CMH Scientific: R&D Laboratory and Scientific AI Instrument Suite

Measurement, memory, intervention, falsification, and clinical assistance

M. Antony Ewing, PhD
Conquer Medical Health – CMH Scientific
ORCID: 0009-0005-1550-1718

Technical Report v1.1 – 10 September 2026

Abstract

CMH Scientific is the research and development laboratory of Conquer Medical Health. It develops and validates the scientific methods, computational engines, experimental systems, and public demonstrators underlying the company's work in biomedical measurement, drug discovery and development, clinical trials, patient-specific intervention design, procedural medicine, and longitudinal sensing. The CMH Scientific software suite is the laboratory's computational-instrument layer, not a single monolithic model. It includes AIO for literature reconstruction and hypothesis adjudication, NPIS for information sufficiency, OptiCeil for tested-representation recoverability, TotemicAI for fitted structural memory, Acquire for inverse measurement design, TopolAI for supervisory control, ABP for individual-first biological/intervention interrogation, CTF for trial falsification, Deferra for trajectory-conditioned clinical assistance, and CMH Guard for governance boundaries. This revision separates the organizational laboratory from the software interface, adds Deferra and CTF to the public instrument map, and distinguishes TotemicAI-Specified from TotemicAI-Learned.

Organizational definition. CMH Scientific is the R&D laboratory. The CMH Scientific software suite is one of the lab's outputs. The public interactive demos are demonstrations of individual instruments developed within that laboratory; they are not the laboratory itself.

1 Why CMH Scientific exists

Biomedical AI increasingly spans more than model selection. A translational program may need to determine whether a dataset supports a claim, whether an instrument has already reached its recoverable frontier, which observations preserve structural history, what should be measured next, which intervention directions are supported for an individual system, whether a clinical AI should intervene during a changing procedure, and whether an apparent trial subgroup survives falsification.

CMH Scientific develops these as separate computational instruments so that each evidentiary job remains explicit and independently testable.

2 From company to laboratory to product

Conquer Medical Health is the biomedical engineering and scientific/clinical AI company. CMH Scientific is its R&D laboratory. The laboratory produces methods, validation studies, software engines, technical reports, experimental systems, and interactive demonstrations. Commercial and translational product programs can draw on one or more of those instruments without implying that every product is the same architecture.

The company's current work therefore spans five application domains:

- clinical instruments and procedural/physiologic AI;
- drug discovery and therapeutic development;
- clinical trials and evidence falsification;
- research instrumentation and biomedical engineering;

- longitudinal sensing and wearable/device concepts.

3 Instrument landscape

Instrument	Computational role	Primary question
AIO	Literature reconstruction / claim adjudication	What does a field's published evidence reproduce on common empirical ground, and which competing explanations can the data distinguish?
NPIS	Information-sufficiency diagnostic	Does the observed substrate contain the distinction required by the declared task?
OptiCeil	Recoverability / acquisition diagnostic	How much appears recoverable from the declared representation, and is the bottleneck measurement or observer?
TotemicAI	Fitted structural-memory model	Which observations preserve response direction, relation, topology, boundaries, and challenge state?
Acquire	Adaptive measurement decision engine	What should be measured next, in whom, and when does further measurement stop earning its cost?
TopolAI	Supervisory scientific controller	What should the scientific system do next given the component evidence state?
ABP	Individual-first biological/intervention model	Which intervention directions and levels does a deeply observed focal biological system itself support?
CTF	Clinical-trial falsification engine	Does a discovered responder subgroup survive the identical procedure when applied to placebo?
Deferra	Trajectory-conditioned clinical assistance controller	Is the current observation adequate, has the course or response relation changed, and should AI assist, withhold, reacquire, or remain silent?
CMH Guard	Governance / route controller	Is a proposed data, code, model, compute, or export path permitted?

Table 1: CMH Scientific develops distinct instruments for distinct evidentiary and control problems.

4 TotemicAI: specified and learned policy modes

TotemicAI is a fitted structural-memory model. In **TotemicAI-Specified**, the structural landmark policy is fixed by design and the observed response field determines which observations become the fitted memory. This is the currently validated AML embodiment.

In **TotemicAI-Learned**, the landmark policy itself may contain fitted coefficients or another learned decision rule. Those parameters must be estimated using training data only and frozen before held-out patient evaluation. Learned mode is an architectural extension; the existing AML results should not be relabeled as learned-policy validation.

This distinction is useful beyond terminology. Specified mode provides a strong anti-overfitting control because the selection policy cannot tune itself to the benchmark. Learned mode tests whether additional adaptability in the policy adds reproducible held-out value.

5 Clinical systems: ABP and Deferra

ABP and Deferra answer different questions. ABP is used before or between interventions to interrogate a deeply observed biological system in reverse: specify a desired state and identify intervention directions represented and supported in that focal system's own history. Deferra operates during a changing physical or physiologic process and decides whether AI assistance is currently justified.

A clinical program can therefore use ABP to define a candidate intervention or trajectory and Deferra to govern selective assistance during execution. The relationship is complementary rather than mandatory.

Deferra also makes observation quality actionable. A poor operative view or inadequate physiologic measurement can route to withhold/reacquire rather than to confident downstream interpretation. A supported trajectory departure or changed

intervention-response relation can route to active assistance. This separates "the AI cannot see well enough" from "the clinical course changed."

6 Drug discovery, development, and trials

CMH Scientific's therapeutic-development work is not limited to conventional prediction. ABP supports individual-first or focal-system intervention interrogation within observed perturbational spaces. Acquire can rank additional assays, perturbations, windows, or measurement families. NPIS can test whether the available substrate distinguishes the mechanistic or response claim. AIO can reconstruct a field's evidence on common ground. CTF can test whether an apparent treatment-responder subgroup is reproduced by the same discovery pipeline under placebo.

These functions can be composed in drug discovery and development without implying de novo molecule generation, causal efficacy, or validated clinical dosing where those claims have not been established.

7 Interactive demonstrations as laboratory outputs

The CMH Scientific demo suite is a public product-demonstration surface. Each demo exposes the central computational question of an instrument, allows a visitor to alter a declared state, and can produce a session report recording the default state, adjustments, resulting states, and final interpretation. Deferra additionally demonstrates a time-indexed procedural transcript.

The demos are intentionally disclosure-safe. They communicate the product behavior and scientific boundaries without distributing protected production engines, credentials, or proprietary calibration/routing internals.

8 Validation map

Program	Released evidence
NPIS	Direct longitudinal validation across ADNI, PPMI, PRO-ACT, HRS, and Add Health, plus construct-level analyses in ADNI/MIMIC-IV; evidence concerns task-relative nonidentifiability and residual resolution, not causal effects.
OptiCeil	Calcium imaging: 914 recording segments, 312 neurons, 146,962 balanced samples, with representation- and indicator-dependent recoverability. PPG: 82,966 balanced samples from 3,840 recordings/38 subjects; adding accelerometry raised both achieved performance and comparative recoverability on identical records.
TotemicAI-Specified	Primary AML leave-one-patient-out structural memory beat equal-size random retention across all nine primary direction/relation/topology comparisons; dedicated 1% analysis beat 100 random controls in every metric/fold.
Acquire / TopolAI	PRO-ACT more-same versus different-measurement validation; cross-replicate perturbation acquisition; COPD selective acquisition; AML streaming challenge/reacquisition.
ABP	Individual-first validation includes 194,010 five-minute OhioT1DM observations from 12 individuals plus additional tests of individual versus population response geometry, support, candidate triage, state/horizon re-interrogation, and cross-scale computation.
Deferra	Retrospective robotic kinematics, laparoscopic video, MIMIC-IV MAP control, sepsis physiology, and longitudinal glioblastoma embodiments support trajectory/departure and selective-routing mechanisms, not prospective clinical benefit.
AIO / CTF	AIO has a frozen Alzheimer evidence-reconstruction program; CTF is a falsification instrument whose product logic is to repeat responder-discovery under placebo before a trial is built around the subgroup.
CMH Guard	Engineering policy tests verify declared route behavior; this is not external security, regulatory, or legal certification.

Table 2: Different validations test different links in the CMH Scientific program and should not be collapsed into one performance score.

9 Public software organization

The software modules remain separately versioned so that users can understand and license the appropriate instrument. Public repositories expose callable clients/contracts, examples, validation fixtures, tests, documentation, and disclosure-safe

demonstrations. Protected production engines can remain hosted, compiled, licensed, or access-controlled where required by the intellectual-property and data-governance boundary.

Public surface	Role
CMH Scientific website	Company/laboratory identity, research program, product families, and access path.
CMH Scientific demo suite	Interactive demonstrations and visitor-generated session reports.
Module repositories	Public clients, contracts, documentation, tests, and frozen validation evidence.
Protected scientific engines	Licensed/authorized computation; not distributed through the public demo source.

Table 3: The public website, demos, repositories, and protected engines serve different roles.

10 Awareness as an engineering concept

Across the suite, "awareness" means explicit computational state, not consciousness. NPIS exposes awareness of what the data distinguish; OptiCeil of what is recoverable; TotemicAI of structural history and challenge; Acquire of what measurement has value; TopolAI of the appropriate next scientific action; ABP of individual-supported intervention space; Deferra of current procedural/physiologic support and trajectory; AIO/CTF of evidentiary and falsification context; CMH Guard of governance constraints.

Making these states explicit is a design strategy: the system can report "unresolved," "reacquire," or "withhold" instead of silently treating missing context as if it were known.

11 Boundaries

CMH Scientific does not claim that one architecture is universally superior to conventional predictive models. It does not infer causality from observational structure alone, guarantee that an untested measurement will repair a deficit, establish a universal information ceiling, transfer specified-policy TotemicAI validation to learned mode, or substitute retrospective Deferra evidence for prospective clinical validation. The laboratory's claim is narrower: these instruments make scientifically and clinically consequential states explicit and testable.

Intellectual property, competing interests, funding, and use

Relevant methods and computational systems are the subject of previously filed U.S. provisional patent applications. Public technical reports disclose scientific objects, validation logic, interfaces, and claim boundaries needed to evaluate the released work while withholding protected operational implementations. Publication does not grant a patent or commercial software license.

The author is Founder of Conquer Medical Health and has financial and intellectual-property interests in the technologies described. No external funding supported preparation of this technical report.

Use of AI-assisted tools

AI-assisted tools were used for editorial and software-documentation support. The author determined the scientific claims, supplied the underlying analyses and validation artifacts, and reviewed the numerical content and final report.

References

[1] Ewing, M. A. *Widespread Nonidentifiability in Patient Data Limits AI Prediction Regardless of Model Sophistication*. 2026.

[2] Ewing, M. A. *TopolAI: A Supervisory Control Architecture for Scientific AI*. Conquer Medical Health, 2026.

[3] Ewing, M. A. *TotemicAI: Fitted Structural Memory for Scientific AI*. Conquer Medical Health, 2026.

[4] Ewing, M. A. *OptiCeil: Task-Conditioned Recoverability*. Conquer Medical Health, 2026.

[5] Ewing, M. A. *Acquire: Inverse Measurement Design for Scientific AI*. Conquer Medical Health, 2026.

[6] Ewing, M. A. *Deferra: Trajectory-Conditioned Selective AI Assistance*. Conquer Medical Health, 2026.