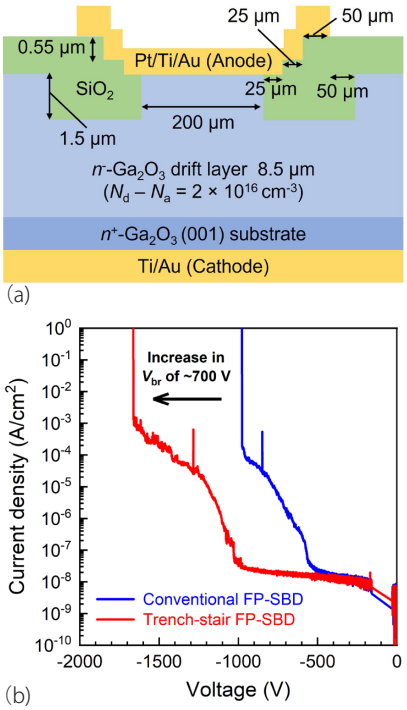

Fig.7 : Ga_2O_3 Schottky barrier diode with a staircase trench field plate: (a) cross-sectional diagram, (b) reverse current vs. voltage characteristics

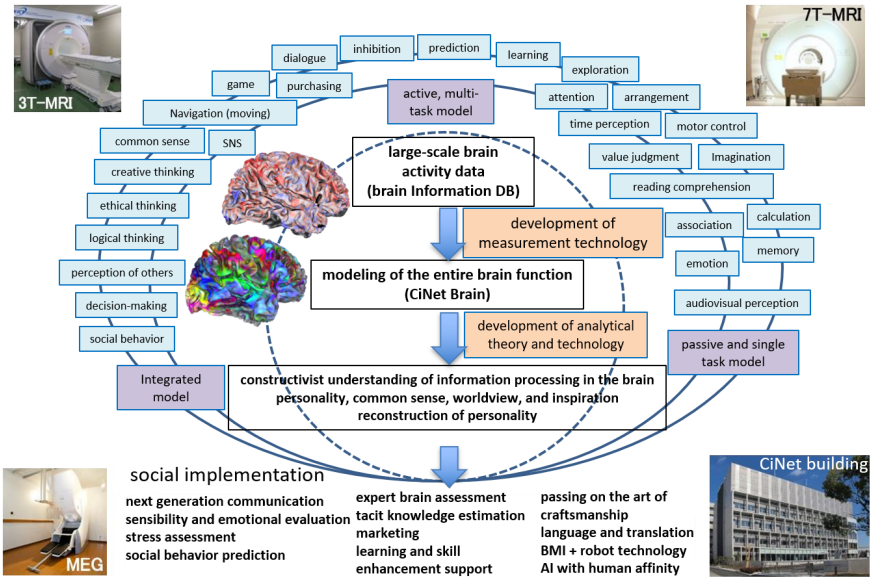

Fig.8 : CiNet Brain: Model of the entire brain

a human-centric ICT society as advocated by Japan's Society 5.0 initiative. Targeting, in particular, higher-order brain functions such as human cognition, emotion, perception, decision-making, action, sociability, and language, CiNet is working to construct "CiNet Brain" as a model encompassing all brain information processing by collecting and analyzing brain activity data under diverse perceptual and cognitive conditions (Fig. 8). This is being highly evaluated as an application to artificial intelligence (AI) that mimics the human brain. Social applications of the results of this research are also progressing. For example, we are working with a company on conducting objective evaluations of impressions and sensations felt by a user in response to products or services using brain information read from brain activity as a result of audio-visual stimuli.

R&D on measurement/analysis of brain functions for constructing an artificial brain model

We have constructed an experimental system that can selectively present smells (olfactory stimuli) within magnetic resonance imaging (MRI) equipment. We have shown with this system that smells change visual subjective evaluations and generate a difference even at the corresponding brain activity level. These results are attracting attention since they provide neuroscientific evidence of cross-modal phenomena between the sense of sight and sense of smell. Additionally, considering a scenario in which a native speaker of Japanese hears natural utterances in English, we have constructed a model that uses those brain waves to identify the brain wave response for different linguistic characteristics and evaluates listening proficiency from brain wave indices. This achievement shows promise as a technology for evaluating the degree of information comprehension from brain information.

R&D on expanding applications of brain information communication technology (brain ICT)

We are using knowledge of brain functions related to human motor functions to generate results that can be implemented in society. We have clarified through MRI measurements that the inhibition mechanisms across brain regions mature with development but deteriorate with age. This result provides the first visualization of lifespan changes in the interregional inhibition mechanisms in the human brain. We also clarified how the interhemispheric inhibition mechanism between the left and right motor cortices relates to finger dexterity. We have teamed up with a company to implement the above knowledge in a motor training program for the elderly as an example of social implementation of brain ICT.

Industry-academia-government collaborative research activities for enhancing social acceptance of brain ICT

At CiNet, we have been working to convey our research results widely to industry and have been actively pursuing joint research with companies. At the same time, we have come to recognize the importance of clarifying issues and their solutions in obtaining social acceptance of human brain function research and its results when being engaged in this pioneering research. To therefore conduct research that takes into account ethical, legal, and social issues (ELSI), we have established an ELSI research group within CiNet and have commenced ELSI-related activities in collaboration with Osaka University Research Center on Ethical, Legal and Social Issues (ELSI Center), a leader in this field. We have also been active in the "AI Technology Estimating Perceptual Information From Brain Information" project under the PRISM program of Japan's Cabinet Office, where we have been surveying and researching the social acceptance of this technology and holding study meetings and discussions toward social implementation.