



Asterisk Women's Health *

A Decentralized Data Platform for
Women's Non-Reproductive Health

Abstract*

Despite the high prevalence of common medical conditions among women, investment in their non-reproductive health remains minimal. This adversely impacts diagnosis and treatment outcomes, reducing social productivity and increasing social costs. Asterisk is working to backfill 500 years of missing data by building a decentralized ecosystem that confronts these issues. To do so, we are building a privacy-optimized data union that crowdsources input from women around the world to close the gender data gap and the Global North/South health divide. This solution will be bolstered by a tech transfer marketplace for female-specific IP, incentivizing institutions to further invest in women's health and providing real-time valuation to research. Data union members will vote on the research undertaken by the DAO, ultimately giving women a say over the research that affects their health.

Contents*

The Gender Gap	3
Evolving Health Data Infrastructures	4
A Historic Look at Women's Health Data Management	4
Web3 Innovations in Health Data Participation	5
Asterisk: Equalizing the Data Gap	7
Astra: An All-Female Data Union & Tracking App	9
Zero-Knowledge Gender Verification with Self	11
Decentralized Storage with Akave O3	12
Vana: Privacy-Preserving Compute	13
Astra Security & Privacy Guarantees	14
Data Monetization Model	15
Tech Transfer Marketplace	16
RWA-IP Fractionalization	17
Marketplace	18
Tokenizing Women's Non-Reproductive Health Data	20
Co-Investment Through Participation	20
Participation Incentives	21
Distribution and Vesting	22
Exchange & Liquidity	23
Future Directions	24
Conclusion	25
References	26

The Gender Gap*

Scientific progress in women's health is historically skewed,¹ with a dominant focus on reproductive care despite the dominance of non-reproductive health issues. Until the 1990s, women were largely excluded from clinical trials, and even today, sex-specific testing in animal studies is not rigorously enforced.² This absence in early-stage research perpetuates a significant shortfall in healthcare innovation and outcomes for women. A meager 2% of medtech funding specifically targets women's health,³ with 80% of femtech investment directed towards reproductive issues,⁴ leaving all other vital areas underaddressed. The prevailing medical framework additionally views female physiological responses through a unisex lens, failing to recognize the unique aspects of female health.

Nearly 50% of women initially receive incorrect diagnoses for cardiac symptoms⁵ and women are 25% less likely to receive adequate pain treatment for acute abdominal pain.⁶ They are significantly more likely than men to die from heart attack⁷ and 25% more likely to be misdiagnosed after a stroke.⁸ They are disproportionately affected by autoimmune diseases, representing about 78% of those diagnosed.⁹

This inefficient allocation of resources and diagnostics has negative social outcomes, reducing the productivity of 51% of the global population while simultaneously imposing negative externalities on its entirety. Experts predict that this leaves \$1T on the table annually.¹⁰

By addressing these gaps, we can pave the way for more accurate, sex-specific healthcare solutions that not only improve health outcomes for women but also enhance healthcare and socioeconomic efficacy across the entire system. This ultimately lays the foundation for advancing discoveries benefitting all of humanity.¹¹

Evolving Health Data Infrastructures*

A Historic Look at Women's Health Data Management

Historically, the acquisition and management of women's health data has been governed by institutional priorities rather than sex-specific needs. Clinical trial data, electronic health records (EHRs), insurance claims, and national health surveys (e.g., NHANES in the U.S.) have served as primary sources. However, these databases have long suffered from sex bias. Until 1993, women were routinely excluded from clinical trials funded by the U.S. National Institutes of Health (NIH), and the FDA's 1977 guidelines recommended excluding women of childbearing potential from early-phase drug trials due to concerns about reproductive harm and hormonal variability.^{12,13} This legacy continues to influence the gender imbalance in biomedical datasets: a 2020 analysis of over 4,000 clinical trials found that women remain underrepresented, especially in studies on cardiovascular disease, neurology, and immunology.¹⁴

Most health data infrastructure is centralized and siloed. EHRs are managed by proprietary software vendors (e.g., Epic, Cerner) and controlled by hospitals or insurers, with limited interoperability and difficult researcher access.¹⁵ Claims data is typically held by private insurers or governmental agencies and is often not disaggregated by sex, race, or geography in publicly available formats.¹⁶ Furthermore, data governance structures rarely include participant consent mechanisms that enable longitudinal, portable, or purpose-specific use — particularly critical for populations historically marginalized by the research industry. Women's ability to control or even know how their data is being used remains limited under most legal regimes, especially in countries lacking comprehensive data protection laws or research ethics oversight.¹⁷

This structural centralization and fragmentation of data has directly limited innovation in women's non-reproductive health. The research ecosystem remains skewed: only ~1% of healthcare research and innovation funding is invested in female-specific conditions beyond oncology,¹⁸ and diseases that predominantly affect women — such as endometriosis, fibromyalgia, and autoimmune disorders — suffer from delayed diagnoses and poor treatment pathways, partly due to insufficient sex-disaggregated, longitudinal data.^{19,20}

In sum, centralized and poorly governed data systems have constrained R&D in women's health outside of fertility and pregnancy. Without access to representative, high-quality, and ethically sourced data, researchers are often unable to detect sex-specific disease patterns or treatment responses — perpetuating diagnostic gaps, therapeutic inequity, and significant health system inefficiencies.

Web3 Innovations in Health Data Participation

Emerging technologies in the Web3 and decentralized science (DeSci) ecosystems offer a robust new foundation for the collection, storage, governance, and monetization of health data. These innovations challenge the extractive, centralized models described above by enabling sovereign data ownership, granular consent, and decentralized monetization — all while maintaining security and compliance with data protection regulations.

Web3 describes a version of the internet that sits at the intersection of democratization, permissionless, and trustless data.

DeSci (decentralized science) applies to health and tech innovations that leverage the Web3 triptych of values.

Decentralized Storage and Computation

Decentralized storage protocols such as [IPFS](#) (InterPlanetary File System), [Akave](#), and [Filecoin](#) make it possible to store encrypted datasets in a redundant, tamper-resistant, and censorship-resistant manner. Unlike traditional cloud services, no single entity controls access, ensuring resilience and auditability. These protocols are already being adopted for biomedical data repositories, particularly within the DeSci ecosystem, where projects like [Molecule](#) and [VitaDAO](#) use decentralized storage to host and share research assets such as genomic data, IP documents, and clinical protocols.

Zero-Knowledge Proofs (ZKPs)

ZKPs — especially in the form of ZK-SNARKs (Zero-Knowledge Succinct Non-Interactive Argument of Knowledge) and ZK-STARKs (Zero-Knowledge Scalable Transparent Argument of Knowledge) — allow for the cryptographic validation of data queries or computations without revealing the underlying data itself.²¹ This has major implications for health data privacy: it becomes possible to confirm a diagnosis, validate a biomarker, or contribute to a federated model without exposing sensitive personal data. Privacy-preserving health data protocols such as [Zama](#) and [Modulus](#) are beginning to implement these approaches at scale.

IP-NFTs and Data Tokenization

Intellectual Property Non-Fungible Tokens (IP-NFTs), pioneered by Molecule and adopted by DAOs such as VitaDAO and PsyDAO, provide a mechanism to tokenize and fractionalize ownership of research data and IP, enabling new models for collaborative funding and data access.²² In the context of health data, this allows patients, communities, or researchers to retain a stake in downstream applications of their data or discoveries — a critical step toward ethical data monetization.

AI Monetization and Federated Learning

Recent advances in onchain and offchain federated learning allow AI models to be trained across distributed data environments without centralizing the data itself.²³ When paired with tokenized incentives and multi-party computation (MPC), this architecture enables both security and compensation. Projects like Ocean Protocol and Vana are building marketplaces where data owners (including individuals) can permission AI developers to train on their datasets while retaining control and earning value in return.

Decentralized Identity (DID) and Consent Management

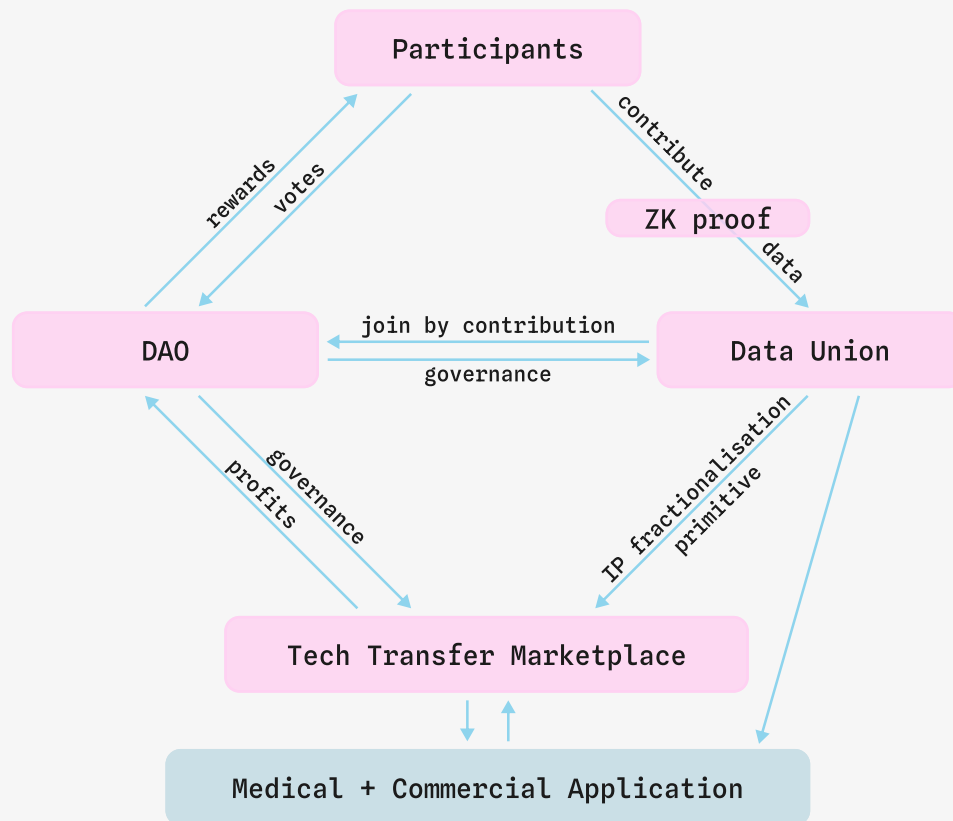
Protocols such as Self.ID, Ceramic, and BrightID offer decentralized identity and reputation layers that are critical for permissioning access to sensitive data. DID frameworks also allow for granular, revocable consent: participants can selectively share data attributes with researchers or clinicians without disclosing their full identity — a key requirement for compliance with privacy regulations such as GDPR and HIPAA.²⁴

The Rise of Data DAOs

Data DAOs are a new organizational technology that pools, governs, and monetizes datasets on behalf of communities. These DAOs provide a democratic framework for data access, licensing, and attribution. For example, Sleep.fun and MindDAO are pioneering ways to coordinate user-collected data and research, allowing contributors to earn tokens and influence based on data contributions, validation, and usage.

Together, these tools provide an entirely new infrastructure for health data collection, sharing, and compensation. No longer do communities need to rely on corporate intermediaries to generate value from their data. Instead, data can be co-governed, encrypted, and monetized in a way that respects privacy, consent, and equity. For women's health — historically underfunded, mischaracterized, and data-poor — this new stack enables a prosumer paradigm shift in who participates in research and who benefits from its outcomes.

Asterisk: Equalizing the Data Gap*



Top-level architecture of the Asterisk platform.

Asterisk is developing a decentralized data infrastructure to address the structural data gaps in women's health research. The core of the system is a data lake designed to enable the secure, consent-based aggregation of longitudinal health data contributed directly by individuals. This infrastructure supports both researcher access and participant governance, advancing new approaches to sex-specific health research.

The data lake is structured with interoperable standards such as PROMIS, with modular design enabling future integration of wearable devices, menstrual cycle trackers, and biomarker inputs. Data is collected through a user-facing application called Astra which invites participants to contribute structured symptom and treatment data across a range of chronic and episodic conditions. Their interaction with the Astra LLM ensures collection of research-ready data while tracking and supporting the individual's health journey. This approach enables data collection beyond traditional clinical environments, allowing for more inclusive and representative health datasets. Astra additionally facilitates female participant acquisition, ensuring research inclusivity through ease of discovery.

In addition to supporting third-party research inclusivity, Asterisk plans to extend its model to address inefficiencies in the current biomedical innovation pipeline. This includes the development of a decentralized marketplace for women's health intellectual property (IP), aimed at improving the commercialization potential of underutilized IP currently held in academic and institutional portfolios. Many early-stage biomedical innovations – especially those related to female-prevalent or sex-specific conditions – face barriers to market entry due to lack of institutional prioritization. By creating a platform that connects available IP with researchers, entrepreneurs, and funders, Asterisk seeks to accelerate the development of targeted interventions.

Over time, Asterisk intends to leverage the Astra dataset to initiate original research programs, focusing on areas that remain underexplored in conventional funding and trial frameworks. This integrated pipeline – from data collection to knowledge generation to translational commercialization – aims to provide a scalable infrastructure to support sex- and gender-informed health research, directed by the DAO members.

In sum, Asterisk is a collaborative decentralized platform that leverages cutting-edge Web3 technologies such as decentralized data storage, NFT fractionalization, and zero-knowledge proofs to address the data gap in women's non-reproductive health. The platform is structured into three interconnected modules:

- 1. Data Union (Astra):** Aims to monetize a diverse array of women's non-reproductive health data while verifiably guaranteeing complete privacy and anonymity using zero-knowledge (zk) compute technologies. Data contributors are incentivized with \$AST tokens to enrich the data lake, and receive support in identifying key trends and communicating them with their clinicians.
- 2. Tech Transfer Marketplace:** Facilitates the sale and licensing of institutionally held IP (ie. that developed in universities) with verified entities for specific, contractual and approved usage. It utilizes a decentralized marketplace to drive innovation and allows users to fractionalize IP-NFTs in order to enhance liquidity in IP exchange. Data ownership remains with those who developed the IP while real-time valuation is unlocked.
- 3. Co-governance:** Allows stakeholders to manage and direct platform activities through the use of \$AST tokens, including:
 - a) **Rewards parameterization:** Determines how \$AST is distributed to participating stakeholders through their data sharing over time.
 - b) **Co-investment:** This module enables stakeholders to collaboratively vote on and support the research performed by Asterisk. By staking \$AST coins, participants can co-invest in initiatives that advance research and development in women's non-reproductive health, potentially leading to innovative health solutions and products. This collaborative financing approach not only accelerates development but also offers women the ability to vote on the research that directly affects their health outcomes.
 - c) **Governance of platform smart contracts:** Including but not limited to the upgradability of the co-governance module, the marketplace's fractionalization primitive, the data lakes and zk compute infrastructures, or any other modules deployed by the Asterisk DAO.

Astra: An All-Female Data Union & Tracking App

The decentralization endemic to the blockchain provides the opportunity for data to be gathered from women around the world. Web3 is inherently global, enabling permissionless participation and value exchange across borders without reliance on centralized intermediaries. The majority of health research is funded in the Global North.²⁵ As a result, existing data sets do not provide a holistic view of the female body and leave out important information that could impact outcomes for women of color.

Our data lake is unique in that it exclusively targets women while remaining globally inclusive, representing diverse geographies, ethnicities, and health contexts. This architecture allows Asterisk to reach women in the Global South directly, offering access to health research, data ownership, and rewards regardless of local infrastructure or financial systems.²⁶ To ensure the best outcome, we are onboarding women from LATAM, Africa, and SEA to advise on cultural inclusivity in the app and build trust in emerging markets. Furthermore, the Astra LLM will speak multiple languages, further expanding our reach and inclusivity.

Incentivised Data Lake

The first phase of data collection is structured to align with the PROMIS research methods. This is the most widely used protocol for qualitative data collection. As we move into data collection from wearables and other aligned healthtech applications, we will expand our structure to also align with Open mHealth standards which are designed to specifically structure patient-reported data.

Women interact with a daily tracking app called Astra, where they interact with the Astra LLM. Astra asks women about their daily experience with the symptoms, medications, and modalities they've identified in their profiles. Data contribution is voluntary and always privacy-preserving.

Participant Benefits

We recognize that meaningful participation often requires tangible value in return. To support this, Asterisk offers a layered incentive system. To encourage participation and ongoing engagement, we provide multiple layers of incentive for contributing data:

- **Points system:** that rewards daily engagement, check-ins, and sharing of anonymous data
- **Token conversion:** points can be converted into \$AST tokens, which can be used for governance, rewards, or exchanged on the open market (subject to liquidity)
- **DAO voting power:** tied to participation and contributions, enabling governance influence
- **Invitations to clinical trials:** or research programs for eligible and willing participants
- **Personal insights and symptom summaries:** facilitating positive clinical outcomes
- **Data Sovereignty:** participants retain ownership of their personal health data.

- **Privacy Preservation:** no entity, not even Astra or Vana, can read the raw data without explicit participant permission
- **Transparent Rewards:** contributors are compensated through a fair, onchain token model
- **Impact at Scale:** individual contributions combine into rich datasets capable of advancing underfunded areas of health research, particularly for non-reproductive conditions affecting women.

Astra tracks symptoms longitudinally, identifies trends, offers personalized recommendations, and can compile a clinical case summary when further investigation is warranted. Astra will provide a clinical readout of relevant data when requested to aid communication with doctors, bridging the communication gap felt by 84% of women who feel unheard by their practitioners and further closing the gender health gap.²⁷

Customer Benefits

Astra is a longitudinal, female-only, non-reproductive health data lake. Where sex-specific data has historically been fragmented, incomplete, or inaccessible, Astra offers a new standard: continuously updated, longitudinal data from verified female participants – enabling faster, more accurate, and more inclusive research.

Customers benefit from a dramatically lower barrier to accessing this data, along with powerful tools for discovery, analysis, and recruitment. Here's how:

- **A Verified, All-Female Dataset:** Astra uses decentralized identity (DID) verification to ensure that all data contributors are real, verified individuals who identify as female. This guarantees biological and experiential relevance for researchers, femtech companies, and aligned organizations seeking high-integrity data on women's health.
- **A Live Pulse on Women's Health:** Unlike traditional datasets that rely on retrospective or episodic inputs, Astra updates in real time. Customers can access day-by-day trends, enabling them to analyze not just static snapshots, but how women's health evolves over time – across cohorts, conditions, geographies, and more.
- **Streamlined Participant Recruitment:** Astra facilitates compliant, privacy-preserving participant acquisition for trials, focus groups, and observational studies. Customers can create double-blind invitations based on key filters like age, location, health history, or diagnosis. Once a participant accepts, both parties are introduced to collaborate – with no scraping, cold outreach, or recruitment overhead.
- **Flexible Licensing & Custom Analysis:** Customers can license data directly or request bespoke analysis done by our team. This enables organizations to generate proprietary insights without owning or managing the raw data – reducing compliance risk while increasing speed to knowledge.

Transparent Data Lineage: Every dataset entry is timestamped and anchored to a verifiable contributor metadata, ensuring auditability and trust. Researchers can trace the origin, context, and evolution of the data they rely on – critical for compliance, reproducibility, and publication standards.

Zero-Knowledge Gender Verification with Self

To ensure data integrity and representational accuracy in women's health research, Astra integrates with Self, a privacy-first identity solution leveraging ZK to verify proof of humanity and key characteristics like age and country of residence (without disclosing sensitive information). Self was incubated by core Celo contributors and launched following the acquisition of OpenPassport, a cohort member of Ethereum's PSE (Privacy + Scaling Explorations). Self enables users to create and manage verifiable digital identities while preserving privacy and data sovereignty.

Purpose of Gender Verification

Since Astra is designed to address the systemic exclusion of women from biomedical research, it is essential to verify that contributions to our dataset reflect the lived experiences of these target populations. Traditional methods of identity verification are often invasive, exclusionary, or centralized, often requiring users to upload photographs of their IDs or passports, with their private, personal information stored in unencrypted databases. In contrast, Self offers a decentralized, user-controlled method for identity assertions — including gender — without exposing personally identifiable information (PII). This backs our promise to researchers of an all-female longitudinal data lake.

Implementation in Astra

- **User Onboarding:** During onboarding, participants are prompted to connect a Self profile or create a new one. This profile allows users to publicly or privately attest to aspects of their identity, including gender, through verifiable credentials anchored to their decentralized identifier (DID). The participant's gender is verified through zero-knowledge proof, requiring user consent and ensuring Astra never receives any of the participant's identification.
- **Privacy-Preserving Design:** Astra reads only the relevant credential (e.g. gender: female) without accessing unrelated profile data, ensuring minimal exposure while maintaining compliance with privacy regulations like GDPR.
- **Incentive Eligibility:** Verified gender identity through Self, which includes a ZK-powered proof-of-humaneity verification, protects the DAO from bots attempting to farm tokens and ensures alignment with our mission of closing the health data gap while minimizing misuse or misrepresentation.

By leveraging Self, Astra creates a verifiable yet privacy-preserving way to validate participant identity characteristics critical to its mission without sacrificing inclusivity or control.

Decentralized Storage with Akave O3

Astra integrates with Akave O3, a decentralized storage solution that is S3-compatible, providing a robust foundation for secure health data collection. O3 mimics the standard Amazon Web Services (AWS) S3 interface, making integration seamless while offering significantly enhanced privacy guarantees through decentralization.

Storage Architecture

- **Decentralized Infrastructure:** Data is distributed across multiple independent nodes, reducing reliance on any single storage provider and eliminating single points of failure.
- **S3-Compatible API:** Developers interact with Akave using familiar AWS SDKs and tools.²⁸
- **End-to-End Encryption:** All health data is encrypted client-side using OpenPGP, ensuring that no unencrypted data ever enters storage.
- **Dual Bucket System:** Data is organized into two distinct categories:
 - `health/{userId}/{timestamp}.json` for structured health profiles.
 - `checkin/{userId}/{timestamp}.json` for daily symptom tracking.
- **Content-Type Hardening:** Files are stored as `application/octet-stream` to prevent MIME-type sniffing and enhance security.²⁹
- **Secure Access Control:** Astra uses signed URLs to enable temporary access, ensuring retrieval is only possible by authorized services for a limited time.
- **Right to be Forgotten:** All data submitted is tagged with the userID, ensuring Astra participants can delete their complete data history at any time in keeping with GDPR compliance.

Multi-Layer Encryption Pipeline

To maximize privacy and ensure data sovereignty, Astra uses a dual encryption model:

1. **Submission-Level Encryption:** All submitted data is first encrypted before uploading to Akave. Only Vana has the keys to check the data and ensure it is valid using their TEE system.
2. **Contract-Level Encryption:** The participant's decryption key is then encrypted with the Vana Data Liquidity Pool (DLP) public key using the Elliptic Curve Integrated Encryption Scheme (ECIES). This enables Vana's smart contracts to process the data in a privacy-preserving environment without exposing it.

This model enables Astra to maintain regulatory compliance while enabling meaningful data aggregation, refinement, and monetization.

Vana: Privacy-Preserving Compute

Astra integrates with Vana, a decentralized data processing and reward infrastructure designed to enable secure computation over encrypted data. Vana facilitates participant incentives, data refinement, and zero-trust computation using Trusted Execution Environments (TEEs) and blockchain-coordinated proofs.

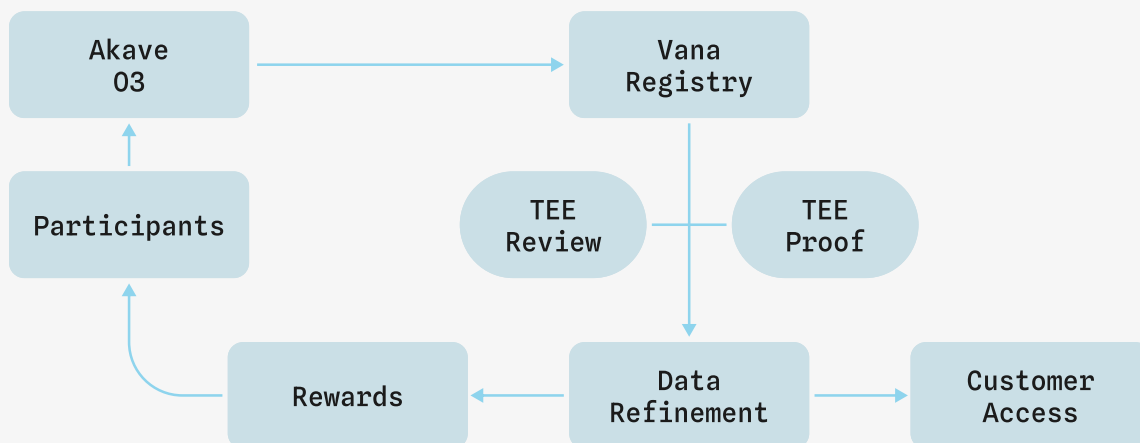
Core Smart Contract Architecture

The integration operates through three core contracts:

- **Data Liquidity Pool (DLP):** Governs token reward distribution and manages decryption permissions.
- **Data Registry:** Logs all encrypted data contributions and their associated metadata.
- **TEE Pool:** Assigns and verifies Trusted Execution Environments used for secure processing.

Data Processing Pipeline

The following five-stage pipeline transforms encrypted participant-submitted data into refined, privacy-preserving research-grade outputs.



1. File Registration

- Encrypted JSON files stored in O3 are registered with Vana's Data Registry.
- The participant's encryption key is re-encrypted with the DLP's public key, ensuring only authorized contracts can decrypt the data.
- Access permissions are programmatically controlled by smart contracts, eliminating manual access intervention.

2. Contribution Proof Request

- A TEE proof request is submitted to the TEE Pool contract along with associated gas fees.

- The system assigns a TEE node and returns the public key and endpoint URL for secure interaction.
- Metadata is used to identify the type of processing needed (e.g., check-in vs. long-form health profile).

3. TEE Proof Generation

- The TEE downloads the encrypted file from Akave O3 and performs computation in a secure enclave.
- Custom logic executes on the TEE to analyze the data and produce cryptographic proofs attesting to authenticity and correctness.
- Importantly, the raw data remains inaccessible even during processing.

4. Data Refinement

TEEs forward processed data to domain-specific refiner services:

- Check-in data is normalized and validated against symptom ontologies.
- Health profiles undergo structured parsing and feature extraction.

Refined outputs are optionally stored on [IPFS](#) via Pinata, offering decentralized, immutable access for approved research partners.

5. Reward Distribution

- Participants receive token reward through the DLP smart contract.
- Rewards are weighted by contribution value, data quality, and demand for specific demographic or clinical traits.
- All transactions are recorded onchain for transparency and auditability.

Astra Security & Privacy Guarantees

Security and privacy are crucial to ensuring the onboarding of underserved groups. Today's sociopolitical atmosphere affects women's safety and security; health data has a history of being weaponized. We counterbalance this threat in the following ways:

- **End-to-End Encryption:** Data remains encrypted at rest and in transit; only encrypted keys are shared.
- **Zero-Knowledge Computation:** No TEE or actor in the pipeline can access raw data.
- **Smart Contract Governance:** Access, permission, and reward logic are fully onchain.
- **ZK-Proofs:** Used to cryptographically confirm data authenticity and traceability without revealing source content.
- **GDPR & HIPAA Alignment:** Through local encryption and participant-managed keys, Astra remains compliant with major privacy laws. Additionally, a participant's profile only requests high-level data, preventing disclosure of natural person identification and aligning with GDPR guidelines. Questions regarding reproductive history are intentionally left optional due to the threat of prosecution in several regions of the world.

Data Monetization Model

Encrypted and anonymized datasets are made available through a tiered access model for researchers, health organizations, and mission-aligned startups. This includes:

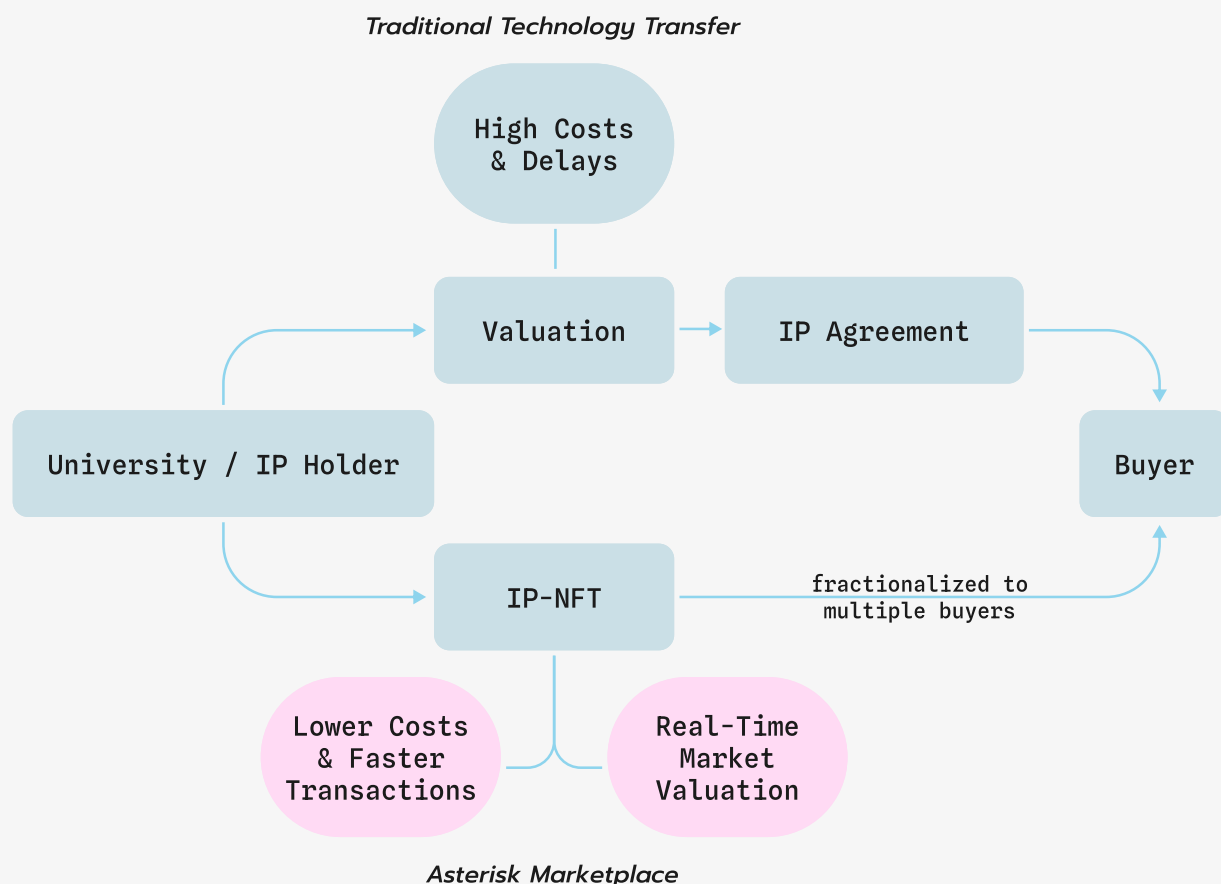
- **One-Time Dataset Access:** Used for longitudinal or large-scale academic research.
- **Subscription Access:** For companies developing AI-driven products requiring ongoing data feeds.
- **Insight-as-a-Service:** Astra will generate de-identified, AI-assisted insights and sell these as white-labeled dashboards or reports.

Advanced machine learning techniques identify patterns and correlations across the anonymized dataset, surfacing emergent findings. This unlocks additional revenue streams while maintaining data privacy.

With explicit participant consent, organizations may also request access to curated cohorts for disease-specific trials, community surveys, or participatory research — accelerating intervention development while compensating contributors.

Tech Transfer Marketplace

Traditional vs. Asterisk Technology Transfer



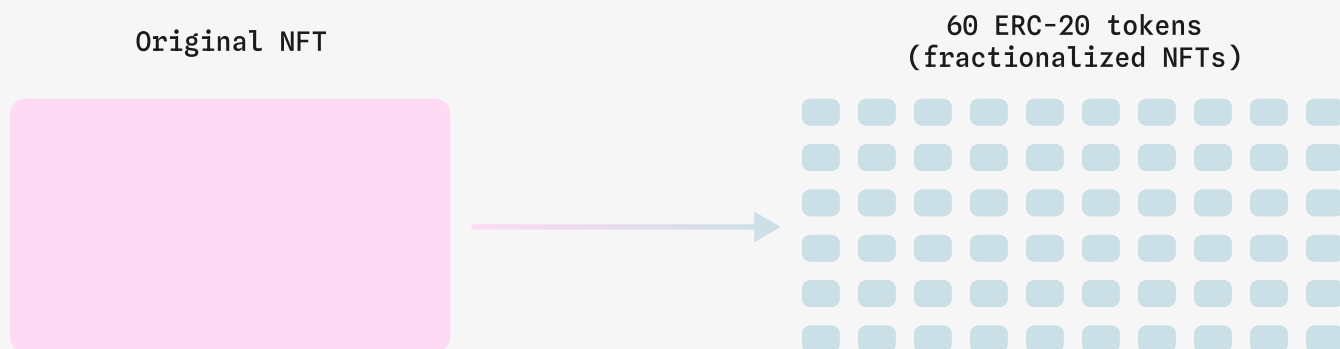
Technology transfer (or "tech transfer") is the process of moving innovations from research institutions — such as universities, hospitals, and public laboratories — into the private sector for further development and commercialization. It plays a central role in translating basic science into applied solutions, encompassing activities like licensing patented technologies, forming startups, and forging industry collaborations.

Despite its importance, the tech transfer process remains inefficient. A substantial portion of intellectual property (IP) generated by academic research — particularly in female-prevalent or sex-specific fields — goes unlicensed and underdeveloped due to institutional bias, resource constraints, or lack of commercial incentives. This results in a significant opportunity cost: inventions that could address urgent health needs remain shelved, while the research pipeline for women's health continues to be underfunded and underprioritized.

To add, research is often duplicated by other institutions due to a lack of insight into what has been accomplished by others, ultimately wasting resources and time. According to the Association of University Technology Managers (AUTM), U.S. universities reported over 25,000 invention disclosures in 2022, yet fewer than 7,000 resulted in executed licenses or options.³⁰

Asterisk aims to address this inefficiency by launching a tech transfer marketplace designed specifically to surface and monetize IP related to women's health. By doing so, we seek not only to unlock latent value from existing research but to create a market-based incentive for universities to fund more female-specific research in the future.

RWA-IP Fractionalization



At the core of this module is a blockchain-based fractionalization system for real-world assets (RWA), including IP. Using smart contracts, patents and other IP rights can be tokenized and represented as non-fungible tokens (IP-NFTs), which are then divisible into fractional units. This approach broadens access to innovation financing and creates new mechanisms for IP liquidity.

Technical Overview

Fractional IP-NFTs are created using smart contract standards ERC-721/1155 for IP-NFTs and ERC-20/ERC-404 for fractional units. Each token contains metadata that anchors it to the underlying IP asset (e.g., patent number, ownership entity, licensing status). Smart contracts govern the conditions of ownership, transferability, and licensing rights, while automatically distributing royalty payments or revenue shares to fractional holders based on predefined terms.

Applications in Licensing and Compliance

Smart contracts can encode licensing terms directly into the IP-NFT structure. Fractionalization enables automatic enforcement of usage restrictions and royalty agreements, reducing the burden of manual oversight and ensuring compliance. Licensees may acquire fractional stakes to secure access, while licensors retain partial or total ownership and continue to benefit from downstream use.

Benefits of IP-NFT Fractionalization

- **Liquidity:** Secondary markets for fractional IP shares allow new capital inflows and real-time valuation of underutilized assets. There is currently no system available for real-time and early-stage IP valuation. As a result, 70-80% of university held IP is never licensed.³¹
- **Accessibility:** Fractionalization lowers the barrier to access IP for researchers, early-stage companies, and impact investors. Furthermore, institutions can test market interest via IP-NFT protection before putting IP through a lengthy patent process.
- **Transparency:** Blockchain-based ownership and licensing records reduce disputes and enhance trust in the commercialization process.
- **Diversification:** Investors and institutional actors can access IP earlier and more widespread, improving go-to-market and further research.

This model draws inspiration from early examples in decentralized science (DeSci), such as Molecule, which demonstrated how IP-NFTs can successfully fund early-stage biomedical research.³² By enabling access to IP via fractionalized IP-NFTs, Asterisk aims to lower friction in the licensing and commercialization of women's health IP – an area historically underserved by venture capital and traditional tech transfer offices.

Marketplace

The Asterisk tech transfer marketplace is a digital platform where tokenized IP can be discovered, licensed, traded, and co-developed. It is designed to be an open-access, blockchain-native system that brings together academic institutions, startups, research funders, and mission-aligned investors with a shared interest in advancing women's health solutions.

Traditional university tech transfer offices may take months to years to assign theoretical value to intellectual property – and even then, only when commercialization is imminent. In contrast, the Asterisk marketplace allows for real-time IP valuation based on live market dynamics, staking, and demand from femtech founders and researchers. This creates not just speed, but continuous price discovery, even before an asset is licensed or sold – a paradigm shift in how value is surfaced and shared in women's health research.

Key Features

- **NFT Minting:** Universities and institutions can mint IP assets into NFTs, enabling standardized, verifiable listings with embedded metadata.
- **Fractional Licensing & Ownership:** Institutions may retain a portion of or full rights while licensing or selling fractions to other stakeholders. They can time gate the duration of licenses and availability on the marketplace, restrict the number of fractions (licenses), and set a flat-rate or variable fee structure to test the value of the IP in question.
- **Searchable Marketplace:** Researchers, founders, and investors can browse available assets by condition, therapeutic area, or modality.
- **Real-Time Valuation:** Ongoing marketplace activity provides continuous feedback on asset value, replacing opaque, one-time valuations.
- **Smart Contract Automation:** Licensing and royalties are managed through tamper-proof, programmable agreements.

University and Institutional Partnerships

We are actively onboarding research institutions, with a particular emphasis on surfacing latent IP in women's non-reproductive health domains — areas that often face lower institutional investment despite high disease burden. A 2023 report from the OECD noted that even as patent activity expands globally, sex and gender disparities persist in both innovation output and technology commercialization, limiting the downstream development of female-driven IP.³³ By monetizing dormant assets, universities can generate new revenue streams while signaling market demand for continued innovation in these fields.

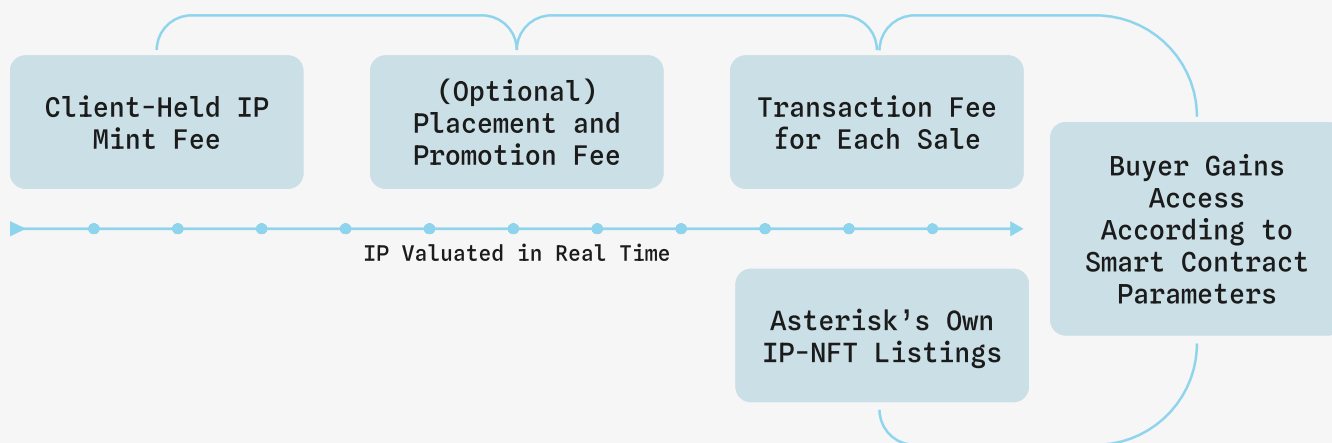
Incentivizing Female Health Research

Crucially, this marketplace is designed not just to unlock existing IP but to create new financial incentives for research. As women's non-reproductive health inventions begin to generate licensing income and attract downstream investment, institutions will be motivated to allocate greater research resources to these historically underfunded areas. This shift is essential to correcting structural imbalances in biomedical and femtech innovation.

Researcher and Startup Benefits

Startups and academic entrepreneurs will gain simplified access to high-quality, field-relevant IP without the need for protracted negotiations with traditional tech transfer offices. Our platform will also lower time-to-market by reducing friction in licensing and providing optional legal templates and compliance support.

Revenue Model



The Asterisk tech transfer module generates revenue through:

- NFT minting fees for institutions
- Transaction fees on fractional sales and licensing agreements
- Premium placement and promotion packages
- Selling and licensing our own IP as it develops out of the Data Union

These funds support platform maintenance and subsidize onboarding for mission-aligned researchers and under-resourced academic groups.

Tokenizing Women's Non-Reproductive Health Data

Asterisk is designed as a data union — a digitally-native cooperative where women contribute personal data in exchange for shared decision-making power, value creation, and upside participation. As defined by the European Commission, data unions are part of a growing "data intermediary" landscape aligned with the principles of the EU Data Governance Act (2022), which prioritizes user agency and equitable value-sharing.³⁴ Our governance module formalizes this relationship using a tokenized system, enabling women around the world to collectively influence and co-invest in the future of healthcare.

Unlike traditional research systems, where priorities are set by funders with little input from those affected, Asterisk allows participants to directly shape the research questions, investment direction, and commercialization outcomes derived from their data.

Co-Investment Through Participation

Through our governance model, women will be voting on the research that directly affects their health. Here's how the system works in Asterisk's alpha and future phases:

The Asterisk token (\$AST) is a utility and governance asset that powers access, participation, and coordination across our decentralized health research ecosystem. It is not designed as a speculative asset, nor does it confer financial yield or revenue rights. Instead, \$AST incentivizes ongoing contribution to the Asterisk platform while enabling participants to collectively shape its research priorities, partnerships, and IP strategy through delegated governance.

Fixed Supply and Long-Term Alignment

\$AST has a fixed supply of 1 billion tokens, with a multi-year unlock and allocation strategy designed to balance platform growth, community participation, and responsible governance. Token rewards will be issued progressively to participants and contributors based on their active participation in the ecosystem, such as submitting data, reviewing research proposals, or serving as governance delegates.

Token rewards are distributed through a points-based system during the app's early phase. These points are earned through daily check-ins, where one point per one check-in per day is allowed to prevent farming or manipulation. Over time, points will become redeemable for \$AST under a controlled, dynamic allocation model — not on a 1:1 basis — with conversion parameters determined by treasury state, participation levels, and data utility. This approach allows us to gradually shift toward onchain distribution while maintaining long-term supply sustainability.

Token Utility

\$AST is the connective tissue of the Asterisk ecosystem, offering:

- **Governance Rights:** Token holders may delegate voting power to elected personnel within the DAO, who collectively direct organizational decisions, IP licensing strategy, and marketplace curation through a Senate-style DAO. Only active participants are eligible for voting.
- **Access to Research & Tools:** Token holders gain access to premium features, early-stage research reports, and participation in exclusive focus groups or data collectives.
- **Marketplace Utility:** \$AST can be used to stake behind promising research listings, access promotion or visibility tools, and contribute to collective curation of valuable data sets.

To minimize regulatory risk, \$AST does not grant revenue shares or profit dividends. However, token staking may grant influence over how Asterisk licenses its IP or allocates platform revenue, in line with DAO governance decisions.

Participation Incentives

Data monetization in Asterisk follows these principles:

- All data is abstracted and anonymized prior to sharing with external parties.
- Revenue from data partnerships is funneled into the DAO treasury.
- DAO members earn a share via:
 - Token-weighted dividend distributions
 - Participation rewards (e.g. staking bonus)
 - Retroactive contributor grants (for those who supported specific research themes)

This structure is subject to local data sovereignty laws (e.g. GDPR, HIPAA), and all data-sharing agreements are governed by transparent, DAO-approved terms.

Our incentives are designed to promote sustained engagement — not speculation. Some guiding features include:

- **Daily activity caps** to prevent farming (e.g., one check-in per day).
- **Dynamic weighting** of data contributions (e.g., demographic balance, data quality, recontact eligibility).
- **Bucket-based reward allocation**, allowing us to limit token issuance by cohort or campaign rather than per-action.
- **Delegated governance**, reducing the advantage of large token holders by emphasizing stewardship and participation over pure token count.

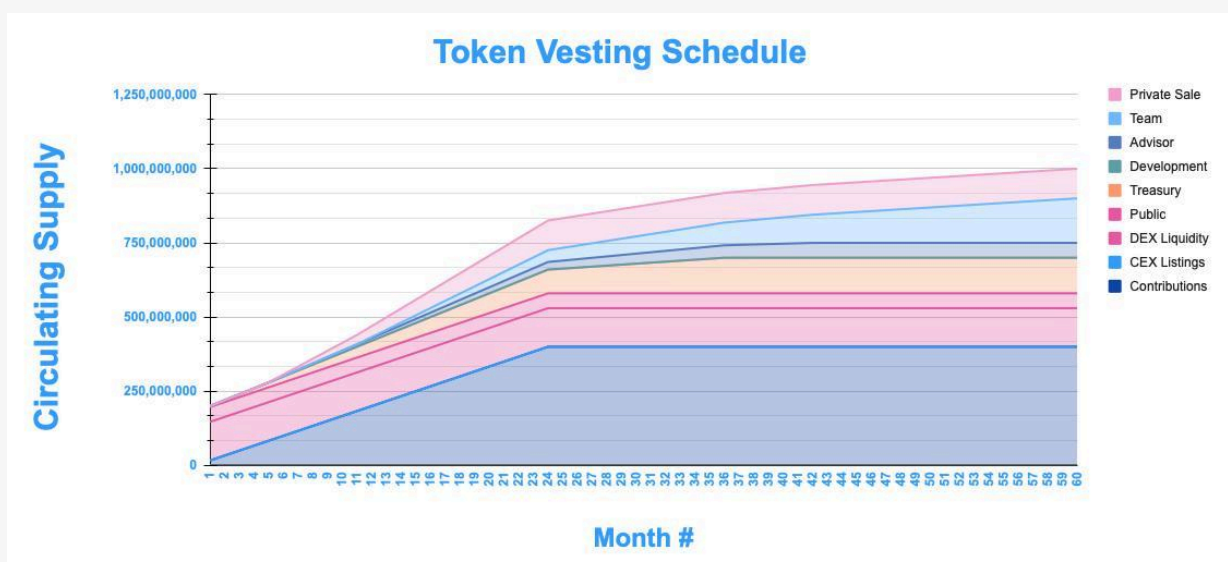
Inactive or “dead” token supply (e.g., unclaimed tokens, or those held by participants who disengage) may be subject to time-based expiration or clawback mechanisms in the future, pending DAO approval.

Distribution and Vesting

Token allocations will be time-locked to ensure long-term alignment across stakeholders. We anticipate the following approximate breakdown, subject to refinement as we approach launch:

Allocation	Share of Supply	Vesting/Lock-Up
Community & Contributors	30%	Gradual, via points → token conversion
Team & Advisors	20%	6 month cliff, 3 year vesting (advisors) 12 month cliff, 4 year vesting (team)
DAO Treasury & Reserve	10%	DAO-controlled, with proposal-based disbursement
Investor / Presale Allocation	15%	Round-based, with lock-up tailored per raise
Exchange Allocation	10%	CEX/DEX liquidity pool
Marketing & Partnerships	10%	Marketing funds and partner incentives
Development	5%	Funds allocated for development and maintenance

Investors may receive a share of revenue generated from commercial products or research initiatives developed using Astra's data, in accordance with pre-defined participation terms and aligned with the DAO's ethical and governance framework. KYC may be required for certain allocations (e.g., team members or investor airdrops) to remain compliant with regional regulations. Below is a vesting schedule based on a fixed supply of 1B \$AST.



Exchange & Liquidity

While no exchange listing is planned at this stage, the \$AST token is being designed to support eventual liquidity on public markets. If listed, we will ensure proper safeguards such as:

- Initial liquidity provisioning via community-owned pools or DAO treasury.
- Token time-locks for insiders and early contributors.
- Reserve supply for buyback-and-burn programs or utility-based redistributions, rather than direct profit sharing.
- DEX allocation to position the DAO to receive Vana DataDAO Rewards and encourage ongoing ethical data usage.

We are intentionally keeping this aspect flexible to accommodate future regulatory and investor strategy.

Future Directions*

As Asterisk grows, so will its initiatives.

The data union will be enriched through data imported from wearable technology (AppleWatch, Oura Ring, etc), lowering the barrier to entry for participants who do not find a daily interaction desirable. Further, we wish to capture menstrual data from partners like Clue who already have a strong ethical track record doing so. This data will be combined with our participant's daily check-ins through zero-knowledge proofs to integrate menstruation (or lack thereof) as a marker alongside non-reproductive symptoms.

We are also exploring scraping existing data from social media, where disenfranchised groups typically gather for support. When health care is under served, individuals are forced into the role of advocate and expert. The data in such support groups offers high-value insights that can be confirmed by the day-to-day experience gathered by our tracking app.

Finally, we aim to collaborate with University research institutions to put forward our own key findings in the data. These will be published in our tech transfer marketplace to snowball female health research.

Conclusion*

Asterisk aims to shift the landscape of women's non-reproductive health on a global level by closing the health gender gap and breaking the Global North paradigm of research and data collection. In turn, our data union, built by women around the world, will provide researchers with needed holistic insight on how disease affects women. Our tech transfer marketplace provides new life to existing research while incentivizing institutions to fund further non-reproductive health research. Finally, our members will be able to vote on the research that we fund, ultimately leveraging the wisdom held on the individual and community level. Put together, these initiatives will improve the outlook for women's non-reproductive health around the world and have a waterfall effect, ultimately improving healthcare for all.

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