Premise

Why doesn't he understand?

Since I started working on microchips back in 1984, I've always wondered why programs don't know what they're doing, why a machine that is solving a process to keep a controlled variable within the set limit, despite being very efficient, does not know what it is doing.

Formal systems

After a few years, I came across Gödel's theorem, but it's with Turing's machine concept that I started understanding: the result was to discover that the completeness of a system cannot be demonstrated using its rules.

Evolution of systems

The next question was, how does a system evolve? How does it discover its own incompleteness and overcome it? For a human it is relatively simple: demonstrate the validity of the axioms in the formal system; an axiom that you cannot demonstrate shows the limit of its completeness. At that point you have to find a new set of rules capable of containing the previous formal system with the addition of the new axioms specific to that system. The new system will also contain an unprovable postulate within it.

Why doesn't it evolve?

Let's suppose we write a program based on a set of rules: this system will continue to execute the its postulates without being able to build further formal systems. Therefore, it can never evolve because a program is never able to modify itself by creating new semantics.
Alan Turing probably also came to this conclusion, infact in the last part of his life he began to study biological systems.

Why biological systems evolve

I would like here to focus on cell replication performed by DNA. DNA contains all the information needed to create new cells with DNA that is absolutely identical to the original. By saying this, we affirm that the DNA of any living species contains the information to reproduce itself according to "simple" rules.
DNA is composed of guanine, adenine, thymine, and cytosine. The only possible chemical bonds in this chain are between adenine and thymine and guanine and cytosine, which means that not all possible combinations can be created with the four bases but only a subset of them. I believe that we can say that DNA is a formal system with biochemical inference rules and subject to incompleteness. Biology is able to evolve and does so through a recursive system, biological systems evolve but not DNA, when DNA changes for any reason it is a mistake.
I know very well that this matter is much more complicated than that and, sometimes, random errors in the DNA allow the evolution of the species, but I just wanted to give a rough idea of this process.

in short:
- The main purpose of DNA is to store and transmit information.
- Replication is the process by which this information is copied and transmitted to daughter cells.

- This process is guided by precise rules that guarantee the precision of the information transmission.
- In summary, the fact that DNA's rules are implemented through complex biochemical processes does not contradict its nature as a self-referential system. The primary goal of DNA is to store and transmit information and, replication is the process by which this goal is achieved, DNA less than the limits of physics has a deterministic behavior.

The brain

The brain is somehow able to self-specialize by creating preferential neuronal pathways. This happens especially in the adolescent phase where entire neuronal pathways are literally pruned: this is the reason why learning languages before puberty is easier than afterwards. Basicallythe brain changes itself by changing its topology, but not its physiological structure. In a very simplistic way, neurons are all the same, magnesium always closes the connection between axon and dendrite and calcium opens it, the hormones that determine this operation never vary.

But, my point here is to emphasize that the brain always works in the same way and cannot modify its functioning, that would result in a mistake, but modifies its topology by modifying synaptic pathways.

Conclusion

I close this first part with a question: can other structures be capable of modifying their topology without necessarily modifying themselves and creating the basis for a system capable of evolving?