# GLIA

Revolutionizing Support
In the World of
Patient Data Collection

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# Problem:

## Excessive Administration leads to Poor Data Collection and Patient Care

- In 2014, Physicians reported **16-20%** of their weekly work was general **admin** *(Woolhandler & Himmelstein, 2014)*
- In 2021, clinicians spent 27% of their time with patients, but **49% on admin** *(Medical Economics, 2021)*
- Excessive Admin impacts Healthcare Services
  - Slows down workflow
  - Leads to increased Overtime
  - Disparate Systems can lead to catastrophic consequences
    - Delay in treatment
    - Missing PHI like allergies
    - Missing contraindicating Medications

# At First...

# Solution:

## Consolidation of Patient Health Information (PHI)

- Consolidating PHI from Electronic Health Records and loose forms streamlines admin
  - Protect against hazards like fires and floods
  - Make complete information accessible sooner
- Using Optical Character Recognition (OCR), translate handwriting into electronic form
  - Ideal for AI integration

# ~~Solution:~~ *Existing Solution*

## Consolidation of Patient Health Information (PHI)

- Consolidating PHI from Electronic Health Records and loose forms streamlines admin
  - Protect against hazards like fires and floods
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- Using Optical Character Recognition (OCR), translate handwriting into electronic form
  - Ideal for AI integration
- *Our idea was so good we learned that Amazon had done with its **AWS Health Services***
  - *Even down to the JSON formatting we had planned on using*
  - https://aws.amazon.com/health/

# Amazon Web Services (AWS)

## Healthcare and Life Sciences

- Provides a comprehensive package of PHI
  - Existing Conditions
  - Medications
  - Personal Information


```
"id": 1,
"name": "John Doe",
"age": 50,
"condition": "Hypertension Diabetes",
"medicine_info": "Lisinopril, Metformin",
"past_medical_history": "High blood pressure since 2010, Type 2 diabetes"
```

```
"id": 2,
"name": "Mary Smith",
"age": 30,
"condition": "Asthma",
"medicine_info": "Albuterol",
"past_medical_history": "Chronic respiratory issues since childhood"
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# Amazon Web Services (AWS)

## Healthcare and Life Sciences

- Provides a comprehensive package of PHI
  - Existing Conditions
  - Medications
  - Personal Information
- ***Isn't anonymized***


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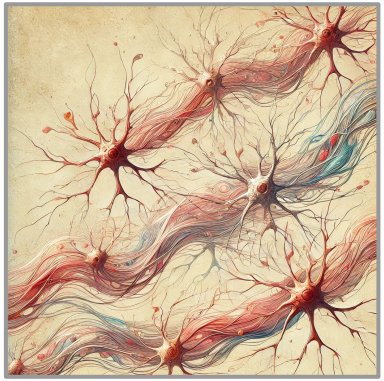
# Limitation

## Privacy of Sensitive PHI

- Privacy concerns are limiting AI integration into Healthcare administration
- Other organizations, like EIS, offer some encryption support for AWS
  - But EIS is specialized and centralized through Amazon
  - Area is in its infancy and has opportunity for expansion
- With our decentralized encryption network, patient health data can be consolidated, protected and utilized in new formats that benefit both patients and healthcare providers
- *The key is a low-barrier-to-entry solution for easy integration into healthcare workflow with large downstream impact*

# Why GLIA?

# **Glia** are the Support network for Neurons



Our Glia Network will accelerate patient care with three goals.

1. Encrypting Patient Information → Digitizing Healthcare Records
2. Lower Barrier to Entry → Incentivizing Data Collection
3. Constructing Federated Learning → Collaborative Research

# Encryption Demo

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1. Encryption Setup:
   a. A secure password and unique salt (randomly generated) are set for AES encryption
   b. A Key Derivation Function (PBKDF2-HMAC-SHA256) derives a robust 256-bit AES key from the password and salt
2. Encryption Process:
   a. Sensitive data is encrypted using AES in CBC mode with unique Initialization Vectors (IV) are padding
   b. Each record is stored with encrypted fields and hashed keywords, creating a searchable index

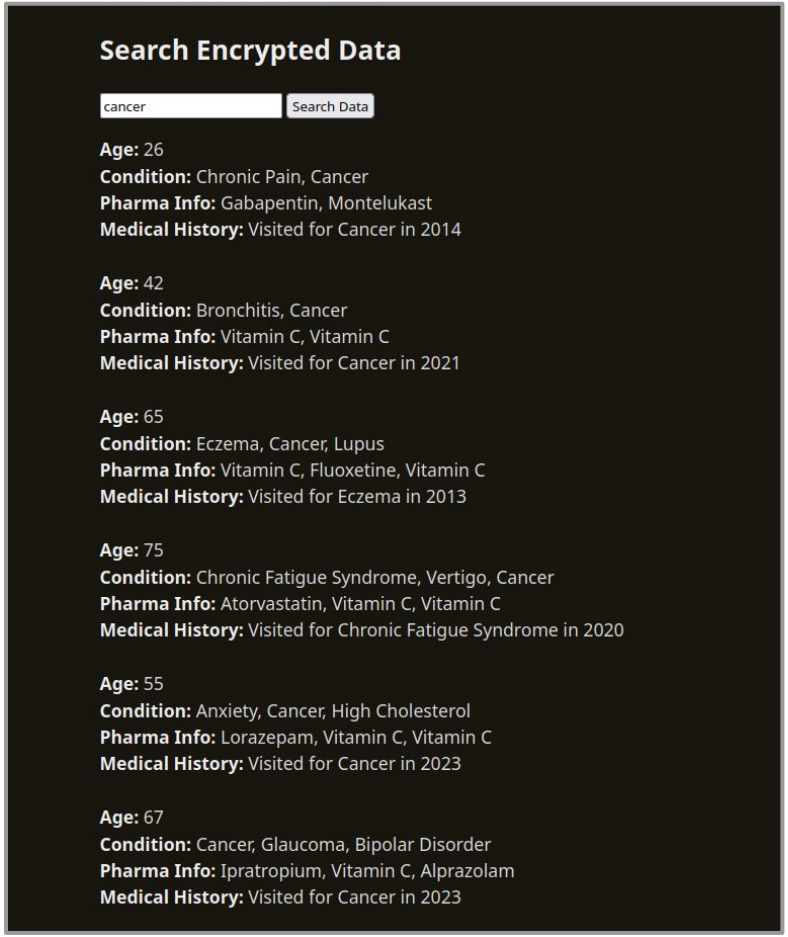
# Search and Retrieval

# Search and Retrieval

(Cancer Use Case)

1. Password Protection:
    a. The user must enter a password to retrieve decrypted records
    b. If correct, matching records based on the keyword are decrypted and displayed

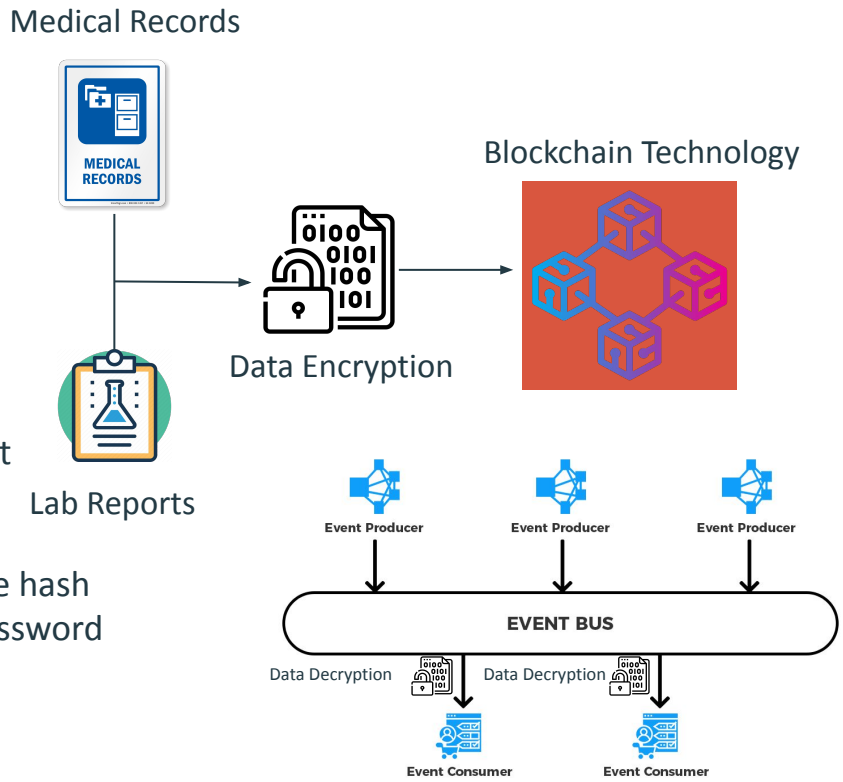
2. Search and Retrieval:
    a. Keywords are hashed (SHA-256) for secure searching
    b. When searching, records containing the hashed keyword are decrypted if the correct password is provided



# Blockchain Integration for Secure Medical Record Storage

# Blockchain Integration for Secure Medical Record Storage

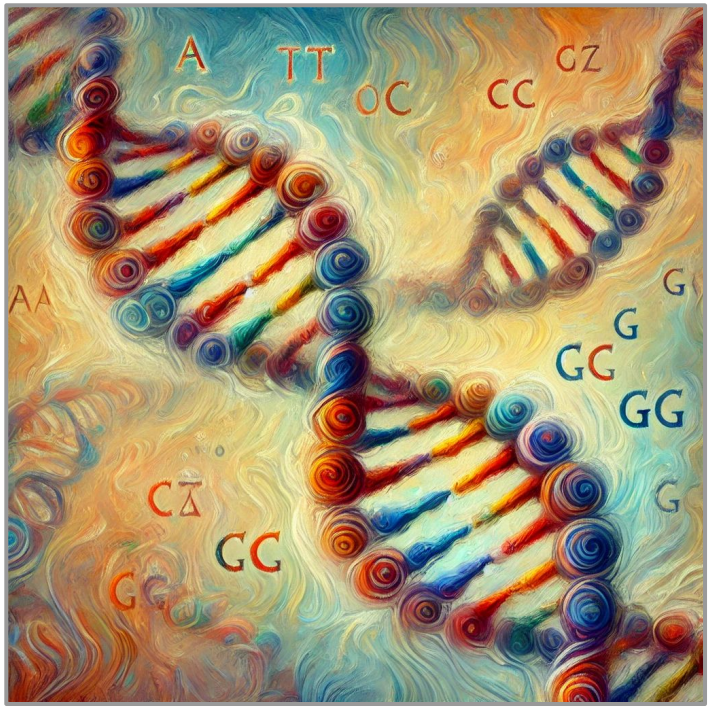
- Encrypted Data on Blockchain
  - Stored with an unique, traceable hash ID
  - Immutable and tamper-proof
- Patient-Controlled Access:
  - Only the patient holds the decryption password-essential for unlocking data
- Traceability and Privacy
  - Blockchain provides a secure audit trail without exposing sensitive data
- Simple Retrieval
  - Patient uses their password which searches the hash ID to locate records and decrypts with their password



# Moving Forward (Next Steps)

# EHR as Digital Asset

- Medical records stored in Glia will be accessible only through the encrypted sequence
- Unlocks possibilities to utilize the data across locations
- Whenever the data is accessed, it maintains its encryption

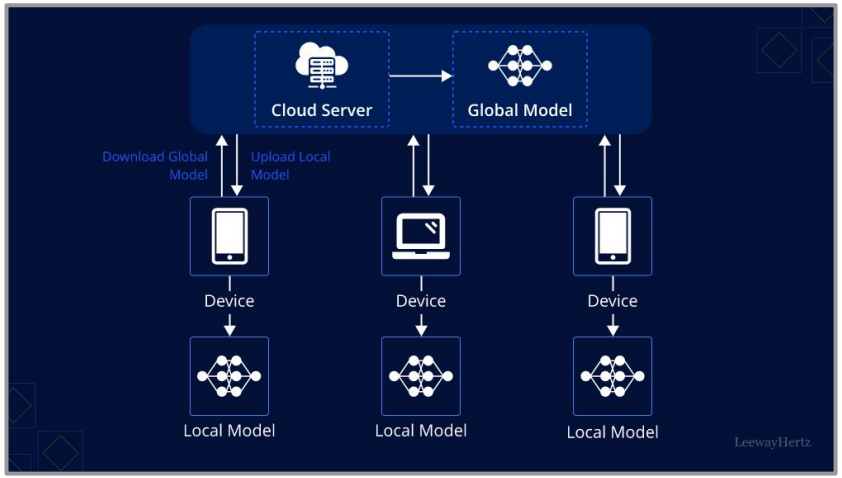



Similar to a base sequence of DNA, each encryption is unique to each patient, storing the information sequentially to relate to their patient history

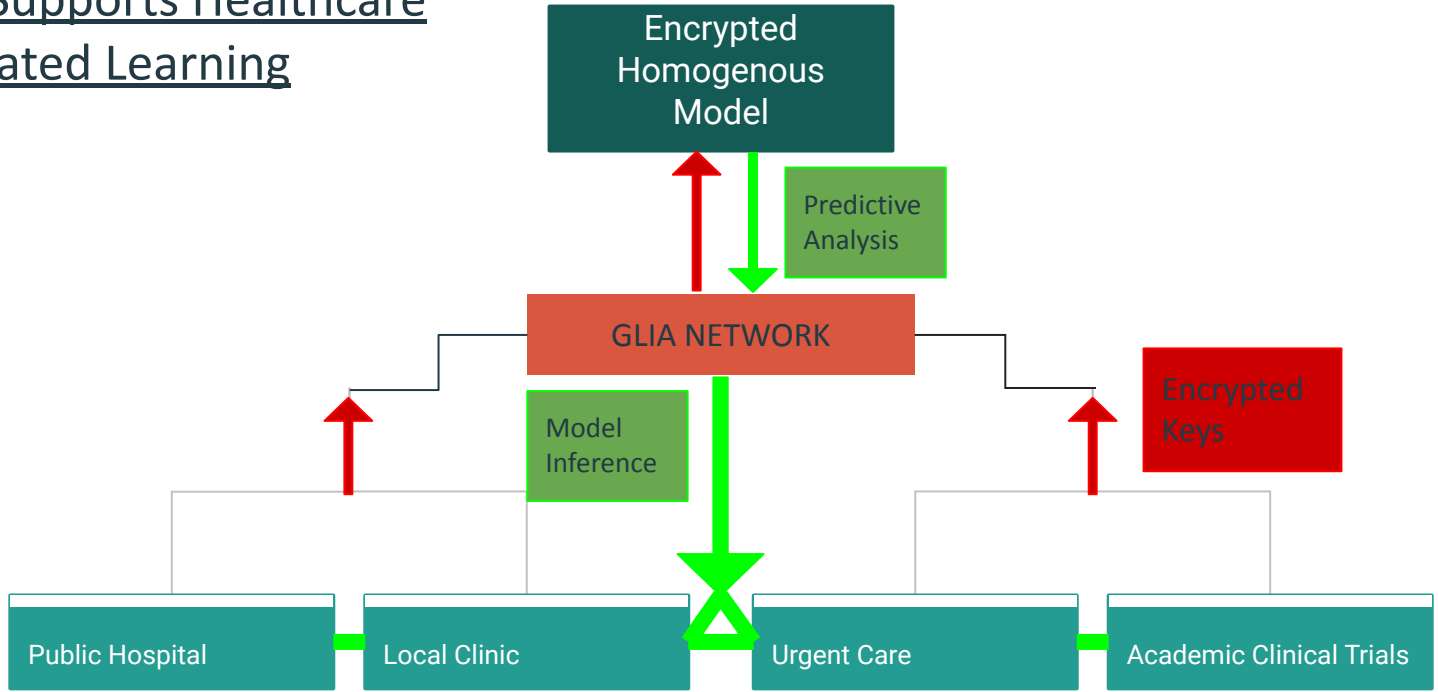
# Federated Learning Potential

Federated Learning is a machine learning technique that trains AI models in a decentralized way, without exchanging data between devices

Limitations: Data Heterogeneity, Communication, and Privacy



# GLIA Supports Healthcare Federated Learning




The Encrypted Keys are the Mechanisms ⟶ Preserves Anonymity & Retains only necessary Information

# Pros

- Both patients and hospitals have **easy access** to patient data
- Supports integration of current platforms for managing patient health data
- Maintains PHI **anonymity** and **security**
- Allows for anonymous search of all patient records while preserving privacy
- **Saves time** for already-overworked healthcare providers
- A variety of applications:
    - Population data
    - Medical trials
    - Infectious Disease Forecasting

# Cons

- Potential for data breaches
  - We address this by encrypting all data securely
- Potential for an AI to regurgitate sensitive patient data on request
  - Solution - Apply similar mechanism to Open AI's “ChatGPT Enterprise” model to protect sensitive data
  - Ally with governing agencies like the HHS for compliance and to increase confidence

# Future Potential

- Lifetime data tracking for personal benefit, paired for individual (independent of location, provider)
- Potential for lifestyle data integration for healthcare tips or learning potential for users
- Forecasting susceptible conditions based on population norms of statistical determinants
    - (using permissible PHI to determine threat level over time of developing conditions)
    - Beneficial for genetic predispositions or family history of conditions like Alzheimer's or Diabetes
- Potential for license to grant clinical trials limited access for relevant analysis with large data that is representative of the population while maintaining anonymization of patient health information
    - Sharing inference, not complete set (Google Maps traffic red line)
- Other options of building out the package for other methods of administrative optimization
    - Automatic inventory digital twin generation
    - Scheduling updating
    - Intake
- Prevention/signaling in contagion outbreaks (CDC)
- Lower threshold to access medication/treatment by reducing overhead (rural areas, underserved populations)
    - Critical in expanding access to psychopharmacological interventions in novel Mental Health treatment
        - i.e. Veterans treating PTSD with psilocybin

# References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Medical Economics. (2021, January ). *Top challenges 2021: #1 Administrative burdens and paperwork.* https://www.medicaleconomics.com/view/top-challenges-2021-1-administrative-burdens-and-paperwork

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# Any Questions?

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