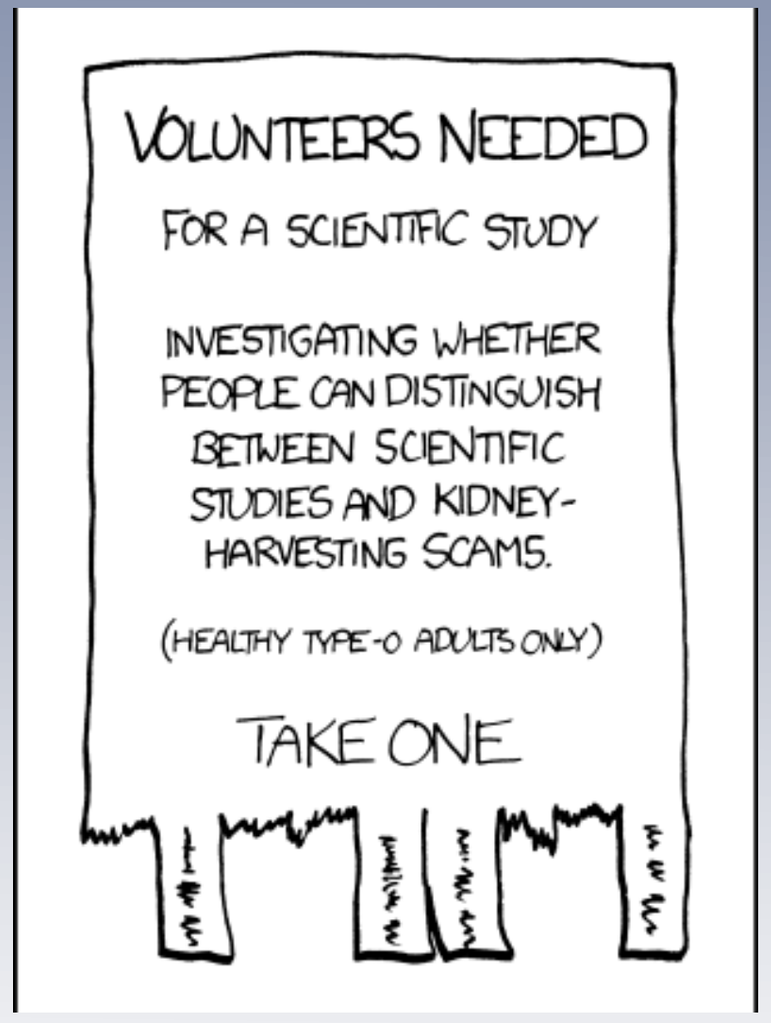
- Make it available for the future

HOW?

Cryogenics

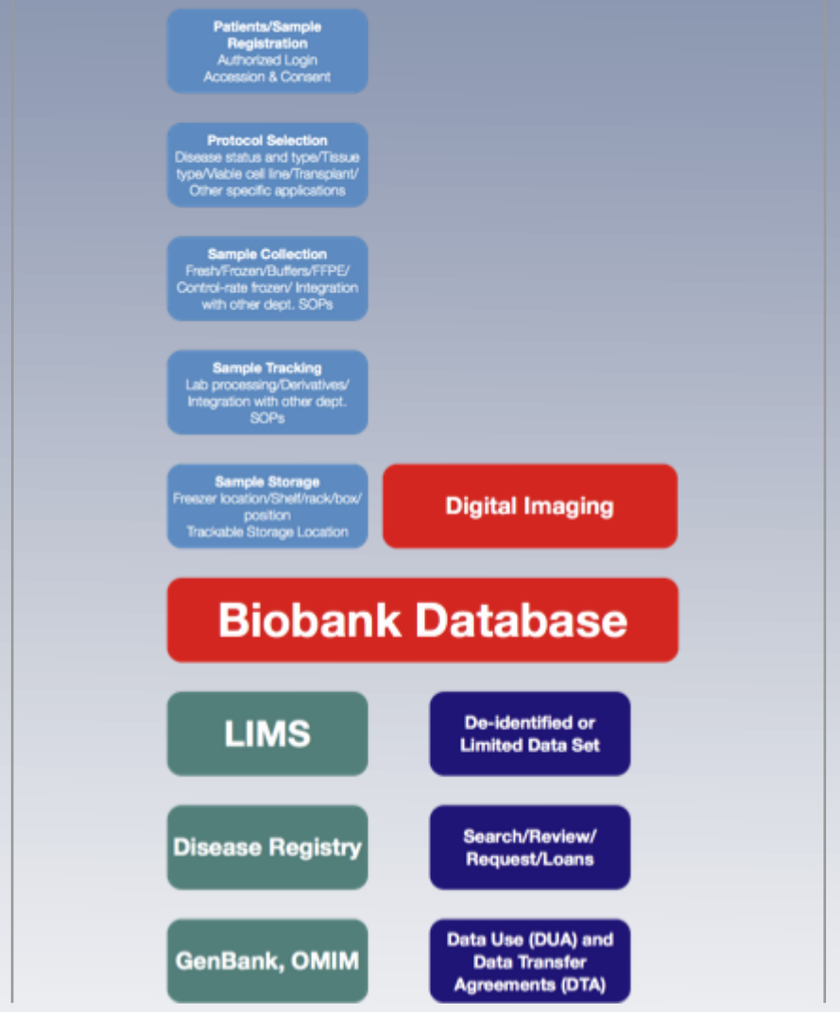


Informatics



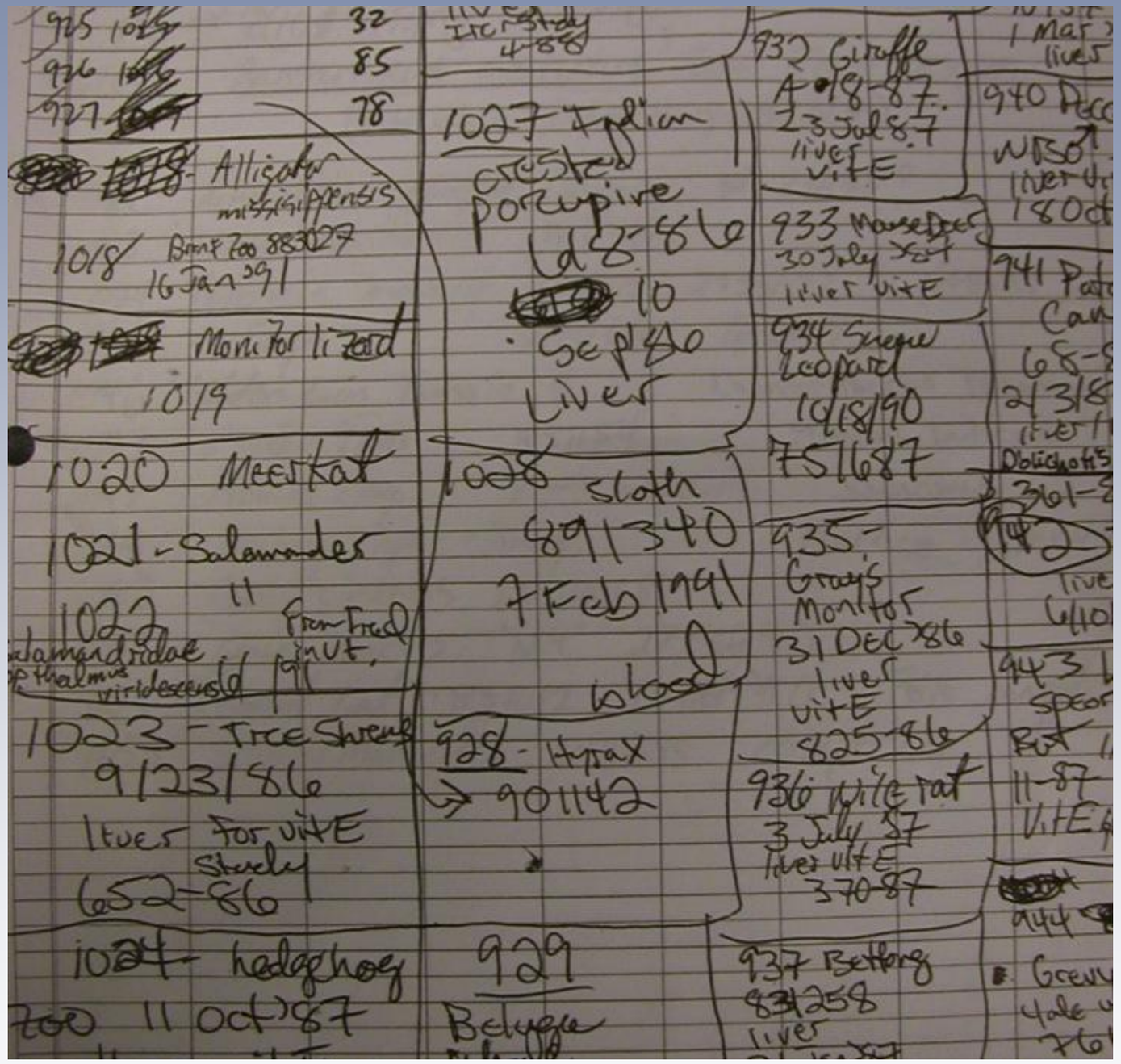
Ethics

HOW?



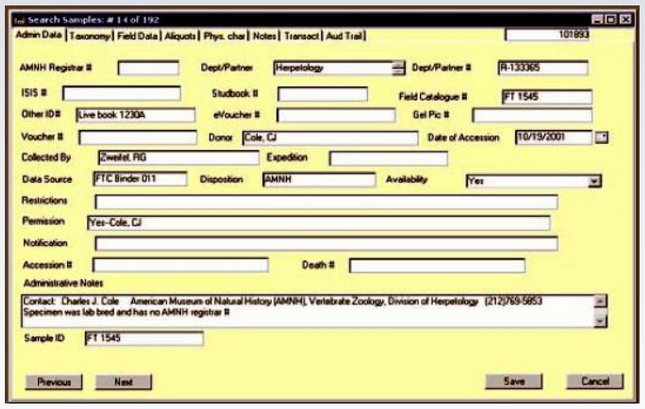
Informatics

Freezerworks
Sample Management Software



American Museum of Natural History 1865 - 2000

Various laboratories “storage units” (aka The Primordial Soup)



American Museum of Natural History Tissue Bank (AMCC) 2000-2006

Corthals, A. and R. Desalle. 2005. An Application of Tissue and DNA banking for Genomics and Conservation: The Ambrose Monell Cryo-Collection. ***Systematic Biology***. 54(5):819–823, 2005

Savolainen, V., G. Reeves, K. Davis, M.P. Powell and A. Corthals (eds). 2006. ***DNA Banking for Biodiversity and Conservation***. Kew Publishing & IUCN

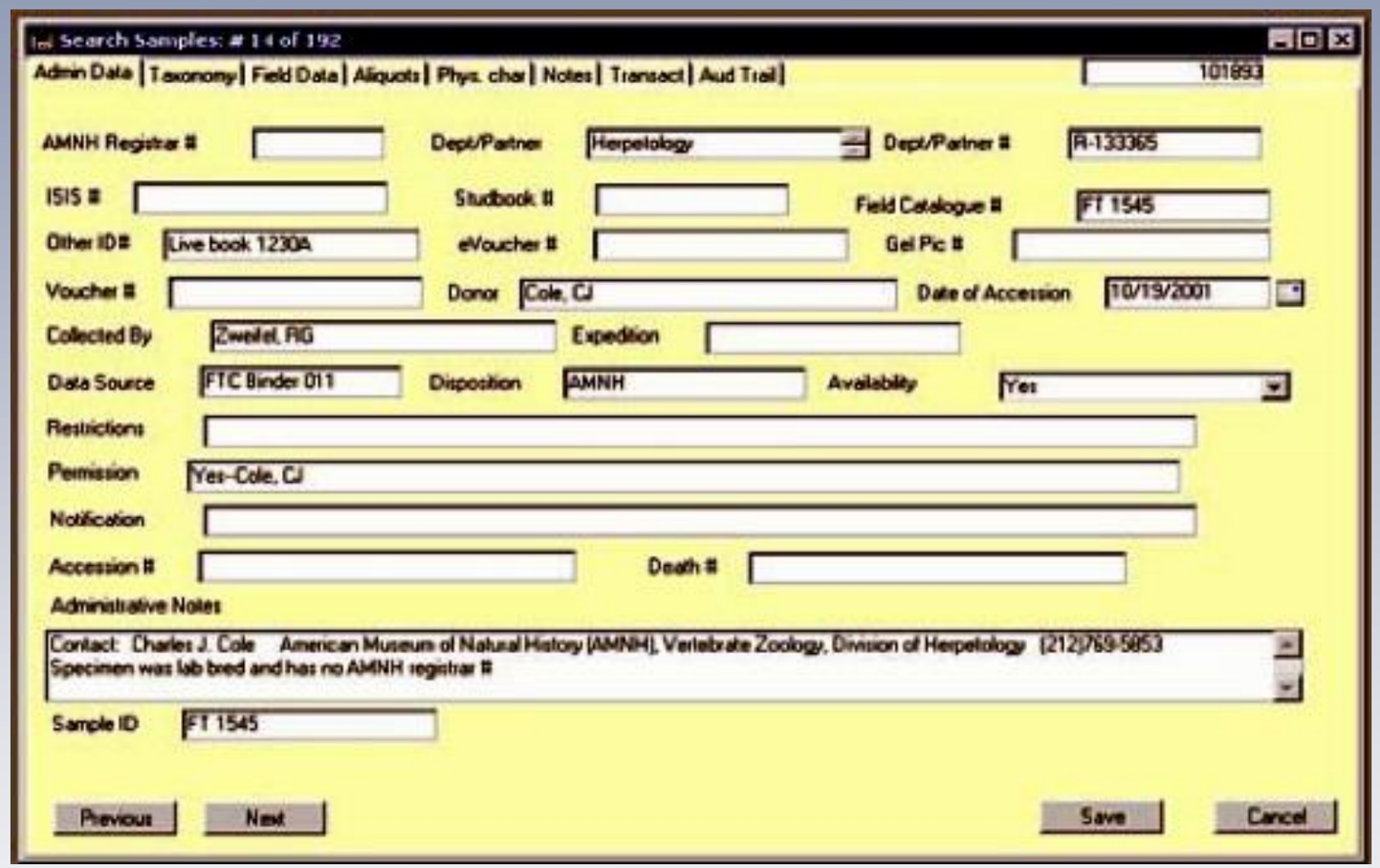
The Problem of most Biobanks

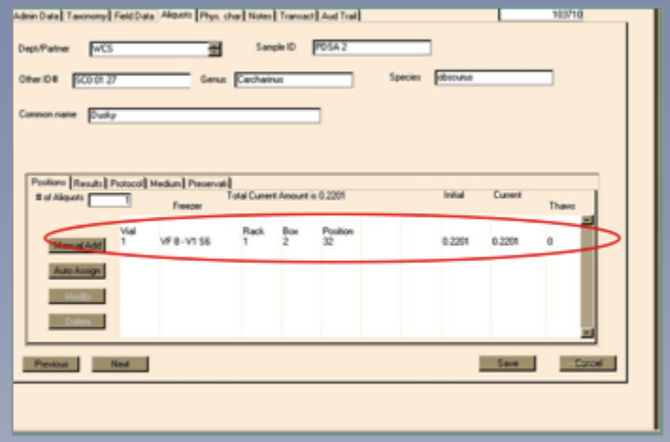
- No or little IT resource
- either Get a programmer ($$$,$$$ or €€.€€€)
- or Get an easily customizable and flexible software solution

The Problem of most Biobanks

- No or little IT resource
- either Get a programmer ($$$,$$$ or €€.€€€)
- Get an easily customizable and flexible software solution

Freezerworks
Sample Management Software





Freezerworks Unlimited at the AMNH

Keeps track of the biomaterial and their aliquots with a unique barcode ID recording not only all basic sample data, the physical location of the sample but also all the “cradle to grave” history of the sample with several levels of security and audits. It is also highly compatible with most DB platforms.

Freezerworks
Sample Management Software

Admin. Data	Taxonomy Data	Field Data	Physical Characteristic Data	Aliquot data
AMNH Registrar #	Kingdom	Collect. Date 1	Sex	Aliquot Type
Dept/Partner	Phylum	Collect. Date 2	Age	Storage Medium
Dept/Partner #	Class	Time of Collection	Height	Preservation History
ISIS #	Order	Season of Collection	Weight	
Studbook #	Suborder	Continent	Length	
Field Catalogue #	Family	Body of Water	Molt status	
Other ID #	Subfamily	Country	Reproductive Conditions	
eVoucher #	Genus	Geo. Division 1	Date of Birth	
Voucher #	Species	Geo. Division 2	Birth Place	
Gel Pic #	Subspecies	Specific Locale	Birth Type	
Donor	Type	UTM	Date of Death	
Date of Accession	Determined By	Latitude Degree	Cause of Death	
Collected by	Authority	Latitude Minutes	Institution of Origin	
Expedition	Questionable ID	Latitude Seconds	Sire ID	
Data Source	Common Name	Latitude North/South	Dam ID	
Disposition	Genbank/EMBL #	Longitude Degree	Sire Institution	
Availability	NCBI #	Longitude Minutes	Dam Institution	
Restrictions	Diagnostic reference	Longitude Seconds	Preservation type	
Permissions	Taxonomic History	Longitude West/East	Phys. Char. Notes	
Notification	Taxonomic History reference	Elevation		
Accession #	Reprints	Depth		
Death #		CPI		
Admin notes		Site/Survey		
Sample ID		Prepared by		
		Ancillary Collection		
		Purpose of Storage		
		Field Prep Method		
		Storage Method		
		Field Notes		
		Habitat Description		

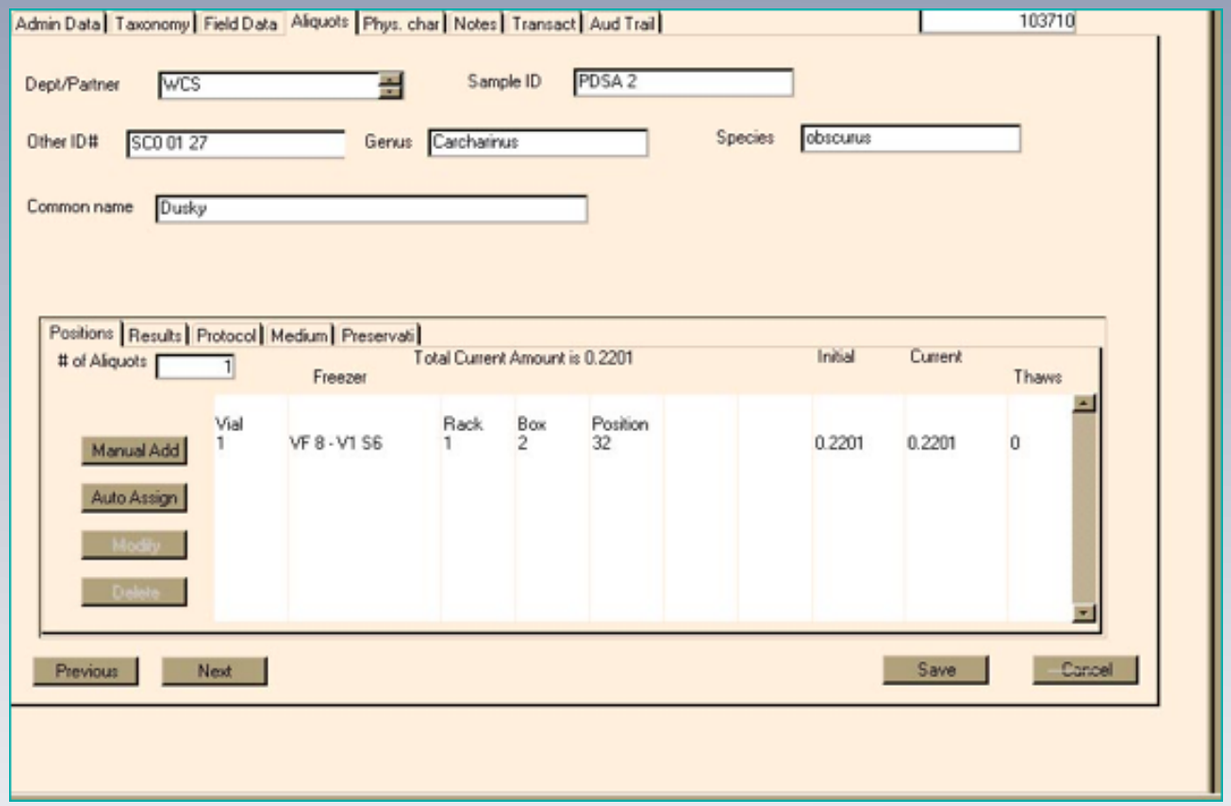
```
 101 c     85 g    119 t

ctggatcg tattgacaat cctgctgcca ttgct
acagttac cttctatccc tatgatgtta ccace
aaaacaat tttcgctcag ctcaaaactg ttgat
gatgatca tcagattgag agaaccattg cagtg
accgccat tttggacttc tgggataagc gtaag
attggttc actgaccggt ttcaatgcca tttac
gcagctgt tgttagcttc actcaatcca ttgcc
```

Freezerworks Unlimited fields at the AMNH

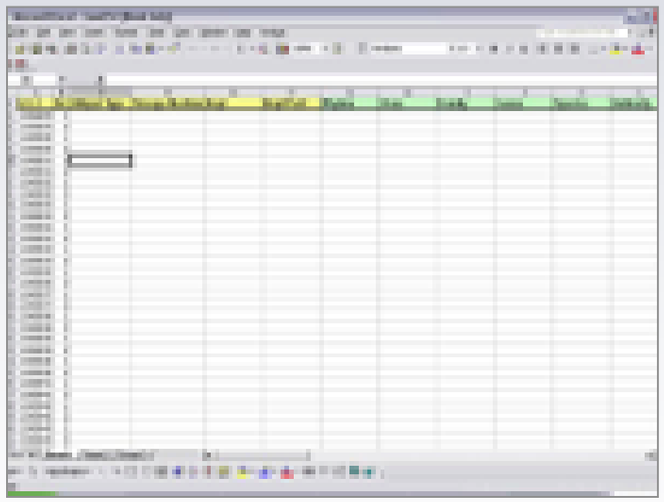
The challenge of tracking ALL data

Freezerworks
Sample Management Software



Freezerworks Unlimited ® at the AMNH

The challenge of tracking ALL data



Freezerworks Sample Management Software

ZIMS zoological information management system

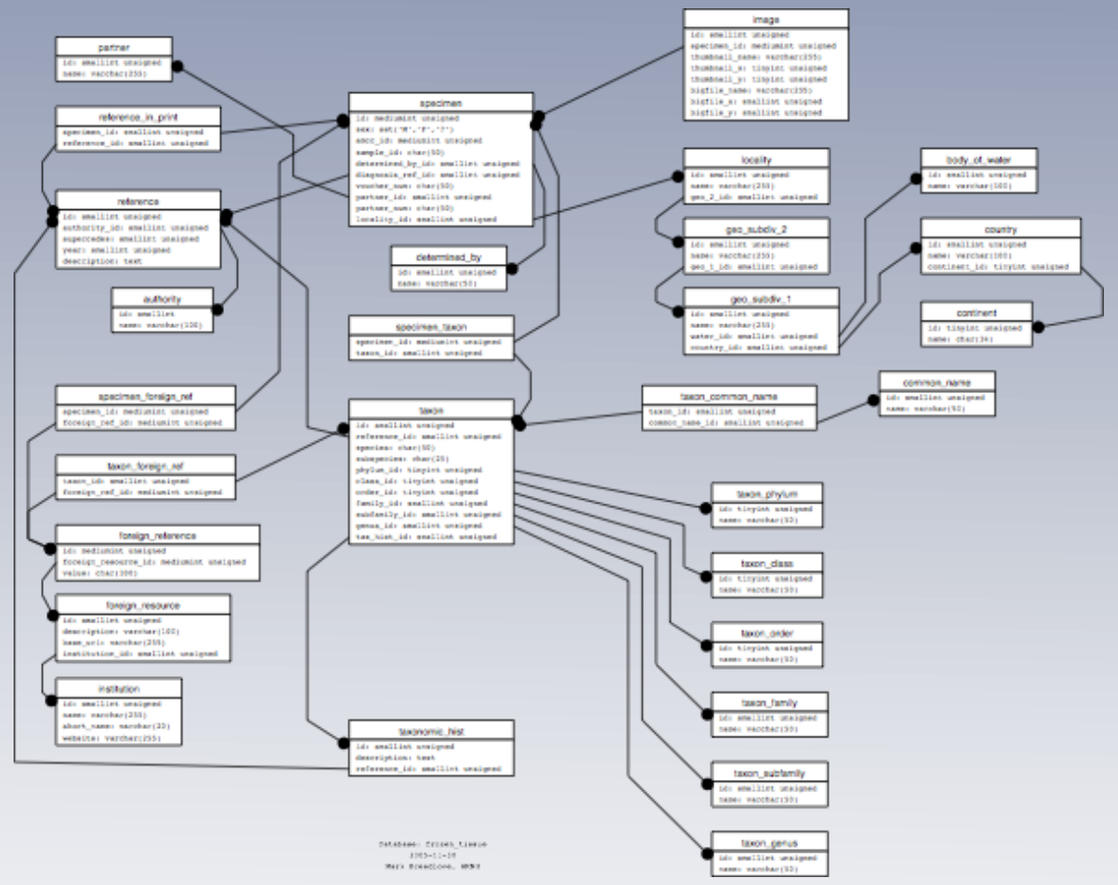
Freezerworks Unlimited in the field

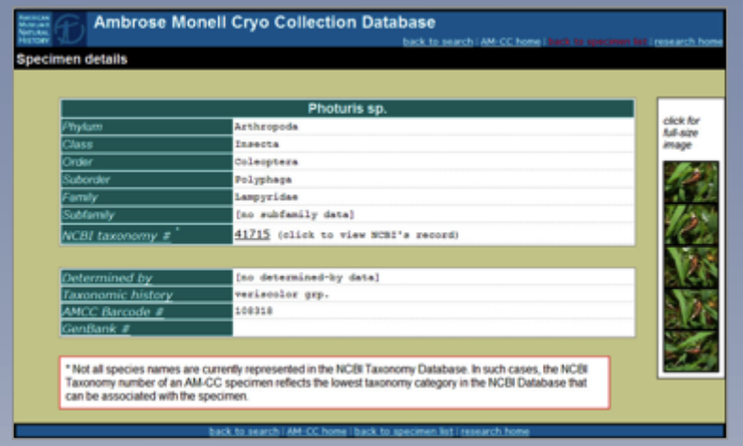
Freezerworks
Sample Management Software

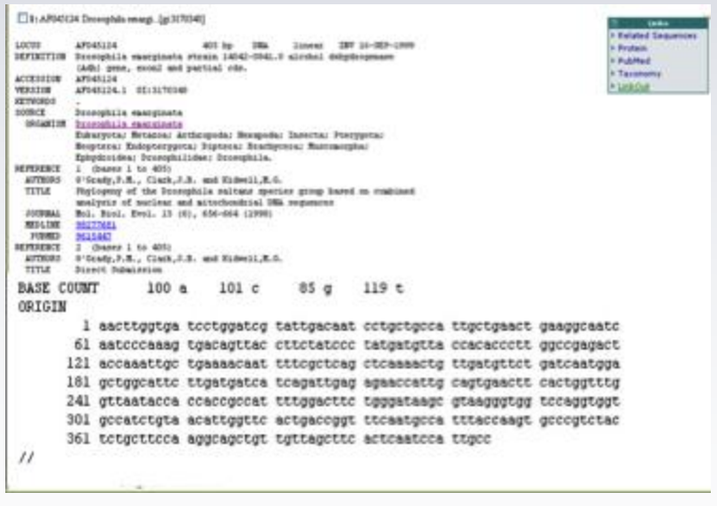
De-identified or Limited Data Set

Search/Review/ Request/Loans

Data Use (DUA) and Data Transfer Agreements (DTA)



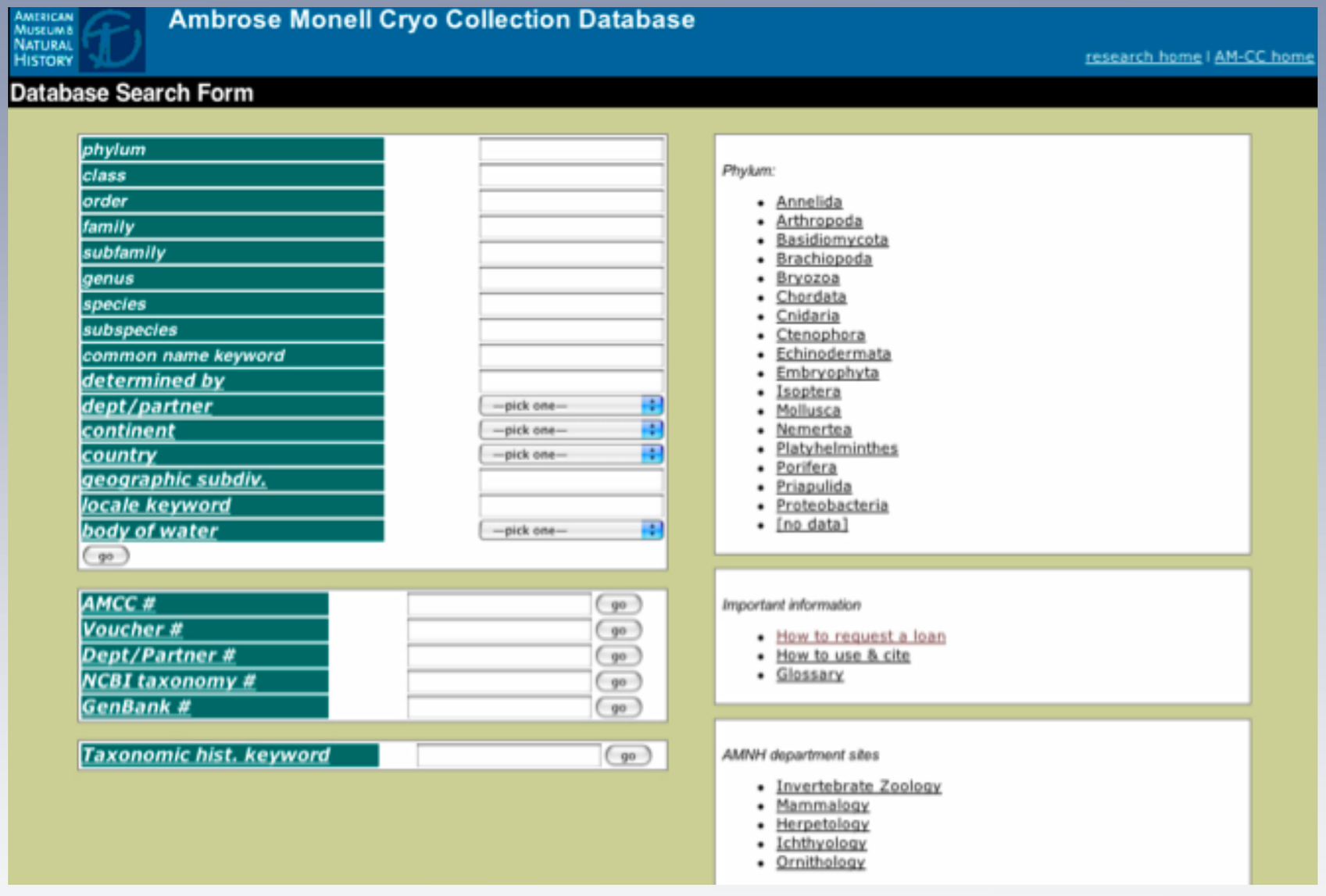


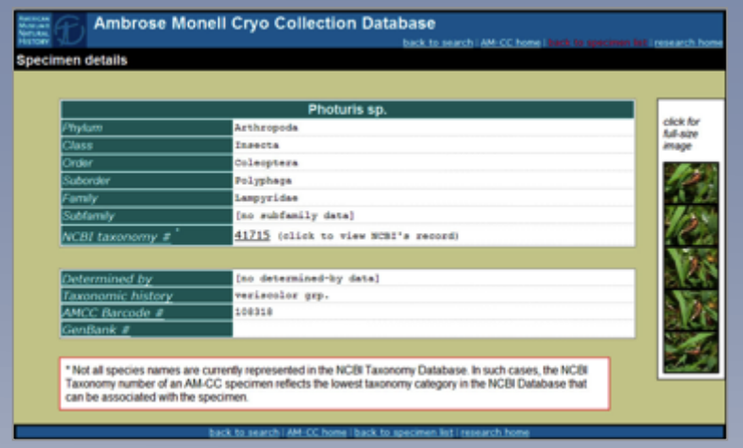


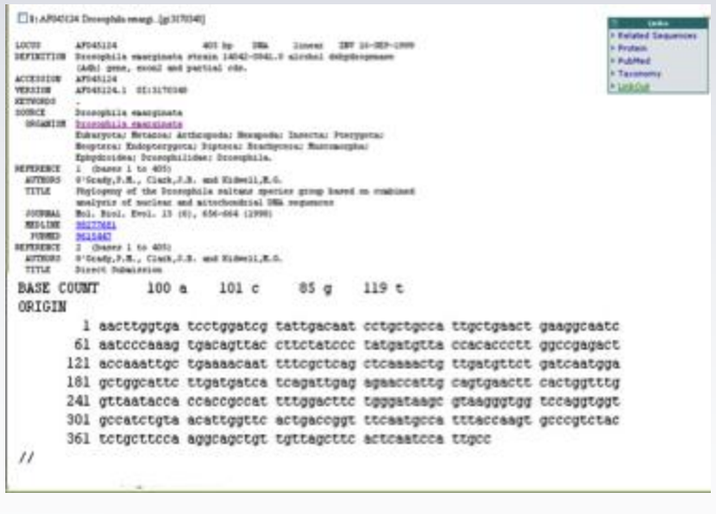
An online database is crucial to providing the scientific community in-house and externally with knowledge of the biobank's holdings and to foster collaboration

From Freezerworks to a MySQL database management system:

- Allows to restrict data access (Ethics)
- Allows unlimited addition of ancillary data
- Allows to LinkOut to other databases (GenBank, OMIM, SwissProt)







Subset of Freezerworks Unlimited in MySQL online Database

Developed by M. Breedlove and A. Corthals

Stony Brook University Medical Center - Development of a new BioBank New Challenges

Biobanking: Of Time and Technology

- How long should the material accessioned in biobanks be preserved? **Forever** (or as close to it as possible)

- Therefore, the software solution should accommodate “forever”

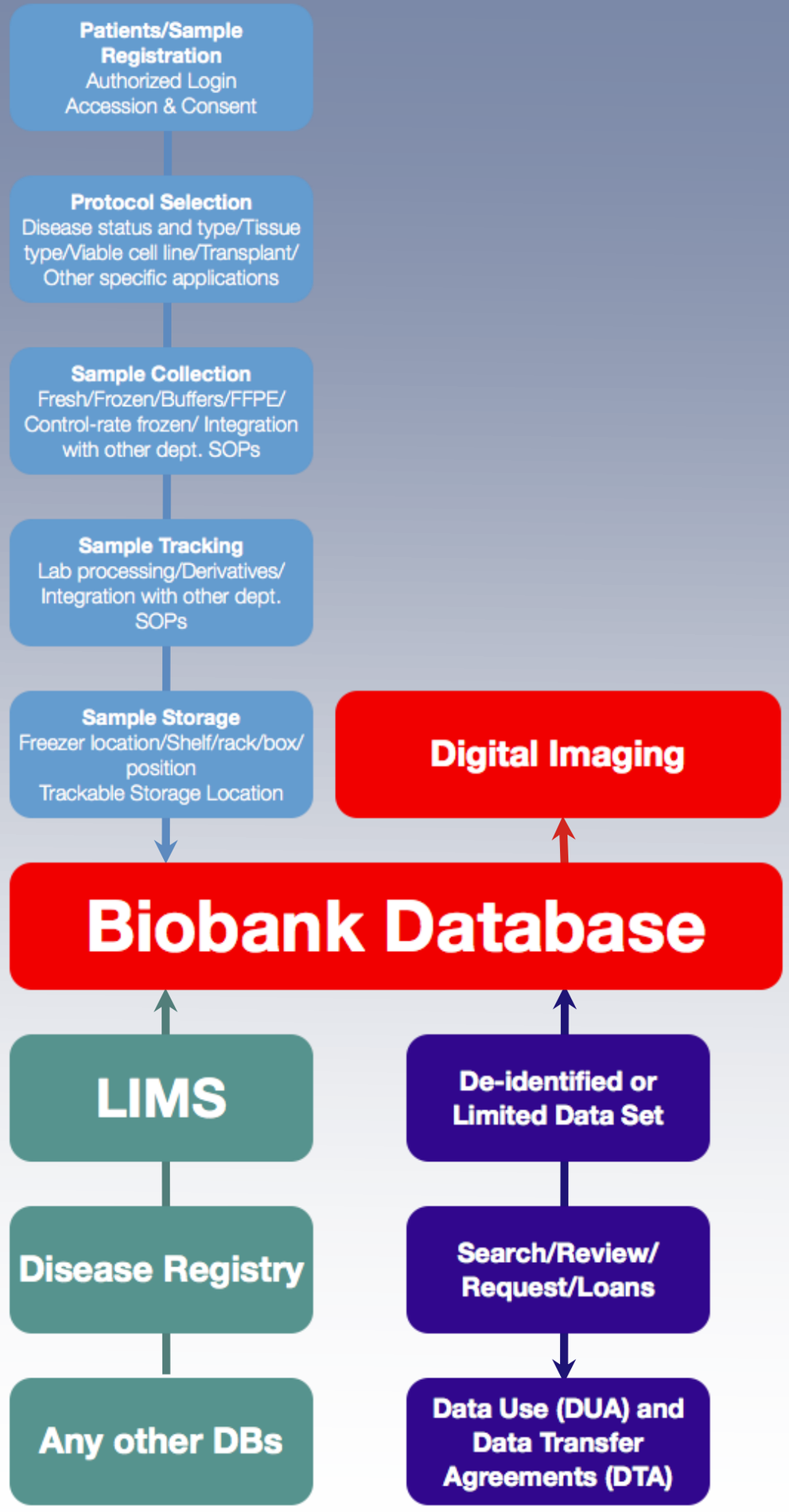
- The software should be flexible enough to evolve with technology and computer power

Biobanking: How much to record?

- Choose the bioinformatics to enable us to combine data from research studies with clinical information
- High quality data is required to support studies as well as clinical and translation research
- How much data? **ALL**
  - Patient clinical data
  - Demographic/Epidemiology data
  - Pathology data
  - Treatment data
  - Outcome and follow-up data
  - Biochemical, genomic, cell and tissue level data
  - E-Vouchers (Imaging, etc)

Biobanking: How much to record?

- 2 interfaces controlled by the biobank:
  - Day-to-day, biobank-based database
  - Customized online version of data holdings (security and ethics)
- External interface compatibility/Data transfer:
  - LIMS
  - Registries
  - Other databases (such as NCBI Genbank, OMIM, etc)



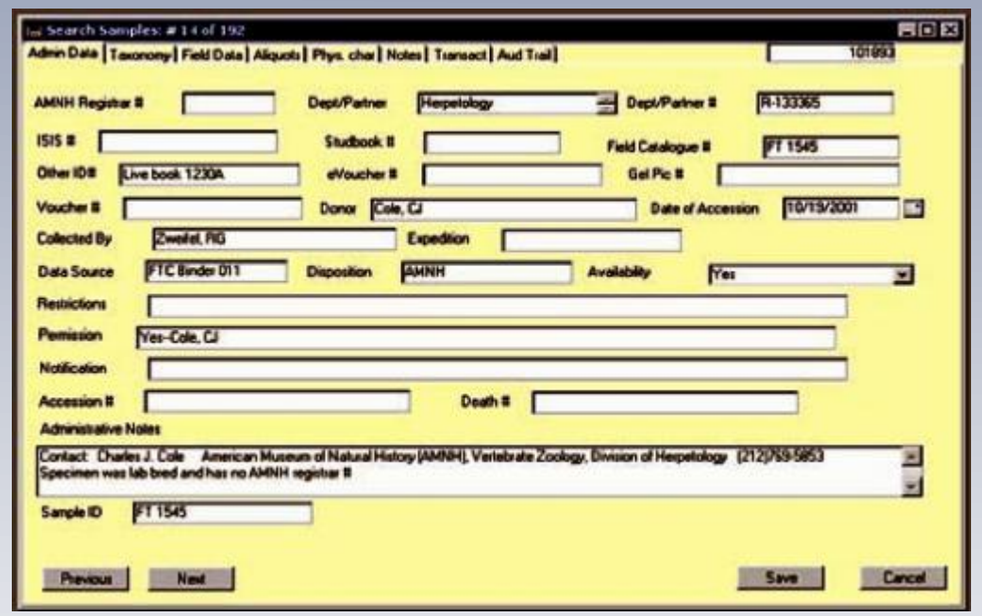
Patients/Sample Registration
Authorized Login
Accession & Consent

Protocol Selection
Disease status and type/Tissue type/Viable cell line/Transplant/ Other specific applications

Sample Collection
Fresh/Frozen/Buffers/FFPE/ Control-rate frozen/ Integration with other dept. SOPs

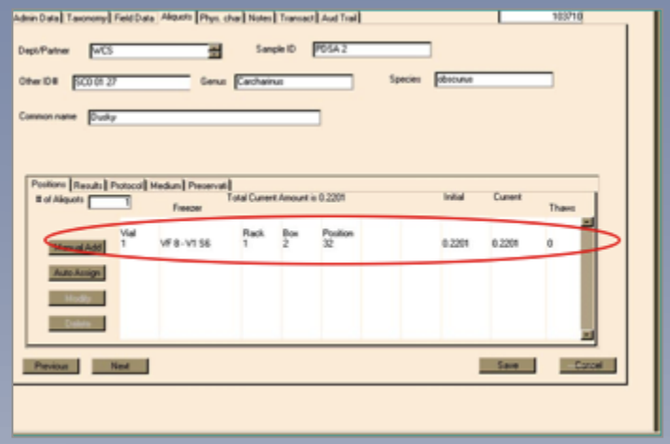
Sample Tracking
Lab processing/Derivatives/ Integration with other dept. SOPs

Sample Storage
Freezer location/Shelf/rack/box/ position
Trackable Storage Location



Freezerworks Unlimited ®

Freezerworks
Sample Management Software

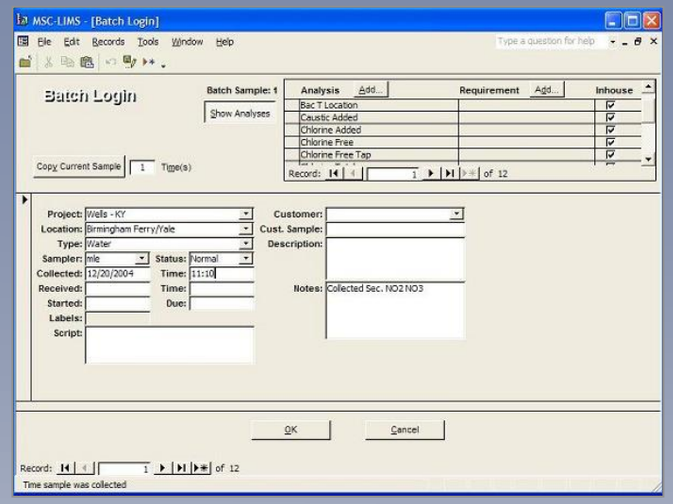


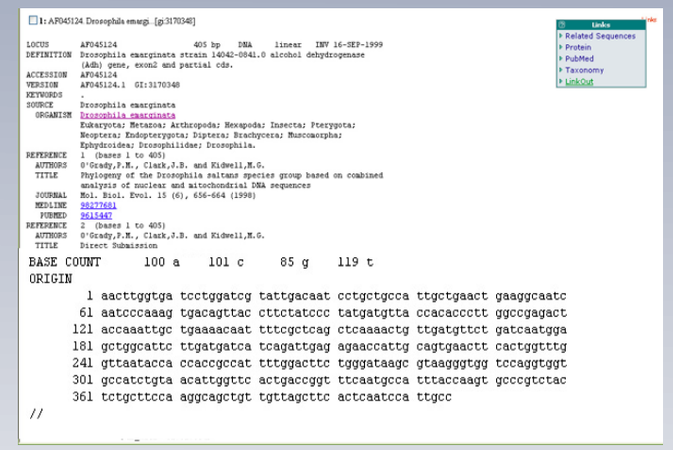
Keeps track of the biomaterial and their aliquots with a unique barcode ID recording not only all basic sample data, the physical location of the sample but also all the “cradle to grave” history of the sample with several levels of security and audits. It is also highly compatible with most DB platforms.

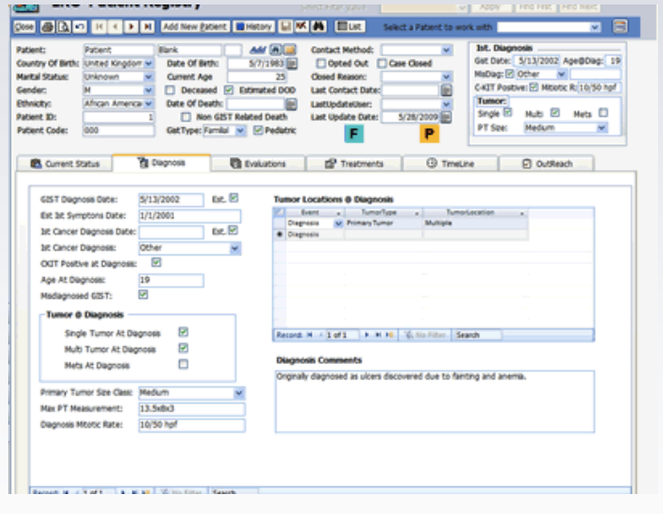
LIMS

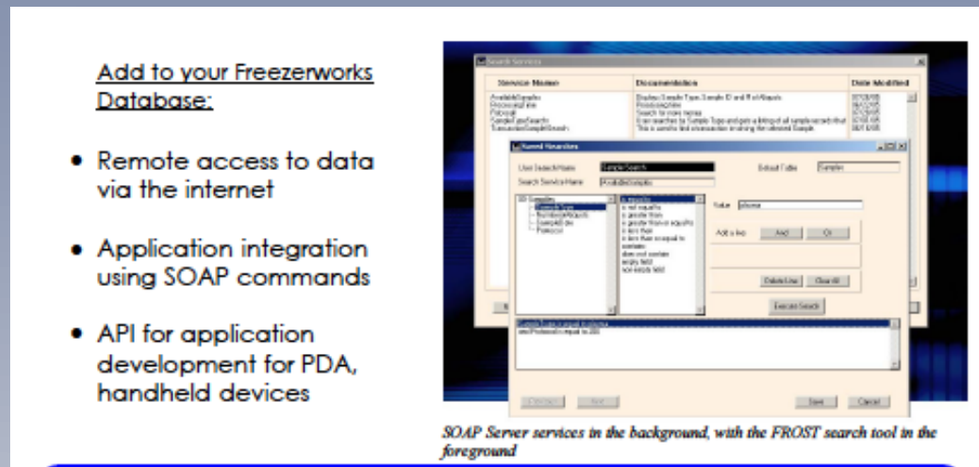
Disease Registry

GenBank, OMIM









Add to your Freezerworks Database:

- Remote access to data via the internet
- Application integration using SOAP commands
- API for application development for PDA, handheld devices

SOAP Server services in the background, with the FROST search tool in the foreground

SOAP Server for Freezerworks Unlimited

If you need to go beyond the client/server architecture of Freezerworks Unlimited, take a look at what the SOAP Server module can do for you.

The SOAP (Simple Object Access Protocol) Server module provides the power to execute remote searches and updates on your Freezerworks Unlimited data via the Internet.

Flexible

Search Services: Create and save Search Services to specify the fields the user can search by and the fields returned by the SOAP Server in the search results. Post your results on a web browser, a separate application, or even a hand held PDA, wireless scanner or other data collection device.

For example, create a Search Service to allow remote users to find available and useful samples for research or testing.

Update Services: Create Update Services to add new samples and aliquots to Freezerworks, or update existing records.

For example, automatically add records with data entered in another application into Freezerworks, eliminating duplication of entry tasks while improving data integrity.

Secure

SOAP Server utilizes user authentication to enforce the powerful security features of Freezerworks Unlimited. This ensures that remote users cannot gain unauthorized access to confidential data. As you configure access for users and groups through the powerful Freezerworks Security interface, the SOAP Server follows your rules, ensuring that users can only access those records you allow. It also comes ready to be SSL enabled, for added security.

Connectivity

The SOAP Server Module provides a flexible API that allows your developers to create fully functional remote applications to access Freezerworks Unlimited data. Any device that can connect to an IP address can be programmed to enter or retrieve Freezerworks Unlimited data.

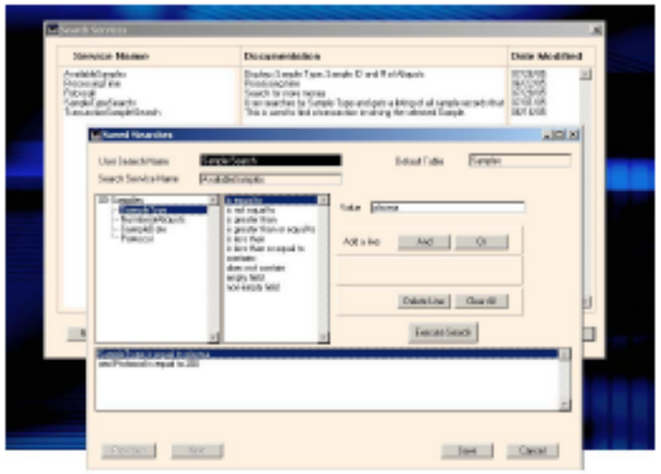
SOAP Server is available for both client/server and standalone versions.

Talking to other databases is crucial.

- Issues of compatibility and data transfer
- Issues of ethics

Add to your Freezerworks Database:

- Remote access to data via the internet
- Application integration using SOAP commands
- API for application development for PDA, handheld devices



SOAP Server services in the background, with the FROST search tool in the foreground

SOAP Server for Freezerworks Unlimited

If you need to go beyond the client/server architecture of Freezerworks Unlimited, take a look at what the SOAP Server module can do for you.

The SOAP (Simple Object Access Protocol) Server module provides the power to execute remote searches and updates on your Freezerworks Unlimited data via the Internet.

Flexible

Search Services: Create and save Search Services to specify the fields the user can search by and the fields returned by the SOAP Server in the search results. Post your results on a web browser, a separate application, or even a hand held PDA, wireless scanner or other data collection device.

For example, create a Search Service to allow remote users to find available and useful samples for research or testing.

Update Services: Create Update Services to add new samples and aliquots to Freezerworks, or update existing records.

For example, automatically add records with data entered in another application into Freezerworks, eliminating duplication of entry tasks while improving data integrity.

Secure

SOAP Server utilizes user authentication to enforce the powerful security features of Freezerworks Unlimited. This ensures that remote users cannot gain unauthorized access to confidential data. As you configure access for users and groups through the powerful Freezerworks Security interface, the SOAP Server follows your rules, ensuring that users can only access those records you allow. It also comes ready to be SSL enabled, for added security.

Connectivity

The SOAP Server Module provides a flexible API that allows your developers to create fully functional remote applications to access Freezerworks Unlimited data. Any device that can connect to an IP address can be programmed to enter or retrieve Freezerworks Unlimited data.

SOAP Server is available for both client/server and standalone versions.

Freezerworks
Sample Management Software

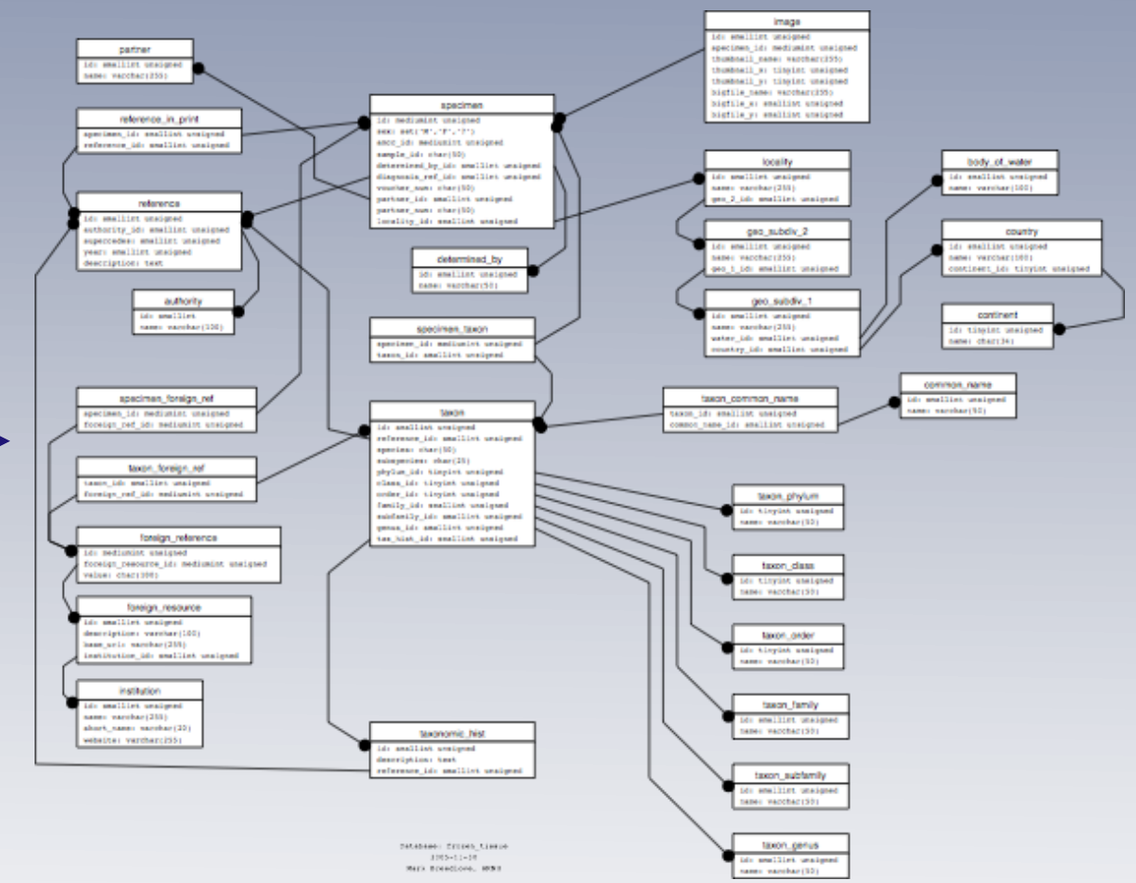
There’s an App for that

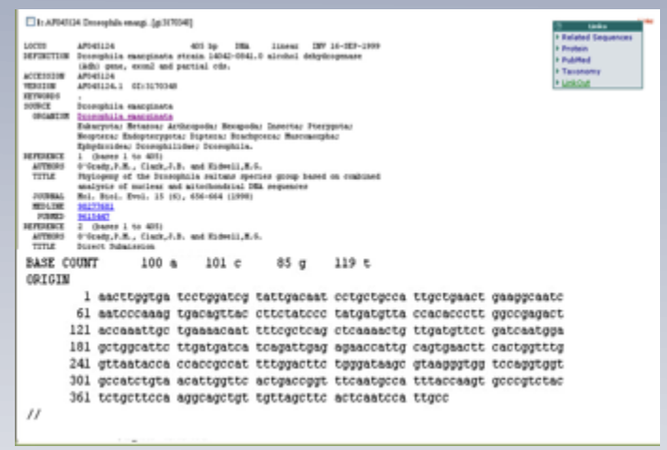
Link the Freezerworks database via an App using the SOAP protocol for easy location and identification of samples *in situ*

De-identified or Limited Data Set

Search/Review/ Requests/Loans

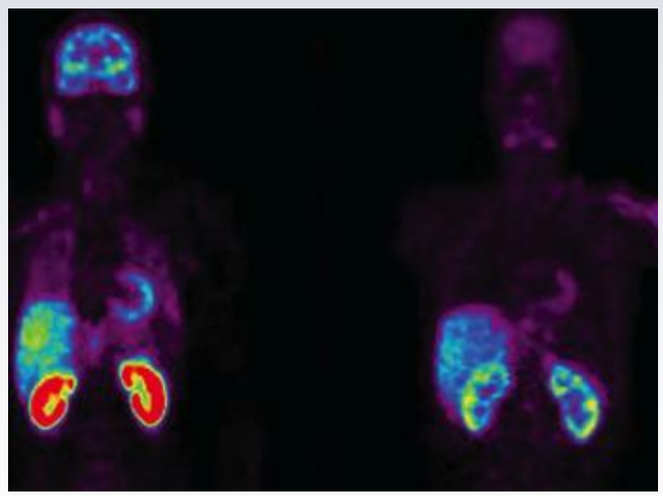
Data Use (DUA) and Data Transfer Agreements (DTA)





```
LOCUS       AF045124                 403 bp    DNA     linear   INV 16-SEP-1999
DEFINITION  Drosophila emarginata strain 14042-0541.0 alcohol dehydrogenase
            (Adh) gene, exon2 and partial cds.
ACCESSION   AF045124
VERSION     AF045124.1  GI:3170348
KEYWORDS    .
SOURCE      Drosophila emarginata
  ORGANISM  Drosophila emarginata
            Eukaryota; Metazoa; Arthropoda; Hexapoda; Insecta; Pterygota;
            Neoptera; Endopterygota; Diptera; Brachycera; Muscomorpha;
            Ephydroidea; Drosophilidae; Drosophila.
REFERENCE   1  (bases 1 to 403)
  AUTHORS   O'Grady,P.M., Clark,J.B. and Kidwell,M.G.
  TITLE     Phylogeny of the Drosophila saltans species group based on combined
            analysis of nuclear and mitochondrial DNA sequences
  JOURNAL   Mol. Biol. Evol. 15 (6), 656-664 (1998)
  MEDLINE   98277681
  PUBMED    9615447
REFERENCE   2  (bases 1 to 403)
  AUTHORS   O'Grady,P.M., Clark,J.B. and Kidwell,M.G.
  TITLE     Direct Submission

BASE COUNT      100 a    101 c     85 g    119 t
ORIGIN
        1 aacttggtga tcctggatcg tattgacaat cctgctgcca ttgctgaact gaaggcaatc
       61 aatcccaaag tgacagttac cttctatccc tatgatgtta ccacacccct ggccgagact
      121 acccaaattgc tgaaaacaat tttcgctcag ctcaaaactg ttgatgttct gatcaatgga
      181 gctggcattc ttgatgatca tcagattgag agaaccattg cagtgaactt cactggtttg
      241 gttaatacca ccaccgccat tttggacttc tggataagc gtaaggytgg tccagytggt
      301 gccatctgta acattggttc actgaccggt ttcaatgcca tttaccaagt gcccgtctac
      361 tctgcttcca aggcagctgt tgttagcttc actcaatcca ttgcc
//
```



An online database is crucial to provide the scientific community in house and externally with knowledge of the biobank's holdings and to foster collaboration

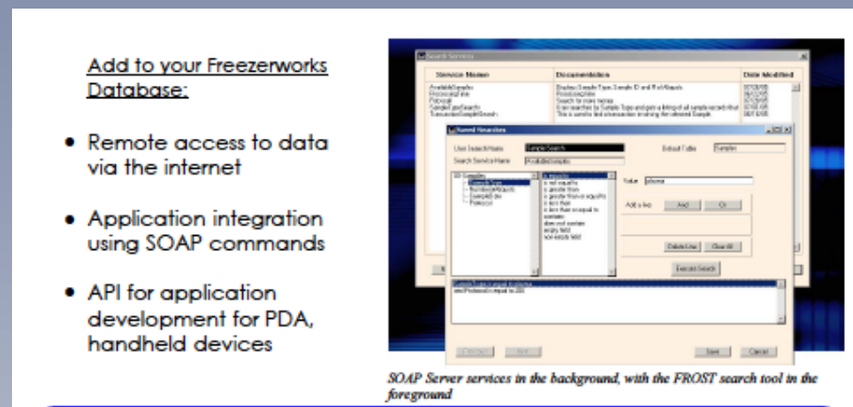
From Freezerworks to a MySQL database management system:

- Allows to restrict data access (Ethics)
- Allows unlimited addition of ancillary data
- Allows to LinkOut to other databases (GenBank, OMIM, SwissProt)

De-identified or Limited Data Set

Search/Review/ Request/Loans

Data Use (DUA) and Data Transfer Agreements (DTA)



Add to your Freezerworks Database:

- Remote access to data via the internet
- Application integration using SOAP commands
- API for application development for PDA, handheld devices

SOAP Server services in the background, with the FROST search tool in the foreground

SOAP Server for Freezerworks Unlimited

If you need to go beyond the client/server architecture of Freezerworks Unlimited, take a look at what the SOAP Server module can do for you.

The SOAP (Simple Object Access Protocol) Server module provides the power to execute remote searches and updates on your Freezerworks Unlimited data via the Internet.

Flexible

Search Services: Create and save Search Services to specify the fields the user can search by and the fields returned by the SOAP Server in the search results. Post your results on a web browser, a separate application, or even a hand held PDA, wireless scanner or other data collection device.

For example, create a Search Service to allow remote users to find available and useful samples for research or testing.

Update Services: Create Update Services to add new samples and aliquots to Freezerworks, or update existing records.

For example, automatically add records with data entered in another application into Freezerworks, eliminating duplication of entry tasks while improving data integrity.

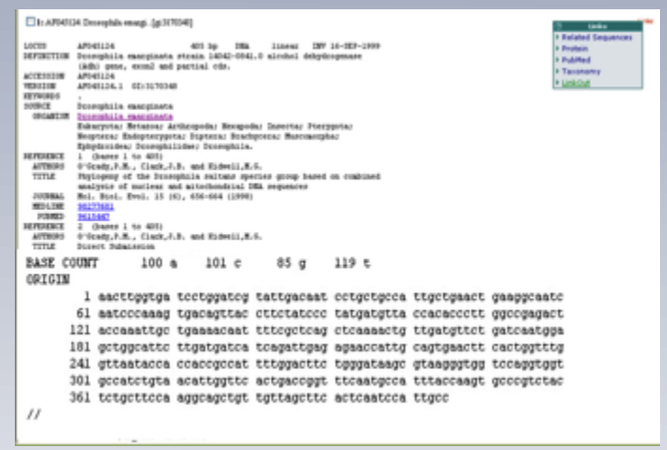
Secure

SOAP Server utilizes user authentication to enforce the powerful security features of Freezerworks Unlimited. This ensures that remote users cannot gain unauthorized access to confidential data. As you configure access for users and groups through the powerful Freezerworks Security interface, the SOAP Server follows your rules, ensuring that users can only access those records you allow. It also comes ready to be SSL enabled, for added security.

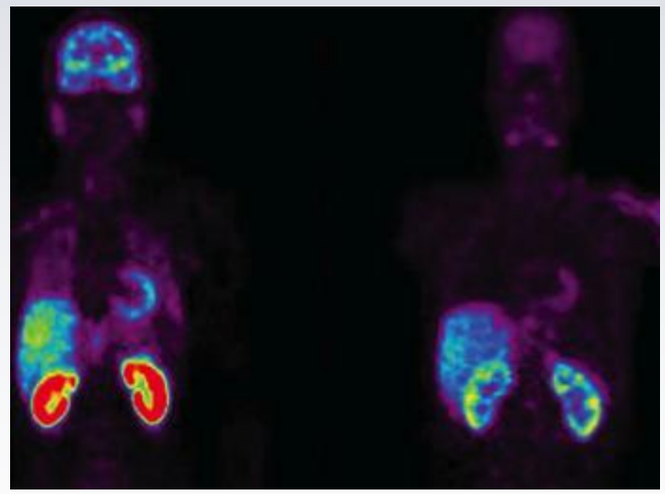
Connectivity

The SOAP Server Module provides a flexible API that allows your developers to create fully functional remote applications to access Freezerworks Unlimited data. Any device that can connect to an IP address can be programmed to enter or retrieve Freezerworks Unlimited data.

SOAP Server is available for both client/server and standalone versions.



```
LOCUS       AF045124                 403 bp    DNA     linear   INV 16-SEP-1999
DEFINITION  Drosophila emarginata strain 14042-0541.0 alcohol dehydrogenase
            (Adh) gene, exon2 and partial cds.
ACCESSION   AF045124
VERSION     AF045124.1  GI:3170348
KEYWORDS    .
SOURCE      Drosophila emarginata
  ORGANISM  Drosophila emarginata
            Eukaryota; Metazoa; Arthropoda; Hexapoda; Insecta; Pterygota;
            Neoptera; Endopterygota; Diptera; Brachycera; Muscomorpha;
            Ephydroidea; Drosophilidae; Drosophila.
REFERENCE   1  (bases 1 to 403)
  AUTHORS   O'Grady,P.M., Clark,J.B. and Kidwell,M.G.
  TITLE     Phylogeny of the Drosophila saltans species group based on combined
            analysis of nuclear and mitochondrial DNA sequences
  JOURNAL   Mol. Biol. Evol. 15 (6), 656-664 (1998)
  MEDLINE   98277681
  PUBMED    9615447
REFERENCE   2  (bases 1 to 403)
  AUTHORS   O'Grady,P.M., Clark,J.B. and Kidwell,M.G.
  TITLE     Direct Submission
BASE COUNT      100 a    101 c     85 g    119 t
ORIGIN
        1 aacttggtga tcctggatcg tattgacaat cctgctgcca ttgctgaact gaaggcaatc
       61 aatcccaaag tgacagttac cttctatccc tatgatgtta ccacacccct ggccgagact
      121 acccaaattgc tgaaaacaat tttcgctcag ctcaaaactg ttgatgttct gatcaatgga
      181 gctggcattc ttgatgatca tcagattgag agaaccattg cagtgaactt cactggtttg
      241 gttaatacca ccaccgccat tttggacttc tgggataagc gtaaggtgtg tccagytggt
      301 gccatctgta acattggttc actgaccggt ttcaatgcca tttaccaagt gcccgtctac
      361 tctgctttcca aggcagctgt tgttagcttc actcaatcca ttgcc
//
```



An online database is crucial to provide the scientific community in house and externally with knowledge of the biobank's holdings and to foster collaboration

From Freezerworks to a MySQL database management system:

- Allows to restrict data access (Ethics)
- Allows unlimited addition of ancillary data
- Allows to LinkOut to other databases (GenBank, OMIM, SwissProt)

Proteomics
(Unique ID + prot. ID)

Genomics (NCBI - LinkOut)
(Unique ID + seq. ID)

Epidemiology

Specimen (Tissue Sample, cell line)
Unique barcode ID

Specimen History
Ischemic time
Protocol...

Diagnostic History
What?
Who did?
When...

Patient History
De-identified but keyd for recognition of same

Images

Internal Labs
Results over time

External Labs
Results over time

Results

Freezerworks
Sample Management Software

Exception Table
Protein to Protein interactions

Exception Table
Expression table

Exception Table
Other filter

Proteomics
(Unique ID + prot. ID)

Genomics (NCBI - LinkOut)
(Unique ID + seq. ID)

Epidemiology

Specimen (Tissue Sample, cell line)
Unique barcode ID

Specimen History
Ischemic time
Protocol...

Diagnostic History
What?
Who did?
When...

Patient History
De-identified but keyd for recognition of same

Images

Internal Labs
Results over time

External Labs
Results over time

Results

Freezerworks
Sample Management Software

Exception Table
Protein to Protein interactions

Exception Table
Expression table

Exception Table
Other filter

Proteomics
(Unique ID + prot. ID)

Genomics (NCBI - LinkOut)
(Unique ID + seq. ID)

Epidemiology

Specimen (Tissue Sample, cell line)
Unique barcode ID

Specimen History
Ischemic time
Protocol...

Diagnostic History
What?
Who did?
When...

Patient History
De-identified but keyd for recognition of same

Images

Internal Labs
Results over time

External Labs
Results over time

Freezerworks
Sample Management Software

Results

Exception Table
Protein to Protein interactions

Exception Table
Expression table

Exception Table
Other filter

Proteomics
(Unique ID + prot. ID)

Genomics (NCBI - LinkOut)
(Unique ID + seq. ID)

Epidemiology

Specimen (Tissue Sample, cell line)
Unique barcode ID

Specimen History
Ischemic time
Protocol...

Diagnostic History
What?
Who did?
When...

Patient History
De-identified but keyd for recognition of same

Images

Internal Labs
Results over time

External Labs
Results over time

Freezerworks
Sample Management Software

Results

Models
(Regressions, phylogenetic analyses etc)

Dr. Angelique Corthals
Angelique.Corthals@stonybrookmedicine.edu
aspcorthals@gmail.com

Stony Brook Medicine

Any Questions?

sales@freezerworks.com
support@freezerworks.com