

Hello and welcome to our second report on our Tourette Syndrome research at the University of Sussex. We have put together this newsletter to keep you up-to-date with the progress of our studies and new research findings at Sussex.

Do get in touch if you would like to ask questions or give us feedback.

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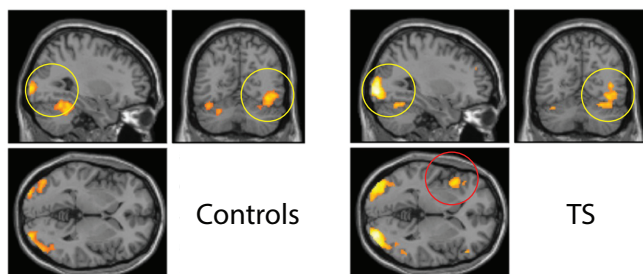
### Face perception in people with tics

One feature of TS you may have experienced is that the environment you are in can influence your tics. For example, the people or objects around you might mean you are more likely to perform a particular tic, or might mean your tics get more frequent in general. We think this may relate in part to the stress of being observed by people who don't understand the condition, and influences of the bodily stress response on neural activity.

We were very curious to find out how seeing people in your surroundings might influence activity in the movement parts of the brain, as we might then be able to better explain the neural basis for this common TS experience of tics being triggered by people around you.

During one of the brain scans, we measured participants' brain activity with fMRI while they saw faces. We asked participants to rate whether the face was male or female to make sure people were focusing on looking at the face, but we were not interested in how people make "male or female" judgements per se – instead we were investigating how activity might be altered in visual and movement areas of the brain while participants were looking at the faces.

We found that activity in visual parts of the brain (circled in yellow) was not radically different between people with TS and controls.



However, we were astonished to find that people with TS additionally activated an area of the brain that the controls did not. This region is called the insula (circled in red).

The insula is associated with processing bodily feelings. We next investigated what activating this region in response to seeing faces might mean for tics. Using a particular brain scan analysis technique, we found that during seeing faces, activity in this insula region propagated to movement areas of the brain (such as the primary motor cortex), and that the degree of activity propagation correlated with individual participants' tic severity in everyday life.

We think this reveals a new neural mechanism by which encountering a potentially stressful social environment may trigger the worsening of tics: through movement circuits that are already slightly "out of balance", combined with increased sensitivity to bodily feelings via an over-active insula, that propagates activity to movement areas under stressful scenarios – tipping an "out of balance" movement circuit even further towards generating tics.

Our next steps are to write these exciting findings for publication in scientific journals. We look forward to sending you copies of the papers when they are published.

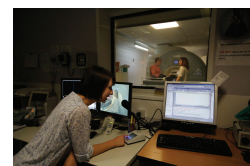
### Study funding

Our MRI study was funded by a donation from the Dr Mortimer and Theresa Sackler Foundation. [www.sussex.ac.uk/sackler](http://www.sussex.ac.uk/sackler)

### 2016-2017 study progress

In 2016 we completed our data collection, having seen 25 people with TS and a group of control participants without tics. We are very grateful to everyone who gave up their time to take part in our MRI brain scanning study. Taking part in brain scanning research can be intimidating, especially if you have tics, so we would like to thank everyone who gave it a go.

In 2017 we moved to the data analysis stage. Our participants provided us with a lot of exciting data to analyse, including not just MRI brain scans but also tests of your bodily perception and questionnaire ratings on your experiences of TS.



In this newsletter we report just some of our fMRI findings so far. We are writing several journal articles to communicate these new insights into TS to our academic research colleagues, some of which are currently under consideration for publication. Once the articles are published in journals, we will be glad to provide you with copies.

In addition to the research insights that we are getting from our study participants, we have also performed a 'meta-analysis' of previously published brain scanning studies of TS. This has just been published in the journal *Neuroimage: Clinical*. We tell you more about the findings below.

Over the next year we will continue to analyse our large dataset and look forward to telling you about more results in a year's time.

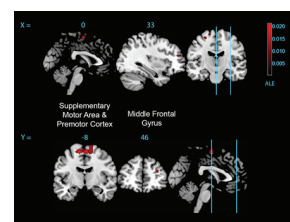
### New meta-analysis publication

In addition to our own research studies here at Sussex, we have conducted a 'meta-analysis' of previously published brain scanning studies. Although research on TS lags behind investigations of other neurological conditions, there are now several published fMRI studies on the condition.

A 'meta-analysis' uses specialised statistical techniques to pool together the results from many individual published studies. We predicted that we would see evidence across the papers from other research teams for changes in activity in movement regions of the brain in TS. However, we were very surprised to see that not only was there evidence for altered activity in movement regions, there was additional evidence for much more widespread alterations, across many regions of the brain.

We think that this may represent the diversity of individuals who have TS and often widely varying symptom profiles, not just in tics, but also in comorbid (accompanying) conditions, such as ADHD and OCD.

It was very interesting to see however that when it came to altered activity in regions that were specifically linked to tic severity, it was only movement planning areas of the brain that were identified. This suggests there are indeed quite specific changes in movement circuits of the brain that relate closely to tics, while other features of the condition may be driven by alterations in brain regions outside the core movement areas.



Brain areas in which altered activity on fMRI scans is correlated with tic severity

You can download the paper for free here <http://www.sciencedirect.com/science/article/pii/S2213158217301948> or you are welcome to email us for a copy ([c.rae@bsms.ac.uk](mailto:c.rae@bsms.ac.uk)).

Polyanska L, Critchley HD, Rae CL. (2017) Centrality of prefrontal and motor preparation cortices to Tourette Syndrome revealed by meta-analysis of task-based neuroimaging studies. *Neuroimage: Clinical*. 16:257-267.

### Acknowledgements

We would like to thank our research volunteers for taking part.



We would also like to thank Tourettes Action for their support for the study and help in advertising for participants, which was invaluable in helping us recruit the number of volunteers we needed.