From AI to IA (Intelligence Augmentation): A Lesson from Insects

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Since Santiago Ramóny Cajal uses a heavy metal staining method invented by Camillo Golgi and visualized single neurons more than 100 years ago, scientists are fascinated by the specificity and plasticity of brain neurons and their numerous connections for information processing and storage. Understanding information flows and their use in the human brain requires a comprehensive map of neural structures at all levels, similar to those of Google Earth for continents, countries, cities, and streets. More than 50 years ago, Marvin Minsky, "father of artificial intelligence", attempted to visualize brain circuits with his invention of confocal microscope but failed and turn to the field of AI. Recent advances in super-resolution microscopy may finally allow us to see all the neuron-to-neuron connections and reconstruct the brain circuits at single molecule resolution. I will discuss how recent breakthroughs in genetics, connectomics and AI technologies open the door for a full understanding of brain functions. Integration of these new technologies, scientists are now capable of manipulating any gene of selection in any target neuron at any time in living and freely moving animals. This allows remote control of brain activities that orchestrate complex behaviors. As a proof-of-concept study, I will discuss how we use fruit flies as a model system to study brain functions, develop new strategies to enhance memory, and find cures for human mental diseases.