

The Future of Laboratory Medicine: Global Trends and Transformations



THE VIII NATIONAL FORUM OF LABORATORY MEDICINE

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I have no conflict of
interest for this
presentation



Cliniques Universitaires

Saint-Luc



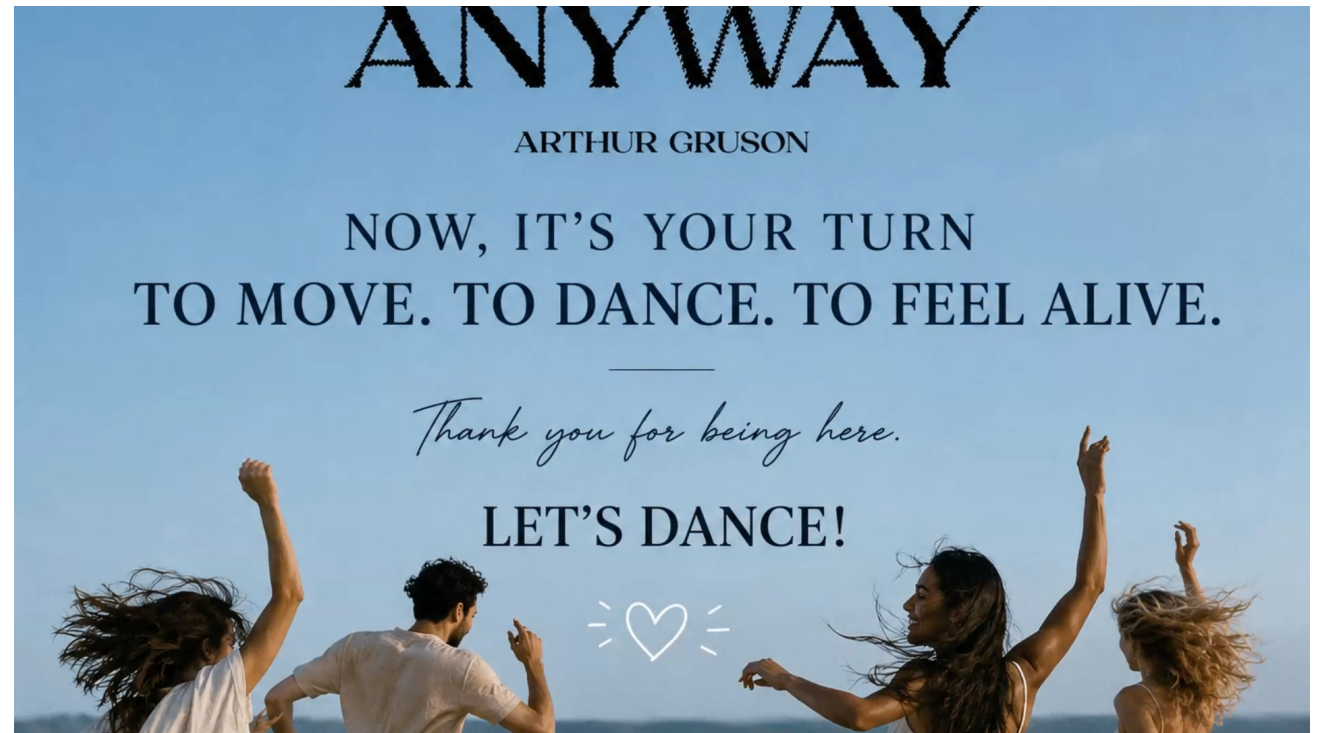
Huni

Brussels, Belgium



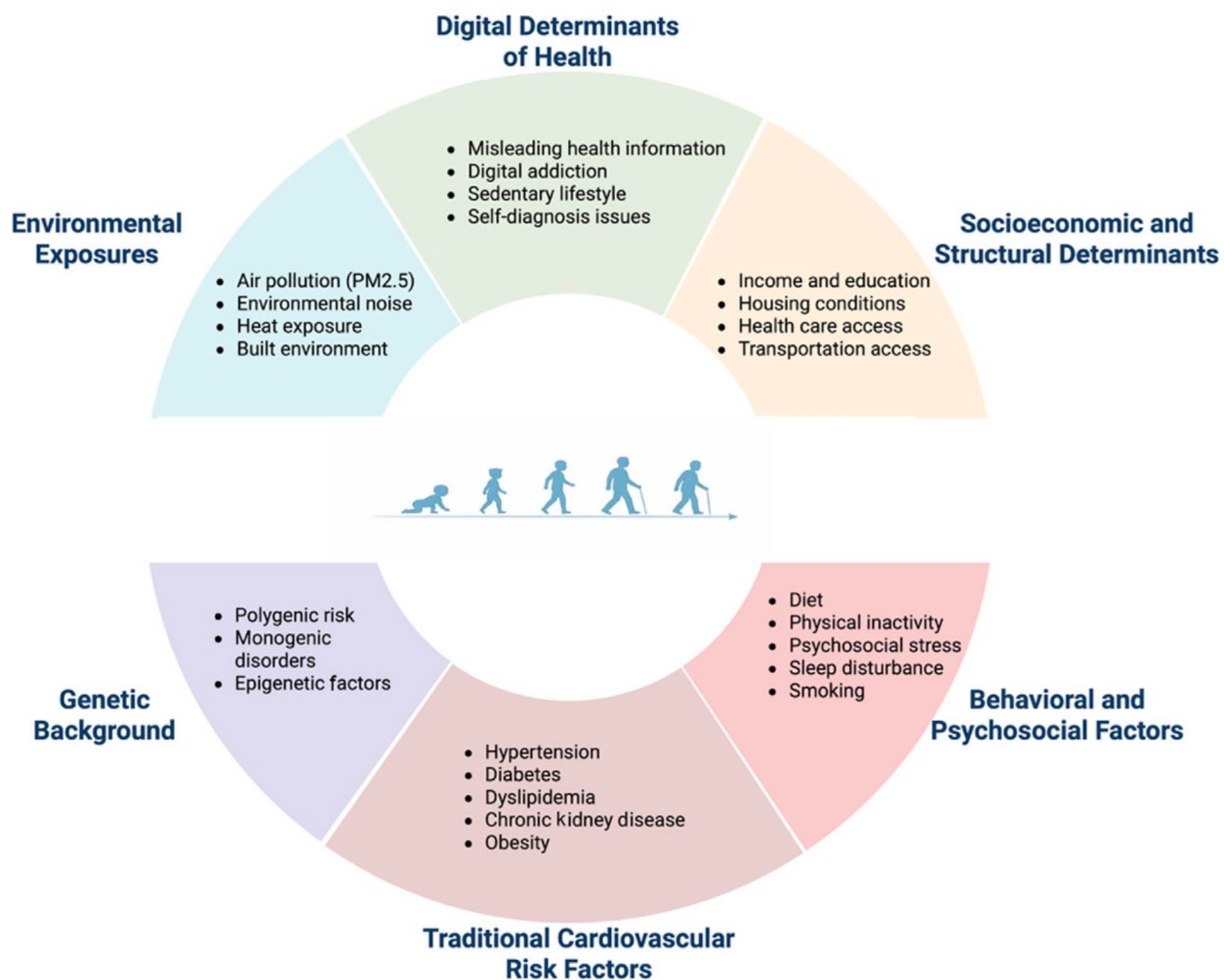


*Emerging technologies require
laboratory medicine specialists and IVD
teams who are well-prepared and in top
form 😊*



A high-resolution image of Earth from space, showing the curvature of the planet and the intricate patterns of clouds and landmasses. The entire image is tinted with a deep blue color. The text 'OUR PLANET EARTH' is superimposed in a clean, white, sans-serif font, centered horizontally and split into two lines. The background is a dark, star-filled space with a bright light source on the right creating a lens flare effect.

OUR PLANET
EARTH



The laboratory is becoming a health-system operating system

It connects signals, decisions, pathways and outcomes.

SIGNALS → **INSIGHT** → **ACTION** → **VALUE**

The transformation is not about producing more data. It is about making better decisions—earlier, everywhere.

Five technologies are converging into one new operating model

Each is powerful alone. Together, they redesign the laboratory.

01

Automation

Scale + reliability

02

Multi-omics

Biological depth

03

**Decentralized
testing**

Reach + speed

04

**Digital
biomarkers**

Continuous context

05

Agentic AI

Orchestration + action

Automation is no longer the destination

It is the foundation for precision, capacity and clinical impact.

PRECISION

Fewer errors
More reproducibility

CAPACITY

24/7 throughput
Predictable TAT

PEOPLE

Safer work
Higher-value roles

IMPACT

Faster decisions
Better pathways

AUTOMATION → HYPERAUTOMATION → INTELLIGENT ORCHESTRATION

Value must be measured across the total testing process

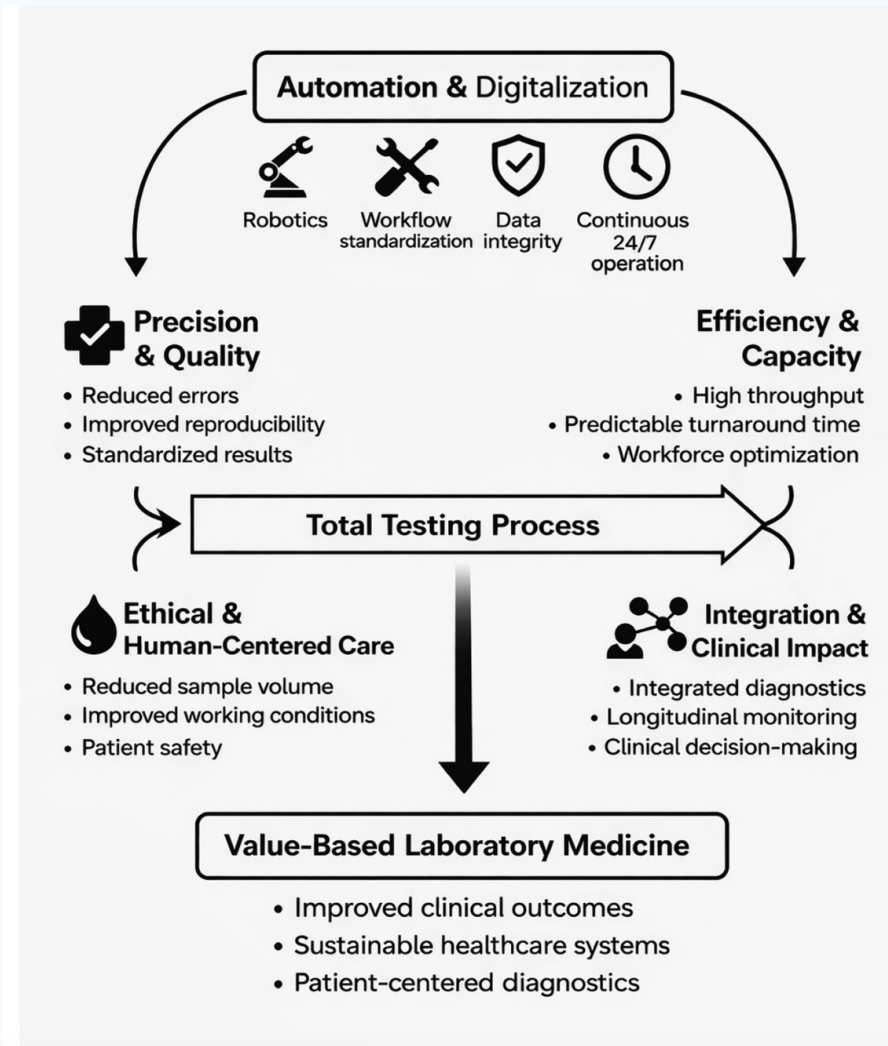
Operational performance matters—but clinical outcomes define success.

Precision & quality

Efficiency & capacity

Human-centred care

Integration & impact



Create value across the testing process

Potential applications — each needs evidence in its intended setting.

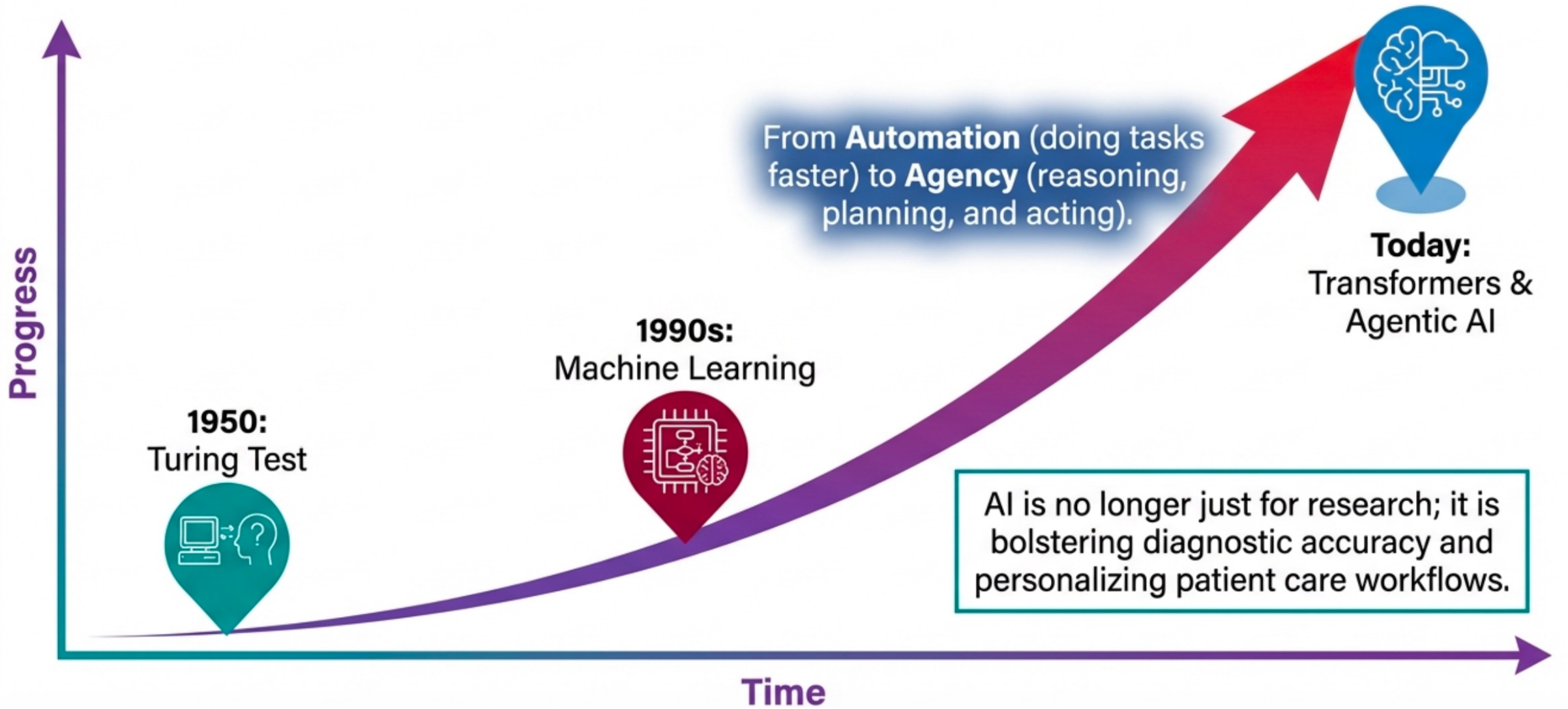
BEFORE THE SAMPLE	Preparation • test selection • duplicate requests	Access + appropriate testing
BEFORE ANALYSIS	Transport • specimen quality • workload routing	Integrity + fewer recollections
DURING ANALYSIS	QC surveillance • anomalies • maintenance	Quality + operational resilience
AFTER THE RESULT	Context • interpretation • risk • communication	Better-informed clinical decisions

ACT I

The machine becomes a system

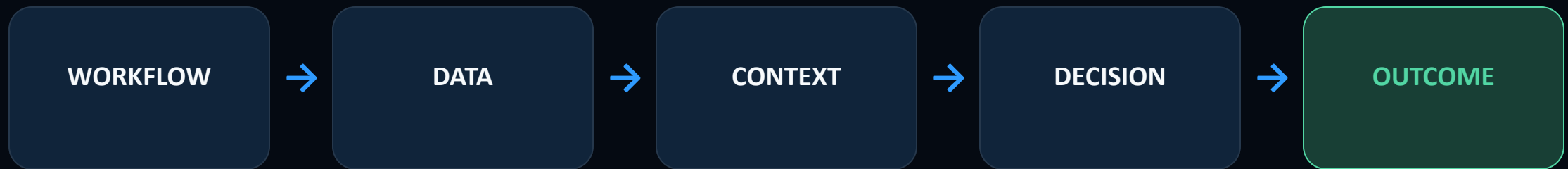
If every instrument is connected, what becomes possible?





Hyperautomation turns isolated workflows into a diagnostic hub

The hub combines operational data, laboratory results, clinical context and outcomes.



The laboratory evolves from a production line into a learning system.

Agentic AI changes the verb

Traditional automation executes. Conventional AI predicts. Agentic AI can reason, plan and act within guardrails.

EXECUTE

Rigid workflow

PREDICT

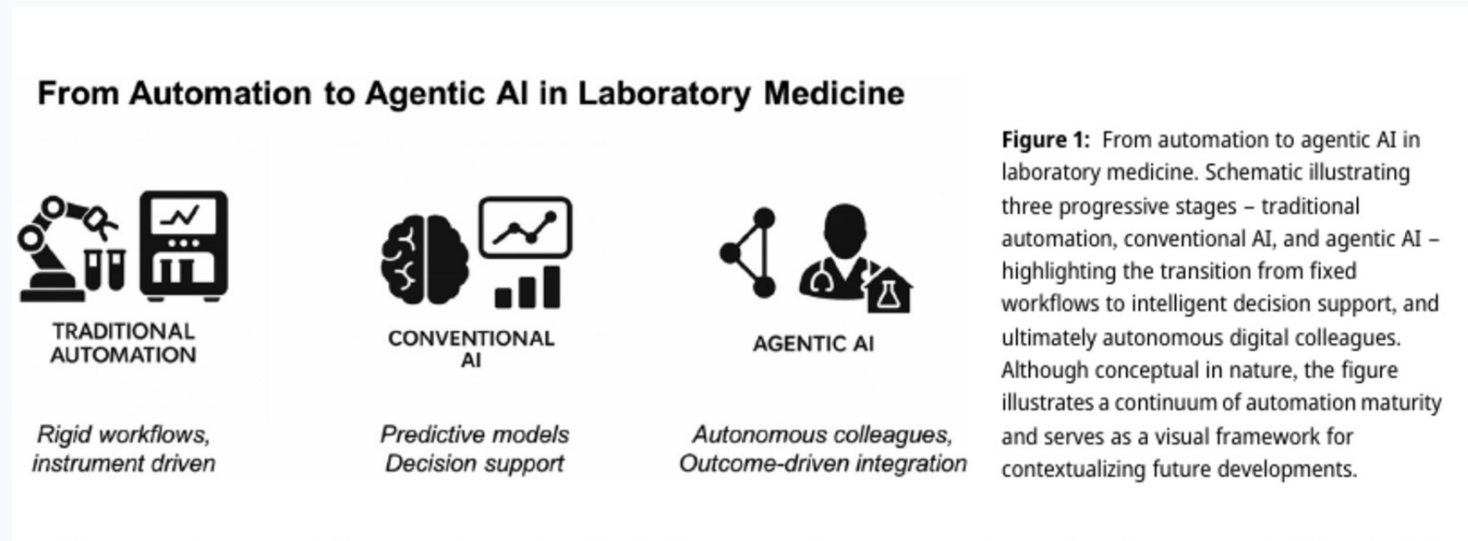
Decision support

ORCHESTRATE

Autonomous colleague

The shift is from instrument-driven to outcome-driven automation

Autonomy grows—but so must validation, traceability and human oversight.



Rigid workflows

Predictive models

Autonomous colleagues

AI changes what we can delegate

The difference is what the system is allowed to do.

AUTOMATION

Execute

Follow a fixed rule

Apply a predefined
reflex rule

PREDICTIVE AI

Estimate

Recognise a pattern

Flag a likely
sample problem

GENERATIVE AI

Draft

Produce new content

Draft an
interpretive comment

AGENTIC AI

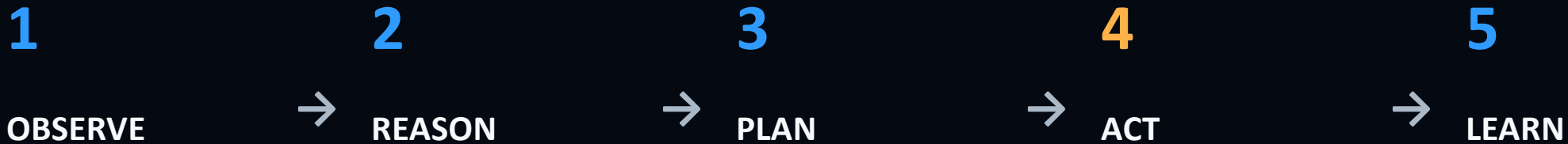
Coordinate

Plan and use tools

Check context, propose
action, record the steps

An agentic laboratory follows a five-step loop

Observe → reason → plan → act → learn.

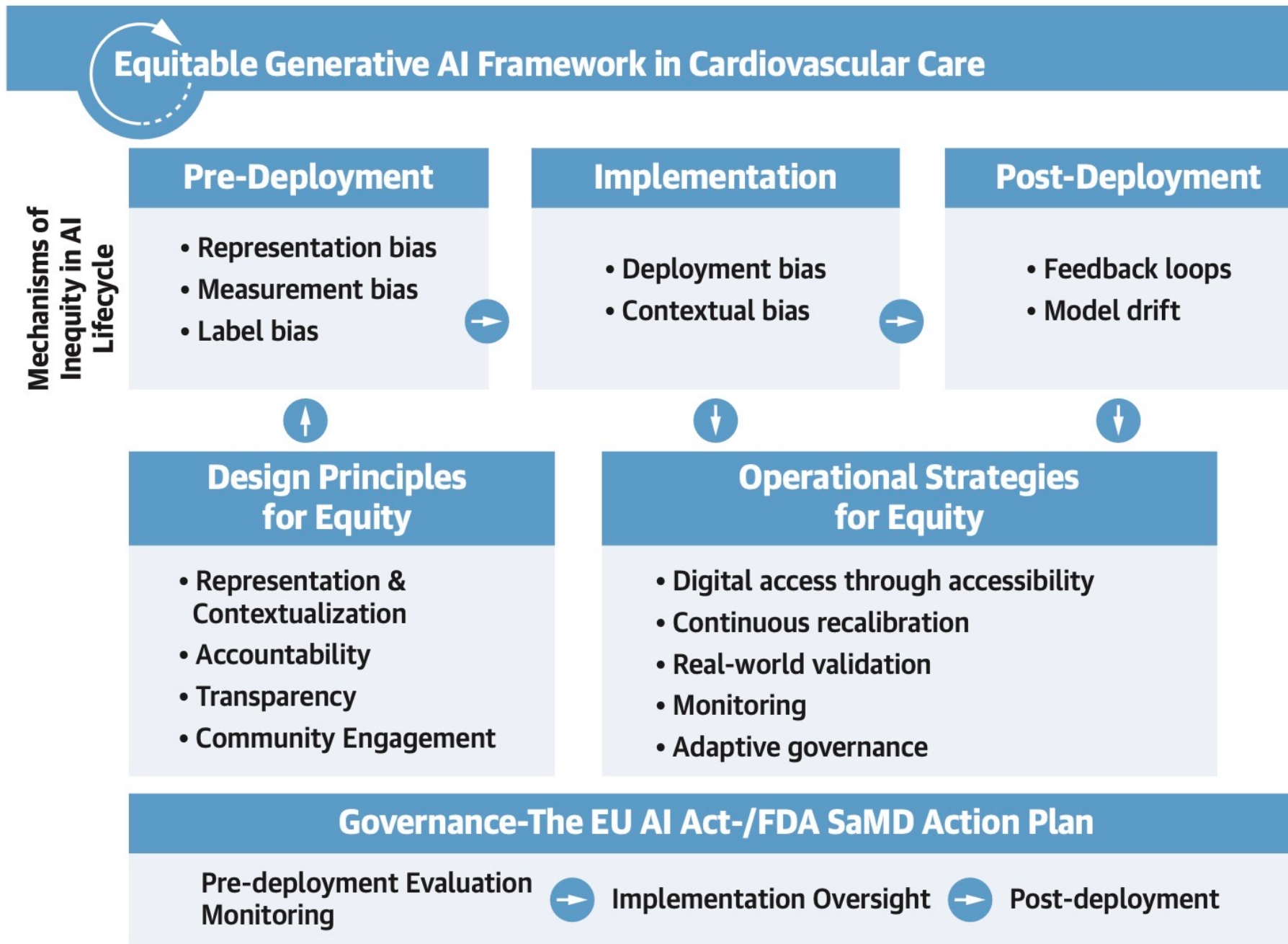


Human-defined goals • validated tools • auditable actions • escalation by design

Governance is part of the architecture—not an afterthought

Trust is engineered through evidence, transparency and human accountability.

- | | | |
|----|---------------------|-----------------------------|
| 01 | VALIDATION | Performance across settings |
| 02 | TRACEABILITY | Every action auditable |
| 03 | FAIRNESS | Bias actively monitored |
| 04 | OVERSIGHT | Humans retain authority |





HUMAN EXPERIENCE BREAK

Less processing. More tasting.

Look. Smell. Let it melt.

One square. One word.
What did you notice?

Participation is optional.

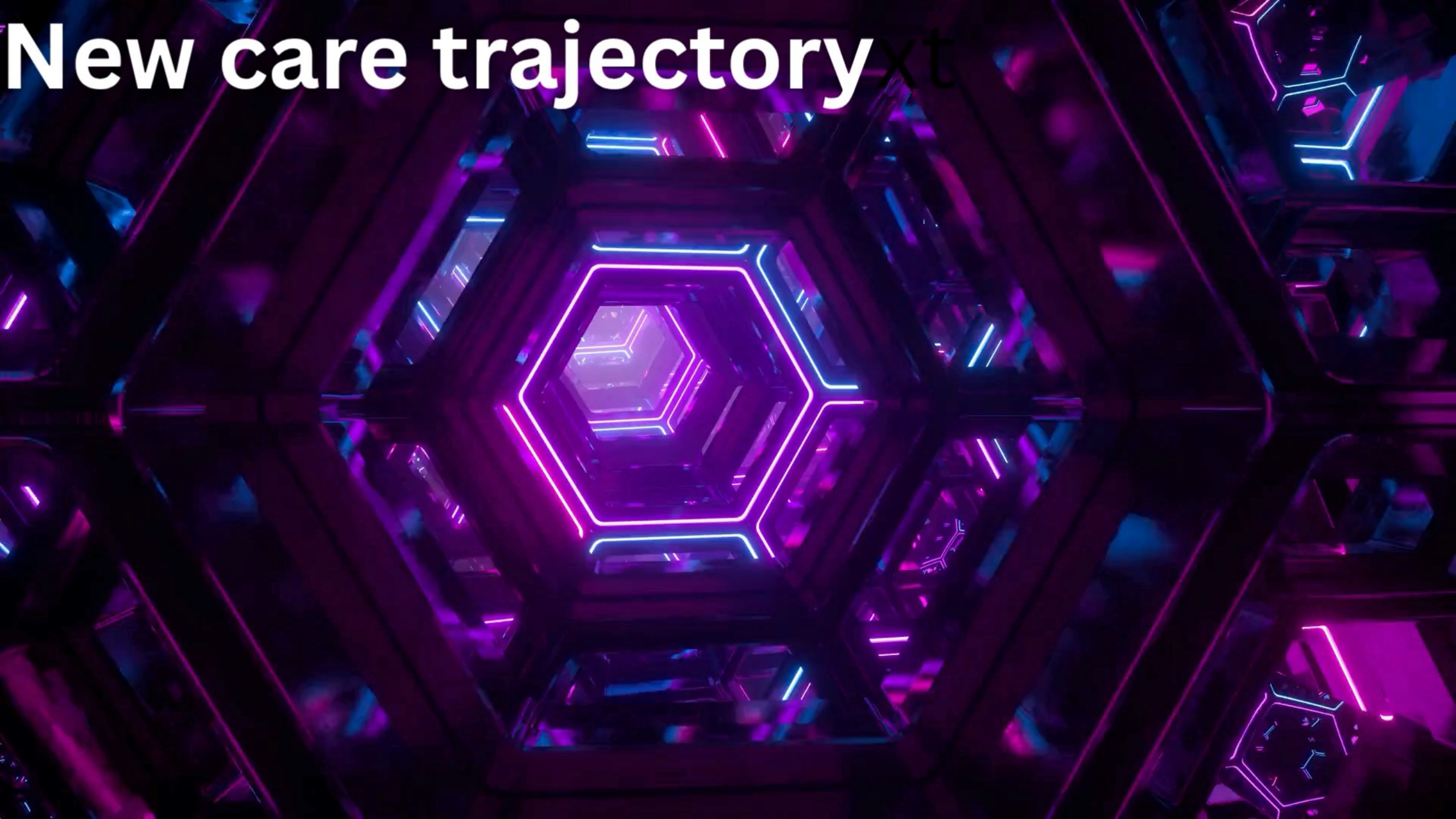


ACT II

The laboratory moves beyond its walls

When testing moves, does responsibility move with it?





New care trajectoryxt

Decentralization amplifies responsibility

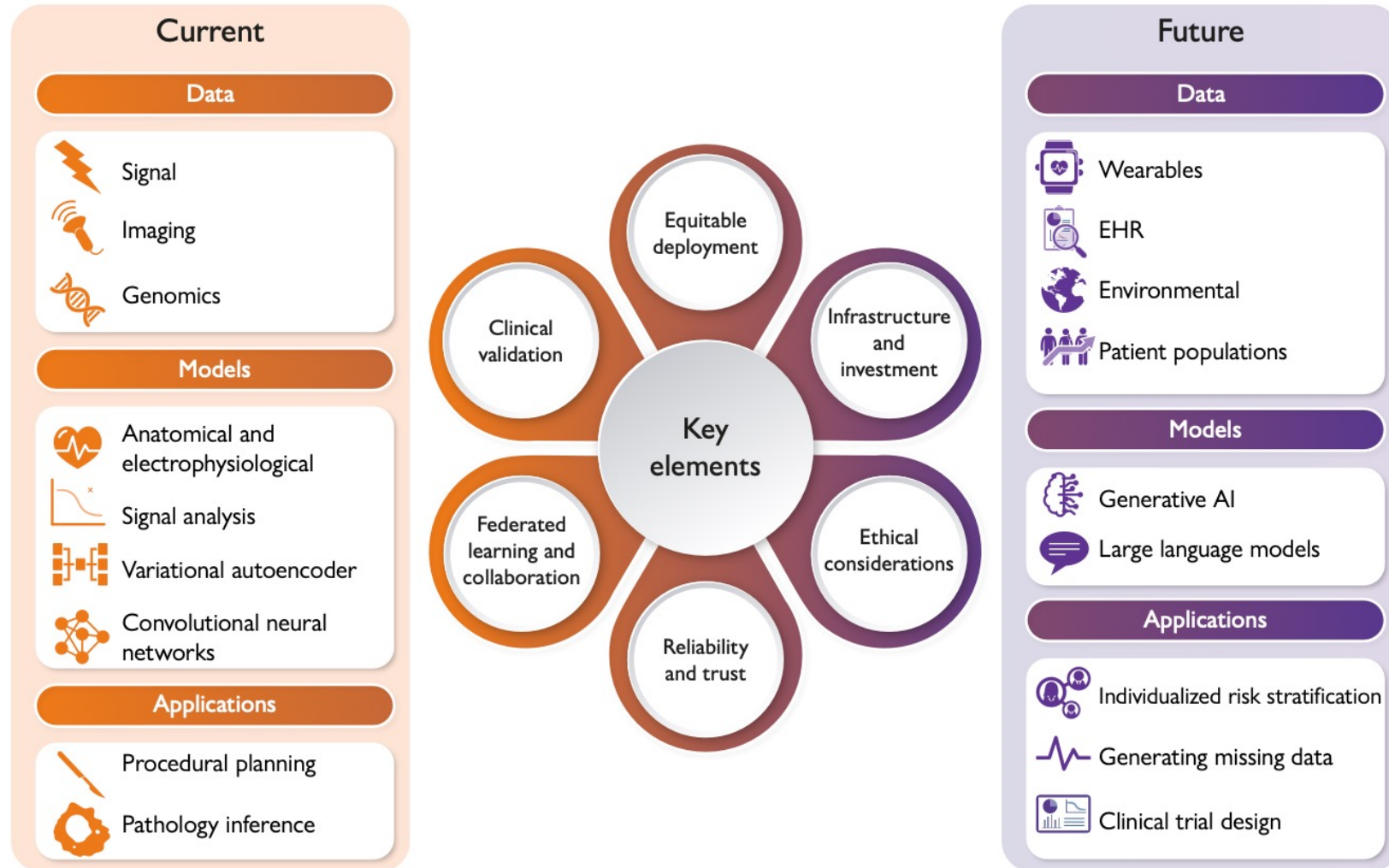
Testing may move closer to patients. Quality, interpretation and connectivity must travel with it.

HOSPITAL → **COMMUNITY** → **HOME** → **EVERYWHERE**

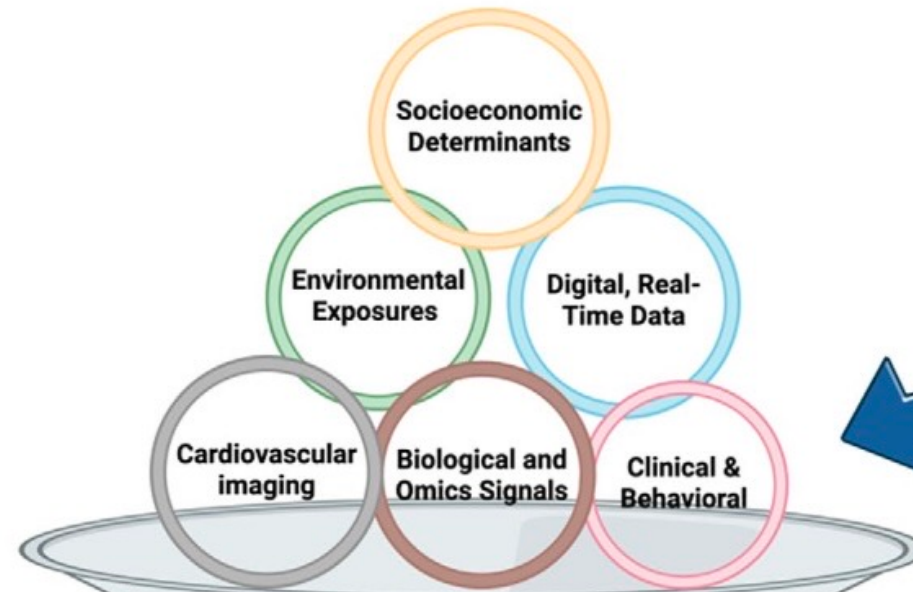
The farther testing moves from centralized oversight, the stronger the stewardship model must become.

The Multi-Modal Approach to Cardiovascular Risk Assessment Using Wearable Devices and Machine Learning

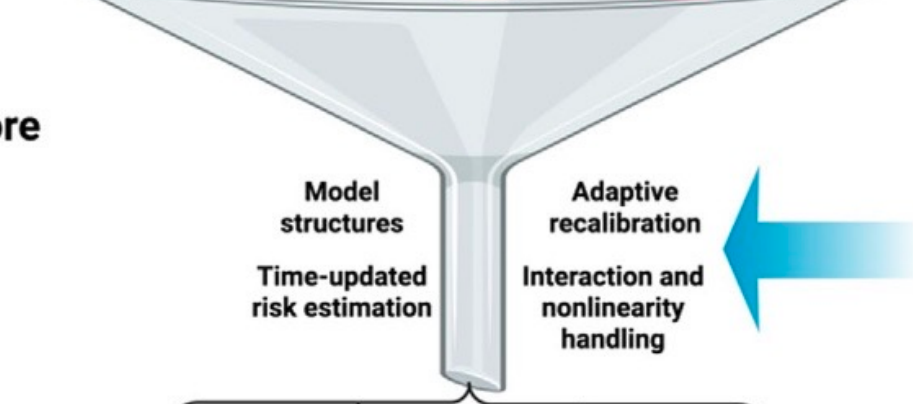
Cardiovascular care with digital twin technology



Data Ecosystem
("What We Measure")

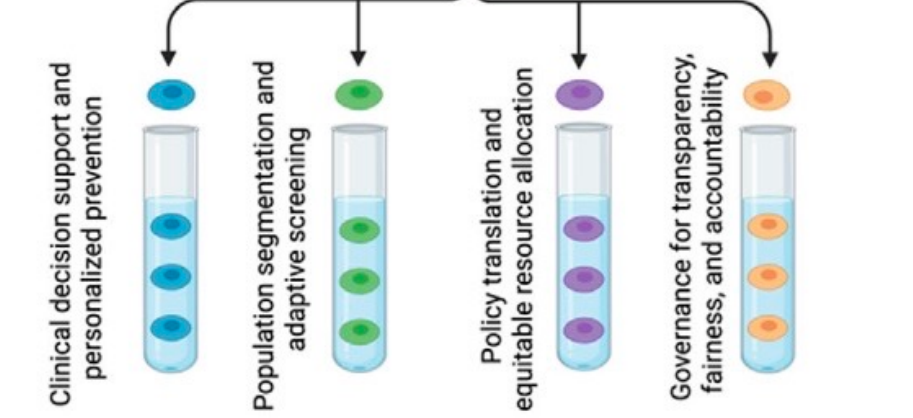


Dynamic Modeling Core
("How We Model It")



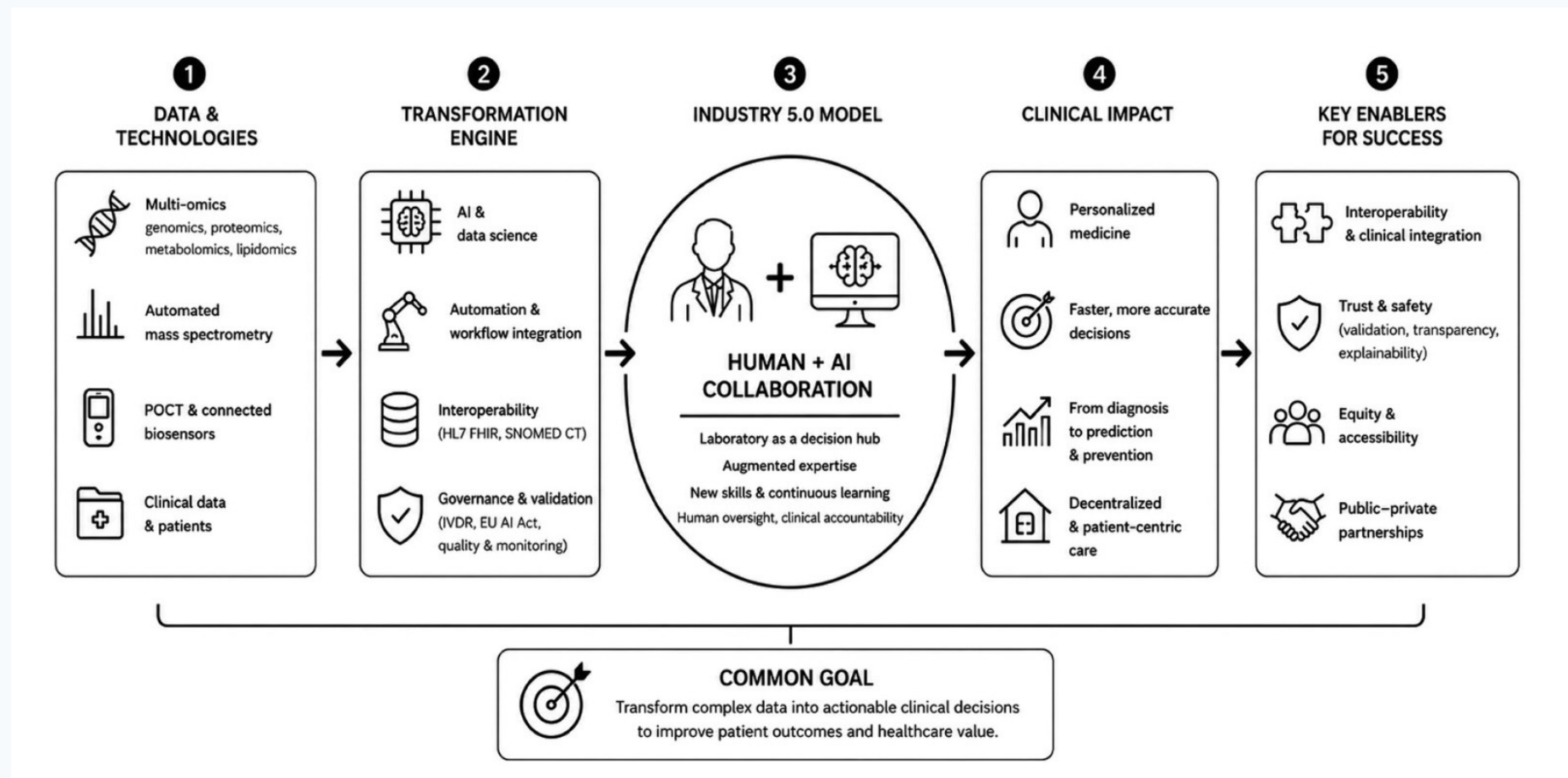
Continuous Learning Health System
(Ongoing recalibration between data, models, and policy implementation)

Implementation & Policy Loop
("How It Translates")



The emerging ecosystem puts human–AI collaboration at its centre

Technology, transformation, business models and clinical impact share one common goal.



Innovation is accelerating. Implementation is not.

A global survey of 51 laboratory leaders exposes the adoption gap.

76.5%

lack of funding

74.5%

infrastructure limits

51.0%

insufficient training

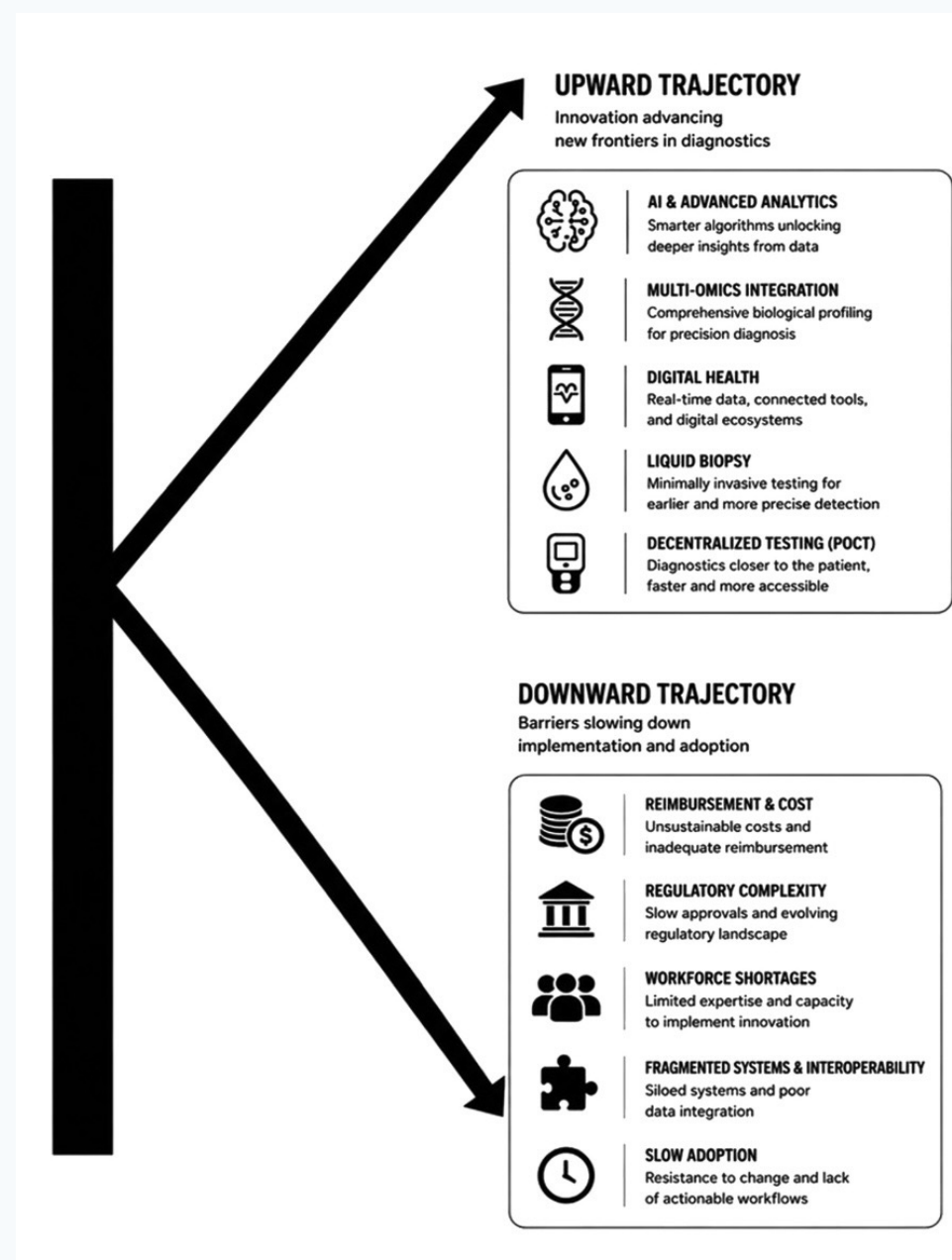
45.1%

limited or no access

Technology is global. Adoption remains deeply local.

The K-curve makes the paradox visible

Some systems accelerate with innovation; others fall behind because adoption capacity cannot keep pace.



Five conditions determine whether innovation reaches patients

The Five A's of Diagnostic Adoption turn the K-curve into an action framework.

- | | | |
|---|----------------------|-------------------------------------|
| 1 | ACCESSIBILITY | Available physically + digitally |
| 2 | AFFORDABILITY | Sustainable payment + reimbursement |
| 3 | ACCEPTABILITY | Trust, literacy + confidence |
| 4 | ALIGNMENT | Pathways, regulation + quality |
| 5 | ACTIONABILITY | Insight linked to the next step |

AI value is created beyond the technology

For every \$1 invested in agentic technology...

1

TECHNOLOGY

Agents · models ·
data
secure
infrastructure

3

PROCESS REDESIGN

Rebuild test pathways,
roles and decision points

5

CAPABILITY + ADOPTION

Skills, trust, governance
and new daily behaviours

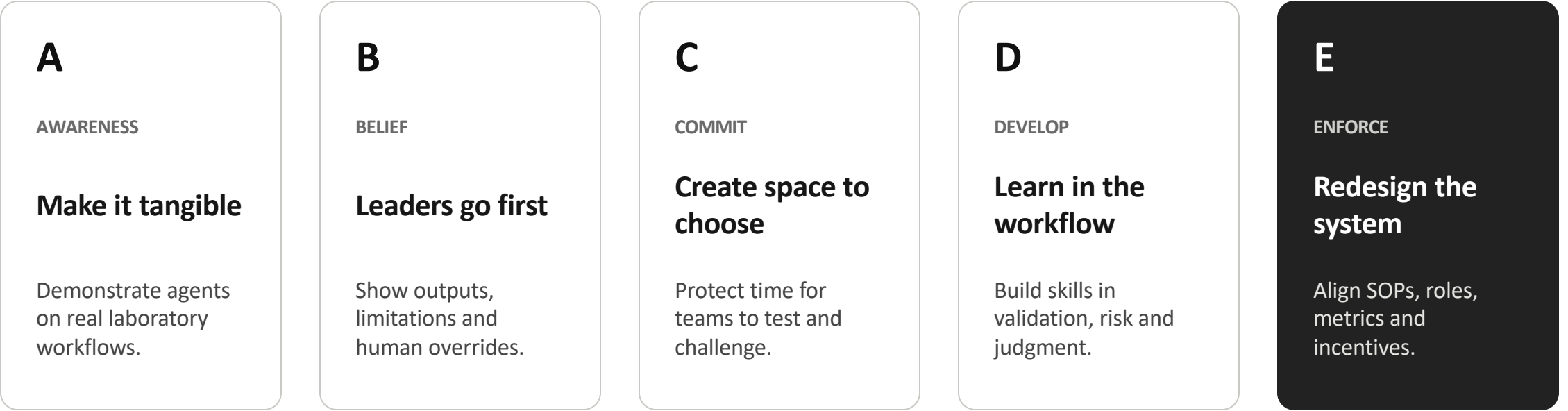
1 : 3 : 5

Laboratories should invest less narrowly in the AI tool—and more deliberately in redesigning the end-to-end clinical pathway and enabling people to use it safely.

LABORATORY EXAMPLE

An AI-supported test-selection agent needs EHR/LIS integration, redesigned ordering and escalation rules, and continuous training for laboratorians and clinicians.

Move teams from exposure to safer, better workflows

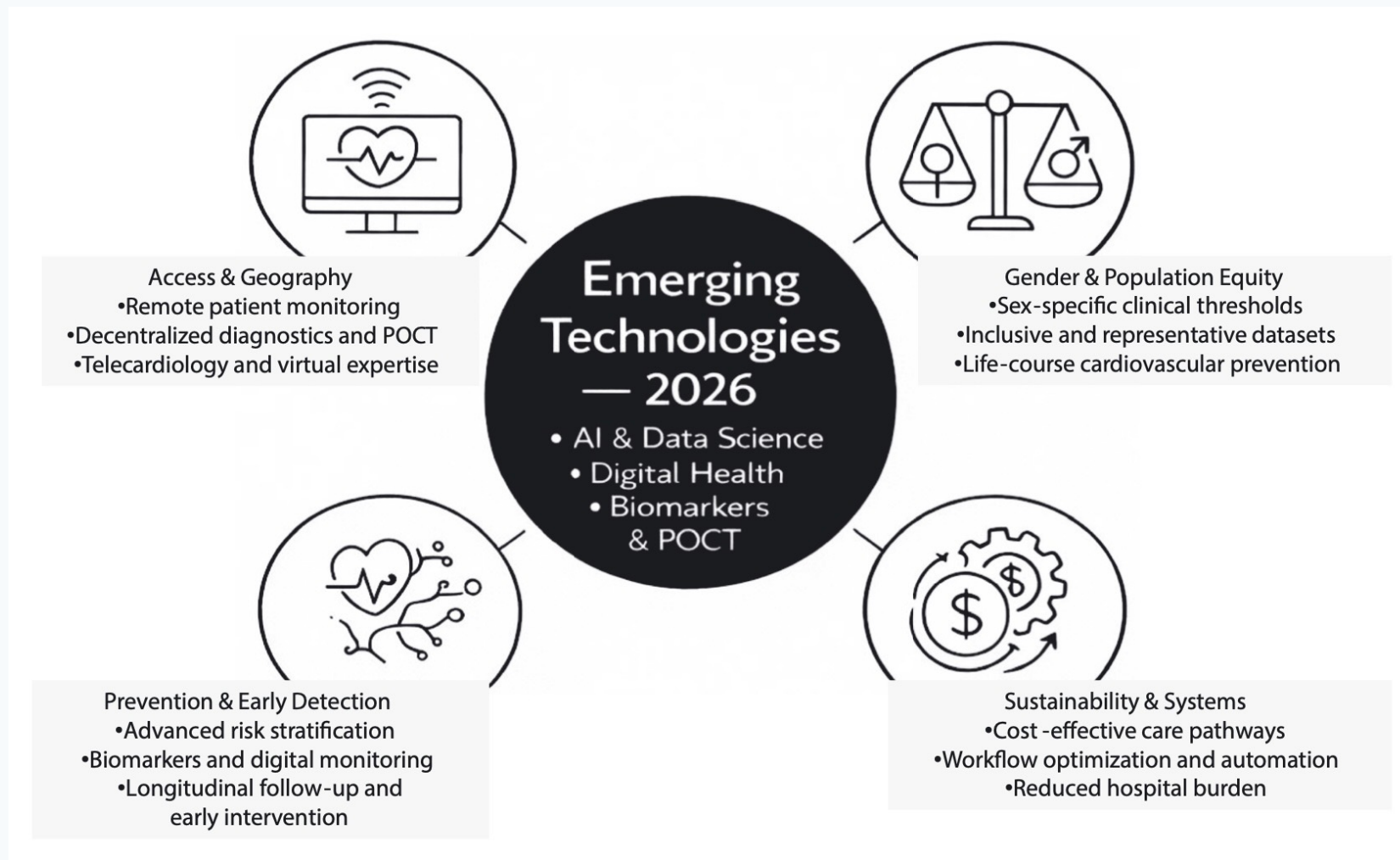


Do not measure adoption by log-ins or prompts alone.

Track whether laboratory work becomes better, faster and safer.



From innovation to equity: the role of emerging technologies in cardiovascular medicine.



Adoption is a workflow redesign

A licence and a training session do not create a new working habit.

AWARENESS

Show one real task — including failure.

BELIEF

Let leaders and trusted peers use it openly.

COMMIT

Protect time to experiment and challenge.

DEVELOP

Coach people in the flow of their work.

REINFORCE

Align procedures, decision rights and outcomes.

Fund the whole lifecycle

The laboratory may pay while value appears elsewhere in the care pathway.

PATIENT

**Optional convenience
or education**

Protect equitable access

HOSPITAL / NETWORK

**Local HTA and
a pathway business case**

Enterprise or AI-middleware licence

PUBLIC PAYER

**Transferable clinical
and economic value**

Reimbursement or pathway funding

Licence + integration + verification + monitoring + revalidation + exit

Evaluate the pathway, not just the model

Comparator: current practice. Count benefits, harms and the work transferred to humans.

CLINICAL	Time to actionable information	Decisions, patient outcomes and harms
OPERATIONAL	Errors, recollections and turnaround	Review burden, capacity and downtime
ECONOMIC	Total cost of ownership	Budget impact and downstream use
HUMAN + EQUITY	Staff and patient experience	Subgroup performance and access

The intelligent laboratory of 2030 is defined by five capabilities

Connected. Decentralized. Multimodal. AI-augmented. Outcome-driven.

1

CONNECTED

2

DECENTRALIZED

3

MULTIMODAL

4

AI-AUGMENTED

5

OUTCOME-DRIVEN

Its competitive advantage will not be the number of technologies it owns—but the value it can reliably deliver.

The laboratory was once a place.

PLACE

...

It is becoming
a connected intelligence.

INTELLIGENCE

...

Soon, it will be everywhere
healthcare happens.

EVERYWHERE

...

Y.M.C.AI.

Your Medicine, Connected by Artificial Intelligence



AI will transform laboratory medicine — if we lead the dance.

Thank you for your attention

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