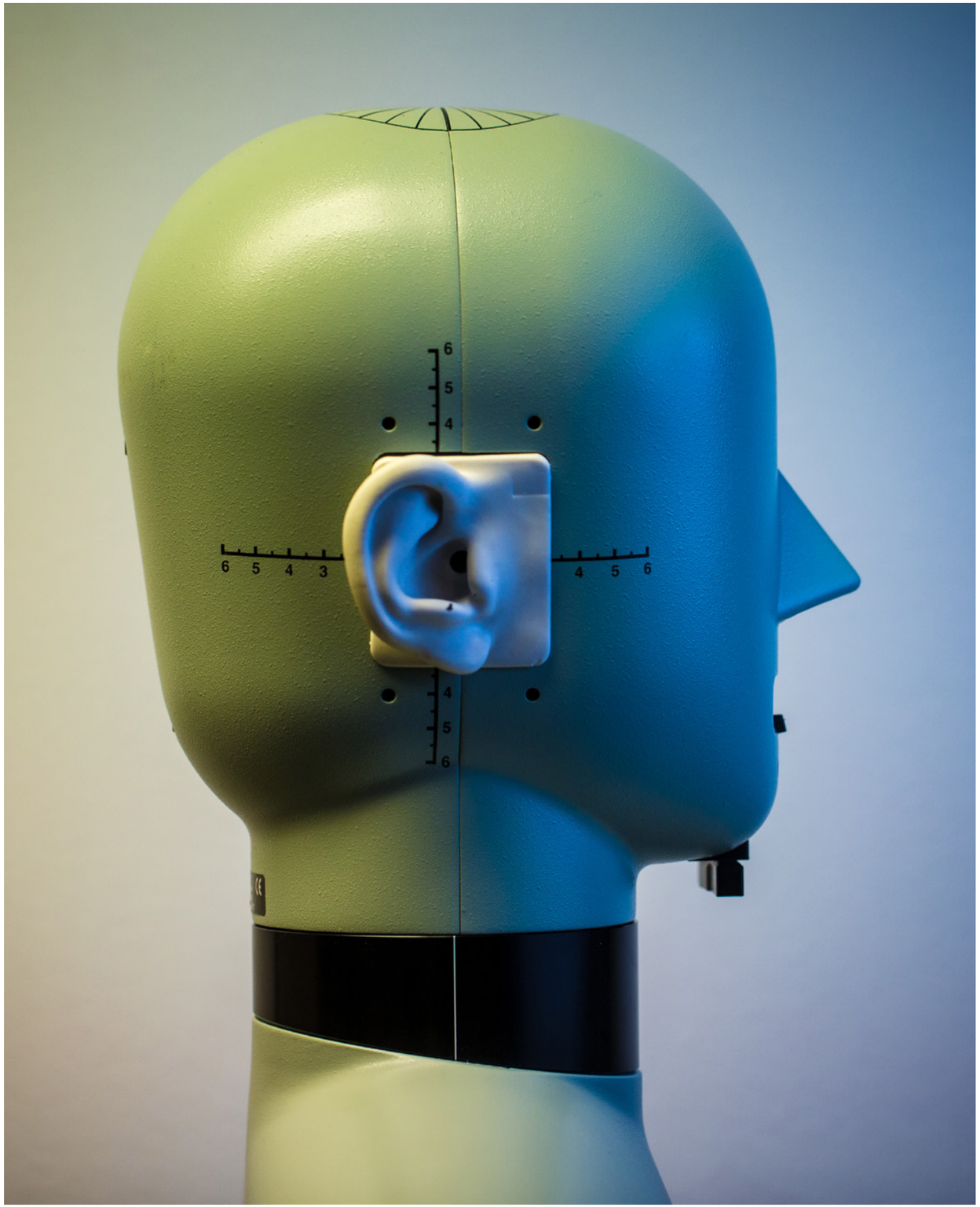

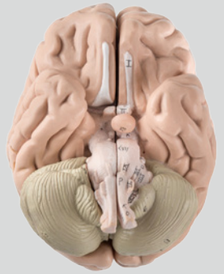

Brainy business

2015 is the European Year of the Brain. The Bergen fMRI Group are amongst those taking part in the celebrations.

TEXT KIM E. ANDREASSEN PHOTO EIVIND SENNESET

This brainiest of years is being celebrated amongst researchers all year long through lectures, debates and a general celebration of that precious bodily organ – the brain.

Professor Kenneth Hugdahl heads the Bergen fMRI Group. Until June 2015, he held an Advanced Grant from the European Research Council (ERC). He is one of the many brain researchers putting Bergen on the international science map.

Just as important has been his efforts to promote the next generation of brain researchers at the University of Bergen (UiB). On the next four pages we present Professor Karsten Specht and Postdoctoral Fellow Marco Hirnstein, both part of the excellent Bergen fMRI Group.

The Bergen fMRI Group is also one of the research environments in Norway to have been offered extra funding through the Toppforsk programme, which aims to attract elite researchers to higher education institutions in Norway.

Professor Kenneth Hugdahl, Department of Biological and Medical Psychology, University of Bergen (UiB).

Marco and the Left-Handed:

More left-handed among schizophrenia patients

More left-handed people are found among schizophrenics than in the general population. Brain researcher Marco Hirnstein believes that this is due to common genes between hand preference and the disease.

Approximately 10 per cent of the world population is left-handed and there are many myths about them. For example, it is said that left-handers are more creative and that there are collectively more geniuses among them compared with the right-handed majority. In addition, an unusually high percentage of American presidents favoured their left hand, although they cannot all necessarily be considered among the geniuses.

Confirming a myth about left-handers

Even though most of the myths about left-handers cannot be proven or are, at times, complete fiction, postdoctoral fellow Marco Andre Hirnstein from the Department of Biological and Medical Psychology at the University of Bergen (UiB) recently confirmed one of them.

"My research shows that more left-handers are found among schizophrenics than in the general population," says Hirnstein, who is a member of the Bergen fMRI Group that is headed by Professor Kenneth Hugdahl, who held an Advanced Grant from the European Research Council (ERC), one of the most prestigious grants in the international research community, until the end of March 2015.

By reviewing 70 studies with around 10,000 participants, Hirnstein found that approximately 15 per cent of schizophrenics are not right-handed, compared with 10 per cent of the population as a whole. The results of Hirnstein's research were recently published in the academic journal, *The British Journal of Psychiatry.*

Connection may be hereditary

Hirnstein cannot establish for certain why there are more left-handers among schizophrenics than otherwise in the population. However, the connection is most likely hereditary.

"It is probably specific genes that, on the one hand, increase the risk of developing schizophrenia, while on the other, increase the chance of being left-handed," he says.

However, the researcher is certain that the difference between being right-handed or left-handed is not in the hands, but in the brain. While, the left side of the brain controls the right hand, the right side of the brain controls the left hand.

"The brain is in fact organised a little differently for right-handers than for left-handers," he says.

For example, for both schizophrenics and left-handers, the language centre is more commonly located in the right side of the brain than is the case for right-handers. While 95 per cent of right-handers have the language centre in the left side of the brain, this only applies for 70 per cent of non-right-handers.

Of the non-right-handers who do not have the language centre in the left side of the brain, half of these have the language centre in the right side of the brain and the other half have it in both sides of the brain. For schizophrenics, the language centre in the left side of the brain is also reduced.

"It is in the actual organisation and specialisation of the brain that I believe it is possible to find answers to parts of the schizophrenia riddle and the link between hand preference and schizophrenia," Hirnstein says.

Stimulating neurons in the brain

He is an expert in so-called transcranial magnetic stimulation. A device the size of a hair dryer is placed against the head of the patient and creates a magnetic field that stimulates the neurons in the brain for a short period.

While fMRI scanning can say something about the areas of the brain that are active, the magnetic stimulation can tell researchers and health care personnel which areas are necessary for different activities. If, for example, a part of the brain is stimulated while another person is speaking, the speech will be changed and distorted if that area is necessary for understanding what the other person is saying.

Magnetic stimulation is also used for treatment and, among other things, has demonstrated good results in the treatment of depression. Hirnstein believes that magnetic stimulation can also assist in treating schizophrenics who hear voices.

"If it transpires that there is an imbalance in the brain activity that causes a person to hear voices, magnetic stimulation can regulate the activity in certain parts of the brain."

Pharmacological treatment is long way off

He notes that the research into brain differences is still a long way off from offering pharmaceutical treatment.

"However, we have established that schizophrenia and brain specialisation are linked in some way or another. The next step is to determine exactly what the connection is. It is only when we have found a causal connection that we can hope to have better treatment," Marco Hirnstein says.

Postdoctoral fellow Marco Hirnstein, Bergen fMRI Group, Department of Biological and Medical Psychology, University of Bergen (UiB).

Looking for clues in the brain

Brain researcher Karsten Specht has discovered a new method of analysis to distinguish between stroke patients with language problem. The result may be individualised treatment for each patient.

The human language centre is located in the left part of the brain. Sometimes this area is damaged after a stroke. The consequence may be that the patient has difficulties in finding words or in understanding language, so called aphasia. Today, patients are treated using general language training programmes, based on their symptoms.

"Strokes strike individually. This is why it is vital to find the right treatment for each patient," says Professor Karsten Specht from the Department of Biological and Medical Psychology at the University of Bergen (UiB).

New analysis may help patients

Professor Specht has recently studied a new method of analysing brain imaging data, or more specifically functional magnetic resonance imaging (fMRI). This new method may, in the long run, lead to better methods of categorising stroke patients and, hopefully, to a more individualised treatment in the future. He suggests that in ten years' time this new treatment could become generally available.

Together with German colleagues, Professor Specht recently published the article "Therapy-induced brain reorganization patterns in aphasia" in the journal *Brain*.

The article addresses a study carried out in Germany that observed a group of stroke patients with language difficulties. They all had their brains scanned using the fMRI technique as an important part of the analysis. An essential part of the research was conducted the Bergen fMRI Group at UiB.

Conducting a multimodal analysis

Professor Specht is the first to use so-called Joint Independent Component analysis on stroke patients, in which information about lesions in the brain is statistically combined with information about brain activity. The patients were scanned several times by an fMRI-machine, both before and during language training. During a multimodal analysis, the researchers studied how the networks of the brain were activated.

The multimodal analysis involves analysing MR scan images of the extent of the brain damage in stroke patients whilst studying brain activity using fMRI scans.

"Using this method, it is possible to localise the damage and to determine the extent of the damage and how the activation patterns in the neural networks are related," the brain researcher explains.

Looking for hidden brain patterns

In recent years it has been established that the adult brain retains its plasticity and is able to form new connections between neurons. If, post stroke, the brain is able to reactivate remaining communication networks or create new networks as a result of the therapy, the prognosis for the patient is much improved. The multimodal analysis makes it possible to observe whether or not this is the case, and Professor Specht's new method makes it possible to observe this indirectly.

"The objective is to track down active patterns that are characteristic for certain types of brain damage. It is then possible to separate the different types of strokes/patients. In the long run, we hope to determine the most effective treatment, based on these different sources of information," Specht says.

One example is the researchers' observation that patients who suffered a stroke in the back left half of the brain and who are able to activate remaining pathways of the language network may have a more optimistic prognosis than patients who suffered a stroke in the front left half of the brain and who do not have this network reactivated after the stroke.

Hunting for a better diagnosis

The ability to differentiate between the extent of the damage and the reorganisation of the brain's language network is crucial information for the health service. According to Professor Specht, with current methods this kind of combined information is difficult to observe in individual patients.

"Until now researchers have analysed the damaged area and brain activity in two separate operations. One has almost had to guess the extent of the damage," he says. "This is why it is important to continue basic research to develop new and better integrative analytic tools, which in a longer perspective will provide us with better diagnosis and improved opportunities for therapy."

The current criteria for treatment is symptom-based rather than causal. If a stroke patient suffers language problems, he or she will often join a more general therapy programme.

"A better diagnosis and status report will hopefully mean more individually adapted treatment in the future. You never find two patients with the same damage after a stroke," Professor Specht says. ●

Professor Karsten Specht, Bergen fMRI Group, Department of Biological and Medical Psychology, University of Bergen (UiB).

FACTS

Bergen fMRI Group

- The Bergen fMRI Group was established in 1994.
- fMRI is short for functional Magnetic Resonance Imaging.
- The group has done pioneering work in fMRI research in Norway and internationally.
- The group is an interdisciplinary research group at the University of Bergen (UiB) and Haukeland University Hospital (HUS).
- The group's work focuses on brain activation studies related to a broad spectre of cognitive functions, including laterality, speech and language, working memory, attention, and emotions.
- A particular focus for the research group is the study of auditory hallucinations in schizophrenia, and dichotic listening studies of cognitive control.
- The group is headed by Professor Kenneth Hugdahl.
- For more information, visit the Bergen fMRI Group home page: fmri.uib.no