ADHD

Dividing and Drugging

This paper is one section of a full critique of ADHD drugging in the UK.

For the full paper please visit:

http://thenewobserver.co.uk/features/adhd/

The genome study; a study in the misuse of science

“Rare chromosomal deletions and duplications in attention-deficit hyperactivity disorder: a genome-wide analysis” (Nigel M Williams *et al.* 2010) was published in the Lancet in September 2010. [1] The work was carried out at Cardiff University. This study is significant because it is used to lend weight to the “ADHD is a genetic disease” narrative.

i) The construction and findings of the study

The study we are reviewing here is a genome-wide association study. Studies of this kind attempt to find correlations between certain traits and genetic factors. The study took a group of 410 “ADHD children” and used genetic analysis methods to count the number of large chromosomal abnormalities, of a certain kind, they had. The study authors then compared these findings with a dataset of controls based on the population at large.

The chromosomal abnormalities under consideration are large chromosomal deletions and duplications. Deletions are when there is a bit of genetic material missing on the chromosome. Duplications are when a section of genetic material is duplicated on the chromosome. The researchers call these two types of abnormalities collectively “CNVs”. Once they had excluded some subjects where the genetic analysis had produced unreliable results the researchers were left with 366 “patients”. The rate of CNVs in this group was compared with a data set from a group of controls supplied by the Wellcome Trust. The control data set was from a cohort of people born in 1958. Overall the researchers found that there was a higher rate of CNVs in the “ADHD” group than in the control group. Rate here is a statistical term. It is total number of CNVs / number of people. Thus it is the average number of CNVs per person. This is a type of analysis in which persons are eroded from sight beneath mathematical sums. The figure thus obtained does not relate to any one individual. Does the methodology give us a clue as to the orientation of the study? Does the “rate” calculation have any medical application? Or is it concerned with assembling numeric proof of difference between the two groups? The researchers also supplied “clinical data”. The “clinical data” recorded the number of individual human beings with one of more large CNVs. In the ADHD group there were 50 out of the total of 366 with one of more large CNVs. In the controls 75 out of 1047. That is 13.6% of the “ADHD children” had one or more large CNVs and 7.2% of the controls. (Using the alternative more statistical approach; in the “ADHD” group the figure was an average of 0.156 CNVs per person compared to 0.075 in the controls). Whichever counting approach is used this is a statistically significant difference using reasonably large sample groups. On the basis of this finding the authors concluded that:

> Our findings provide genetic evidence of an increased rate of large CNVs in individuals with ADHD and suggest that ADHD is not purely a social construct. [1]

The study also found that:

> CNVs identified in our ADHD cohort were significantly enriched for loci previously reported in both autism (p=0· 0095) and schizophrenia (p=0· 010). [1]

The study included further data from Iceland. The researchers stated that the findings were replicated in this data set.

The interpretation of the genome study researchers that “ADHD is not purely a social construct” is somewhat surprising. This is not a report of an empirical result or a scientific claim. It is a political claim. In fact what they have done is show that it is possible to statistically correlate possession of an ADHD label with the genetic factor they studied. Given what is known about the links between behaviour, environment and genes this is not all that surprising. We would expect that if people are divided into groups based on behaviours there would be some genetic correlates. The specific genetic factor chosen was probably chosen because it was a strong candidate for statistical correlations. Arguably the surprise is that the significant genetic variant was only found in a small percentage of the ADHD group.

What is the purpose of showing that the ADHD label or “diagnostic category” of psychiatry can be shown to have a genetic correlation *statistically across large groups?* Precisely because the finding is a statistical one across groups and not related to individual clinical pathology the finding has little use in terms of treating any individuals for any actual disease. It can however be used to develop a wider political narrative about some people “having a genetic disease”. The way they articulate their findings politically rather than empirically shows that the study authors saw providing support for the ADHD narrative as one of their mission objectives.

The researchers broke down their findings into two groups: one of “ADHD” people with an IQ of less than 70 and one for those having an IQ of 70 or above. Having an IQ < 70 is an accepted (though arbitrary) definition of “intellectual disability”. The researchers found a significantly higher rate of CNVs in the ADHD group with an IQ < 70 than with an IQ >= 70. In the ADHD group with an IQ of less than 70 36.36% of people had one or more large CNVs. In the ADHD group with an IQ of 70 or greater 11.41% had one or more large CNVs. The average IQ for this group was 89. In the control group 7.2% had one or more large CNVs. The average IQ of this group is, by definition, 100. These findings raise the question whether the kind of behaviours which may get an “ADHD” “diagnosis” may not be a secondary “effect”. The CNVs “cause” low IQ and in turn this leads, in certain social contexts, to impulsive/inattentive behaviour. We discuss this matter in sub-section vii) below.

In the following we discuss a number of the points of interest of this study. We do not question the essential finding of the study, that a statistical correlation can be established between possession of an ADHD label and a certain genetic abnormality. However we should be cautious about what has actually been “found”. Statistical correlations do not make a disease as one of the study authors appeared to claim.

ii) Professor Thapar's stories

That the purpose of the study was to provide material to support a certain narrative is borne out by how it was promoted to the press. One of the researchers on the project gave a series of interviews to the press in which she made a series of fictitious claims about her study and what it shows. This was Professor Anita Thapar. For example, Professor Thapar told the Independent:

> Now we can say with confidence that ADHD is a genetic disease and that the brains of children with this condition develop differently to the brains of other children. [2]

And, the Wellcome Trust press office:

> Now we can show people that these children have a neurodevelopmental disorder with an observable genetic contribution. [3]

The claim made here by Professor Thapar about a “genetic disease” which effects “these children” is simply wrong and was in no way established by her study. Taking her statement at face value any member of the public would be forgiven for thinking that the study has established that every “child” “with” “ADHD” has a genetic condition. The study has not shown anything of the sort. She is making all this up. She makes these claims to the press outside a context where they would be subject to peer review but she claims the weight of her peer-reviewed study to justify them.

The Independent headlined their report:

> Bad behaviour down to genes, not poor parenting, says study [2]

This is fiction. It would appear though that this was the kind of headline which Professor Thapar was aiming at. Recall; the study simply showed that somewhat more of the “ADHD group” possessed the deleterious genetic variant than the control group. The figures were 14% in the ADHD group and 7% in the control group. Even in the 14% of the ADHD group who possessed one or more large CNVs the study did not show a causal pathway. The study did not even show that everyone who possessed this particular genetic variant would be unusually inattentive/impulsive.

Many press outlets simply repeated the stories put out by Professor Thapar. The Daily Mail’s headline for this story could have been written by Professor Thapar:

> ADHD is 'in a child's genes' as scientists provide hope to ending bad behaviour stigma. [4]

The Guardian published a piece by their Health Editor headlined “Hyperactive children may suffer from genetic disorder, says study” and the Health Editor informed her readers that:

> But today the furore around ADHD moves into a different space. Researchers, funded not by drug companies but by the Wellcome Trust and other bodies, are publishing the results of a study which for the first time identifies genetic changes in children diagnosed with ADHD. [5]

The detail that the correlation was only found in a percentage of the ADHD group is mentioned half-way down the page in this article. The above statement from the Guardian's Health Editor that the fact that the study was (part) funded by the Wellcome Trust (“not a drug company”) somehow ensures its reliability is naive to the point of absurdity. Firstly; a study can be assessed for its scientific merit on the contents of the paper; it doesn't matter who funded it. (The contentious point about funding by pharmaceutical companies is how it can distort the literature as a whole because more studies which are linked to commercial products are carried out than ones which are not linked to commercially exploitable products). Secondly; the Wellcome Trust is a not-for-profit with roots deep in the pharmaceutical industry. It appears to fund research which lends itself to supporting the ADHD-drugging narrative. (Section 5) ii)).

The BBC provided a rare critical commentary in this sea of uncritical journalism. This is the BBC's Medical Correspondent:

> There is a danger of reading too much into new research in the Lancet on attention-deficit hyperactivity disorder (ADHD). The headline of the Lancet press release says: "Study is the first to find direct evidence that ADHD is a genetic disorder". One of the authors, Professor Anita Thapar is quoted as saying: "Now we can say with confidence that ADHD is a genetic disease and that the brains of children with this condition develop differently to those of other children". That's that then. Or perhaps not. Because those bold claims do not seem to be borne out by the actual research paper.[6]

In her narrative to the press Professor Thapar does not appear to have made it clear that in fact only 14% of the young people in the study had the deleterious genetic variant. Time and time again, in the press she gave, she gives the impression that the study has shown that *all* young people labelled “ADHD” “have a neurodevelopmental disorder” or “a genetic disease”. Furthermore; she does not make it clear that even in the case of the 14% who did have the deleterious genetic variant no direct causal link has been established. The talk about “a genetic disease” and “Now we can show people that these children have a neurodevelopmental disorder with an observable genetic contribution.” [3] is pure fiction. It is quite hard to believe that Professor Thapar was simply making a number of mistakes. It seems more likely that she was simply telling stories. Her claim for a “genetic disease” is no more accurate than saying, based on a small statistical correlation between fish oil and less chance of '”getting ADHD” (which has also been established by studies which look for statistical correlations [7]), that “ADHD is a dietary disease caused by lack of fish oil”. Or, indeed that hyperactivity is a disorder related to food additives based on studies which show that food additives are linked to hyperactive behaviour in young people. [8]

It seems to be the case, based on a review of several press reports (The Independent, The Daily Mail, and the Guardian) [9][10][11], that Professor Thapar has kept largely quiet about the fact that there was also a strong correlation between IQ scores and possession of the deleterious genetic variant in her study. She does address this point in an interview with the Wellcome Trust. However here too she provides a misleading interpretation of the actual results of her study. Thapar claims (correctly) that the association was strong in the group with an IQ less than 70, but does not acknowledge that the correlation between IQ and possession of large CNVs stills exists even when this group is removed. See sub-section vii) below for a full discussion.

What these statements to the press show is that some at least in the academic community are so wedded to a certain narrative that they will tell stories. The Wellcome Trust, who part-funded the study, took up and amplified Professor Thapar's stories to the world. [12] The Wellcome Trust initially headlined their press release about this research, which they helped to fund, with the headline "Study finds first direct evidence that ADHD is a genetic disorder". They subsequently changed the headline for the article to: "Study finds first direct genetic link to ADHD". This can be confirmed by using the Wayback machine [13], an Internet service which keeps previous copies of web pages, and comparing this with the current page [12]. Whether this change (from something which is not true to something which could be defended) was made in response to this author's email correspondence with Dr Nigel Williams one of the genome study authors, and, separately, with the Press Department of the Wellcome Trust we cannot say. In many ways though the damage was done and the headline which makes the fictitious claim of “genetic disorder” was widely repeated in the medical press around the world as a “scientific discovery”.

Unfortunately the misleading claims by Professor Thapar have been taken up by people who deserve to be better informed by publicly funded scientific research. One ADHD support group, Adders.org, put out a release saying:

> This is indeed extremely welcome news of clear evidence to confirm that attention-deficit/hyperactivity disorder (ADHD) is indeed a brain development disorder with closer links to autism than was previously thought. I hope this will be a welcome relief to the many families who have to face criticism and ridicule on a daily basis, when trying to explain the behaviour of their ADHD child. I hope also that many adults with ADHD, will feel much better knowing that their condition wasn't something to do with their upbringing or diet. Extremely low self esteem is probably the biggest common factor in those diagnosed with ADHD, both children and adults. Now we can point to proof that it is a neurodevelopmental disorder. Let us hope that this leads to a better understanding and treatment for children and adult sufferers alike. [14]

The headline on this piece was:

> It's Official! ADHD Is A Genetic Disorder [14]

The Cardiff genome study does not “confirm” anything even remotely close to the wishful thinking on display here. Possibly Professor Thapar is telling these people what they apparently want to hear, but it isn't science. Adders has received drug company funding [15]. The attentive reader will note a nexus of drug companies, The Wellcome Trust, an ADHD support group and the stories told by Professor Thapar. (As a side-note it does appear that diet can be linked to “symptoms of ADHD” [16]. Adders is embarrassingly eager to leap at the “genetic” narrative).

It seems that Professor Thapar has a “theory” about “ADHD” and eager to prove her “theory” made much more out of the actual findings of the genome study than they can in fact support. Here is Professor Nigel Williams, one of the lead researchers on the study, also talking to the Wellcome Trust:

> These findings are testament to the perseverance of Professor Thapar and colleagues to prove the often unfashionable theory that ADHD is a brain disorder with genetic links. [12]

This statement confirms that Professor Thapar is indeed persevering in trying to “prove” her theory. So persevering in fact that she didn't let the actual results of her study get in the way.

The explanation has been offered to this author in private email correspondence, with Dr Nigel Williams who led the study, that the large CNVs identified by the study should be understood as a “risk factor” which could determine the chances that someone might “get ADHD”. This is a welcome correction of Professor Thapar's wild claims, and indeed the statements Dr Nigel Williams made to the press were more accurate than those of Professor Thapar. The report of the study carried by Channel 4, for example, shows Dr Williams making it clear that the study showed a statistical correlation and not an explanation of a “disease”:

> Children with ADHD have a significantly higher rate of missing or duplicated DNA segments compared to other children and we have seen a clear genetic link between these segments and other brain disorders. [17]

However even this statement is potentially misleading. 76% of the “ADHD” young people in the study *did not* possess a large CNV. They are completely in the clear. They do not possess the factor in question. Dr Williams may perhaps be thinking of the rate calculation which we discussed above. If you divide the overall number of CNVs in a group by the number of people in the group then the ADHD group as a whole has a higher 'rate' of CNVs than the control group. Using this statistical method enables Dr Williams to make general claims about the ADHD group (in his study) as a whole and treated statistically. But in this statistical working of the empirical results individuals become nothing more than statistical abstractions. The empirical result was that in the ADHD group 14% of individuals possessed one or more large CNVs. And in the control group the figure was 7%. Looking at the results directly without the benefit of statistics makes it clear that the majority of young people in the ADHD group did not possess a large CNV. This makes it clear that the genetic factor identified in the study cannot be an explaining factor in the majority of cases. The statistical method makes it easier to generate the genetic narrative. But the public should be aware that this is a mathematical abstraction.

iii) “ADHD” is still a construct however often they use the word “disease”

“ADHD” is a term which has meaning in a psychiatric system of classification. Its “validity” as a genetic or biological disorder can be bolstered by findings which produce statistical correlations between groups of people so labelled and various physical factors. It is not a term of the same order as say “Cystic Fibrosis”, or lung cancer, terms which always refer to a physical condition. Someone does not “have” ADHD in the same way that they have Cystic Fibrosis. In the latter case the “having” refers in each and every case to something physical which the person really has, which can be tested in a laboratory and is experienced by the person. None of these apply when a person is said to “have” “ADHD”.

ADHD was brought into being by being defined in the 1987 edition of the Diagnostical and Statistical Manual of Mental Disorders, the handbook of the American Psychiatric Association. There were forerunners. “Hyperkinetic reaction of childhood" was introduced in the 1968 edition. ADD (Attention Deficit Disorder) was introduced in the 1980 edition. As is the case with other psychiatric disorders ADHD is defined in terms of behaviour observed by a psychiatrist. Reports by parents and teachers can be taken in evidence. (Contribute to helping the psychiatrist make a “diagnosis”). Since many of the check-list points which form the “diagnosis” relate to compliance with adult instructions the system is one which contains the potential to be fundamentally unjust. Who is to define, for example, when not finishing chores (one of the DSM-IV criteria, see Appendix i)) is reasonable and when it is a “sign” of a “disorder”? Do all parents have the same expectations around “chores”? There is no scope within the diagnostic system to investigate whether the chores that are not finished were a reasonable demand. This is a sinister system which, like 18th century *lettres de cachet*, allows family members to put others away for non-compliance.

The attempt to find a biological basis for “ADHD” is a game of catch-up. The Cardiff genome study found that 14% of the “ADHD” subjects had one or more large CNVs, compared to 7% in the general population. The response of the authors of this study when questioned as to why they were making claims about a “genetic disease” on the basis of just 14% of their sample possessing the identified genetic factor is that the other factors have simply “yet to be identified”. For example; the Guardian reported:

> Although this finding was limited to 16% of all the children with ADHD, they say it is highly likely the rest have other genetic variants that have not yet been identified. [5]

See also this report in the Daily Mail [10] which reports the same argument. (The 16% figure in the Guardian report seems to relate to the statistical method of presenting the results. This divides the total number of CNVs found by the number of people in the group to produce a statistical "rate'" figure. The statistical figure produces a slightly higher figure than the clinical figure which counts the number of individuals with one or more large CNVs (14%). 15.6% has been rounded up here to produce 16%).

Right now only 14% of the "ADHD" group had the significant genetic variant tested for and studies testing for other genetic variants have yet to be carried out. If the "condition" is the result of a range of genetic factors then it is *still* a construct. It is a label which is then back-filled by statistical studies to give it some "validity". Any correlation at all is taken as providing that validity. At the moment there is no evidence for the other genetic factors which the authors confidently expect to be identified. The claim that in time other genetic correlating factors will be found to fully or nearly fully explain "ADHD" is unscientific. It is a proposition which cannot be falsified. This is akin to claiming that pink giraffes exist somewhere on the planet. Such a proposition could in theory be proven, by finding one. It cannot, however, ever be disproved. Genome wide association studies work by identifying and counting genetic factors of some kind and contrasting the count between the control group and the target group. To prove that other genetic factors are not involved would involve producing a list of all possible candidates and testing for each one. That list is open-ended. Those who make the claim that "the other genetic factors exist but have yet to be found" are not making claims which can be be tested. In making these claims about other proposed genetic factors which will be found the genetics lobby is privileging its own role. It is inherently unlikely that the fabled "other genetic variants" will be found in anything even remotely approaching 100% of an ADHD group. Similar claims have long been made for schizophrenia, yet genetics research in this area has yet to produce anything like a clear-cut list of genetic variants which are always associated with a diagnosis of "schizophrenia". It is a reasonable hypothesis that *some* other genetic correlates will be found. It is not scientifically plausible to say that "the rest" will *all* be found to have a genetic factor.

Even in its own terms the genetic story is too simple. Even when there is evidence of a genetic correlating factor the determinant can be an interaction between genes and environment. (I.e. a person could have this genetic variant but if their environment were different they would not manifest the behaviour). Furthermore; there are a range of possible environmental causes for inattentive/impulsive behaviour which may or may not interact with a genetic predisposition. For example; diet [18], use of stimulant drugs, maternal abuse of drugs, lead poisoning, and mild closed head injuries. [19] There is also a statistically significant association between the mother's consumption of fish during pregnancy and the likelihood of her child being seen as exhibiting ADHD behaviours by a teacher. (More consumption of fish reduced the chances of an ADHD diagnosis). [7] Given the range of possible correlations it becomes clear that even as a category of psychiatry "ADHD" is doubtful. A construct which can be linked in some cases to environmental factors such as fish oil, IQ, maternal drug abuse, head injuries and to a genetic factor (though not to any one specific missing or damaged gene) is not a "genetic disease".

The Cardiff researchers claim that showing a statistical link between possession of an ADHD label and a certain kind of genetic damage shows that ADHD is "is not purely a social construct". But this is not the case. ADHD is "purely a social construct". It does not exist in nature. It was brought into being in DSM-IV by the American Psychiatric Association in 1987. If the Committee hadn't decided to include it it wouldn't "exist". What the Cardiff researchers mean is that this "social construct" can be correlated, statistically, to some genetic factors. Therefore it isn't a complete phantasy. They are saying that the behaviours that fall under an "ADHD" umbrella in some cases have a genetic background. To anyone who knows that there is a correlation between biology and behaviour this is no surprise. Nonetheless ADHD is a "social construct". It doesn't need to exist. Other sets of behaviours could be identified and labelled and linked to genetic factors but are not. The institution of psychiatry has created the label "ADHD".

It has been demonstrated that in some instances of ADHD labelling the whole thing is in the imaginations of school-teachers and psychiatrists. It has been demonstrated that young people who are young for the class are more likely than their peers to receive an ADHD “diagnosis”. This finding has been repeated in three separate studies. [20][21][22] This finding shows conclusively that the “ADHD” label is not 100% linked to genetic factors, as the Cardiff researchers apparently propose. Unless, that is, we are to suppose that genetic variations are not evenly distributed across all birth dates. (Which would suggest a belief in astrology). The Cardiff researchers' dream of “the rest having other genetic variants” has *already* been comprehensively disproved. We look at these studies in more detail in sub-section vi) below.

The authors of the Cardiff genome study have assumed that something called ADHD exists. They referred to “children with ADHD” and “participants with ADHD” no less than 27 times in their paper. But this supposed ontological, actually existing, condition was not established before the genome study and was not established by it. The Cardiff researchers offer statistical correlations not accounts of disease pathways. They have researched correlates between possession of a label (which was awarded without a biological test) and a genetic factor. They have not researched a physical condition called “ADHD” as they appear to believe they have done.

iv) Removing stigmatization

In statements to the press the authors of the genome study claimed that the findings would “help overcome the stigma associated with ADHD “. [12] This claim makes Professor Thapar and her colleagues appear in the role of knights in shining armour riding to the rescue. Part of the reason for making this claim may be to counter the obvious criticism of the study that it has no clinical purpose. Its purpose, as we have discussed above, appears to be political. It appears aimed at developing the narrative that “ADHD is a genetic disease”.

The argument about stigmatization seems to be that there is a stigma arising from a perception that inattentiveness/impulsivity is due to bad parenting which the parents “of ADHD children” suffer from. Unless the Wellcome Trust Press Office has mixed up the quotes the implication therefore is that the stigma which Professor Thapar thinks she has helped removed is the one that apparently attaches to parents. It is not, as one might have expected, the one which attaches to the young people who actually have to carry the label:

> We hope that these findings will help overcome the stigma associated with ADHD," says Professor Anita Thapar. "Too often, people dismiss ADHD as being down to bad parenting or poor diet. As a clinician, it was clear to me that this was unlikely to be the case. Now we can say with confidence that ADHD is a genetic disease and that the brains of children with this condition develop differently to those of other children. [12]

In other words; the children really are bad. Faulty goods to the core. The parents cannot be blamed. There is some faulty reasoning here though. If only 14% of the subjects in the study possess the relevant genetic characteristic how, rationally, does that in fact remove the stigma from these parents? Assuming for a moment that such a stigma exists and it is the job of geneticists to remove it. Does a stigmatised ADHD parent say “well, there is a 14% chance that my child has a genetic variant which is associated with inattentive behaviours so you can't stigmatise me”? It is totally absurd.

The proposal by Professor Thapar about “removing stigmatisation” suggests some polarised thinking. The thinking appears to be that “ADHD” is either down to “genes” or

“bad parenting”. Professor Thapar seems to think that the public believe 'it' is down to “bad parenting” and hold the parents of ADHD children in low esteem as a result. She then, with her genetic study, is showing the public, on behalf of ADHD parents, that in fact “ADHD is a genetic disease” and thus 'it' is not down to “bad parenting”. It seems the basic dynamic is a proposal that ADHD parents who are being “stigmatised” are being invited to improve this with the comforting thought that their children really are genetically faulty. In fact though it does not appear to be the case that the public holds in large numbers to this “bad parenting” “causing ADHD” narrative. At least the comments threads when the online press covers ADHD stories tend to divide into those expressing scepticism about the label, a minority who think that the problem is a lack of discipline in modern society and a few strident believers in “ADHD”. The “bad parenting” narrative appears to be largely a creation of Professor Thapar. Possibly some of the parents she meets in her clinical practice (Thapar runs an ADHD clinic) really do report that they feel that other people blame them for being “bad parents”. But, shifting the blame onto the children, is not a real solution to such feelings. It should be possible to reassure parents that they are not “bad parents”, if indeed they aren't, without pinning a “faulty” sticker onto their child.

The serious stigmatisation in the ADHD story relates to the experience that ADHD labelled young people have. Once labelled they are marked out as different from their peers. The ADHD label may well make it harder for them to make friends. Being labelled as different is not an easy experience for a young person. That is why discipline systems in schools have historically used just such marking out as different as a technique of punishment. (Dunce's cap, ADHD label).

Finally, it should be added that if there is a stigma associated with the diagnostic category of ADHD the simplest way to resolve the problem would be to stop labelling young people. Thapar is blind to the role that psychiatric labelling plays in creating ground for stigmatization.

v) More effective treatments

Apart from the “removing stigmatisation” claim the other claim which Professor Thapar makes for her study is that it will lead to “more precisely tailored treatments”:

> These aren't the sort of findings that will lead to a test for ADHD. We already have that - the best method for diagnosis at present is to ask the right sorts of detailed, careful questions. But this type of research might help us to refine our diagnoses or define meaningful subgroups. Most importantly, the results can help us understand the causes and biology of ADHD, which can suggest how it might be treated. At the moment, we only have a limited range of treatments available; but if we can understand what is happening in the brain during the development of ADHD, we might be able to develop more precisely tailored, more effective treatments. [23]

Once again though Professor Thapar is confused. If there is no test for ADHD, and she is at pains to explain that her study will not lead to a test, on what basis would these new “treatments” be distributed? You cannot rationally suggest that a treatment should be given “for ADHD” based on a survey which found 14% possessed a certain trait and at the same time declare that no test which could establish whether or not someone was in that 14% be developed. A “treatment” developed on the basis of this study but then administered to all young people with an ADHD label would be like playing Russian roulette with 5 bullets in a 6 chambered revolver. Five young people would get a treatment they didn't need, with all the “side-effects” (see Section 3) v)) that might entail, for each one who got the “precisely tailored” treatment.

Possibly one reason why Thapar is keen to emphasise that her study should not lead to a test “for ADHD” is were it to form the basis of a test the numbers “diagnosed” would drop overnight to 13.6% of their current levels. (Not even the 15.6% produced by the rate method; see sub-section i) above).

The genome study has not shown that the identified genetic variant is other than correlated statistically to possession of an ADHD label. It has not shown a causal pathway. And in fact the evidence from the study is that in the 14% with the statistically relevant genetic variant IQ plays a significant part too. Is Thapar planning to “treat” low IQ? Even leaving those considerations aside Thapar does not explain what kinds of “treatments” are available for chromosomal duplications and deletions. The “more precisely tailored treatments” are not specified. Is she proposing gene therapy for young people identified as “having ADHD”? That would surely imply a test? In fact; it is more likely that talk of these mysterious “more precisely tailored treatments” is simply fiction.

In general terms *statistical* studies which show correlations between a physical factor and a certain behaviour trait cannot lead to treatments. Highlighting difference statistically is not medically useful. Again, then, the question of the purpose of this kind of study (statistical correlations at the genetic level) is raised. In the absence of any other clinical derivatives from this kind of study the suspicion must be that the main purpose is to develop the biological narrative about “ADHD”, which in turn is aimed at legitimizing drugging. Certainly the narrative about “While the exact cause of ADHD is as yet unknown, it is generally accepted that it is likely to be biological in nature” is often found in close proximity to the narrative about “chemical imbalance” and in turn to the narrative about “the benefits of the drug.” (See for example this folksy leaflet about ADHD from Gateshead Council: [24]).

vi) Teachers' perceptions

Research has indicated that teachers' perceptions play a role in leading to an “ADHD” “diagnosis”. It has been shown by three separate studies that age in class is a significant risk-factor in being labelled “ADHD”. We mentioned these studies in sub-section iii) above. Two of these studies were published in the September 2010 issue of the Journal of Health Economics [20] [21]. The other was published in the Canadian Medical Association Journal in 2012. [22] The three studies have independently confirmed that there is a significant correlation between ADHD diagnosis and age in class. All three studies also showed that this correlation extended to likelihood of being drugged. The results of these studies present a very different narrative to the narrative about “ADHD” being developed by Professor Thapar. They conclusively show that, contrary to the claims apparently made by the genome study authors [5], it will not be the case that a fully “genetic explanation” will ever be produced to account for the ADHD label.

The correlation with age was significant. For example in Richard L. Morrow *et al.* 2012. [22] the study found that boys who were born in December were 30% more likely to receive a “diagnosis” of ADHD than boys born in January. Boys born in December were 41% more likely to be given a prescription for a “medication” (drugged) than if they were born in January. The figures for girls were 70% more likely for the “diagnosis” and 77% more likely for drugging. The reason is that birth month determines which year group a student joins in school and thus whether they are young for the class or old for the class. Those young for the class were likely to be “misdiagnosed” as “having” “ADHD”. Their age appropriate behaviour is misread as “symptoms of ADHD”. In Todd E. Elder 2010 the finding was that young people in the fifth and eighth grades were “nearly twice as likely as their older classmates to regularly use stimulants prescribed to treat ADHD”. [21] This latter finding is on a par with the strength of the genetic correlation found in the Cardiff genome study.

Speaking about his paper "The importance of relative standards in ADHD diagnoses: Evidence based on exact birth dates" [21] Dr Todd Elder, Assistant Professor of Economics at Michigan State University commented:

> If a child is behaving poorly, if he's inattentive, if he can't sit still, it may simply be because he's 5 and the other kids are 6. [25]

The findings from the two studies published in the Journal of Health Economics studies are summarised here. The italics are mine:

- ADHD diagnoses are driven by subjective comparisons across children in the same grade.
- The youngest children in school are twice as likely to use Ritalin as older children.
- *Teachers' perceptions are the mechanisms that drive these relationships.*

Todd E. Elder 2010 [21]

- Rising rates of ADHD have lead to the concern that ADHD is often misdiagnosed.
- We find evidence of medically inappropriate ADHD diagnosis and treatment in school-age children.
- Children younger than classroom peers have significantly higher rates of ADHD.
- *Age relative to peers directly affects a child's probability of being diagnosed with ADHD*.

William N. Evans, Melinda S. Morrill, Stephen T. Parente. 2010 [20]

Recall at this point how behaviour in class is a critical part of the ADHD diagnosis and how teachers play a role in the "diagnosis". NICE specifically recommends this:

> While universal screening of the school population is not recommended, teachers may benefit from receiving some training to help them spot children who are suspected of having ADHD in order to initiate referrals and to implement support packages
> at the earliest possible stage. [26]

and

> Tier 1 professionals (including healthcare professionals and teachers) working in settings where children at high risk of ADHD might present should consider the possibility of ADHD. [27]

and

> A diagnosis of ADHD should not be made solely on the basis of rating scale or observational data. However rating scales such as the Conners' rating scales and the Strengths and Difficulties questionnaire are valuable adjuncts, and observations (for example, at school) are useful when there is doubt about symptoms. [28]

The studies cited were conducted in America and Canada. However given the role of teachers in “spotting” “children with ADHD” recommended by NICE it seems likely that a similar picture would be found in the UK too.

It is interesting to note that two of these three studies were published in September 2010, in the same month that the genome study was published. The genome-wide association study, according to its lead author Dr Nigel Williams, showed “Children with ADHD have a significantly higher rate of missing or duplicated DNA segments compared to other children” [17]. The papers, which were published in the Journal of Health Economics, showed “Children younger than classroom peers have significantly higher rates of ADHD” (William N. Evans *et al*.) [20] and “ADHD diagnoses are driven by subjective comparisons across children in the same grade” (Todd E. Elder. 2010) [21]. The genome study gained, as we have seen, considerable media traction. But there were no headlines screaming “Studies show that ADHD depends on teachers' perceptions”.

vii) IQ as a covariant

The Cardiff genome study was a genome-wide association study. In studies of this kind which seek to identify a single specific factor which is linked to the trait being studied it is sometimes necessary to identify other factors, which could be the actual explaining element. These other factors are called co-variants. To obtain the evidence of a link between the being tested factor and the trait in question co-variants need to be controlled for. A simple example illustrates this point, as follows. When constructing a study to evaluate the effects of smoking on life-span by comparing a group of smokers with a group of non-smokers it might be necessary to control for alcohol consumption too. The study might show that smokers are more likely to die 10 years earlier than non-smokers, but if it is the case that the group of smokers also consume twice as much alcohol as the control group then we could not be sure that it was not the alcohol consumption rather than the smoking which was linked to the shortened life-spans. To show that smoking was the relevant factor alcohol would have to be identified as a co-variant and the test group would have to be selected to have the same alcohol consumption patterns as the control group. This is a standard practice for these kinds of studies. ADHD is known to be associated with low IQ. (On average). The IQ data for the ADHD group in the genome study confirms this. (The average IQ score for the whole ADHD group was 86). This raises the question as to whether the genome study should not have treated IQ as a co-variant and controlled for it. Without controlling for IQ it can be argued that IQ rather than the genetic factor is the explaining factor for the ADHD behaviours.

I put the point to Dr Nigel Williams, one of the authors of this study, that IQ should have been treated as covariant. His response was to direct my attention to a paper "Why IQ is not a covariate in cognitive studies of neurodevelopmental disorders" (Dennis M. *et al*. 2009). [29] This paper argues firstly, in a section titled “The Historical Reification of General Intelligence”, that IQ is not a measure of anything. It is simply a measure with a questionable political history that one assumes, wrongly, to be a measure of something objective. Given that the ADHD narrative is built-up with reification upon reification there is considerable irony in being referred to a paper which presents an argument about reification in the context of defending ADHD. However, the covariate paper accepts that this argument about IQ not being an objective measure may not be 100% convincing. After all IQ probably measures something (even if it is not a single “thing”). The argument then moves on to a more complex discussion about whether IQ should be treated as a covariant in studies of “neurodevelopmental disorders”, such as ADHD. (Like all psychiatric papers relating to “ADHD” these authors too talk about the psychiatric label ADHD as if it

refers to something which exists). The argument is that lower than average IQ is known to be a factor in learning difficulties and “neurodevelopmental disorders” in general and so to try to control for this factor would be to create an artificial group and would likely distort the findings from the study. The authors write:

> To the extent that IQ represents the same processes as the construct of interest, then controlling for IQ removes variability in the outcome measure that is directly related to the construct of interest. [30]

and

> Covariance analysis using IQ is usually predicated on the hypothesis that IQ “causes” the difference on a correlated variable (e.g., memory). When there is an inherent IQ difference between groups and the IQ difference is not separable from the level of the independent variable to which the patient belongs, the causal mechanism cannot be determined. The group difference in IQ remains a potential explanation for group differences on other cognitive measures and cannot be ruled out through statistical adjustment or explained away statistically, regardless of whether IQ is significant as a covariate or whether the differences on the dependent variables are significant. [31]

What these authors are saying, as applied to the case of ADHD studies, is that to control an ADHD group for IQ (perhaps by selecting an ADHD group with an average IQ of 100) would be to create an unrepresentative ADHD group. For this reason they suggest that the ADHD group should not be controlled for IQ. This advice appears to have been followed by the authors of the genome study. This means, though, that it will not be possible to say that it is not the low IQ which is causing the differences between the groups. As Dennis M. *et al*. say: “The group difference in IQ remains a potential explanation for group differences on other cognitive measures and cannot be ruled out through statistical adjustment ...“. In the case of the genome study this means that the authors cannot say that the large CNVs are the explanatory factor for the ADHD behaviours. Inattentiveness/impulsivity (“ADHD”) is confounded with low IQ and the exact causal relationships cannot be indicated by a study of this kind.

Had the authors of the genome study ignored this advice and controlled for IQ as a covariant they would have found much less of a difference in the rate of possession of large CNVs between the ADHD group and the control group than they did. Quite possibly they would have found no difference at all. The following table shows the different groups and the percentage of individuals in each group who possessed one or more large CNVs. This data is all contained in the study.

Group	**Average IQ**	**Percentage of people with one or more large CNVs**
ADHD group with IQ < 70	60	36%
All ADHD group	86	14%
ADHD group with IQ >= 70	89	11%
Controls	100 [32]	7%

The table shows that in the overall ADHD group possession of one or more large CNVs is strongly correlated to IQ score. Notice also how the chances of possessing one or more large CNVs falls as IQ rises in the ADHD group. This data suggests very clearly that had there been an ADHD group

with average IQ of 100 the percentage of young people in that group with one or more large CNVs would have been less than 11%, possibly quite close to the 7% in the control group. In which case no claim at all about “a genetic link to ADHD” [12] could have been made. These considerations make it clear that possession of an ADHD label is strongly related to IQ.

All this presents a dilemma for the authors of the genome study. If they control for IQ it seems likely based on the data from the study that they will not be able to make a claim for a “genetic link”, or if they can, one with only very slight statistical significance. If they don't control for IQ they will get the correlation between an ADHD label and possession of the identified genetic variant they want, but cannot claim it is not also linked to IQ. They want to avoid controlling for IQ but still make claims that say that the identified genetic factor is directly related to the ADHD label and the relationship is not mediated by IQ.

The solution to this dilemma was effectively a ruse using the tried and tested psychiatric technique of dividing people into categories and making claims based on those categories. The ADHD group was divided into those “with intellectual disability” and those “without intellectual disability”. Professor Thapar explains in her interview with The Wellcome Trust:

> Also emerging from the study was the finding that the increased rate of CNVs in ADHD was not related to intellectual disability. “A proportion of people with ADHD do have intellectual or learning disabilities, so it could be that the CNVs we found are related to IQ, not to ADHD," she explains. "But we've shown that these CNVs are not just found in people with learning disabilities." [23]

It is true that the study showed that there was a higher rate of CNVs in the ADHD group “with learning disabilities” (IQ < 70) than in the general population. However it is *also* true that the ADHD group without “learning difficulties” had an average IQ score significantly lower than the general population (89). Professor Thapar does not mention this. This is probably because this points to precisely the result she is trying to avoid reporting. There is a strong correlation between inattention/hyperactivity, low IQ and possession on one or more large CNVs throughout the study. Thapar attempts to box the question away by creating an artificial group, based on a category of psychiatry, of those “with learning disabilities” in whom she can acknowledge the link. But the link is still present in the remaining group. However you divide up the data the study cannot show that IQ is not a factor. In fact Thapar is attempting precisely what Dennis M. *et al*. were at pains to point out cannot be done: “The group difference in IQ remains a potential explanation for group differences on other cognitive measures and cannot be ruled out through statistical adjustment or explained away statistically”. [31]

These observations open the way to an alternative interpretation of the study. It may be that it is IQ and not inattentiveness/hyperactivity which is linked to possession of one or more large CNVs. Young people who have a lower than average IQ struggle more in class. They appear “inattentive” because they are not following the lesson. They appear “hyperactive” because, bored, they start acting up or trying to find distractions. This interpretation is as consistent with the empirical findings of the genome study as the idea that large CNVs lead directly to inattentiveness and impulsivity. Possibly more so. On this basis “ADHD” is simply a label for people with low IQ who struggle in large classes. If this is the case then the “clinical implication” is quite clear. Unrealistic demands are being placed on young people with below average IQ. Rather than drug them to try to force them to meet those demands the demands should be adjusted to what they can manage. This explanation is perhaps too simplistic. Nonetheless it is supported in broad terms by the study data and points towards one “solution” to the problem of hyperactive young people in school. And a solution which does not involve drugs.

In summary, the Cardiff genome study cannot determine if the genetic variant studied causes inattentive/hyperactive behaviours or whether it is linked to low IQ and the behaviours are a secondary effect. In her comments Professor Thapar attempts to create an impression that the correlation between large CNVs and an ADHD label is independent of IQ. The study authors want to do this so as to produce the “ADHD is a genetic disease” narrative or at least the “genetic link” narrative. But the actual data in the study directly contradicts this claim.

viii) Gender bias

The fact that IQ was strongly statistically correlated to the genetic factor studied, as well as ADHD behaviours, was not the only finding in this study which was not amplified to the press. The study reported that in the “ADHD” group there was no difference between boys and girls. Both genders carried the chromosomal duplications and deletions equally:

> In each of the ADHD and control samples, the rates of CNVs did not differ between male and female participants (data not shown; results available from NMW). [33]

This is a very interesting finding indeed. It is nothing short of astonishing that this finding found no prominence at all in the summary of the study or in Professor Thapar's round of press interviews.

In reality boys are much more likely than girls to be “diagnosed with ADHD”. It is difficult to obtain accurate figures for this. The NHS for example tracks the numbers of prescriptions issued (because of cost) but does not track who they are issued to. In general terms though there seems to be a consensus that boys up to nine times as likely to be “diagnosed with ADHD” as girls. [34] In the ADHD group selected for the Cardiff genome study there were more than six times as many boys as girls.

What does this result tell us? It more or less shouts at us that ADHD is largely to do with teachers in classrooms and parents in homes finding it harder to manage male young people than girls. It tells us that ADHD is what its critics say it is: more to do with the behaviour management requirements of schools than anything biologically “wrong” with young people so labelled. This is the case even if some biological correlates can be shown.

If the proposal is that “ADHD is a genetic disease” then the irrefutable corollary is that there is an absolute massive over-diagnosis of boys relative to girls. It might be argued that the gender imbalance in ADHD “diagnosis” or labelling reflects an “under-diagnosis” in girls. The NICE ADHD Guideline authors attempt just such a cynical escape with reference to the gender disparity in ADHD labelling. [35] Saying that girls are being “under diagnosed” however still leaves unexplained the *disparity* in rates of “diagnosis”. Whether you want to say that boys are “over-diagnosed” or that girls are “under-diagnosed” the disparity in diagnosis remains to be explained. If the biological factors are equally spread out between boys and girls then the explanation for the disparity has to be social or political.

(The suggestion might be made that the genetic factors which the authors of the Cardiff genome study propose exist but are yet to found are sex-related. However; this author has not seen the suggestion that any genetic correlation to inattentiveness/hyperactivity which may be found will be a sex-related genetic factor. As far as he is aware no one claims that “ADHD is an X

chromosome disorder" like haemophilia).

Why did the study authors and the Wellcome Trust not lead with a headline that the study showed evidence of massive over-diagnosis of boys? That a statistical correlation was found associating some members of an ADHD group with a genetic abnormality is not surprising. The news is the finding that the link cuts completely equally across the sexes. This shows that the ADHD "diagnosis" is far more influenced by social and political factors than by "genetic" ones. Given how the diagnosis is made; referrals by parents and schools based on "disruptive" behaviour this is not remotely surprising. When the authors of the Cardiff genome study trumpeted "not purely a social construct" the unpublicised subtext was "almost entirely social construct". The Cardiff genome study ignores the evidence that suggests that the construct is linked to social factors while amplifying the (much smaller) findings that do link the construct, statistically, to genetic factors. (As we have discussed above the ability to find correlating biological factors does not mean that the label is not a "construct").

ix) Quantitative genetic studies (twin studies) and the problem with the "genetic explanation"

Professor Thapar is a believer in the genetic basis "of ADHD". She wants to say with confidence that "ADHD is a genetic disease". This is however an act of faith. In her interviews with the Wellcome Trust about the findings of the genome study Professor Thapar cites twin studies as existing evidence of the genetic "contribution":

> We've known for many years that ADHD tends to run in families, so there is likely to be a genetic contribution," says Professor Thapar. "Over a decade ago, we studied identical and non-identical pairs of twins, and showed that ADHD is indeed highly heritable, as people who have close relatives with ADHD are more likely to develop it themselves." [3]

ADHD twin-studies do not in fact provide clear-cut evidence for hereditary. Twin studies work in a somewhat complex way. Essentially they take a set of non-identical twins and produce a figure for the similarity of "symptoms of ADHD" (or whatever trait is being studied) between the twins across the set. (For example; if one twin "has ADHD" what are the chances the other twin also "has ADHD?"). Then they take a set of identical twins and produce the same figure for that group. Then they compare these figures. Non-identical twins are expected to share about 50% of their DNA in common and identical twins 100%. Therefore any greater similarity in the trait being studied in the identical twin set is attributed to genetic factors. For example; in a group of non-identical twins if one twin "has ADHD" there may be a 50% chance of the other twin also "having ADHD". In a group of identical twins if one twin "has ADHD" there may be a 75% chance of the other twin "having ADHD". The higher figure in the identical twin group is ascribed to their having a higher proportion of genes in common. This shows that the trait being studied has a genetic component. The higher the difference between the two figures the more genetic the trait is taken to be.

There are though a wide range of problems with these kinds of studies. A good review of the problems with twin studies has been published by the American Psychological Association. This paper, "A second look at twin studies", (Lea Winerman 2004) [36] reviews four assumptions which underlie twin studies. The most well-known and controversial of these is known as the "equal environments assumption". The assumption is that parents of identical twins will parent them (on average over a set) in the same way as parents of non-identical twins do their twins. If this is not the case, for example if parents of identical twins in general treat their twins both in the same way to a greater extent than parents of non-identical twins do then *this* might explain the greater similarity in the identical twin group, not the greater percentage of shared genes in this group.

There is some evidence that this is the case. This assumption is therefore contested.

Another problematic assumption in twin studies from the point of view of “ADHD” is the assumption that people marry, or partner with, people who are different to them as often as with people who are similar to themselves. This is known as the “random mating assumption”. It is on this basis that it is assumed that non-identical twins have 50% of their genes in common. This is an assumption. In fact the evidence is that people tend to marry others with similar traits. This is particularly so for intelligence. Intelligence is a key factor in “ADHD”. Professor Thapar's own study shows this. Thus “ADHD” twin studies in particular should take account of non-random mating. If twin-study researchers have not taken this factor into account they may be claiming a greater genetic effect than the evidence warrants.

Another problem with twin studies is that in general they only consider the additive genetic mechanism (mixing of genes producing a 'blended' and proportional result) and not dominant genetic mechanisms. In the latter case one gene “trumps” another; it is not a question of a blended effect. The mathematics of twin-studies is based on the additive genetic mechanism.

A fourth assumption which some twin studies make is to assume that a trait is the result of either genes or environment. They underestimate the complexities of gene-environment interaction. In some cases at least the propensity of “having” a given trait is a factor not of environment or genes but genes plus environment. A study which analyses the effect in terms of either a genetic influence or an environmental influence is over-simplifying. For example developing certain kinds of “inattentive” behaviours may be a factor of having a certain kind of genetic damage and attendance at a certain kind of school. If a twin study has not considered this and made sure that school attendance was equal in both sets of twins the study will be inaccurate.

Finally, it is worthwhile to notice that the base “data” for twin studies on “ADHD” is a subjective interpretation of behaviour not a physical fact. In some twin studies at least the behaviour is recorded by parents and/or teachers. This adds a further subjective element to the reported data which cannot be controlled for. The assumption will be that parents and teachers perceive and record in the same way for identical and non identical twins. But this may not, in fact, be the case.

In general twin studies are an example of how the use of over-simplified mathematical models superimposed on reality can be used to generate narratives.

The authors of the NICE ADHD Guideline are aware of some of the limitations of twin studies. They specifically mention the equal environment assumption and accept that it can be contested:

> A systematic review of 20 population twin studies found an average heritability estimate of 76%. In most cases, heritability in these studies is estimated from the difference in the correlations for ADHD symptoms between identical and non-identical twin pairs, as reported by parents and teachers: with the correlation for identical twin pairs in the region of 60 to 90% and for non-identical twin pairs being half or less than half of this figure in most studies (Faraone, 2005). Under the equal environment assumption for the two types of twin pairs, heritability can be estimated as twice the difference in the two sets of correlations.
>
> The assumption of ‘equal environment’ for identical and non-identical twins can be questioned. If it were not valid, then the estimated effect of genetic influences would decrease and that of shared environmental influences would increase. Even if this were to be the case, however, it would not argue against the validity of the disorder. It is not in doubt that twins’ scores are highly correlated – the level of ADHD symptoms in one child predicts that in the other. This tendency to run in families supports the idea that it is a coherent syndrome, whether the reasons are genetic or environmental. [37]

(They also acknowledge the problem of complex gene-environment interactions).

The NICE authors hold to an account of “ADHD” which allows for “multiple genetic and environmental factors” [38]. It is not necessary for this pure form of the narrative to insist on a genetic explanation or link. Thus they are free to report some of the doubts around twin-studies. The account which privileges genetics and which insists on a “genetic disease” or “genetic link” can be understood as a strand within the wider ADHD narrative. This strand is less critical of twin-studies.

Twin-studies then tend to use a number of questionable assumptions. There is an argument that most or all of these assumptions can be controlled for and that more complex studies can take them into account. This. however, is not always done. Whether or not the twin-studies which Professor Thapar refers to have controlled for some of the variables mentioned above we cannot say. She made her claim about twin-studies in an interview and it is not referenced. Even if the studies she is referring to have managed to control for the equal environments assumption some of the other problems with twin-studies cannot readily be resolved. For example; it would be impossible to reliably produce a figure which took account of the variations caused by people partnering with people who are like themselves.

In any event, however these studies have been managed, it is not something called “ADHD” which can be shown (or not) to be heritable. Strictly speaking a diagnostic category of psychiatry is not a heritable characteristic.

The genetic narrative exaggerates the slender correlations that do exist between genes and impulsivity/inattention. It tends to assume causality and downplay the possibility of more complex environment-gene interactions. It assumes that more genetic correlations will be found but the evidence is that a purely genetic explanation for impulsive/inattentive behaviours will never be established. Indeed, as we have seen, there is compelling evidence that just being young for the class can get a young person “diagnosed” “with ADHD”. However; perhaps the main problem with the genetic narrative is that it lacks a medical application. Simply establishing that a percentage of young people “with ADHD” possess a certain genetic trait does not provide a basis for any kind of medical treatment. A medical intervention requires a) a test and b) a model of a disease pathway and c) an explanation of how the proposed treatment modifies the disease pathway. The genetic narrative on ADHD provides none of these things. The purpose of developing the genetic narrative is to support drugging. This is because if people can be persuaded that “ADHD is a genetic disease” then they are more likely to accept a biological intervention i.e. drugging.

x) Summary

The authors place on their study not a summary of their empirical findings but a political statement. They say that their results “suggest that ADHD is not purely a social construct”. This is somewhat misleading. Their study has shown that 14% of young people in an ADHD group possess one or more large CNVs. For the other 86% the study has produced no evidence that *their* “ADHD” (possession of the label) can be correlated to anything genetic. For 86% of the sample group therefore the study does not suggest that *their* “ADHD” is anything other than a “social construct” in the sense in which the authors mean it. I.e. a label with no genetic correlation.

For the Cardiff researchers “ADHD” is a statistical category. Their claim about “not just a social construct” is true for the statistical category. But the term “ADHD” when it is ordinarily applied is not a statistical category. It is a clinical label attached to an individual by a psychiatrist in a consulting room. When “ADHD” is used in this way there is no biological test. In clinical terms the best the Cardiff study can say is that for any given young person with an ADHD label the probability that they will have one or more large CNVs is 14%.

The Cardiff genome study does not support the claim that: “Now we can say with confidence that ADHD is a genetic disease and that the brains of children with this condition develop differently to

those of other children". [12] A process of inflation has occurred here.

The Cardiff genome study does not show a correlation between possession of the deleterious genetic variant in question and inattentiveness independent of IQ score. In the words of Dennis M. *et al.:* "The group difference in IQ remains a potential explanation for group differences on other cognitive measures and cannot be ruled out through statistical adjustment or explained away statistically, regardless of whether IQ is significant as a covariate or whether the differences on the dependent variables are significant." [31] The data presented in the study could equally well be interpreted as showing that the causal relationship is between IQ and the genetic variant. It is quite possible to construct an explanation based on the material in this study which would associate the large CNVs with IQ and see the ADHD behaviours as a secondary socially determined development. The authors do not develop this line of interpretation. On the contrary Professor Thapar sought to obscure the relationship between IQ and large CNVs which was present throughout the study.

The study found that the CNVs (duplications or deletions of genetic material) which were found tended to be in loci previously associated with "autism" and "schizophrenia". Scientifically this is probably the most interesting finding from the study. It was to be expected that some genetic correlation could be found. It is however news that this was in this loci. This at least helps to identify an area on the human genome which is associated with higher mental functioning. This does contribute to real scientific knowledge. But it was not this detailed and factual finding which was amplified to the world. This may be because this finding does not help to construct the ADHD narrative. The finding that genetic variations and damage in a certain loci on the human genome are associated with problems with higher-order mental functioning, the ability to do mathematics and reasoning ability etc. is too general for that. Such a finding might lead to compassion. It does not lead to deliverable treatments. (See Section 5) i)). Psychiatry's preference for categorisation such as "learning difficulties", "intellectual disability", "ADHD", "autism", "schizophrenia" requires that you show correlations which link specific factors with the specific categories. It is clear that a specific aim of the study was to: "prove the often unfashionable theory that ADHD is a brain disorder with genetic links". [12] The study aimed to support the biological strand in the ADHD narrative, not illuminate an area of human experience.

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Section 2.4.2

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32. In fact the control data set which the authors of the genome study [Note 1] used did not contain “psychiatric data”, which means that it did not contain IQ data. However the IQ system defines 100 as the average in a large enough sample of the population so it is reasonable to assume that the control group in this study had an average IQ of 100.

33. *Ibid*. Note 1. p 1404

34. *Ibid*. Note 16. Appendix 1.

35. *Ibid.* Section 5.15.2 (F)

36. Lea Winerman. *A second look at twin studies*. American Psychological Association Monitor. April 2004.

http://www.apa.org/monitor/apr04/second.aspx

37. *Ibid*. Note 16. Section 5.8.1 Quantitative genetic studies

38. *Ibid*. Section 2.4