The Biotech Research Collaboration Database

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Project Summary

Project Description:

The idea behind Biotech Research Collaboration Database is to streamline and enhance collaboration and data management within the biotechnology industry. This database system aims to address the challenges faced by biotech researchers and organizations in managing their projects, data, and resources efficiently. It will serve as a central hub for researchers, labs, and stakeholders to collaborate, access vital information, and accelerate breakthroughs in biotechnology.

Database System Overview:

The Biotech Research Collaboration Database is a cutting-edge, user-friendly platform designed to facilitate data management, project tracking, and collaboration in the biotechnology sector. It will offer a unified digital environment where researchers, labs, and funding organizations can seamlessly interact, share resources, and accelerate research efforts.

Unique Features:

Research Project Lifecycle Tracking: This system will provide an end-to-end view of research projects, from inception to publication. It will allow users to track project progress, milestones, and outcomes, enhancing project management and decision-making.

Sample and Gene Management: Unique sample and gene tracking capabilities will enable researchers to efficiently manage and document their biological samples and genetic data. Automated labeling and storage location tracking will reduce errors and save time.

Collaborative Experimentation: The system will enable multiple researchers to collaboratively design and conduct experiments. It will provide version control, real-time data sharing, and data analysis tools to streamline the research process.

Funding Source Integration: Researchers and labs can seamlessly connect with funding sources, simplifying grant applications and reporting. The system will automate budget tracking, expenditure reporting, and grant proposal submissions.

Publication and Citation Tracking: Researchers can link their projects to publications and track citations in real time. This feature will enhance visibility and recognition of biotech research outcomes.

Use Cases:

Collaborative Experimentation: Researchers from different labs can collaborate on a genetic experiment, sharing data and resources within the system, ensuring efficient knowledge transfer and enhanced research outcomes.

Funding Proposal Management: Research organizations can use the system to create, submit, and track funding proposals, streamlining the funding process and increasing their chances of securing research grants.

Sample and Gene Tracking: Laboratories can efficiently manage their biological samples and genetic data, reducing errors and improving the traceability of research materials.

Project Progress Monitoring: Lab managers can monitor the progress of ongoing research projects, identify bottlenecks, and allocate resources more effectively to meet project deadlines.

Publication and Citation Tracking: Researchers can link their projects to publications, and the system will automatically track citations, providing a comprehensive view of the impact of their work.

Benefiting Existing Software Tools:

Lab Management Software: Existing lab management tools can integrate with the Biotech Research Collaboration Database to provide enhanced sample and gene tracking capabilities, improving overall lab efficiency.

Research Project Management Software: Project management tools used by biotech organizations can benefit from the database's integration, enabling better tracking of project lifecycles, resources, and outcomes, ultimately leading to more informed decision-making.

Functional Requirements List

1. User

1.1. A user in the biotechnology database system shall have a unique user ID.

1.2. A user shall have a first name and a last name.

1.3. A user shall be associated with at least one biotech project.

1.4. A user shall have a unique username.

1.5. A user shall be able to update their contact information.

1.6. A user shall be able to submit research proposals.

1.7. A user shall be able to view project status updates.

1.8. A user shall have a role (e.g., researcher, administrator).

1.9. A user shall be able to reset their password.

1.10. A user shall be able to upload research documents.

2. Project

2.1. A biotech project shall have a unique project ID.

2.2. A project shall have a project name.

2.3. A project shall be associated with multiple researchers.

2.4. A project shall have a project description.

2.5. A project shall have a start date and an end date.

2.6. A project shall have a project lead.

3. Role

3.1. A role shall be linked to multiple users.

3.2. A role shall have a unique role ID.

3.3. A role shall have a role name (e.g., researcher, administrator).

3.4. A role shall define access permissions for users.

4. Equipment

4.1. Equipment shall have a unique equipment ID.

4.2. Equipment shall have an equipment name.

4.3. Equipment shall be associated with a specific lab.

4.4. Equipment shall have a maintenance schedule.

4.5. Equipment shall have a maintenance log.

4.6. Equipment shall be available for reservation.

5. Lab

5.1. A lab shall have a unique lab ID.

5.2. A lab shall have a lab name.

5.3. A lab shall be associated with multiple equipment items.

5.4. A lab shall have a lab manager.

5.5. A lab shall have a location (e.g., building and room number).

5.6. A lab shall have a maximum capacity of people

5.7. A lab shall maintain a log of equipment usage

5.8. A lab shall have the capability to request maintenance or repairs

5.9. A lab shall have an associated safety protocol document

5.10. A lab shall be able to assign different access levels to researchers and

personnel

6. Publication

6.1. A publication shall have a unique publication ID.

6.2. A publication shall have a title.

6.3. A publication shall have one or more authors.

6.4. A publication shall have a publication date.

6.5. A publication shall be associated with a specific research project.

6.6. A publication shall have a DOI (Digital Object Identifier).

7. Funding

7.1. A funding source shall have a unique source ID.

7.2. A funding source shall have a source name.

7.3. A funding source shall provide funding for multiple research projects.

7.4. A funding source shall have a funding amount.

7.5. A funding source shall have a contact person.

8. Sample

8.1. A sample shall have a unique sample ID.

8.2. A sample shall have a sample name.

8.3. A sample shall be associated with a specific research project.

8.4. A sample shall have a description.

8.5. A sample shall have a storage location.

9. Gene

9.1. A gene shall have a unique gene ID.

9.2. A gene shall have a gene name.

9.3. A gene shall be associated with one or more samples.

9.4. A gene shall have a sequence.

10. Experiment

10.1. An experiment shall have a unique experiment ID.

10.2. An experiment shall be associated with a specific sample.

10.3. An experiment shall have an experiment date.

10.4. An experiment shall have a description.

10.5. An experiment shall have experimental results.

Non-Functional Requirements List

Performance

1. The database system shall support concurrent transactions efficiently to handle at least 100 simultaneous users.

2. Database queries shall return results within a reasonable amount of time.

Storage

1. The database system shall allocate a decent amount of storage toward research data.

- File attachments to research articles shall be limited to a maximum size of 50 MB.
- The system shall support automatic data compression to optimize storage utilization.
- Database backups shall be stored in redundant off-site locations to ensure data integrity.

Security

User authentication shall be performed securely using industry-standard protocols

1. Access to sensitive patient data shall be restricted to authorized medical personnel with role-based access control.

2. The database system shall log all access attempts and maintain audit trails for security analysis.

3. Personally identifiable information (PII) shall be encrypted at rest and during transmission.

4. Passwords shall be securely hashed before storage.

5. Data validation shall enforce constraints and domains for all incoming data.

6. The database system shall employ intrusion detection and prevention mechanisms to safeguard against unauthorized access and cyberattacks.

Entity Relationship Diagram
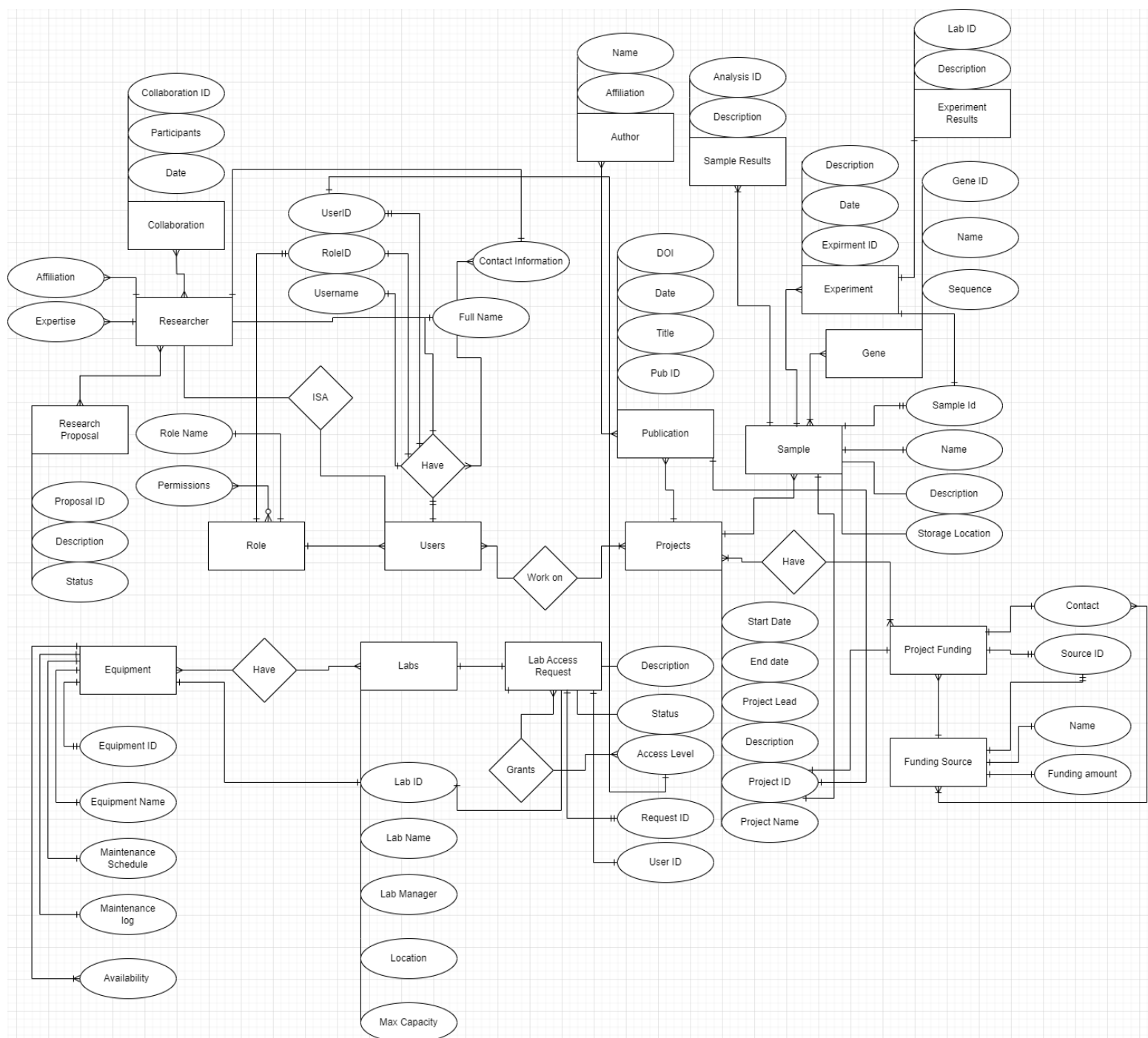
Entity Description

1. User (Strong)

- User_id: Primary Key (PK), Numeric
- first_name: Composite, Alphanumeric
- last_name: Composite, Alphanumeric

2. Project (Strong)

- project_id:PK, Numeric
- project_name: Composite, Alphanumeric
- project_description: Composite, Alphanumeric
- start_date: Multi-Valued, Timestamp
- end_date: Multi-Valued, Timestamp
- project_lead_id: Foreign Key (FK), Numeric (refers to User.user_id)

3. Role (Strong)

- role_id: PK, Numeric
- role_name: Composite, Alphanumeric
- role_Permissions: Alphanumeric

4. Equipment (Strong)

- equipment_id: PK, Numeric
- equipment_name: Composite, Alphanumeric
- maintenance_schedule: Alphanumeric
- maintenance_log: Alphanumeric
- is_available: Alphanumeric
- lab_id: FK, Numeric (refers to Lab.lab_id)

5. Lab (Strong)

- lab_id: PK, Numeric

- lab_name: Composite, Alphanumeric

- lab_manager_id: FK, Numeric (refers to User.user_id)

- location: Composite, Alphanumeric

- max_capacity: Numeric

6. ExperimentResults(Weak)

- Results_id: PK, Numeric

- experiment_id: PK, Numeric (refers to Experiment.experiment_id)

- experiment_description: Composite, Alphanumeric

7. Publication (Strong)

- publication_id: PK, Numeric

- title: Composite, Alphanumeric

- publication_date: Multi-Valued, Timestamp

- DigitalObjectIdentifier: Alphanumeric

- project_id: FK, Numeric (refers to Project.project_id)

8. FundingSource (Strong)

- source_id: PK, Numeric

- source_name: Composite, Alphanumeric

- contact_Info: Alphanumeric

9. Project Funding(Weak)

- source_id: FK, Numeric (refers to FundingSource.source_id)

- project_id: FK, Numeric (refers to Project.project_id)

- funding_amount: Numeric

10. Sample (Strong)

- sample_id: PK, Numeric

- sample_name: Composite, Alphanumeric

- description: Alphanumeric

- storage_location: Alphanumeric

- project_id: FK, Numeric (refers to Project.project_id)

11. Gene (Strong)

- gene_id: PK, Numeric

- gene_name: Composite, Alphanumeric

- sequence: Alphanumeric

- sample_id: FK, Numeric (refers to Sample.sample_id)

12. Experiment (Strong)

- experiment_id: PK, Numeric

- experiment_date: Multi Valued, Timestamp

- description: Alphanumeric

- Sample_id: PF, Numeric (refers to Sample.sample_id)

- lab_id: PK, Numeric (refers to Lab.lab_id)

13. Researcher (Strong)

- researcher_id: PK, Numeric (refers to User.user_id)
- researcher_name: Composite, Alphanumeric
- affiliation: Alphanumeric
- expertise_area: Alphanumeric

14. ResearchProposal (Strong)

- proposal_id: PK, Numeric
- proposal_description: Alphanumeric
- status: Alphanumeric
- researcher _id: FK, Numeric (refers to Researcher.researcher _id)

15. Collaboration (Strong)

- collaboration_id: PK, Numeric
- collaboration_Date: Multi Valued, Timestamp
- number_Participants: Numeric
- fk_researchertId: FK, Numeric (refers to Researcher.researcher _id)

16. LabAccessRequest (Strong)

- request_id: PK, Numeric
- request_description: Alphanumeric
- status: Alphanumeric
- access_Level: Alphanumeric
- lab_id: FK, Numeric (refers to Lab.lab_id)

17. PublicationAuthor (Strong)

- author_name: Composite, Alphanumeric

- affiliation: Alphanumeric

- user_id: FK, Numeric (refers to User.user_id)

- publication_id: FK, Numeric (refers to Project.project_Lead_Id)

18. Sample Results (Strong)

- analysis_id: PK, Numeric

- analysis_description: Alphanumeric

- Sample_id: FK, Numeric (refers to Sample.sample_id)

EER MAP
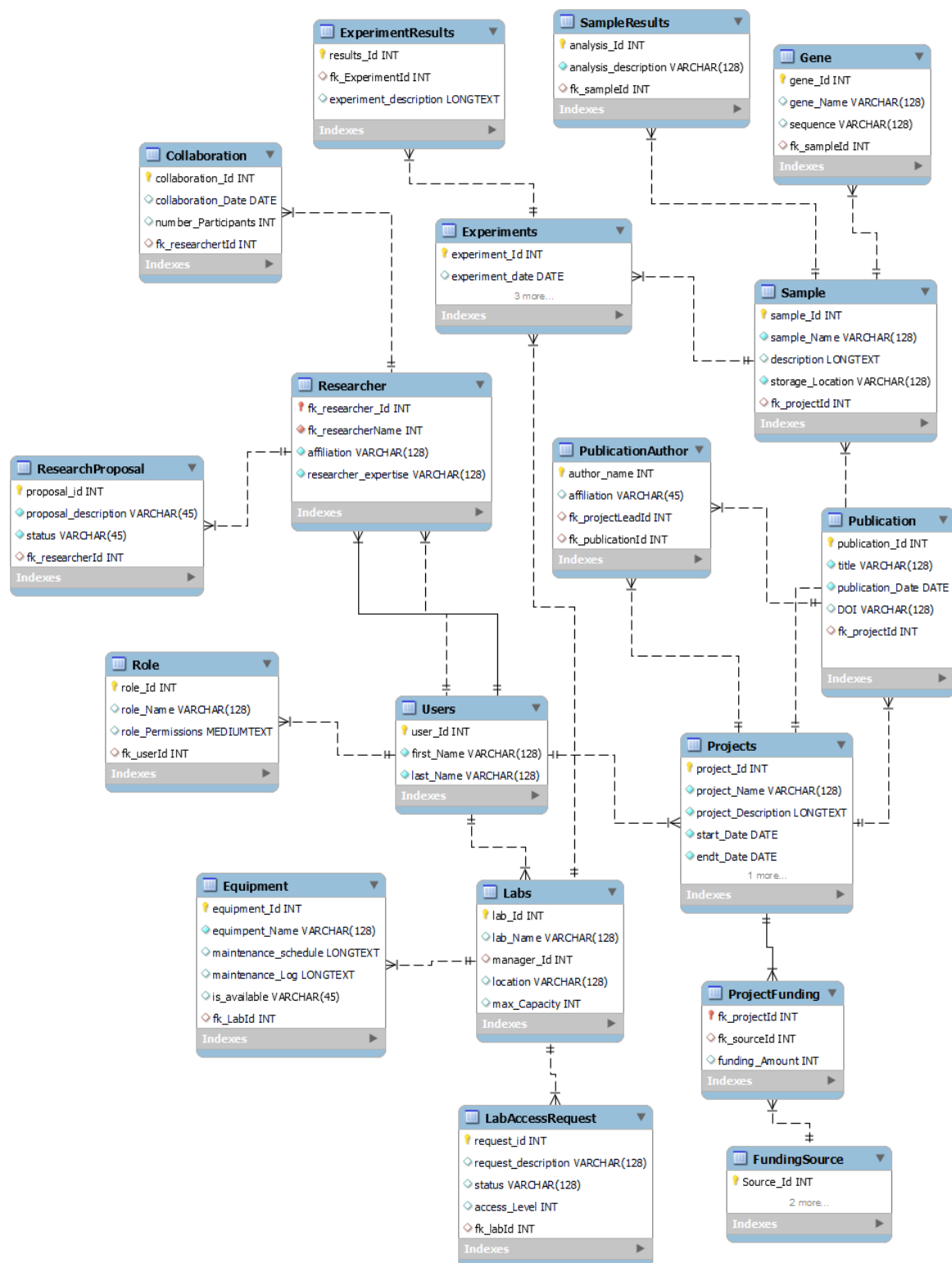
Constraints Description

Table	FK	ON UPDATE	ON DELETE	Comments
Collaboration	fk_researchertId	CASCADE	CASCADE	If a researcher (User) is deleted or updated, we would want to have that change in collaboration as well.
Equipment	fk_labId	CASCADE	NO ACTION	If a lab is deleted, the equipment will still be able to be seen. If updated, we can see where the equipment is currently.
Experiment Results	fk_ExperimentId	CASCADE	NO ACTION	If an experiment is deleted, our results would still be able to be saved. If updated, we will have the new ID for the experiment.
Experiments	fk_sampleId	CASCADE	CASCADE	If a sample is deleted, we would want it to be removed from our experiment. If updated, we want the new information in our experiment.
Experiments	fk_labId	CASCADE	CASCADE	If a lab is deleted, it would be removed from our experiment. If updated, our experiment would also be updated to the new lab.
Gene	fk_sampleId	CASCADE	NO ACTION	If a Sample is deleted, the gene would still be available and untouched. If updated we would update our gene FK.
LabAccessRequest	fk_labId	CASCADE	CASCADE	If a lab is deleted, we wouldn't want anyone to request access, so we delete. If updated, we can have the correct lab ID to apply.
Labs	fk_userId	CASCADE	RESTRICT	If a user is deleted, we don't want the lab to be deleted, so we restrict. If updated, we want the user to be updated on the lab as well.
ProjectFunding	fk_projectId	CASCADE	CASCADE	If a project is deleted, we would remove the funding for it as well. If it is updated then we want the new ID of the project.

ProjectFunding	fk_sourcetId	CASCADE	CASCADE	If the source is deleted, we would remove it from project funding. If it is updated, we would update our project funding accordingly.
Projects	project_Lead_Id	CASCADE	SET NULL	If the lead for the project is deleted, we would leave null as the place holder. If It is updated, we would update our table as well.
Publication	fk_projectId	CASCADE	SET NULL	If the project is deleted, we would set this fk to null so that we can keep our publication. If it is updated, then we can see our new project in this table.
Publication Author	fk_projectLeadId	CASCADE	CASCADE	If the Lead is deleted, we would also delete it in this table. If it is updated we can see this update here as well.
Publication Author	fk_publicationId	CASCADE	SET NULL	If the publication is deleted, we can set this section to null so that we can still have the publication information. If updated we can have the new information in this table.
Researcher	fk_researcherId	CASCADE	CASCADE	On delete, we would remove from this table so that we can clean up the user's account. If updated we can keep the users account up to date.
Researcher	fk_researcher Name	CASCADE	CASCADE	If the user deletes their name, we would remove it from this table to clean up. If updated, we can see the change here.
Research Proposal	fk_researcherId	CASCADE	CASCADE	If the user is deleted, we can remove any proposals they have. If it is updated we can link to the same user when changed.
Role	fk_userId	CASCADE	CASCADE	If the user is deleted, we want their roles to be removed as well. If updated, we can move the roles to that new user.
Sample	fk_projectId	CASCADE	CASCADE	If the project is deleted, we would remove it from this sample. If it is

				updated we will see that new information on this table.
SampleResults	fk_sampleId	CASCADE	CASCADE	If the sample is deleted, we can clean up the results. If updated, we can see the new changes here as well.