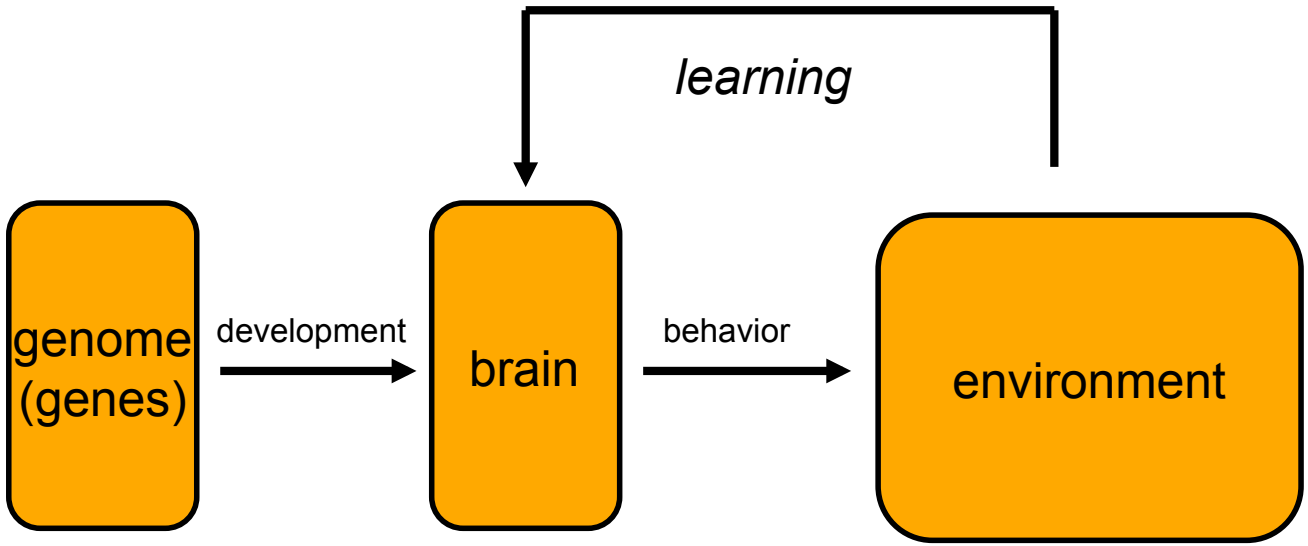
The following slides are for teaching only

It is not allowed to use any of the slides for other purposes than learning

remaining lectures of „Genes, Brains and Behaviour“

04.7.2012 Split brain & alian hand
11.7.2012 Schizophrenia & Associative Disorders
18.7.2012 Trinucleotide Diseases (Huntington etc.)
25.7.2012 Alzheimer Disease



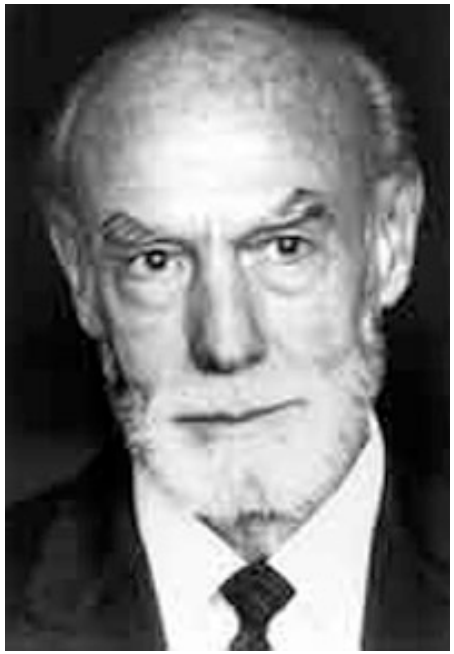
Lecture 9: Genes, Brains and Behaviour: split brain & alian hand

Karl-Friedrich Fischbach, Neurogenetics, Freiburg

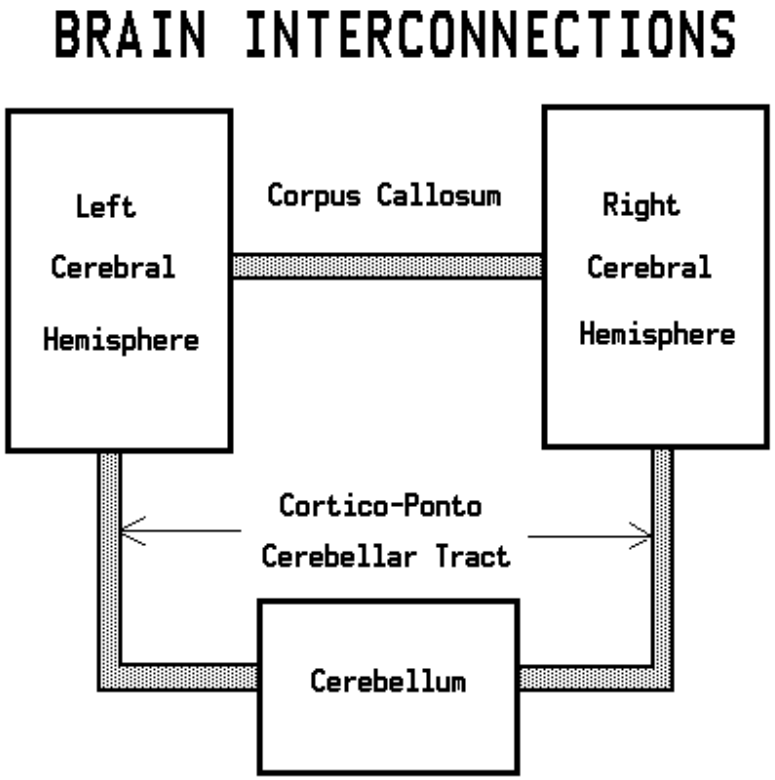
Specific properties of damage to different brain regions

- corpus callosum (split brain patients)

Damage to the corpus callosum can give rise to "purposeful" actions in the sufferer's non-dominant hand (a right-handed sufferer's left hand will turn alien, and the right hand will turn alien in the left-handed) as well as a problem termed "intermanual conflict" in which the two hands appear to be directed at opposing purposes



Roger Sperry

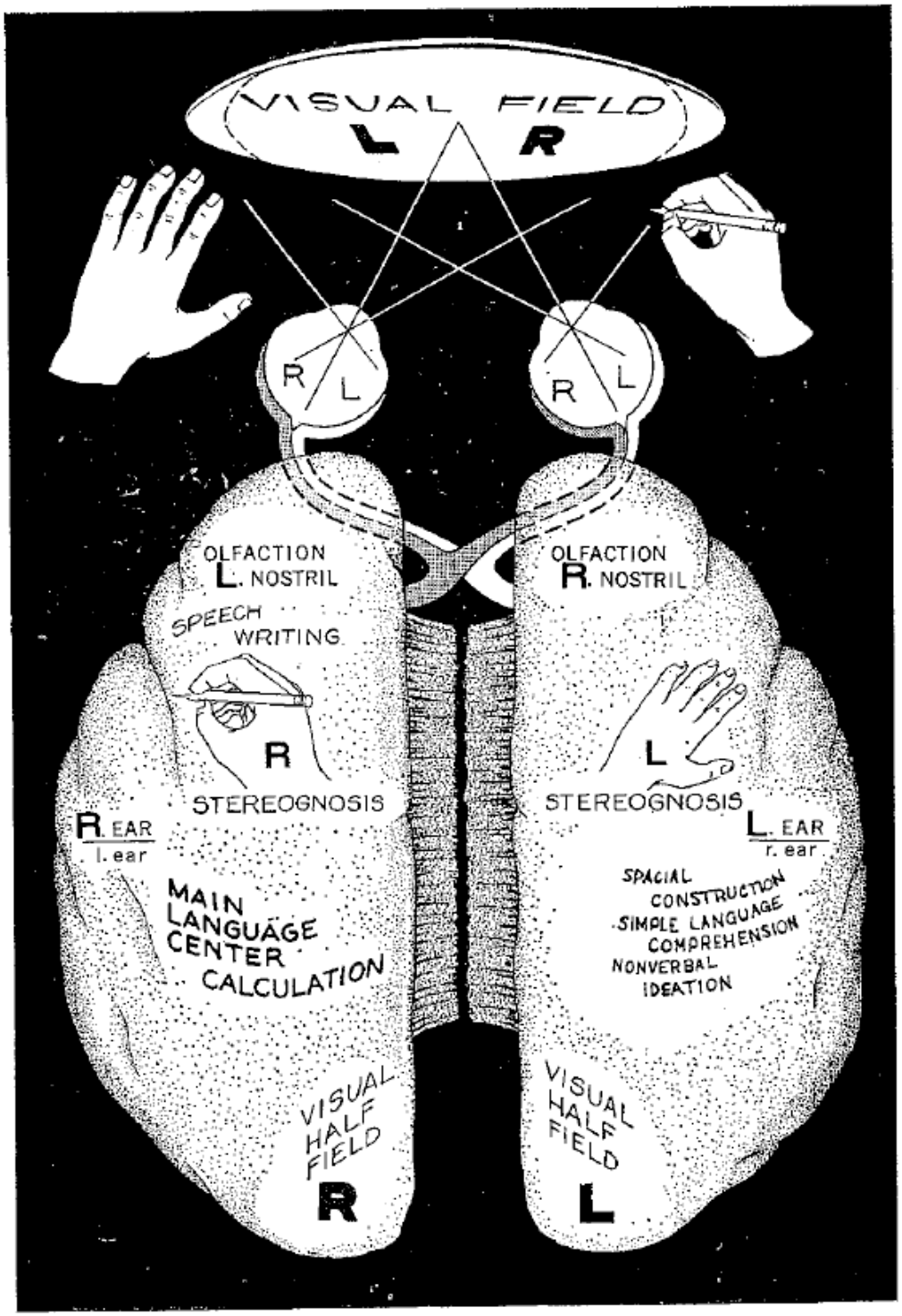


Specific properties of damage to different brain regions

corpus callosum (split brain patients)

For example, one patient was observed to be putting a cigarette into her mouth with her intact right dominant hand. Her alien opposite nondominant left hand then came up to grasp the cigarette, pull the cigarette out of the mouth, and toss it away before it could be lit by the controlled dominant right hand.

The patient then said "I guess **she** doesn't want me to smoke that cigarette".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Split brain Patient

http://www.youtube.com/watch?v=ZMLzP1VCANo

Discovery of the alien hand

http://www.youtube.com/watch?v=p9Glq9SVSxQ

Split brains with different believes

http://www.youtube.com/watch?v=PFJPtVRII64

Alien hand syndrome (AHS)

In patients with AHS, the most frequent pathological findings are focal **lesions to the anterior corpus callosum** (non dominant AHS) **or a combination of callosal and frontal lesions** (frontal AHS)

Causes of „alien hand“

- mechanical brain damage
- stroke
- brain tumors
- surgery
- developmental (genetic) defect

to different brain regions

- frontal lobe
- parietal lobe and/or occipital lobe
- corpus callosum

Definition of „alien hand“

An Alien Hand sufferer can feel normal sensation in the hand, but believes that the hand, while still being a part of their body, behaves in a manner that is totally distinct from themselves. They feel that they have no control over the movements of their alien hand, but that, instead, the hand has the capability of acting independent of their conscious voluntary control.

Alien hands can perform complex acts such as undoing buttons or removing clothing. Alien behavior can be distinguished from reflexive behavior in that the former is flexibly purposive while the latter is obligatory and stereotypical. Sometimes the sufferer will not be aware of what the alien hand is doing until it is brought to his or her attention.

„general theory“ of alien hand syndromes

- The brain houses several fairly independent action agents
- When brain regions are disconnected from each other, the autonomously initiated behavioral pattern does not reach consciousness (of the speaking personality)
- ... but there might be another non-speaking consciousness?

Mike or me? Self-recognition in a split-brain patient

David J. Turk, Todd F. Heatherton, William M. Kelley, Margaret G. Funnell, Michael S. Gazzaniga and C. Neil Macrae

nature *neuroscience* • volume 5 no 9 • september 2002

JW MG

90% JW

10% JW

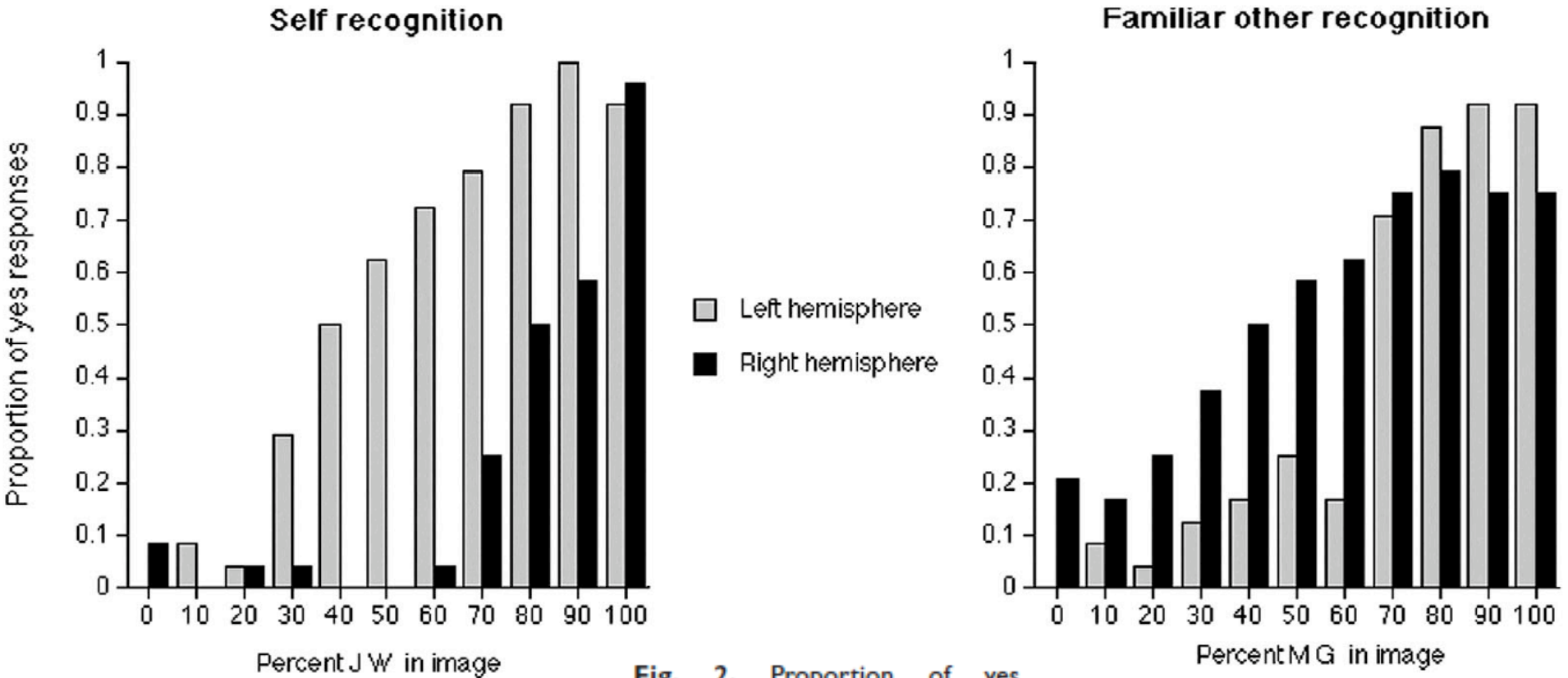


Fig. 2. Proportion of yes responses to recognition judgements as a function of the percentage of the individual contained in the image and the cerebral hemisphere to which the image was presented. In one condition (left), JW was asked to determine whether or not the image was self; in the other condition (right), JW was asked to determine whether or not the image was MG. JW showed a bias for self-recognition in the left hemisphere, and a bias for familiar other person recognition in the right hemisphere.

Sex determination in Drosophila and man

In Drosophila the relationship between the number of X-chromosmes to the number of the autosomal set counts

	Drosophila	Homo sapiens
• XX →	female	female
• XY →	male	male
• XO →	male	female (Turner Syndrom)
• XXY →	female	male (Klinefelder S.)

In Homo sapiens the absence or presence of the Y-chromosome is important

DEVELOPMENTAL GENETICS 23:215–229 (1998)

Klinefelter's Syndrome as a Model of Anomalous Cerebral Laterality: Testing Gene Dosage in the X Chromosome Pseudoautosomal Region Using a DNA Microarray

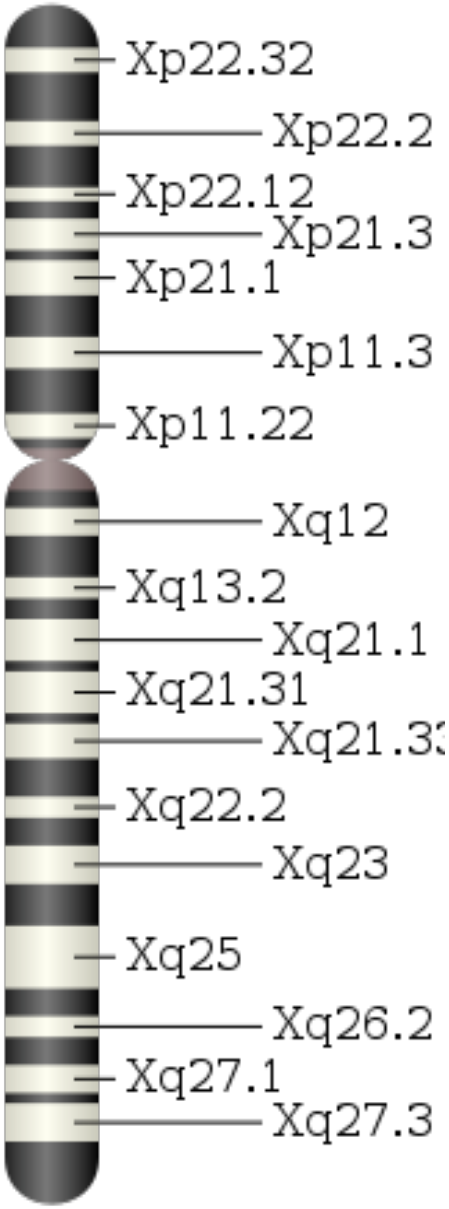
D.H. GESCHWIND,[1]* J. GREGG,[2] K. BOONE,[3] J. KARRIM,[1] ANNA PAWLIKOWSKA-HADDAL,[3] E. RAO,[4] J. ELLISON,[5] A. CICCODICOLA,[6] M. D'URSO,[6] R. WOODS,[1] G.A. RAPPOLD,[4] R. SWERDLOFF,[3] AND S.F. NELSON[7,8]

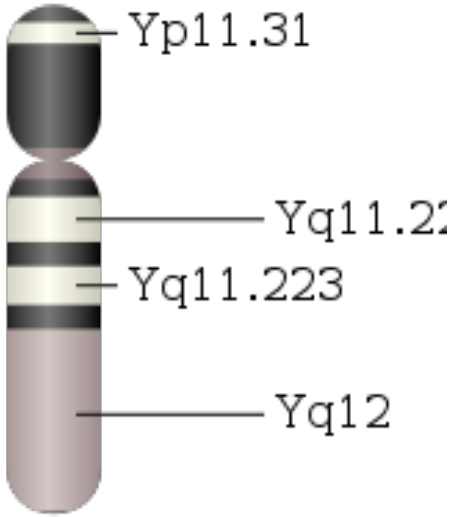
Child Neuropsychol. 2008 Mar;14(2):135-47.

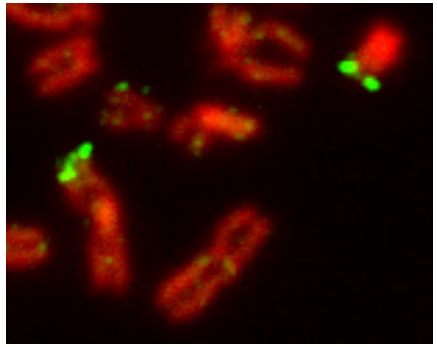
Cerebral laterality in Turner syndrome: a critical review of the literature.

Ganou M, Grouios G.

The human gonosomes





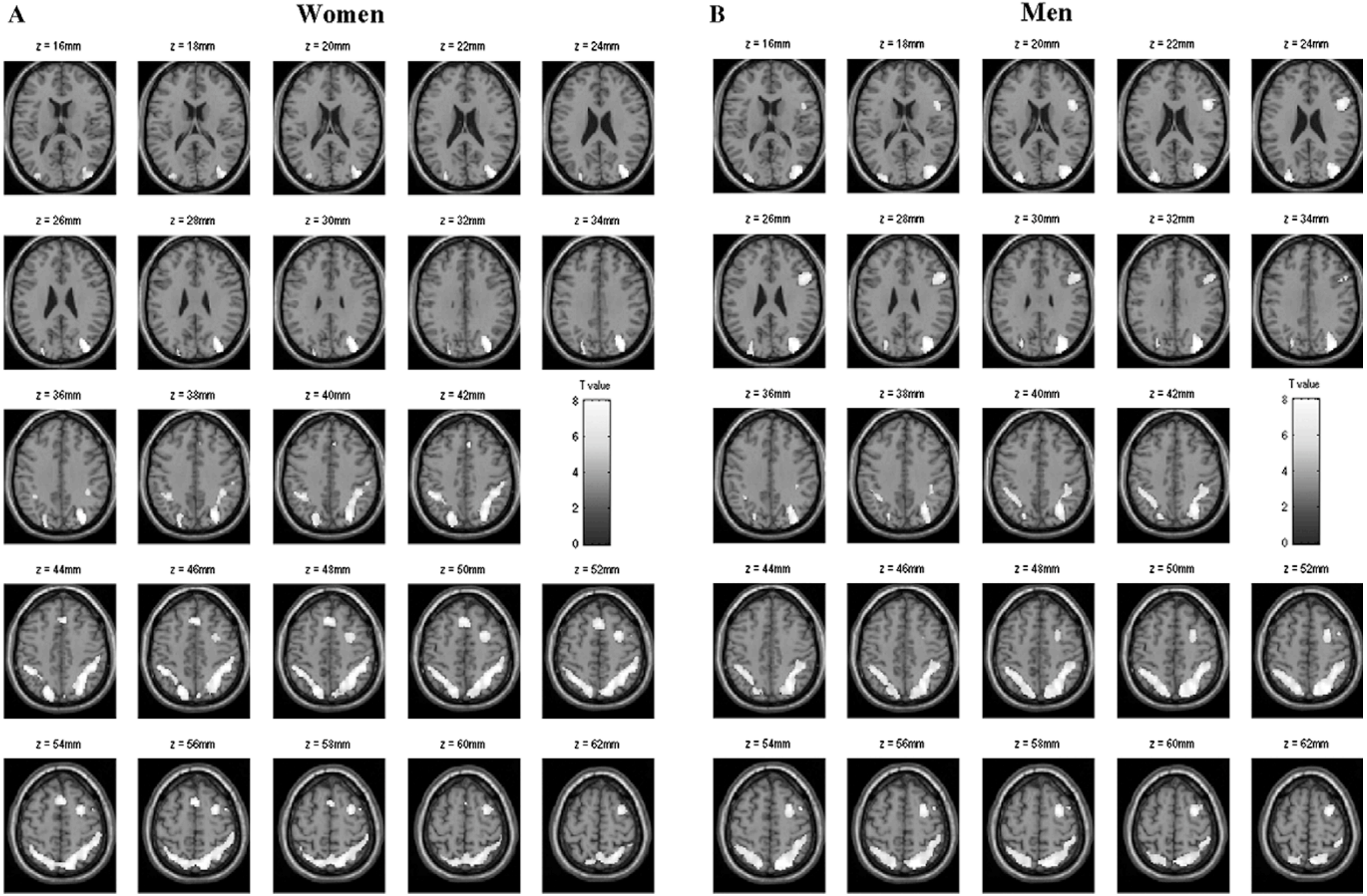


The pseudo-autosomal regions are labelled green

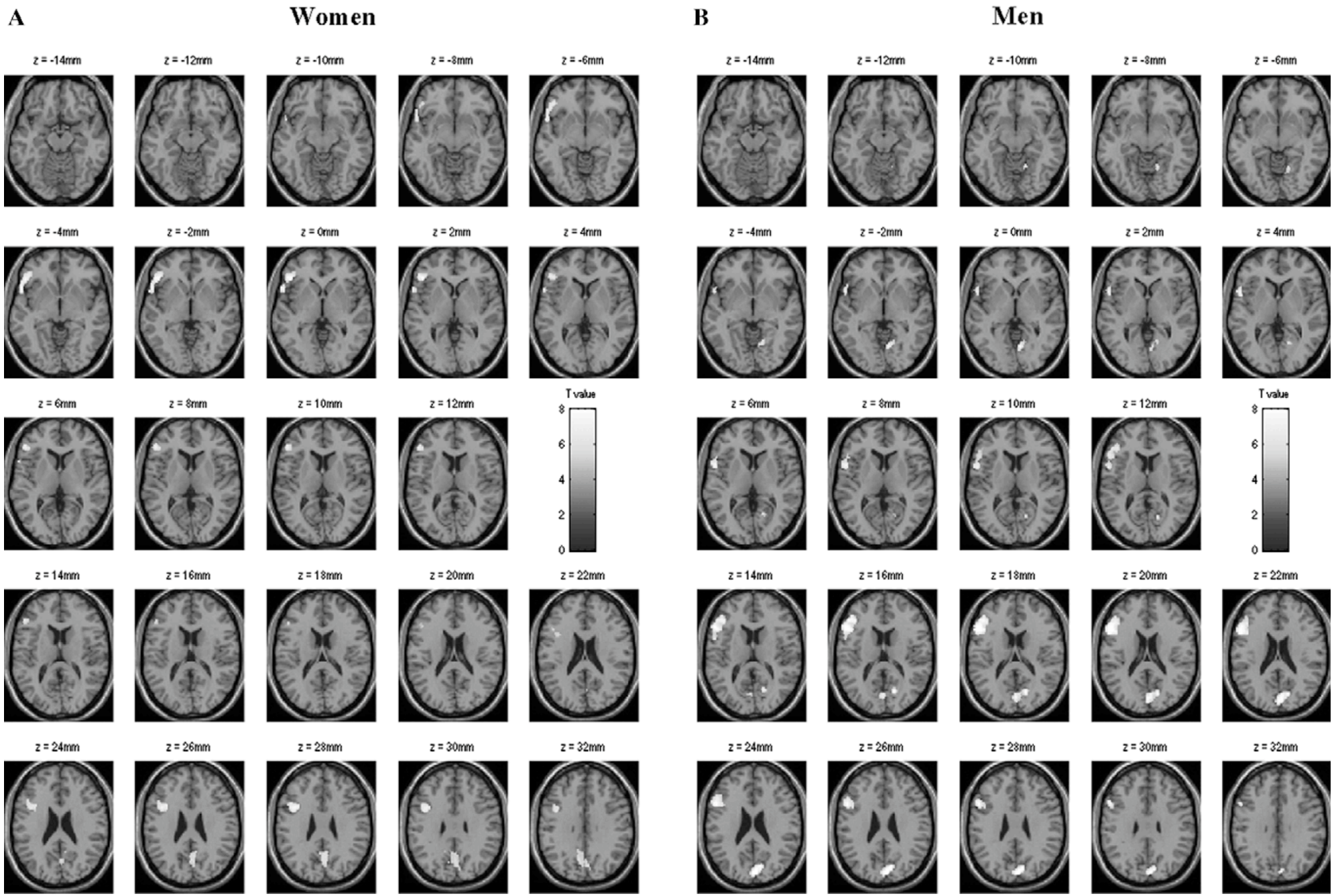
Sex differences in cerebral laterality of language and visuospatial processing

Clements et al. (2006) Brain and Language 98, 150–158

The authors used functional magnetic resonance imaging to study thirty participants, matched on task performance, during phonological and visuospatial tasks. For each task, region-of-interest analyses were used to test differences in cerebral laterality



Contrast images for **visuospatial task** greater than baseline visual discrimination task in females (A) and males (B).



Contrast images for phonological task greater than baseline visual-matching task in females (A) and males (B).

Summary

Results indicate that lateralization differences exist:

Males are more left lateralized during the phonological task and show greater bilateral activity during the visuospatial task.

Females showed greater bilateral activity during the phonological task and were more right lateralized during the visuospatial task.

Thank you