

PetChain Whitepaper

Digital Passport & Verified Pedigree System for Purebred Dogs

1. Introduction

Across Europe, dog ownership, breeding, and cross-border movement rely heavily on trust — yet the systems supporting that trust are outdated. Pedigrees are mostly paper-based, easily lost or forged, and rarely backed by scientific parentage verification. Veterinary records are scattered across clinics and countries. Buyers often lack the tools to confirm the identity, health, or true lineage of a dog.

This is not a small issue. The purebred dog industry represents a **multi-billion-euro global market**, and a single purebred puppy typically costs **€1,000–€5,000**, with sought-after breeds or champion lines reaching **€10,000 or more**. Despite the high economic and emotional stakes, the infrastructure for documenting lineage and health has barely evolved in decades.

At the same time, in **Switzerland and many European countries (and in well-regulated markets such as Japan, South Korea, and Australia)**, every dog already carries a microchip ID, and DNA testing has become affordable and widely accessible. These two elements — identity and genetics — create the perfect foundation for a modern, verified, and trustworthy system.

PetChain introduces the Digital Passport for purebred dogs:

a secure, tamper-proof digital identity combining microchip information, DNA-based parentage verification, verified pedigree, and breeder/veterinarian confirmations — all stored in a format that cannot be altered or forged.

2. Problem Overview

2.1 Fragile and Forged Pedigrees

Paper pedigrees can be edited, copied, or falsified. Even official clubs struggle to maintain consistency or prevent manipulation. A peer-reviewed study in *Canine Genetics and Epidemiology* (Lewis et al., 2019) confirmed that pedigree records frequently contain inaccuracies or incorrect parentage, highlighting a systemic vulnerability in traditional paper-based lineage documentation.

(<https://cgejournal.biomedcentral.com/articles/10.1186/s40575-019-0074-3>)

2.2 No Guaranteed Parent Verification

Most international registries, including the Fédération Cynologique Internationale (FCI) and its national member clubs, record parentage based primarily on breeder-submitted declarations. DNA testing is generally optional and not required for standard litter registration. As a result, scientific lineage verification is often absent, and studies have shown that unverified breeder-reported pedigrees can lead to incorrect or inconsistent parentage records.

(FCI International Breeding Regulations: <https://www.fci.be/medias/ELE-REG-en-15497.pdf>)

2.3 Fragmented Medical Records

Health data is split between clinics, owners, and borders. Missing information harms responsible breeding and long-term care.

2.4 Lack of Shared Standards Across Europe

Each country maintains separate systems with no standardization, making international breeding and verification unnecessarily complex.

2.5 Rising Fraud and Illegal Puppy Trade

Europe faces growing problems with forged papers, false breed claims, and misleading sales practices. Buyers often lack any reliable way to verify a dog's true origin or lineage.

According to a report by FOUR PAWS ("Billion Euro Industry – Why the EU must strengthen regulations to end the illegal puppy trade now"), the illegal and unknown-source puppy trade in Europe is valued at approximately €4.6 billion annually.

(https://media.4-paws.org/b/5/a/6/b5a69681da94fa61edddf0b00c8a101d2482ba8a/2024-10-29_Billion-Euro-Industry-Report_web.pdf)

3. Vision — A Digital Passport for Purebred Dogs

PetChain establishes a **Digital Passport** that accompanies each dog for life and provides:

- **Verified identity** linked to the microchip
- **Scientific parentage confirmation** through DNA
- **Digital pedigree** that cannot be changed or forged
- **Trusted confirmations** from breeders and veterinarians
- **Optional privacy-preserving medical information**

The goal is not to replace existing kennel clubs or registries, but to **strengthen the entire ecosystem** with a modern, transparent, and interoperable infrastructure.

Just as Europe is building **Digital Identity Wallets** and **Digital Product Passports**, PetChain applies the same principles to animals — identity, verification, transparency, and trust.

4. System Overview

PetChain is built on three interconnected layers:

4.1 Identity Layer — the Digital Passport

Each dog receives a digital identity linked to its microchip number.

This acts as the core of the passport: a unique, permanent anchor for all future information.

4.2 Verification Layer — DNA & Vet Confirmation

DNA parentage results and vet/breeder signatures confirm the accuracy of lineage and key events.

This layer gives the passport its credibility.

4.3 Pedigree Layer — Verified Lineage

A digital pedigree is generated automatically once parentage is confirmed. The structure is simple and clear:

Father ← Puppy → Mother

This pedigree is part of the Digital Passport and cannot be altered once created.

5. Key Components (Digital Passport Architecture)

PetChain is built as a set of simple, modular smart contracts that together create the Digital Passport for each dog. These contracts define how identity, parentage, and pedigree data are stored, validated, and connected on-chain.

5.1 Digital Passport Contract (Pet Identity)

This smart contract establishes the dog's core identity and anchors it to the blockchain. It includes:

- Microchip ID (primary unique identifier)
- DNA hash (optional at birth, required for verified pedigree)
- Sex, birthdate, breed
- Digital signatures from breeder and/or veterinarian

Once written, the identity cannot be altered — ensuring tamper-proof records.

5.2 Parentage Verification Contract

This contract links the puppy's Digital Passport to the Digital Passports of the sire and dam:

Father ← Puppy → Mother

It includes:

- Parent IDs (mother and father)
- DNA parentage confirmation from a certified laboratory
- Logic ensuring the DNA matches both parents
- Automatic creation of the on-chain lineage record

This establishes a **verified, tamper-proof family link** that forms the basis of the digital pedigree.

5.3 Digital Pedigree Contract (Lineage NFT)

Once parentage is verified, an NFT-based pedigree is minted. It includes:

- Verified lineage
- DNA confirmation status
- Metadata (birthdate, breeder, breed, colour)
- Links to ancestors (multi-generation tree)

This becomes the tamper-proof digital pedigree that can be shown, transferred, or shared.

5.4 Ownership Module (Future Integration)

A lightweight smart contract can support:

- Ownership registration
- Transfer of ownership
- Full ownership history

However, in Europe and Switzerland official dog ownership must be recorded in national databases (such as AMICUS, I-CAD, TASSO) and can only be updated by authorized veterinarians or authorities.

Therefore, while the ownership module will be developed as part of the MVP, its real-world integration will come in Phase 2, once a working solution is demonstrated and partnerships with national registries can be established.

5.5 Privacy Layer (Zero-Knowledge Proofs)

To protect sensitive data (health, DNA, owner details), the system will integrate zero-knowledge proofs:

- “Prove vaccination validity without exposing the medical record”
- “Prove the dog belongs to a breed group without exposing raw genotype”
- “Prove no breeding restrictions apply without exposing full pedigree data”

This keeps the Digital Passport useful while preserving privacy.

6. Technology Overview

6.1 Blockchain as the Trust Layer

The PetChain app uses blockchain to ensure that key information about each dog remains:

- Tamper-proof once recorded
- Consistent across borders
- Accessible for the lifetime of the dog
- Independent of any single organization or registry

Cardano is chosen for its low transaction costs, native assets, identity frameworks, and strong research-backed architecture.

6.2 Zero-Knowledge Proofs for Privacy

The app integrates zero-knowledge proof concepts to allow users to demonstrate facts without exposing sensitive data.

Examples:

- Proving that vaccinations are up to date
- Proving that a dog belongs to a breed group
- Proving genetic health conditions without exposing full DNA results

This enables transparent verification while maintaining privacy.

6.3 App Architecture (MVP)

The MVP is delivered as a simple mobile app (iOS/Android) that connects to the blockchain and backend services.

It does not require external integrations.

The app supports:

- Breeders (register litters, link microchips, upload DNA information)
- Veterinarians (validate microchips and DNA sampling)
- Buyers/owners (view Digital Passport, scan QR/NFC)

All information is managed through the app, creating a clean and user-friendly experience.

6.4 External Integrations (Future Phases)

While the MVP works independently, future integrations may include:

- DNA laboratories (automatic result imports)
- Veterinary software systems
- National microchip registries (where regulations allow)
- Breed clubs, kennel clubs, and academic institutions

These integrations are optional and will only be pursued after the MVP is validated.

7. User Flows (Simplified – App-Based)

7.1 Breeder Flow

The breeder uses the PetChain app to:

- Register the litter
 - Enter basic details
 - Add microchip numbers (already implanted by the vet)
- Submit DNA evidence
 - Use any certified DNA test kit (recommended by the vet)
 - Upload lab results or a lab reference number into the app

- Approve puppy details
 - Confirm sire and dam information
 - Review the Parentage Verification (Father ← Puppy → Mother)
 - Generate Digital Passports
 - Each puppy receives a verified Digital Passport
 - Breeder can share a QR/NFC link with potential buyers
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7.2 Veterinarian Flow

The veterinarian uses the app to:

- Confirm identity
 - Scan or manually check microchip ID
 - Validate DNA sampling
 - Confirm that the DNA sample was taken correctly
 - Sign the verification digitally in the app
 - Approve Digital Passport data
 - Validate identity, microchip, and basic health info
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7.3 Buyer / New Owner Flow

The buyer uses the app (or scans a QR/NFC tag) to:

- Access the Digital Passport
 - Verified identity
 - Verified parentage
 - Verified pedigree
 - Check breeder authenticity
 - Digital breeder signature
 - Vet signature
 - Request ownership transfer (Phase 2)
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7.4 Public Verification Flow

Anyone scanning the QR/NFC tag sees:

- Verified identity
 - Verified lineage
 - Breeder and vet signatures
 - No sensitive data
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8. Benefits for Stakeholders

Breeders

- Strong credibility and higher valuation
- Protection against false claims
- Tools for responsible breeding

Veterinarians

- Clear lineage and medical context
- Better continuity of care
- Stronger collaboration with breeders

Buyers

- Confidence and transparency
- Protection against fraud
- Verified lineage and health

Clubs & Institutions

- Optional integration
- Better data accuracy
- Strong, modern infrastructure

9. Pilot Strategy

To avoid bureaucracy and demonstrate value quickly, the MVP will launch with a small, focused pilot using the PetChain mobile app.

The pilot will include:

- 1 veterinarian
- 1–2 breeders
- 1–2 new litters (to show Digital Passports from birth)
- 2–4 existing adult dogs (to show that Digital Passports can be created retroactively)
- Microchip IDs
- DNA tests using existing lab kits
- The PetChain mobile app (iOS/Android)

This approach demonstrates both core use cases:

1. Newborn puppies

Full workflow: breeder → microchip → DNA → vet validation → Digital Passport.

2. Existing dogs

Identity and lineage reconstruction (microchip + DNA + vet confirmation) → Digital Passport issuance.

This mix produces real Digital Passports, real data, and real user feedback, allowing refinement before approaching larger organizations, kennel clubs, or national registries.

10. Future Extensions (Beyond MVP)

The current MVP already delivers meaningful value:

Microchip → DNA → Digital Passport with Verified Pedigree.

This solves major problems in identity, lineage, and trust — even without additional features.

The ideas below represent possible future directions, not commitments. They show how the PetChain Digital Passport could evolve once the MVP is validated and real-world needs are better understood.

Possible extensions include:

- Full medical record integration with privacy protection
- Optional API connections with breed clubs or kennel clubs
- Genetic health scoring (based on lab data)
- Responsible breeding recommendation tools
- Verified marketplace built on Digital Passports
- Collaboration with universities and research institutions
- A knowledge graph for breeders, veterinarians, and authorities

These are preliminary ideas, and each would be explored only after user feedback and regulatory evaluation.

The project's immediate focus remains a simple, strong foundation:

identity, DNA-verified parentage, and a trusted Digital Passport.

11. MVP Scope and Requirements

The MVP focuses on delivering a fully functional Digital Passport app that demonstrates verified identity, verified parentage, and a trusted digital pedigree for both new litters and existing dogs.

11.1 Included in the MVP

- Mobile App (iOS/Android) for breeders, veterinarians, and buyers
- Core Digital Passport (microchip + identity + breeder/vet confirmation)
- DNA parentage verification workflow (using existing certified lab kits)
- Digital pedigree generation (verified lineage tree:
Father ← Puppy → Mother)
- Breeder & vet app interfaces
- Backend + Cardano smart contract layer
- Live pilot with real dogs (newborn + existing adults)

This MVP is fully independent and requires no external system integrations.

11.2 Team

Boaz Unger — Project Lead

20+ years as a product and marketing executive and entrepreneur. Experienced in delivering high-value digital products and leading funded blockchain projects within Catalyst. Brings expertise in product strategy, user research, branding, and partnerships.

Udai Solanki — Technical Lead (AIQUANT Technologies)

Over two decades of software engineering and system architecture experience, including proven Cardano expertise across multiple ecosystem projects. Leads the blockchain, backend, and smart-contract implementation to ensure security, scalability, and robustness.

Zachi Diner — Head of Design & UX/UI

20+ years in digital product design, branding, and user experience. Former design lead for global brands including Waze, AT&T, Verizon, and T-Mobile. Co-founded design studios in San Francisco and Israel and previously headed the Visual Communication Department at a leading design institute.

DVM. Andrea Neagu — Veterinary Advisor

Licensed veterinarian with over 10 years of experience in Switzerland and France. Expertise in DNA testing, newborn puppy registration, and clinical validation. Provides veterinary workflows, regulatory insight, and professional validation processes.

Amots Assaf — Breeder, Field Testing Partner & Advisor

Experienced Bernese Mountain Dog breeder with veterinary training and deep hands-on breeding expertise. Provides real-world workflow insight, testing scenarios, and practical feedback essential for validating the PetChain MVP.

12. Conclusion

PetChain introduces the **Digital Passport for purebred dogs**, offering verified identity, verified lineage, and trusted health information in a clear, tamper-proof format.

This system doesn't replace existing institutions — it strengthens them by providing the technological foundation they currently lack. With microchip identity, DNA verification, and immutable records, PetChain brings the world of dog breeding into the modern era.

The project is ready to move beyond the idea stage into a working prototype supported by real users and real data.