

BioTake: Real-World Intellectual Property (RWIP)

An On-Chain Protocol for Pricing, Funding, and Governing
Translational Medical Research

BioTake Research

Version 1.0 · Testnet edition · contact@biotake.xyz

This document describes a testnet demonstration. It is not an offer, a solicitation, or investment advice.

Abstract

The overwhelming majority of biomedical research never crosses the translational “valley of death” between a published result and a therapy, not because the science is wrong but because translational capital is scarce, slow, and allocated privately. We introduce **Real-World Intellectual Property (RWIP)**, an on-chain asset class that tokenizes the translation upside of specific intellectual property — peer-reviewed papers, patents and clinical data. BioTake operationalizes RWIP with four coupled mechanisms: (i) a deterministic **Proof-of-Value** engine that scores a paper across six weighted dimensions into a composite and a valuation whose conservative end binds an on-chain raise cap; (ii) a compliant, KYC-gated fixed-price primary sale; (iii) a milestone escrow that releases working capital only against public deliverables; and (iv) a monotone **NAV ratchet floor** that guarantees an only-rising cash redemption value, after which positions graduate into a freely tradable, dividend-bearing token. We formalize each mechanism, prove the floor’s monotonicity, specify the contract architecture and parameters, and discuss compliance, security, and limitations. The protocol is implemented and demonstrated on a BNB Chain testnet.

Keywords: decentralized science (DeSci) · real-world assets · intellectual-property tokenization · proof-of-value · milestone escrow · redemption floor · security tokens · BNB Chain.

1 Introduction

Modern medicine advances on published research, yet publication is where public funding typically stops. The unglamorous work that turns a result into a therapy — independent replication, toxicology, formulation, regulatory preparation, early clinical testing — is chronically under-funded. Roughly one percent of biomedical papers ever reach a human trial; the bench-to-bedside path averages close to two decades; and bringing a single therapy to market costs on the order of a billion dollars [4,5,6]. The public that funds this research through taxes, and ultimately pays for the resulting products, can own none of the upside created in between.

Two ingredients are missing from the space between a grant and a venture round: an *objective price* for early research, and *accountable capital* that anyone can supply and audit. BioTake supplies both. We define an asset class for the translation rights to intellectual property, price it with a reproducible engine, distribute it through a compliant sale, gate its capital behind public milestones, and protect its holders with an only-rising cash floor and real dividends.

1.1 Contributions

This paper makes four contributions. **(1)** We define RWIP, a formal on-chain asset class for the translation upside of intellectual property (§3). **(2)** We specify a deterministic Proof-of-Value valuation whose conservative end is enforced on-chain as a hard raise cap (§5). **(3)** We describe a milestone-escrowed primary market and a monotone NAV redemption floor, and prove the floor never decreases (§7–8). **(4)** We give the full contract architecture, parameters, compliance and security model of a working testnet implementation (§4, §12–13).

2 Background & Related Work

2.1 Real-World Assets (RWA)

RWA protocols bring off-chain physical and financial assets — real estate, treasuries, private credit — on-chain as tokens backed by legal claims. Their value derives from an appraised or contractual price and their yield from rent or coupons. RWIP adapts the same legal-wrapper-plus-token pattern but targets a different underlying: intellectual property, whose value is forward-looking and must be *estimated* rather than appraised from comparables.

2.2 Decentralized Science (DeSci)

DeSci initiatives fund and coordinate research using on-chain primitives, typically via project DAOs and IP-NFTs that assign ownership of a research program. BioTake differs in three ways: positions are *fungible and divisible*

securities rather than singleton NFTs; pricing is produced by a *deterministic, published* engine rather than negotiated; and capital is *milestone-escrowed* with an enforced redemption floor rather than transferred up-front.

2.3 Why prior approaches fall short

Grant capital is merit-reviewed but slow, publication-biased, and confers no ownership or post-award accountability. Venture and pharma capital enters only after de-risking and cannot write the small checks translational science needs. Donation crowdfunding offers participation but no price signal, ownership, or recourse. Token launchpads offer liquidity but price on hype, leave treasuries unrestricted, and provide no downside protection. BioTake targets exactly these gaps.

3 RWIP: A Formal Asset Class

We define a **Real-World Intellectual Property (RWIP) asset** as a tokenized, fungible claim on the translation upside of a specific piece of intellectual property, characterized by three properties, each realized by an on-chain mechanism:

(P1) Priceable. There exists a deterministic map from the asset’s public description to a valuation and an enforceable raise cap (§5). **(P2) Ownable.** The claim is a transferable, divisible security that graduates into a liquid token carrying redemption and dividend rights (§8–10). **(P3) Accountable.** Capital is released only against verifiable, public milestones, and every state transition emits an on-chain event (§7).

An RWIP asset is thus the tuple $A = (I, V, S, E, F, D)$ of the underlying IP I , its valuation V , its sale S , its escrow E , its redemption floor F , and its dividend stream D . The remainder of the paper specifies each component.

4 Protocol Architecture

4.1 System overview

Each project deploys an isolated set of five contracts wired to three platform singletons (Figure 1). Isolation is a first principle: no project shares mutable state with another except the KYC allowlist and the registry, so a failure in one asset cannot affect the funds of any other. Deployment is atomic — valuation, five contracts, and registration occur in a single flow that registers nothing on partial failure.

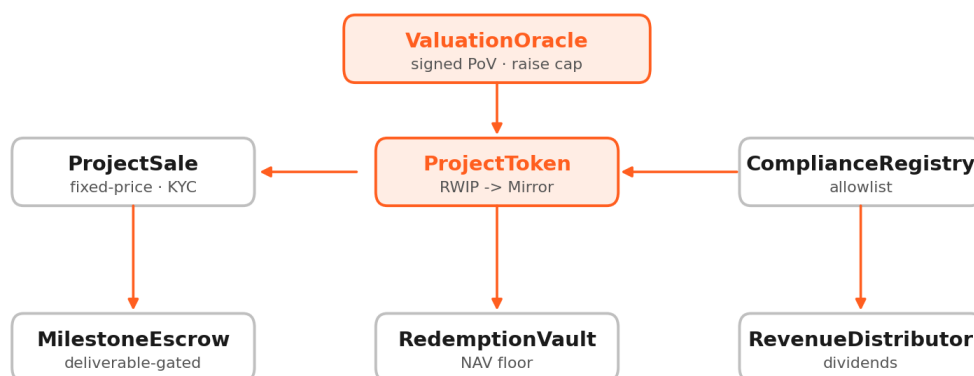


Figure 1. Protocol architecture. A per-project quintet (Sale, Token, Escrow, Vault, Distributor) is wired to three platform singletons (ValuationOracle, ComplianceRegistry, ProjectRegistry). Arrows denote value or authority flow.

4.2 Contract set

Table 1. The eight contracts of the protocol (Solidity 0.8.24).

Contract	Kind	Responsibility
<i>ProjectToken</i>	ERC-20 (restricted)	The RWIP security; graduates into the tradable Mirror token; charges a 1.5% post-graduation transfer fee.
<i>ProjectSale</i>	Fixed-price sale	KYC-gated subscription at a fixed price; hard-capped; refunds on failure.
<i>MilestoneEscrow</i>	Escrow	Holds working capital; releases tranches on approved deliverables.
<i>RedemptionVault</i>	Redemption	Holds the reserve; quotes and honours the NAV floor.
<i>RevenueDistributor</i>	Dividends	Streams stablecoin revenue pro-rata to holders.
<i>ComplianceRegistry</i>	Singleton	On-chain KYC allowlist consulted by token and sale.
<i>ValuationOracle</i>	Singleton	Stores the signed PoV report hash and valuation; source of the cap.
<i>ProjectRegistry</i>	Singleton	Index of every deployed project and its contract set.

4.3 Trust model

Economic parameters — the raise cap, the redemption floor, the fee schedule — are constructor-set and have no administrative setter; no privileged actor can change them after deployment. An *operator* role advances lifecycle state (finalize, graduate, approve and release milestones, distribute dividends) but

can neither exceed the cap, lower the floor, nor seize escrowed funds. On the demonstration network the operator is a single signer; production gates the same functions behind a multisig and timelock without altering the contract surface.

5 Proof-of-Value Engine

5.1 Dimensions

The engine scores a paper on six weighted dimensions (Figure 2, Table 2). The weights reflect that feasibility and clinical utility dominate early-stage value, while commercial and competitive factors modulate it.

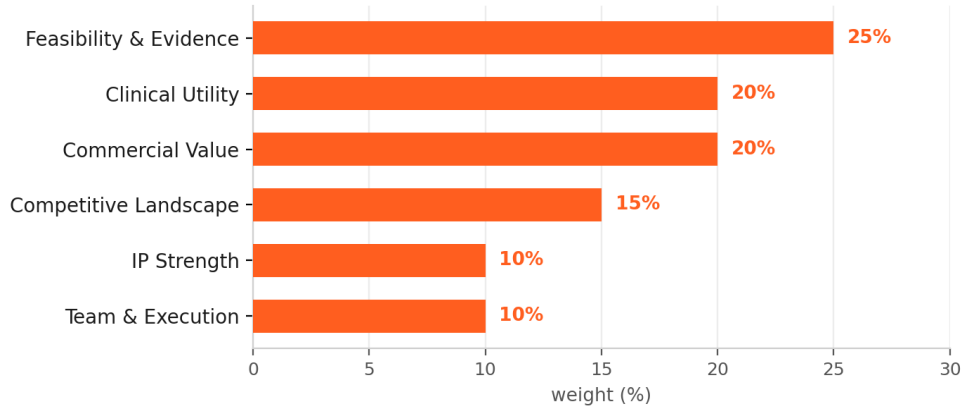


Figure 2. Proof-of-Value dimension weights. The composite is their weighted sum; feasibility (25%) carries the most weight.

5.2 Scoring function

Let $s_i \in [0,100]$ be the score of dimension i with weight w_i , where $\sum w_i = 1$. Each s_i is a deterministic function of textual signals in the paper and structured inputs (stage, IP status, market size). The composite is

$$C = \sum_{i=1}^6 w_i \cdot s_i \in [0, 100]. \quad (1)$$

Determinism is essential: identical inputs yield an identical score under a pinned model version, so any party can recompute and challenge the result. The full report — scores, weights, rationales, version — is published and its hash anchored on-chain.

5.3 Valuation mapping

Let B_{stage} be a stage base value, μ_{field} a field multiplier, and $\sigma(C) = 0.4 + 1.2 \cdot C/100$ a monotone score multiplier. The base valuation and range are

$$V_{base} = B_{stage} \cdot \mu_{field} \cdot \sigma(C), \quad V_{low} = 0.8 \cdot V_{base}, \quad V_{high} = 1.3 \cdot V_{base}. \quad (2)$$

The on-chain raise cap uses only the conservative end, scaled by the equity offered e (in basis points):

$$R_{cap} = V_{low} \cdot e / 10^4. \quad (3)$$

and the sale can accept at most the smaller of the cap and the fixed-price capacity (§6):

$$R_{max} = \min(p \cdot A, R_{cap}), \quad (4)$$

where p is the fixed token price and A the sale allocation.

5.4 Guardrails

Four properties box the engine in. Stage acts as a hard multiplier ceiling, so a paper-stage asset cannot be priced like a clinical-stage one. Founders raise only against V_{low} , never the optimistic tail. Scoring is deterministic and version-pinned, precluding silent re-rolls. And the cap is enforced by the sale contract reading the on-chain oracle, so no off-chain component can inflate it. The valuation remains an estimate; §15 discusses its limits.

6 Primary Market

The primary sale is a fixed-price subscription — no bonding curve, no auction. Every fill clears at the same price p , so the last subscriber pays exactly what the first did; this is the only structure compatible with a security-type instrument and a fixed valuation cap. A subscription of stablecoin amount x mints

$$n(x) = x / p \text{ tokens, subject to } \sum x \leq R_{max}. \quad (5)$$

A transaction that would breach R_{max} reverts. Only wallets on the ComplianceRegistry allowlist may subscribe (§12). On a successful close, funds split into a platform fee, the redemption reserve, and milestone escrow (Table 3). If the sale fails to reach its minimum by the deadline, every subscription is refundable one-to-one, trustlessly and without expiry.

7 Milestone Escrow

Working capital never rests in a founder wallet. It is locked in *MilestoneEscrow* against a public roadmap; each milestone carries a title, category, budget, and deadline. The scientist submits a deliverable URI and a tamper-evident evidence hash (keccak-256); the operator approves; the tranche releases. A milestone thus traverses the states Pending → Submitted → Approved → Released, each transition emitting an event. Deadlines may be extended a bounded number of times, each extension public. Undelivered tranches are never released and remain part of the asset's backing — a stalled project therefore decays toward a redeemable cash position rather than a loss.

8 NAV Ratchet Floor

The *RedemptionVault* holds a reserve R against circulating supply N and quotes a per-token cash floor

$$F = R / N. \quad (6)$$

Any holder may redeem x tokens at any time after finalization, receiving $F \cdot x$ in stablecoin and burning the tokens. We claim the floor is **monotone non-decreasing**: it rises with reserve inflows and is invariant under redemption.

Proposition 1 (redemption invariance). A redemption of x tokens leaves the floor unchanged.

Proof. Redeeming x pays $F \cdot x$ from the reserve and burns x from supply, so the new floor is

$$F' = (R - F \cdot x) / (N - x) = (R - (R/N)x) / (N - x) = R(N - x) / (N(N - x)) = R/N = F. \quad (7)$$

reserve and supply fall in equal proportion, leaving $F' = F$. ■

Reserve inflows (the sale's reserve share, retained revenue, treasury top-ups) increase R at fixed N and thus raise F ; no operation lowers it (Figure 3). The floor is therefore downside protection that is verifiable by construction rather than promised — redemption arbitrage makes selling below F irrational even absent secondary buyers.



Figure 3. The NAV ratchet floor $F(t)$. Reserve inflows step the floor up; redemptions leave it invariant (Proposition 1); nothing lowers it.

9 Graduation & Secondary Market

A successful, finalized sale *graduates*: the same ERC-20 that was a transfer-restricted security unlocks, one-way, into a freely tradable **Mirror token** (Figure 4). Balances and address are unchanged; only the transfer rules change. Post-graduation transfers are unrestricted but incur a 1.5% fee routed to the protocol treasury; the vault, distributor, and sale are fee-exempt so redemptions, dividends, and refunds never pay it. Supply is fixed at

deployment and no mint function survives graduation, so dilution is structurally impossible.



Figure 4. *Token life-cycle. One ERC-20 transitions once, irreversibly, from a restricted RWIP security (BioShares) to a tradable Mirror token upon graduation.*

10 On-Chain Dividends

Clinical and licensing revenue arrives as stablecoins in the *RevenueDistributor* and streams to holders using the magnified-dividend accounting pattern: constant gas per distribution regardless of holder count, exact pro-rata accounting, and pull-based claims that never expire. Maintaining a global magnified-dividend-per-share accumulator M and a per-holder correction $c(h)$, the claimable balance of holder h is

$$\text{claimable}(h) = M \cdot \text{bal}(h) - c(h). \quad (8)$$

A distribution of amount d over supply N increments M by d/N in a single storage write; transfers adjust $c(h)$ so that accrued dividends move correctly with tokens. Dividends are cash flow from real events, not emissions.

11 Token Economics

Every project uses a fixed supply with a standard allocation (Table 3) and identical fee schedule. The protocol earns from success and liquidity — a 10% fee on sold-out sales and a 1.5% secondary transfer fee — and never from failure: refunds, redemptions, dividend claims, and milestone releases are free.

Table 2. *Standard supply allocation and where a sold-out raise is directed at close.*

Component	Share	Purpose
Scientist / Team	30%	Founder alignment, vested against milestones
Project Treasury	25%	Post-raise runway and contingency
Public Sale	15%	The RWIP sale allocation
Ecosystem / Reserve	15%	Backs the redemption reserve
Liquidity	10%	Secondary-market depth at graduation
Curators	5%	Rewards for the curation stage

Table 3. *Protocol parameters (demonstration network).*

Parameter	Value	Enforced by
Platform fee	10% of a sold-out sale	ProjectSale.finalize()
Trading fee	1.5% per transfer (post-graduation)	ProjectToken
PoV dimensions / weights	6 · 25/20/20/15/10/10	Valuation engine
Raise cap	$V_{\text{low}} \cdot e / 10^4$	ValuationOracle → Sale
Reserve / working split	reserve + milestone escrow	ProjectSale
Settlement asset	USDT (stablecoin)	Platform
Network	BNB Chain (BSC Testnet)	—

12 Compliance & Regulation

RWIP tokens are treated as security-type instruments by design. Compliance is enforced in the token, not the interface: before graduation, both the sale's `buy()` and every token transfer consult the `ComplianceRegistry` allowlist and revert for non-allowlisted wallets. The allowlist is a public, revocable, on-chain record shared across projects; on the demonstration network a wallet self-attests in one step, while production substitutes a licensed KYC/KYB provider behind the identical `setAllowed()` call. Redemptions and dividend claims are never gated — they are property rights of the holder. Post-graduation transfers are unrestricted to support open secondary liquidity.

13 Security Considerations

Isolation. Per-project contracts localize the blast radius of any bug; singletons are deliberately minimal. **Immutable economics.** Caps, floors, and fees are constructor-set with no setter, removing an entire class of admin-key risk. **Reentrancy and accounting.** Redemption and dividend paths follow checks-effects-interactions and the audited magnified-dividend pattern. **Oracle integrity.** The sale reads its cap from the on-chain oracle; a compromised backend cannot raise it. **Operator containment.** The operator can only advance lifecycle state within contract-enforced bounds; production adds multisig and timelock. A formal audit precedes any mainnet deployment.

14 Roadmap

Phase 0 — Testnet (current). Full protocol on BNB Chain testnet: valuation, sale, escrow, floor, dividends, and the research library. **Phase 1 — Audit & compliance.** Third-party security audit, licensed KYC integration,

multisig/timelock operator. **Phase 2 — Mainnet & curation.** Mainnet launch with a staked curation market gating which papers reach a sale. **Phase 3 — LLM valuation & expansion.** An optional large-model valuation path with published prompts and challenge periods, and extension of RWIP beyond medicine to other research IP.

15 Limitations & Future Work

The valuation engine reads a paper’s description; it cannot detect fraud in underlying data, predict clinical outcomes, or foresee competition, which is precisely why its output caps a raise rather than promises a value, and why the floor-and-escrow architecture assumes valuations will sometimes err. Early-stage research is intrinsically high-variance: most translational programs fail and dividends may be years away. The legal enforceability of the off-chain IP wrapper varies by jurisdiction and is an active area of work. Finally, the current heuristic scorer is deliberately simple; a version-pinned model path with public prompts and a formal challenge mechanism is future work.

16 Conclusion

BioTake turns neglected translational research into a priced, compliant, accountable, and liquid on-chain asset class. By pairing a deterministic valuation whose conservative end is enforced on-chain with milestone-escrowed capital, a provably monotone redemption floor, and real dividends, RWIP makes the upside of science ownable without asking holders to trust the platform — only the contracts. The mechanisms are implemented and demonstrated today; the path to mainnet is audit, compliance, and curation. Science is the most under-priced asset on Earth; RWIP puts an honest, accountable price on it.

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Appendix A • Notation

Table A1. *Symbols used throughout.*

Symbol	Meaning
C	PoV composite score, 0–100 (Eq. 1)
s_i, w_i	score and weight of dimension i
$V_{low}, V_{base}, V_{high}$	valuation range (Eq. 2)
R_{cap}, R_{max}	raise cap and effective maximum raise (Eq. 3–4)
p, A	fixed sale price and allocation
F, R, N	NAV floor, reserve, circulating supply (Eq. 6)
$M, c(h)$	magnified dividend accumulator and per-holder correction (Eq. 8)
e	equity offered, in basis points