

Art and Immunity: Two Systems of Adaptive Knowledge

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Science and art are often presented as fundamentally different domains: one grounded in evidence and consensus, the other in ambiguity and interpretation. Yet this opposition is only partial. Scientific knowledge is not simply empirical observation, as it also involves the testing of theoretical models, while artistic practice is not merely expression but a generator of knowledge through experience, symbol, and interpretation. We propose that art and the immune system share an important structural analogy: both are adaptive systems that respond to novelty, transform challenge into meaning or protection, and remain in permanent evolution. Using immunology as a conceptual lens, we argue that the immune system and artistic creation are best understood not as closed repositories of fixed responses but as open systems capable of anticipating the unexpected. This comparison helps illuminate how biological adaptation and artistic creativity both rely on diversity, recognition, interpretation, and responsiveness to change.

THE STARTING POINT

The relationship between science and art has often been framed in terms of opposition. Science seeks consensus, reproducibility, and verification. On the contrary, art tolerates plurality, ambiguity, and divergent readings. This distinction is valid, but incomplete. Scientific practice depends on theoretical frameworks that organise observation, and artistic work frequently emerges from accumulated experience, intuition, and tacit knowledge. In that sense, both fields produce knowledge, though not in the same form.

We can start from a more unusual proposition: the immune system and art are structurally similar because both respond to what challenges them (i.e., challenges us). The immune system has evolved not simply to recognise a fixed list of threats, but to generate vast diversity. So vast that it can respond to novelty, including variants that have not yet appeared, as we cannot anticipate the nature of the flu virus from the next season or the nature of a future pandemic. Art, similarly, is not exhausted by communication. It is a trigger for interpretation, discovery, and the production of new meaning.

SCIENCE, ART, AND THE STATUS OF KNOWLEDGE

A common misconception is that science is purely empirical. In reality, experiments are often used to validate models that were first imagined theoretically. Physics offers a clear example: elementary particles were postulated before they were directly observed and measured. Scientific reasoning therefore combines abstraction, inference, and testing. The same is true, in a different way, of artistic creation: the work may arise from lived experience, but its meaning is not fixed by authorial intention. It is completed in interpretation.

This is where art becomes epistemologically important. Art is not only a means of communication. It is a device that produces knowledge by eliciting reflection, association, and reinterpretation. A literary or visual work can function as a “trigger” that activates meanings not explicitly planned by the creator. The artwork does not merely transmit content, it opens a field of possible understanding.

The difference from science lies partly in consensus. Scientific knowledge aims, in principle, at shared agreement under agreed methods of validation. Artistic knowledge does not require consensus. Multiple interpretations can coexist, including interpretations that differ from the artist’s own account. That plurality, far from being a defect, is one of the distinctive virtues of art.



THE IMMUNE SYSTEM AS AN ADAPTIVE SYSTEM

Immunology provides a powerful metaphor, but also a serious conceptual parallel. The immune system must deal with a moving target. Pathogens mutate, adapt, and evade host defences. Therefore, immunity cannot rely on a rigid catalogue of preformed responses. Instead, it depends on immune cells (lymphocytes) with an outstanding receptor diversity, clonal selection, memory, and learning-like processes that expand the system's capacity to recognise the unfamiliar.

Vaccination illustrates well this principle. By exposing the immune system to selected molecules (each different molecular "shape" that the immune system recognises is termed an antigen), vaccination amplifies specific lymphocyte populations and prepares the host for future encounters. This is not a passive way to deal with a threat to come but active anticipation. This way, the immune system becomes more capable of responding to threats that are not yet present in the immediate environment.

This is why the immune system can be described as "perfect" in an evolutionary sense: not because it is flawless, but because it is open-ended. It is built to identify and react to entities that may exist now, may emerge later, or may never have existed before in exactly that form. Its logic is prospective as much as reactive.

ART AS AN ADAPTIVE SYSTEM

Art can be understood in a comparable way. It originates in an individual gesture, but its significance exceeds the initial impulse. A work of art is not complete at the moment of production. It becomes fully active when it encounters a viewer, reader, or listener who interprets it. Furthermore, art is responsive to stimuli from culture, history, and society. When society changes, the conditions of artistic reception and production change as well.

This responsiveness resembles immune adaptation. The immune system does not "repeat" a single answer as it needs to recalibrate its output continuously toward an evolving microbial landscape. Art also mutates in response to new problems, new materials, new audiences, and new forms of attention. It can therefore be thought of as a living system of symbolic responsiveness, able to anticipate forms of experience that are not yet fully imaginable.

The analogy is especially suggestive because both systems depend on variation. Immunity depends on receptor diversity, clonal expansion, and memory. Artistic culture depends on plurality of artists, with their diverse views and interpretations, and the circulation of art forms across contexts. In both cases, robustness arises not from uniformity but from diversity.

INTERPRETATION, CONSENSUS, AND TRANSFORMATION

One of the most important differences between science and art concerns the role of interpretation. In science, interpretation is constrained by methodological norms and by the demand for intersubjective agreement. In art, interpretation is constitutive. A work does not merely contain meaning as it generates meaning through engagement. The artist may intend one thing, yet the artwork may produce another in the mind of the observer.

This interpretive openness does not make art arbitrary. It means that artistic meaning is relational rather than fixed. Likewise, immune recognition is not a mechanical matching of one static key to one static lock. It is contextual, shaped by prior exposure, tissue environment, and regulatory networks. Modern immunology increasingly emphasises diversity across individuals and populations, as well as the influence of environment, microbiome, and age on immune responsiveness.

The parallel is conceptual but productive: both art and immunity transform contact into response. Both are systems that make the world legible by being altered through it. A painting, a novel, or a performance can change the viewer's perception. An antigen can change the immune repertoire. In both cases, encounter becomes development.

CONCLUSION

The relationship between art and immunology is more than metaphorical. Both are adaptive systems that depend on diversity, responsiveness, and the capacity to generate novelty from encounter. Science seeks consensus and verification while art tolerates multiplicity and ambiguity. Yet both produce knowledge, and both are sustained by interpretive processes rather than merely reactive ones.

From an immunological perspective, vaccination illustrates how a biological system prepares for the future by enlarging its repertoire. From an artistic perspective, creation similarly prepares the future by opening meanings

that cannot be fully foreseen. Art and immunity are therefore alike in one essential respect: they are both poised toward what has not yet arrived.

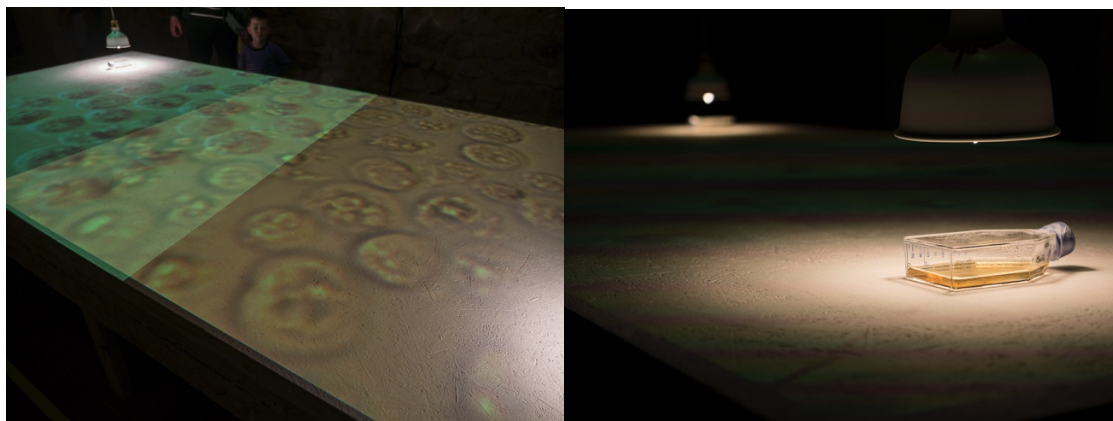


Fig. 1. Immortality for Two, Marta de Menezes and Luis Graca, 2014. In this artwork, we explored the concepts of identity, intimacy, and immortality. We immortalized each other's white blood cells by introducing cancer-inducing oncogenes via a viral vector. This genetic modification causes the cells to bypass normal regulatory mechanisms and proliferate indefinitely, granting them biological immortality at the cost of their disease-causing potential. In this installation, all laboratory equipment is intentionally hidden from view, ensuring the audience remains focused solely on the essence of the work: the immortal cells themselves. These cells, albeit from two people in love, pay a tragic price for immortality, as they cannot be physically together, as immune cells reject each other. Consequently, the only place where they can truly come together is in the virtual space of the overlapping video projection in the middle of the table that serves as a screen for the live feed from the cell culture flasks. Images provided by Marta de Menezes, from the Touch Me Festival "It's about time!", in Zagreb 2015. Copyright Marta de Menezes



Fig. 2. Anti-Marta, Marta de Menezes and Luis Graca, 2018. This work explores the biological boundaries of intimacy and individuality through live skin graft transplants between the two of us. By exchanging tissue, our immune systems inevitably rejected the foreign grafts, but this process triggered the lifelong production of unique antibodies specifically designed to recognise each other. Ultimately, the artwork demonstrates that a deep human bond can coexist with a fierce biological identity, leaving us with a permanent, molecular "sixth sense" for one another's presence. Image, Marta de Menezes, 2018. Copyright Marta de Menezes