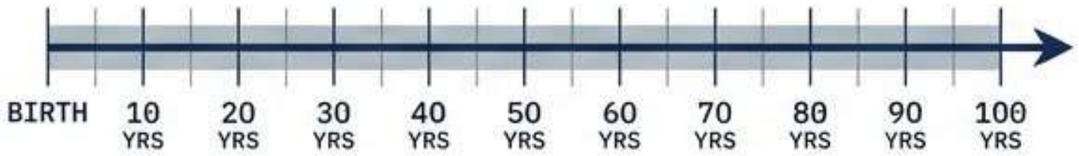
SYSTEM_STATUS: ONLINE

Operationalizing Phenotypic Age

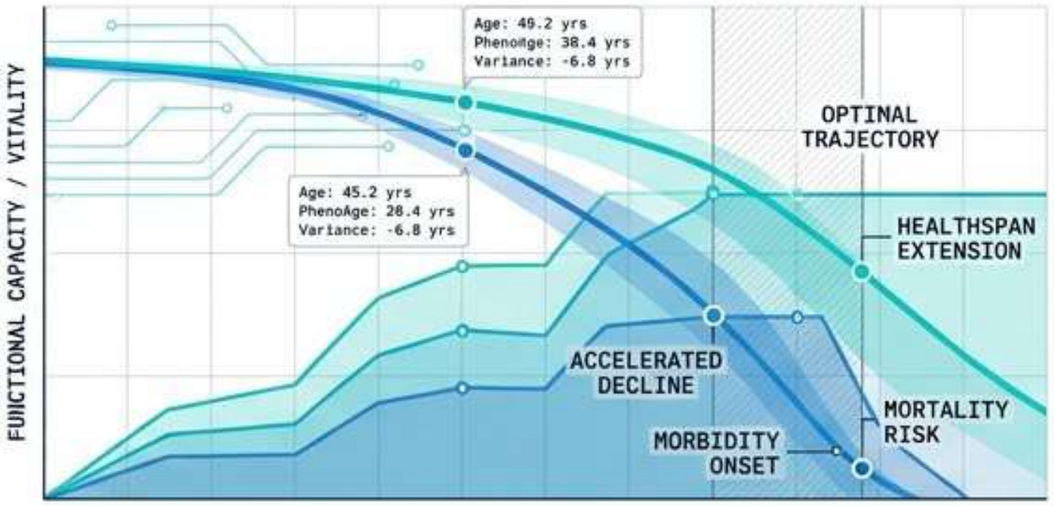
From Biomarker Science to Clinical Execution: Implementing the Levine/PLOS ONE (2018) Methodology.

CHRONOLOGICAL AGE



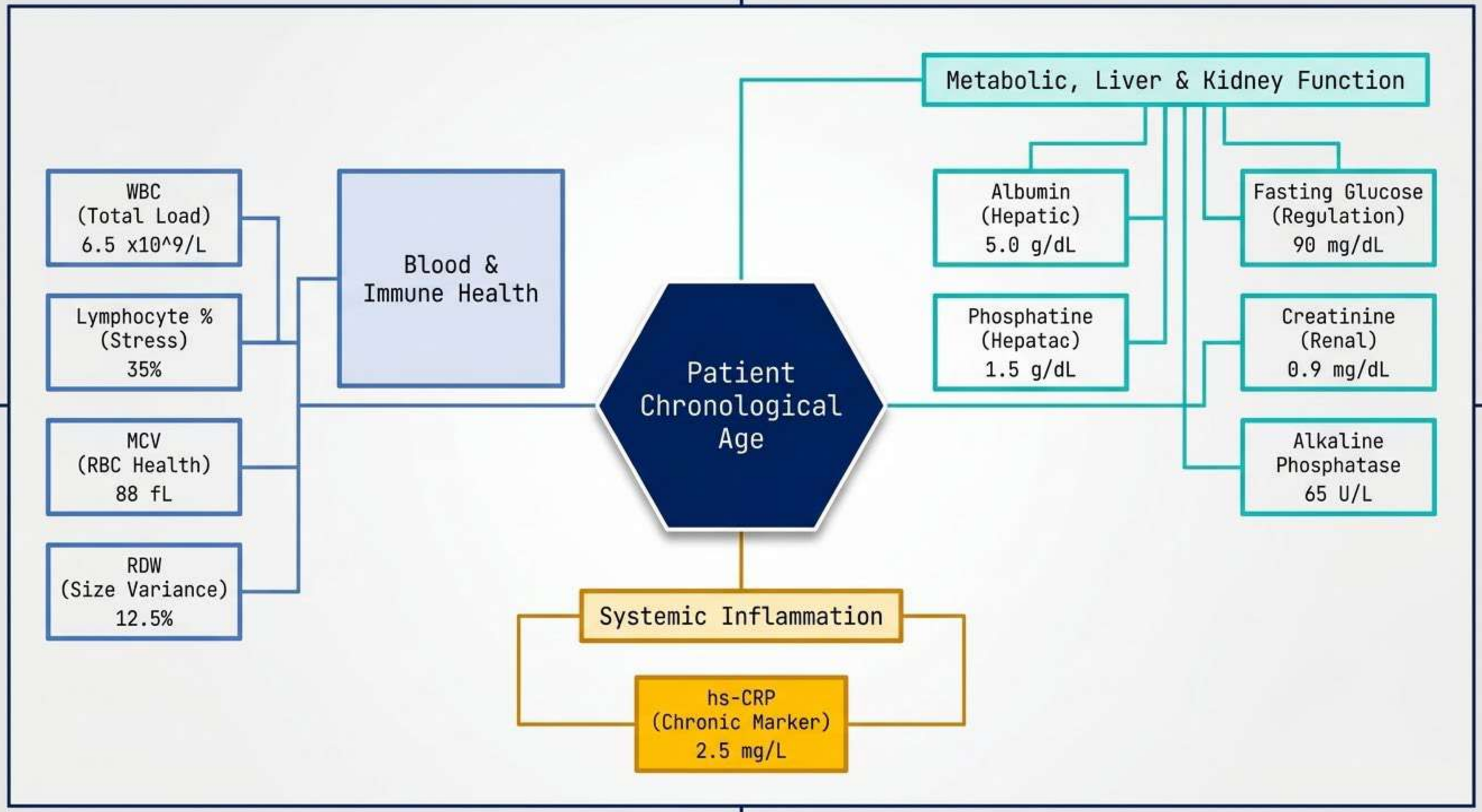
Fixed. Purely temporal. A fundamentally poor predictor of functional decline or individualized disease risk.

PHENOTYPIC AGE



Dynamic. Physiological. Highly predictive of morbidity, functional decline, and 10-year mortality risk.

CORE PREMISE: Shift the clinical focus from measuring time alive to measuring actual physiological decline.


Metabolic, Liver & Kidney Function
Albumin (Hepatic) 5.0 g/dL
Fasting Glucose (Regulation) 90 mg/dL
Phosphatine (Hepatac) 1.5 g/dL
Creatinine (Renal) 0.9 mg/dL
Alkaline Phosphatase 65 U/L
WBC (Total Load) 6.5 x10^9/L
Lymphocyte % (Stress) 35%
MCV (RBC Health) 88 fL
RDW (Size Variance) 12.5%
Blood & Immune Health
Patient Chronological Age
Systemic Inflammation
hs-CRP (Chronic Marker) 2.5 mg/L

3-step Gatekeeper

Fasting Mandate

Minimum 12-hour fast prior to blood draw. Strict water-only restriction to stabilize glucose and metabolic markers.

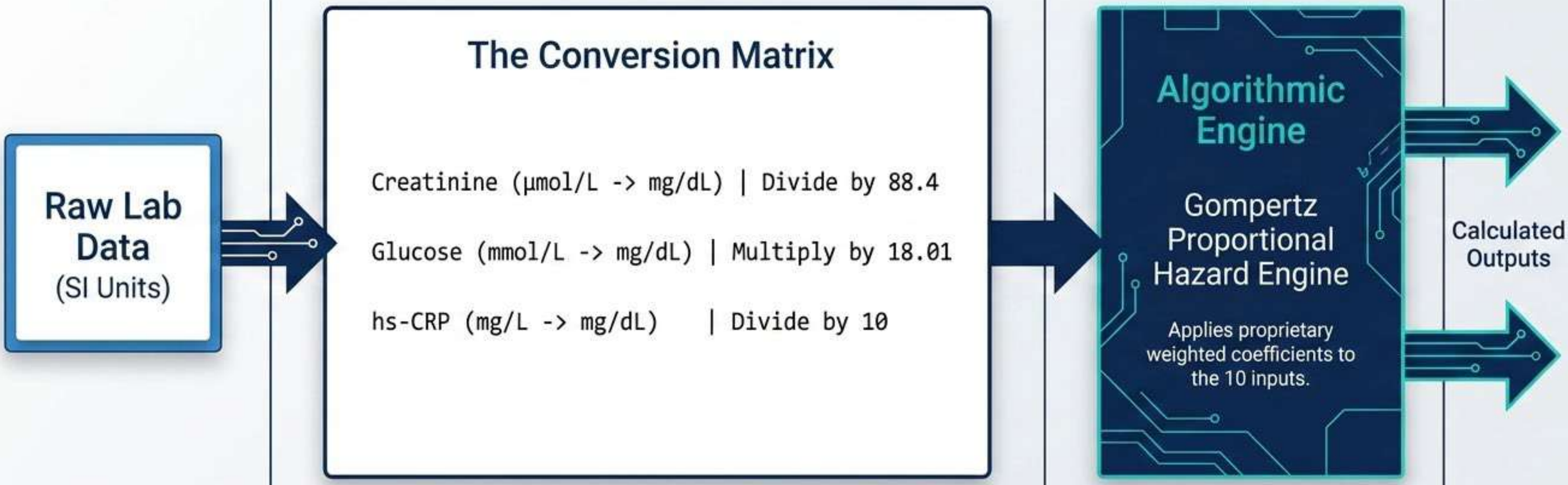
Immune Baseline

Zero active infections or high-stress/inflammatory states. Transient immune activation severely skews WBC and hs-CRP parameters.

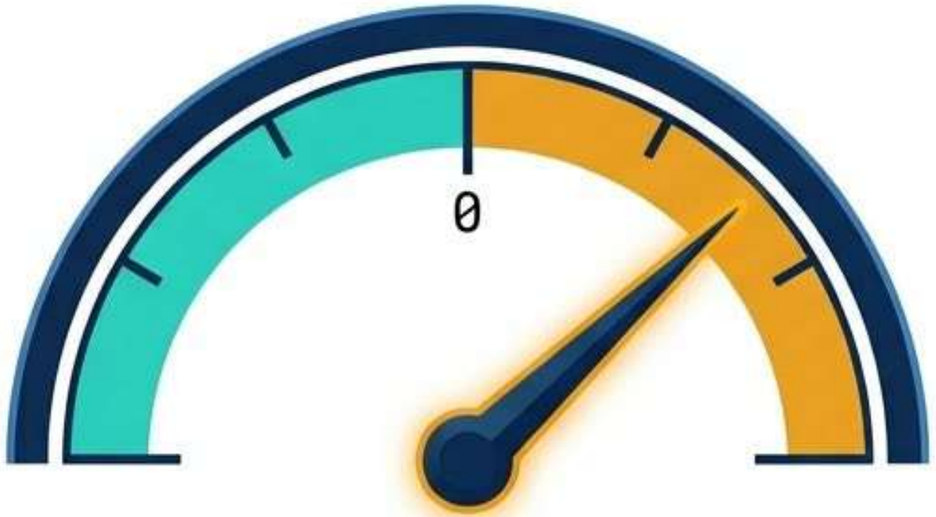
Physical Recovery

Absolute prohibition of heavy or vigorous exercise within 24 hours prior to the draw.

Failure to enforce these prerequisites invalidates algorithmic outputs.


Raw Lab Data
(SI Units)
The Conversion Matrix
Creatinine (µmol/L -> mg/dL) | Divide by 88.4
Glucose (mmol/L -> mg/dL) | Multiply by 18.01
hs-CRP (mg/L -> mg/dL) | Divide by 10
Algorithmic Engine
Gompertz Proportional Hazard Engine
Applies proprietary weighted coefficients to the 10 inputs.
Calculated Outputs

Metric 1: Age Acceleration

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Formula: Phenotypic Age - Chronological Age
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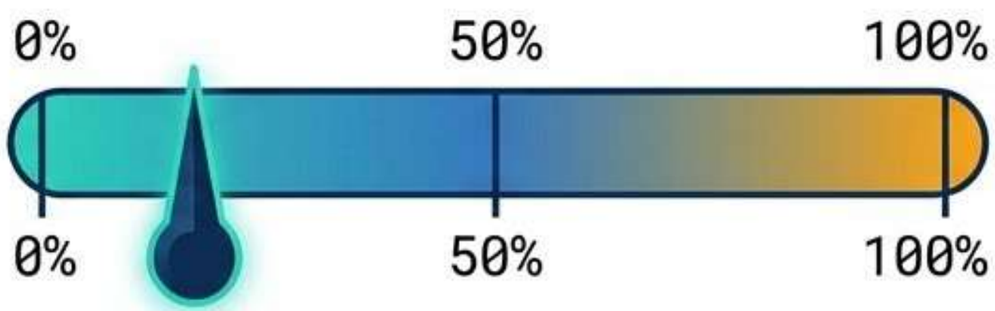
Positive values indicate accelerated biological aging. Negative values indicate biological youth and physiological optimization.

Metric 2: 10-Year Mortality Score



A direct **probability projection** based on biomarker **weightings**. Represents the statistical likelihood of mortality within the next decade based on the Gompertz baseline.

Patient Profile A

Biomarker Status: Out-of-range, elevated parameters.

Chronological Age:	70 Years Old
Calculated Phenotypic Age:	84.0 (+14 years accelerated)
10-Year Mortality Score:	63.8%

Patient Profile B

Biomarker Status: Optimized, clinically low-normal ranges.

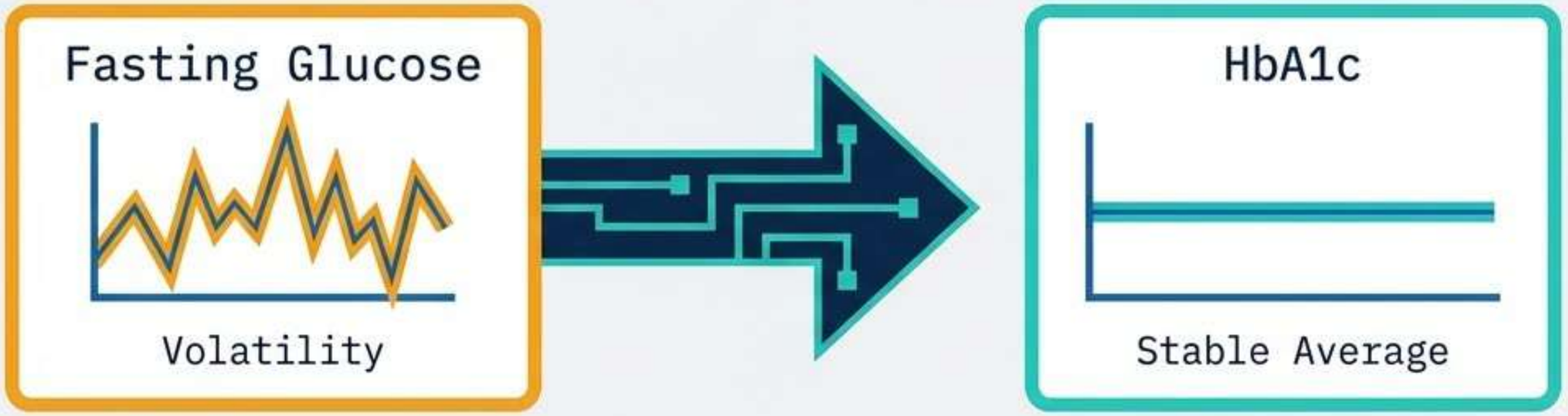
Chronological Age:	53 Years Old
Calculated Phenotypic Age:	43.8 (-9.2 years younger)
10-Year Mortality Score:	2.7%

Comparison Matrix

	Blood Phenotypic Age	Epigenetic Clocks
Diagnostic Methodology	Standard blood panels	Digital PCR / Microarray DNA Methylation
Cost Feasibility	High affordability / scale	>100,000 NTD per test minimum
Operational Turnaround	24-hour turnaround	Weeks / Months
Integration Timeline	Immediate	Requires 6-12 months of R&D integration

Epigenetic profiling remains an R&D luxury; Blood-based Phenotypic Age is a highly scalable, immediate clinical reality.

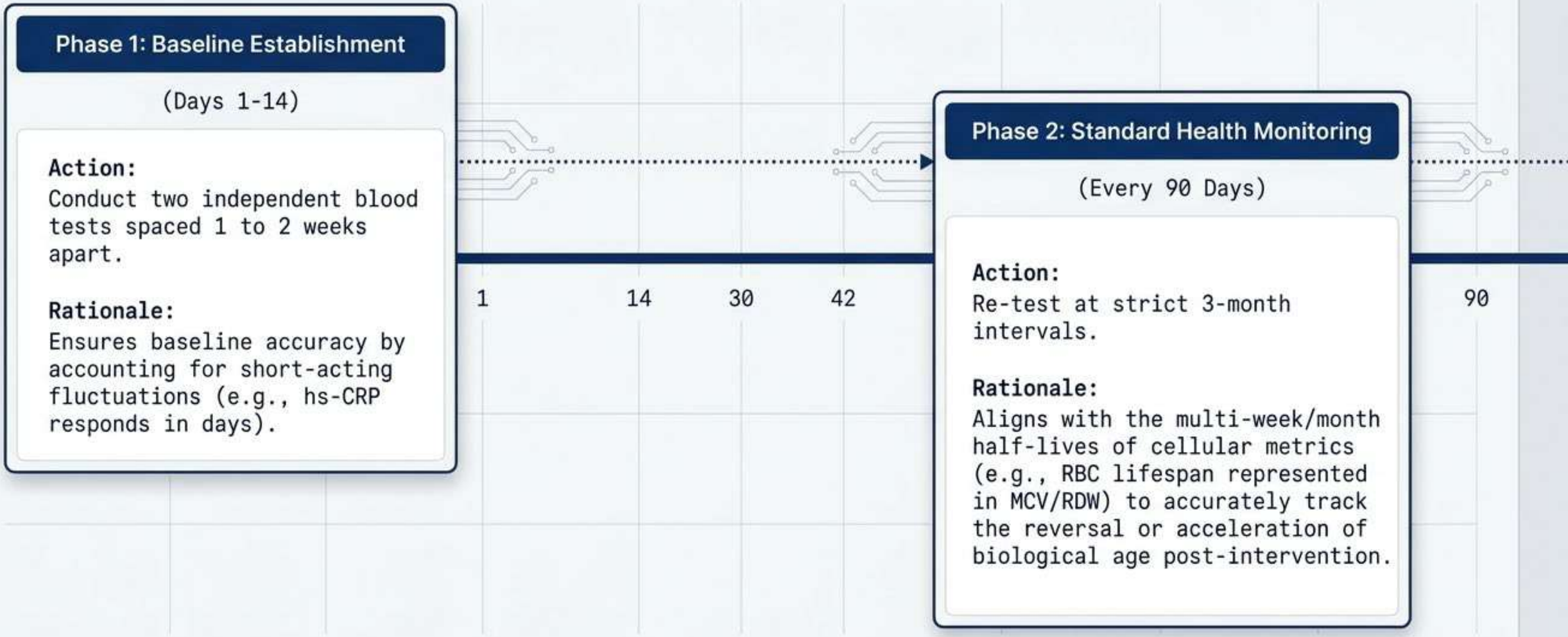
The Dilemma: “Fasting Glucose” relies on subjective patient reporting (varying interpretations of fasting windows or sleep deprivation), introducing severe algorithmic input variance.



The Operational Swap: Replace standard Fasting Glucose with HbA1c.

Rationale: HbA1c operates as a proxy that captures a stable, 120-day glycemic average, entirely eliminating short-term patient variability and compliance errors.

Clinical Monitoring Cadence & Timeline



Operational Mandates & Compliance **Checklists**

Mandate 1: 24-Hour Turnaround Time

No exceptions. Data in, results out within exactly **one day**. Operations must be streamlined to meet this SLA without excuse.

Mandate 2: Minimum Stock Assurance

Strict inventory management for reagents, BCA, and test kits. Historical **'out-of-stock'** failures are absolutely unacceptable.

Mandate 3: Verified Audits

Regular, mandatory inventory audits must be maintained and formally signed off by both procurement and legal departments.

Dual-Track Roadmap: Operations & R&D