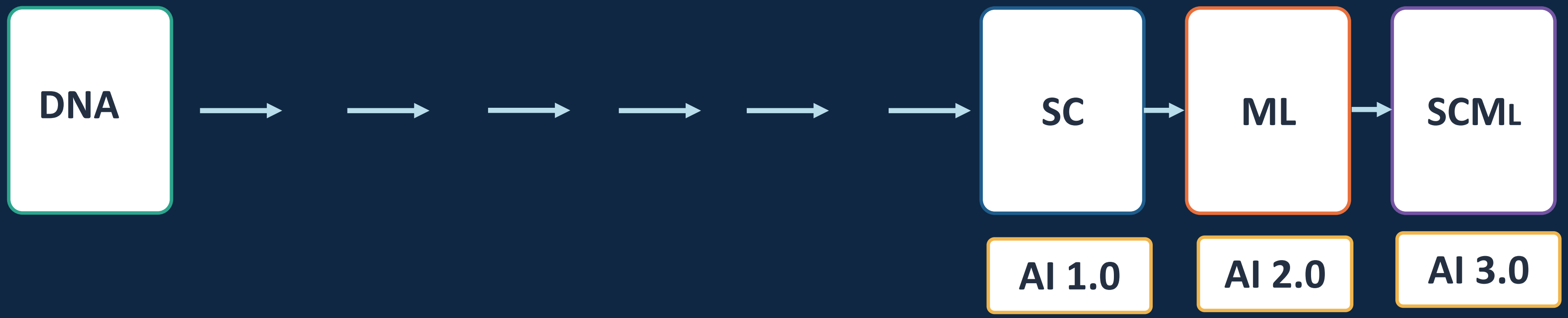
“The Extended Scientific Method”

From DNA to SC, ML and SCML

SCML 2026 · Erhard Glötzl · JKU Linz



SCML is not just a technical combination of two methods.

SCML is the last step in the evolution of information technologies

Symbolic Computation
AI 1.0

→

Machine Learning
AI 2.0

→

SCML
AI 3.0

It may be a new qualitative step in how we process information

Three steps of the argument

1

Extended Scientific Method ESM

A way to understand complex systems

2

General Evolutionary Theory GET

Evolution of information technologies

3

SC · ML · SCML

From AI 1.0 and 2.0 to AI 3.0

1. The Extended Scientific Method ESM

Scientific Method

Observation and hypotheses → Testing and application

Extended Scientific Method

Observation and hypotheses → Basic elements reductionism → Structure structuralism → Testing and application

Why it matters:

predict missing elements

generalise principles

combine structures into new fields

Two examples

How complexity becomes structure

Chemistry

Compounds → Elements → Periodic Table → Prediction (gaps)

Mathematics

Linear systems → Eigenvectors → Spectral Theorem → Solution

Polynomial systems → **Gröbner basis (Buchberger)**

All mathematical systems → **Langlands programme**

2. General Evolutionary Theory

Core claim:

- **Evolution can be understood with information types and information technologies as basic elements.**

- **Every information type relates to a triad of information technologies:**

Storage → **Duplication** → **Processing**

The triad in three examples

Information type	Storage	Duplication	Processing
DNA	stores genetic information	replication	sexual reproduction
Brain	stores complex neural information	language	logical reasoning
Writing	stores external symbolic information	printing	electronic data processing

A sequence of information ages

From biological to cultural to artificial information processing

1 **Crystal**
no processing

2 **RNA**
limited

3 **DNA**
reproduction

4 **Simple Neural**
limbic system

5 **Brain**
logical reasoning

6 **Writing / SC**
AI 1.0

7 **Cloud / ML**
AI 2.0

8 **SCML**
AI 3.0

biological
cultural
artificial

3. The big picture

Symbolic Computation = AI 1.0

Strong when structure is explicit

explicit symbols
rules
formal structures

Strength

exact reasoning

transparency

verification

Weakness

needs explicit rules

weak with noisy high-dimensional data

Machine Learning = AI 2.0

Strong when patterns are hidden in data

large data
patterns
statistics
correlations

Strength

adaptability

pattern recognition

works with images, text, speech, signals

Weakness

often lacks explicit reasoning

difficult to verify

may produce plausible but false results

SCML = AI 3.0

A synthesis, not just a mixture

SC
Small data
Logical structure

ML
Large data
patterns

SCML
learn + explain
hypothesis + test
search + verify

The goal: systems that work with logical structure AND very large data.

SCML as computer-aided implementation of ESM

ESM: Observation → Basic elements & structure → Application

SCML: ML finds patterns in data → SC suggests elements and structures → SCML tests, verifies and applies

SCML: A possible new, indispensable, fundamental tool for science

Evolution from DNA to SCML

ESM leads from data to structured Information

SCML as computer-aided implementation of ESM

**Human progress depends not only on having more information —
it depends on turning information into structure.**

without structure → noise

without elements → confusion

without rules → weak prediction

SCML may help us design structured artificial intelligence.

A longing for a new way of doing science

Inspired by Antoine de Saint-Exupéry

> *“If you want to build a ship, do not merely explain to people how it is technically done, but awaken in them a longing for the wide, endless sea.”*

> *“If you want to develop SCML, do not merely explain to people how it is technically done, but awaken in them a longing for a completely new way of doing science.”*

SCML may awaken a new way of doing science.

Thank you very much

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