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MMR & AUTISM: FIXING A LINK

This is an author's background document giving information additional to the peer-reviewed report "How the case against the MMR vaccine was fixed" by Brian Deer, published in the *BMJ* in January 2011 (*BMJ* 2011;342:c5347). That report is the first part of a special *BMJ* series by Deer, "Secrets of the MMR scare".

Table 1 below is a retabulation by Deer of three key reported features of 12 child patient cases presented in the now-notorious Wakefield *Lancet* paper of February 1998 from the Royal Free hospital and medical school, London. This paper linked regressive autism, inflammatory bowel disease and the three-in-one measles, mumps and rubella vaccine (Wakefield AJ, Murch SH, Anthony A, Linnell, Casson DM, Malik M, et al. Ileal lymphoid nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children. *Lancet* 1998; 351:637-41 [retracted]).

Table 2 below is a tabulation by Deer of corresponding data drawn from confidential UK National Health Service records of the same 12 children. In all but one case (child 11), this data was presented by the UK General Medical Council to a fitness to practise panel hearing charges of serious professional misconduct against the three senior authors of the paper: Andrew Wakefield, John Walker-Smith and Simon Murch. The panel sat for 217 days between July 2007 and May 2010.

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To contrast the tables online, reduce to whole-page view, and use *page up* and *page down* keys. Use the mouse on reference numbers to consult footnotes. If downloaded, the tables can be viewed side-by-side in page display.

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Table 1	Wakefield et al, the Lancet, February 1998			
Child[1]	(a) Regress autism[2]	(b) N/S colitis[3]	(c) Within[4] days of MMR	All three features[5]
1	yes[6]	yes[7]	yes[8]	yes
2	yes[9]	yes[10]	yes[11]	yes
3	yes[12]	yes[13]	yes[14]	yes
4	yes[15]	yes[16]	yes[17]	yes
5	yes[18]	yes[19]	no[20]	no
6	yes[21]	yes[22]	yes[23]	yes
7	yes[24]	no[25]	yes[26]	no
8	no[27]	yes[28]	yes[29]	no
9	no[30]	yes[31]	no[32]	no
10	no[33]	yes[34]	no[35]	no
11	yes[36]	yes[37]	yes[38]	yes
12	yes[39]	yes[40]	no[41]	no
	9/12	11/12	8/12	6/12

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Table 2	NHS, including Royal Free hospital, records			
Child	(a) Regress autism[42]	(b) N/S colitis[43]	(c) Within[44] days of MMR	All three features[45]
1[46]	?[47]	yes[48]	no[49]	no
2[50]	yes[51]	yes[52]	no[53]	no
3[54]	?[55]	no[56]	?[57]	no
4[58]	?[59]	no[60]	no[61]	no
5[62]	?[63]	no[64]	no[65]	no
6[66]	no[67]	yes[68]	?[69]	no
7[70]	no[71]	no[72]	no[73]	no
8[74]	no[75]	no[76]	no[77]	no
9[78]	no [79]	no[80]	no[81]	no
10[82]	no[83]	no[84]	no[85]	no
11[86]	?[87]	no[88]	no[89]	no
12[90]	no[91]	no[92]	no[93]	no
	? 6/12	3/12	? 2/12	0

[1] Children are numbered as in Wakefield AJ, Murch SH, Anthony A, Linnell, Casson DM, Malik M, et al. Ileal lymphoid nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children. *Lancet* 1998; 351:637-41 [retracted].
[2] Regressive developmental disorder - autism. From *Wakefield et al*, table 1. The paper's first sentence states: "We investigated a consecutive series of children with chronic enterocolitis and regressive developmental disorder." The regressive developmental disorder is tabulated as "autism" in nine cases. In study protocols, explanatory material for parents and clinicians, and post-publication commentary, Wakefield sometimes uses references to regressive autism interchangeably with "disintegrative disorder", although this is, in fact, professionally recognised to be a different disorder. The paper stipulates that the 1994 American Psychiatric Association's DSMIV criteria were used. One patient, child 9, is tabulated as having an "autistic spectrum disorder", indicating that the authors understood the nosology of ASDs and did not wrongly understand all ASDs to be "autism". In a contemporaneous document issued to doctors by Wakefield during the study period, titled "Rationale for our investigation of children with regressive autism and bowel symptoms", he explained of the project: "Finally we hope that the possible role of MMR will be elucidated and that further insights into the pathogenesis of regressive autism will be provided."
[3] Non-specific colitis. This is a clinically significant inflammatory bowel disease, most often pending allocation to either Crohn's disease or ulcerative colitis. It is commonly associated with bloody stools, failure to thrive and/or raised inflammatory markers. From *Wakefield et al*, table 1. The use of this terminology in the paper is at variance with professional practise multiple reference sources and is discussed in: Deer B, Wakefield's "autistic enterocolitis" under the microscope. *BMJ* 2010; 340:838-41.
[4] Time to what the paper calls the "first behavioural symptom". From *Wakefield et al*, table 2. This "symptom" is also described in the paper as a "behavioural feature". The paper states that in 8 of 12 cases the onset of the first behavioural symptom occurred within 14 days of MMR vaccination, which (explaining table 2 in the paper's "results" section) is described as "the apparent precipitating event". The mean time to onset is given in the paper as 6.3 days. This is apparently derived from alleged parental recollections, generally some years after the child's vaccination. The information, however, is not left as the mere reporting of parental allegations. These times to onset are adopted by the authors as fact in the paper's findings, results, tables and interpretation, including in statistical calculations. "Behavioural symptom" is not defined in the paper, but a briefing issued jointly by the Royal Free medical school and hospital, London (under whose aegis the study was published) on the *Lancet* paper's cover date, explains of the children: "They were withdrawn, they could not communicate or socialise in the normal way and avoided eye contact… Behavioural changes included repetitive behaviour, disinterest in play or headbanging." In a video news release, issued by the school and hospital to promote the research claims, Wakefield explained: "Well, the interesting thing is that the damage, the behavioural or developmental change tends to occur quite soon after administration, and this is where, why parents or GPs or paediatricians have been able to make the link, the association with MMR."
[5] All three tabulated features: regressive autism, non-specific colitis and the onset of the first behavioural symptom within 14 days of MMR.
[6] Regressive developmental disorder - autism.
[7] Acute caecal cryptitis and chronic non-specific colitis.
[8] 1 week.
[9] Regressive developmental disorder - autism.
[10] Acute and chronic non-specific colitis; reactive ileal lymphoid hyperplasia.
[11] 2 weeks.

[12] Regressive developmental disorder - autism.
[13] Acute and chronic non-specific colitis; reactive ileal and colonic lymphoid hyperplasia.
[14] 48 h.
[15] Regressive developmental disorder - autism? Disintegrative disorder?
[16] Chronic non-specific colitis; reactive ileal and colonic lymphoid hyperplasia.
[17] Measles vaccine at 15 months followed by slowing in development. Dramatic deterioration in behaviour immediately after MMR at 4.5 years.
[18] Regressive developmental disorder - autism.
[19] Chronic non-specific colitis; reactive ileal lymphoid hyperplasia.
[20] Self-injurious behaviour started at 18 months. The table cites the "exposure identified by parents or doctor" to be "None - MMR at 16 months".
[21] Regressive developmental disorder - autism.
[22] Acute and chronic non-specific colitis; reactive ileal lymphoid hyperplasia.
[23] 1 week.
[24] Regressive developmental disorder - autism.
[25] Normal.
[26] 24 h.
[27] Regressive developmental disorder - post-vaccinial encephalitis?
[28] Acute and chronic non-specific colitis; reactive ileal lymphoid hyperplasia.
[29] 2 weeks.
[30] Regressive developmental disorder - autistic spectrum disorder.
[31] Chronic non-specific colitis; reactive ileal and colonic lymphoid hyperplasia.
[32] 1 week (MMR 2 months previously). The table cites the "exposure identified by parents or doctor" to be "recurrent otitis media".
[33] Regressive developmental disorder - post-viral encephalitis?
[34] Chronic non-specific colitis; reactive ileal lymphoid hyperplasia.
[35] 24 h. The table cites the "exposure identified by parents or doctor" to be "Measles (previously vaccinated with MMR)".
[36] Regressive developmental disorder - autism.
[37] Chronic non-specific colitis.
[38] 1 week.
[39] Regressive developmental disorder - autism.
[40] Chronic non-specific colitis; reactive colonic lymphoid hyperplasia.
[41] Loss of speech development and deterioration in language skills noted at 16 months. The table cites the "exposure identified by parents or doctor" to be "None - MMR at 15 months".
[42] Diagnosis at admission or on discharge from the Royal Free.
[43] As reported by the Royal Free hospital pathology service. In some cases, hospital clinical records were subsequently altered to reflect retrospective changes to diagnoses reached in the medical school, generally without explanation being given in the children's records.
[44] The first behavioural symptom within 14 days of MMR.
[45] All three tabulated features: regressive autism, non-specific colitis and the onset of the first behavioural symptom within 14 days of MMR.
[46] Male. Age 3½ at admission.
[47] No evidence of regression in child 1 has come to light, except for a GP letter apparently repeating what the mother said when seeking referral to Wakefield's project. She had supplied a note to the GP surgery stating: "I would like you to refer my son [1] to the below address immediately," citing "a severe metabolic disorder", naming John Walker-Smith, the Royal Free's professor of paediatric gastroenterology and the senior clinical author of the *Lancet* paper, and saying that the child "needs tests done". The Royal Free admission clerking note

says: “Complaining of classical autism diagnosed 1 year ago, diarrhoea, concern over deterioration of eyesight.” The discharge summary says: “The main problems are of classical autism diagnosed a year ago, and of diarrhoea.” The child first presented to the GP at age 9 months, with his mother concerned that he couldn’t hear properly, and with a discharge from one ear. Repeated hearing tests found no abnormality. His older brother was diagnosed as autistic. A Royal Free (adult) neurologist took a history of normal development until “18 months or so”.

[48] Histology report. “I. Sections show large bowel mucosa with a somewhat distorted lymphoglandular lesion with no histological abnormality. II. Large bowel mucosa with preserved architecture. There is a patchy chronic inflammatory infiltrate. There is a focus of transepithelial neutrophil migration (Cryptitis) with crypt abscess formation. No granulomas, ova or parasites are seen. III- IV. Sections show pieces of large bowel mucosa within normal histological limits.” The pathology service comments: “Colonic series biopsies with focal active chronic inflammation in the caecum (II).” The ileum was not entered due to gross faecal loading. On a second, also unsuccessful, attempt, “scope trauma” was noted.

[49] Child 1 is recorded (as a parentally-recalled fact) only to have been “pale” 7-10 days after MMR.

[50] Male. Age 8 at admission. Previously seen at the same hospital clinic in London as child 9.

[51] It is common to all accounts that child 2, vaccinated at 15 months, experienced several phases of severe regression. The discharge summary states: “The main problems are of developmental regression from 20 months of age, diarrhoea from 20 months of age and abdominal pain in the same period.” Professor Sir Michael Rutter, who studied the records as an expert for the UK General Medical Council (GMC), told the GMC fitness to practise panel: “These are quite a heterogeneous group of cases. In some cases there is some evidence of regression. In child 2’s case, quite marked and repeated.”

[52] Histology report. “I. These are fragments of small bowel mucosa with mild chronic inflammation within the lamina propria. No granulomas are identified. II. [caecum] These are fragments of large bowel mucosa with a moderate chronic inflammatory infiltrate within the lamina propria. No granulomas are identified. III-V. All these specimens show fragments of large bowel mucosa with patchy increase of chronic inflammatory cells within the lamina propria and occasional prominent lymphoid follicle with a germinal centre within the ascending and transverse colon biopsies. An occasional focus of acute cryptitis is present within the ascending colon specimen and there is mild crypt distortion. No granulomas are identified. VI. [rectum] This is a fragment of large bowel mucosa with mild chronic inflammation of lamina propria and very focal cryptitis.” The pathology service comments: “The mild patchy generalised increase in inflammatory cells with lymphoid aggregates and follicles is not very specific but could be in keeping with low grade quiescent inflammatory bowel disease.” Child 2’s ileo-colonic pathology, later diagnosed as food intolerance, showed “complete return to normal” on 8 weeks’ enteral feeding, as reported in Walker-Smith JA, Davies SE, Murch SH, Wakefield AJ. Ileo-caecal lymphoid nodular hyperplasia non-specific ileo-colitis with regressive behavioural disorder and food intolerance: a case study, *J Pediatr Gastroenterol Nutr* 1997; 25 (suppl 1): S48.

[53] Despite an account taken verbally from the mother by the Royal Free’s child psychiatrist that “head banging” and “screaming” occurred within two weeks of MMR, this is unsupported by any contemporaneous document. Accounts, including the mother’s, after the child’s full records were later extensively reviewed for litigation, put these symptoms, which she said were the first, months after MMR. No developmental issues were recorded proximate to vaccination. Interviewed by Deer, the mother said that head banging and screaming began up to six months later. The hospital’s discharge summary dates the first regression from 20

months. This boy was born on 29 July 1988. The first GP record suggesting possible parental concern over the vaccine was made on 2 November 1994: “Nil obvious re MMR story.”
[54] Male. Age 6½ at admission.
[55] According to records, child 3’s development was delayed from a very early age. A consultant letter, written when the boy was almost 3 years old, summarised the history. “He walked at 13 months of age and used 2-3 words of speech until he was 18 months when this left him. He now has lots of unintelligible babble and appears to understand at one word level.”
[56] Histology report. “I. Shows small bowel mucosa with an increase in intra-epithelial small lymphocytes, but no architectural abnormality. II. Shows small bowel mucosa with prominent lymphoid follicles. III-VII. Each show large bowel-type mucosa within normal histological limits.” The pathology service comments: “Mild inflammatory and reactive changes in the small bowel samples, of uncertain significance on morphological grounds alone. No microbes or granulomas identified in any of these samples.”
[57] After contact with the JABS anti-MMR group, and making an application for legal aid to sue vaccine manufacturers, the parents said that problems started “within three days” of vaccination. There is no confirmation of this. Records indicate that child 3, vaccinated with MMR at 14 months, never had a vocabulary of more than 2-3 words, which were said to have been lost at around age 18 months.
[58] Male. Age 9½ at admission. From the same GP practice as child 8.
[59] It was the mother’s stated impression that child 4 regressed. This was not adopted by doctors, although one notes “I think his general behaviour seems increasingly abnormal.” A history says child 4 crawled at 14 months and walked at 18 months.
[60] Histology report. “I. Small bowel type mucosa with a lymphoid follicle. II-VII. Large bowel mucosa, some with attached muscularis mucosae, with no evidence of architectural distortion or increase in inflammatory cells in the lamina propria. Lymphoid follicles with germinal centres are present in many of the biopsies. No cryptitis or crypt abscesses are seen. The surface epithelium appears intact. No granulomas, ova or parasites are seen.” The pathology service comments: “Large bowel series with terminal ileum, with no histopathological abnormality.”
[61] Multiple concerns of the parents and doctors over child 4’s development are documented before he received MMR. These include “developmental delay”, “general delay” and restricted vocabulary. The boy’s mother had persistent concerns that he was “deaf”, and there were also “concerns over his head and appearance”.
[62] Male. Age 7½ at admission.
[63] Contemporaneous records neither confirm nor disprove whether child 5’s autism could be described as regressive, although a Royal Free record from 2001 describes him as having a diagnosis of regressive autism. There was no record of any such diagnosis before or during his admission for the study.
[64] Histology report. “Specimen I consists of fragments of small intestinal mucosa which includes lymphoid follicles but which is without pathological abnormality. Specimens II, III and IV are large bowel mucosa fragments with normal crypt architecture. There is at best a minimal increase in chronic inflammatory cells within the superficial lamina propria. No active inflammation is seen. Specimens III and IV show minor crypt architecture distortion, including occasional bifid forms. Paneth cell metaplasia is not seen. No excess chronic inflammatory cells are seen. A very occasional polymorph is seen within surface crypt epithelium. No ova, granulomas or parasites are seen in any of these biopsies.” The pathology service comments: “Large bowel series; minor changes the significance of which are uncertain but do not amount to the diagnosis of inflammatory bowel disease.” Also of interest: child 5 was reported by endoscopist and *Lancet* co-author Simon Murch as *not* having ileal lymphoid

hyperplasia, but the published *Lancet* paper said that he *did* have this.
[65] No claim is made that behavioural symptoms were proximate to vaccination. Child 5 was admitted to hospital with generalized convulsions at age 11 months. He received MMR at 16 months.
[66] Male. Age 4½ at admission. Brother of child 7.
[67] Child 6 was admitted following a specialist assessment and a diagnosis of Asperger's syndrome, which is distinct from autism under the DSMIV classification, stated in the paper to have been used for assessments, and is not recognised as a regressive disorder. This diagnosis is adopted at the Royal Free, where none of the 12 children underwent appropriate neuropsychiatric assessment for the diagnosis of a developmental disorder.
[68] Histology report. "I. Sections show pieces of small intestinal type mucosa with normal villous architecture and a piece of probable ileocaecal mucosa with prominent reactive lymphoid follicles and a mild focal cryptitis. No granulomas or parasites are seen. II-V. Sections show large bowel mucosa, some with attached muscularis mucosa, with prominent lymphoid follicles. There is a mild patchy increase in inflammatory cells in the lamina propria with focal cryptitis but no crypt abscess formation. There is mild architectural distortion with focal irregularity of the surface epithelium. No granulomas or pathogens are identified." The pathology service comments: "Colonic series with a mild histologically non-specific proctocolitis."
[69] No contemporaneous record confirms any such temporal link. Child 6 received MMR on 15 June 1993. Among other things, a GP record three months previously, dated 18 March 1993, documents an admission to hospital following a febrile convulsion, with florid measles rash. The onset of behavioural symptoms within 1 week of MMR, reported in the *Lancet*, was apparently derived by Walker-Smith from the assertion of the mother, a former JABS activist and litigant against the vaccine's manufacturer. A Royal Free discharge letter reported: "Mum gave a history in [child 6] of changes in social interaction following on immediately from his MMR vaccination." Wakefield reported in the *Lancet* that both this boy and his brother had "gaze avoidance" after MMR, but no medical record was produced to any such effect. Her GP - himself the father of a child with autism - told the GMC panel of his worries over the mother's reliability. He said he was "getting increasingly concerned about the amount of intervention" that she was requesting, and that he felt her demands were "detrimental to the health of her children". He said that "she did vary her histories from time to time" and that: "It was difficult to be certain what she was telling different professionals. There was a history of her consulting several professionals for one problem and then take the answer she required." With regard to a medicine, he said: "I think it is very difficult to be consistent in my answering in the sense that she was a very confusing person and the story would vary between consultations. It was difficult to a get a consistent pattern. At times she would say it is fantastic and made a huge difference, then a week later it would be a different story."
[70] Male. Age 2½ at admission. Brother of child 6.
[71] Child 7 was not diagnosed with autism, before, during or after admission to the Royal Free. He would later be diagnosed with pathological demand avoidance syndrome. His GP referred him to the project on grounds that his brother, child 6, was enrolled, and because child 7 had an established history of epileptic fits - beginning prior to vaccination - which the GP (for both boys) thought might make him eligible for Wakefield's study.
[72] Histology report. "I-II. Two pieces of small intestinal type mucosa with essentially normal villous architecture. There is no increase in inflammatory cells in the lamina propria or in intraepithelial lymphocytes. Part of a lymphoid follicle is included. No parasites or granulomas are identified. III-IV. Sections from all sites show large bowel mucosa with no abnormality of crypt architecture or significant increase in inflammatory cells in the lamina

propria. Some of the biopsies contain lymphoid follicles. No granulomas or parasites are seen." The pathology service comments: "Small bowel biopsy and large bowel series without significant histological abnormality."

[73] Child 7 was not "normal" prior to MMR, as the paper stated for all 12 children, having already suffered reported epileptic fits and a "history of complex seizures". He was reported, before MMR, with "dragging" of one leg, apparent breath-holding spells, an incident involving loss of consciousness for 20 minutes and abnormal EEG results. He had been prescribed sodium valporate for his fits. A fit-like episode is recorded to have been reported by the mother after MMR, but such episodes also occurred before. Wakefield reported in the *Lancet* that the child, and his brother, suffered "gaze avoidance" immediately after MMR, but no record was produced to the GMC of such a phenomenon. The GP's records showed difficulties with the mother, including an incident where a health visitor had noted "numerous medical presentations on somewhat dubious grounds". Difficulties between the mother and the local hospital and also with the Royal Free were reported.

[74] Female. Age 3½ at admission. From the same GP practice as child 4.

[75] No claim is made that child 8 - the only girl - had regressive autism. She left the Royal Free without any developmental diagnosis. She was seen by the Royal Free's child psychiatrist, Mark Berelowitz, who was "left wondering whether in fact she had post vaccination encephalitis rather than anything more complicated than that". This was not a diagnosis, however, and the child was not seen at the hospital by a developmental paediatrician.

[76] Histology report. "I. These are both fragments of poorly orientated, but normal small bowel mucosa. A lymphoid reactive centre is seen in each sample. II-IV. These are all pieces of normal colonic type mucosa containing occasional lymphoid aggregates. Minimal inflammatory changes may be the result of operative artefact."

[77] Child 8 was not developmentally normal prior to MMR, and she showed "behavioural symptoms" before vaccination. The GP warned Wakefield at referral that the girl's hospital and primary care doctors had concerns about her some months before vaccination. She was globally delayed. She had a documented febrile convulsion two weeks after her MMR, in the reported context of a diarrhoeal illness. Records suggest a possible regressive episode, involving the loss of the 2-3 words she had by then vocalised - an abnormally small vocabulary for her age - but the time-frame after the febrile convulsion is unclear.

[78] Male. Age 6 at admission. From the island of Jersey. Previously seen at the same hospital clinic in London as child 2.

[79] No claim is made that child 9 had regressive autism.

[80] Histology report. "I. Small bowel mucosa showing no histological abnormality. II-VII. Large bowel mucosa showing prominent lymphoid follicles but no histological abnormality."

[81] No claim is made that the first behavioural symptom was proximate to vaccination.

[82] Male. Age 4 at admission.

[83] No claim is made that child 10 had regressive autism. A local report refers to a severe speech and language disorder with some autistic features.

[84] Histology report. "I. The specimen consists of small bowel and have sampled a Peyer's patch. Where present, the overlying villae appear unremarkable. The lymphoid tissue shows reactive changes. Parasites and granulomas are not seen. II-VI. All these biopsies show large bowel mucosa with occasional isolated bifid glands. The inflammatory population is within normal limits. Parasites and granulomas are not seen." The pathology service comments: "No significant histological abnormality." A supplementary report was requested, following a weekly histology meeting with clinicians, and possibly with Wakefield. This said: "These biopsies have been reviewed following a clinicopathological meeting. The ileal biopsy shows confluent lymphoid aggregates within otherwise unremarkable small intestine. The large

bowel biopsies show a very subtle scattering of chronic inflammatory cells within the lamina propria. The superficial lamina propria contains focal nuclear debris and the surface epithelium appears slightly degenerate. No active inflammation is seen. More levels have been cut and no granulomas have been identified." The pathology service comments: "Minor abnormalities. ? Significance." Child 10's biopsies were also examined at another centre. Following the supply of samples to the University Hospital of Wales, Cardiff, Huw Jenkins, consultant paediatric gastroenterologist, wrote: "I've now had a chance to review 10's intestinal biopsies kindly sent down from the Royal Free hospital, and although there are lymphoid follicles present in the small intestine these are often regarded as a normal finding, and certainly our pathologists here would suggest that the colonic biopsies were within normal limits. Certainly they do not feel he has good evidence of gut inflammation in the biopsies."

[85] Child 10's developmental problems were reported to have begun with a viral infection, initially suspected to be rubella.

[86] Male. Age 5½ at admission. From California.

[87] Documentation is incomplete. As with other children in the series, child 11 does not appear to have been neuropsychiatrically assessed at the Royal Free, which had no department for child development and no paediatric neurologist. The hospital discharge summary refers to "autism", and the father recalls a diagnoses in California that his son was "autistic". According to the father, the boy never started to talk at an appropriate age. "Speech didn't come in," he said. "My wife thought about having another kid, and she said, 'No I'm going to wait till he starts speaking.' Even at age 2, no speech." Child 11 received MMR at 14 months.

[88] Discharge summary. "Histology of biopsies taken during this procedure demonstrated a lymphoid fragment within the terminal ileum. The caecal biopsy demonstrated a mild increase of lymphoid cells within the lamina propria and an occasional pigmented macrophage. Further sections throughout the colon showed prominent pigmented macrophages within the lamina propria. These did not stain for haemocyderin and therefore have an appearance suggestive of mild melanosis coli. The rectal biopsy contained two lymphoid aggregates and also showed occasional pigmented macrophages but there was no other histopathological features." Barium meal and follow-through: "No inflammatory process affecting the colon was demonstrated." Child 11 was not reviewed by the GMC panel, apparently because the records could not be located. This document was signed by David Casson, then senior paediatric registrar and *Lancet* co-author. The histology report is not available. However, evidence presented in the cases of the other children showed that histology reporting in Casson's discharge summaries closely followed the text of the pathology service reports. Melanosis coli, confirmed at a clinico-pathological meeting, generally indicates possible chronic laxative use, but was not reported in the *Lancet* paper.

[89] The incident reported at the time of the alleged "first behavioural symptom" was a chest infection. According to the discharge summary, the parents first noticed what they felt was a gradual deterioration in their son about a month before he received MMR.

[90] Male. Age 6 at admission. Previously seen at the same hospital as child 6 and child 7.

[91] No autism diagnosis was made, and no evidence adduced that this child suffered developmental regression. The diagnosis at admission was "an impairment in respect of language," given by Gillian Baird at the specialist developmental unit at Guy's hospital, London. Michael Rutter, for the GMC, said in evidence to the fitness to practise panel that there was "no evidence that I could identify" in the child's examined records indicating any significant regressive element in his disorder.

[92] Histology report. "I-IV. Pieces of large bowel mucosa including lymphoid follicles with germinal centres. There is no architectural abnormality and no increase in inflammatory cells

in the lamina propria. No organisms or granulomas are seen."
[93] No claim is made that the first behavioural symptom was proximate to vaccination.

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Summary of the MMR investigation
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