Neutral Citation Number: [2017] EWFC 64

**IN THE FAMILY COURT**
**SITTING AT THE ROYAL COURTS OF JUSTICE**

29 September 2017

**Before** :

**THE HONOURABLE MR JUSTICE PETER JACKSON**

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**Between :**

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| | **THE LONDON BOROUGH OF BARNET** | **Applicant** |
| | **-and-**<br><br>**(1) T (Mother)**<br>**(2) G (Father)**<br>**(3) H (Child)**<br><br>**-and-**<br><br>**(1) ALERE TOXICOLOGY**<br>**(2) E4 LAW LIMITED (t/a LEXTOX)**<br>**(3) DNA LEGAL** | **Respondents**<br><br>**Interveners** |

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**William Tyler QC and Emily James** (instructed by instructed by Sarah Johnson, Legal Services) for the **Local Authority**
**Hannah Markham QC and Kate Tompkins** (instructed by Dawn Wilson of Creighton & Partners) for the **Mother**
**Paul Hepher** (instructed by Jalpa Vadgama of Guile Nicholas Solicitors) for the **Father**
**Timothy Parker and Edward Lamb** (instructed by Sabina Mahmood of Gary Jacobs & Co) for the **Children's Guardian**
**Tina Cook QC and Damian Woodward-Carlton** (instructed by Nick Cunningham of Gowling WLG (UK) LLP) for **Alere Toxicology**
**Ronan O'Donovan** (instructed by David Martin of Carbon Law Partners) for **Lextox**
**John Tughan QC** (instructed by Philip Banks-Welsh of Royds Withy King, Solicitors) for **DNA Legal**

Hearing dates: 18-22, 25 & 29 September 2017
Judgment date: 29 September 2017

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# JUDGMENT – Re H: Hair Strand Testing

**Mr Justice Peter Jackson:**

## Introduction

1. This judgment considers the science of hair-strand testing for cocaine (at paragraphs 25-56) and the way in which expert reports on the test results are presented (57-59).

2. The proceedings are about an eight-month-old baby girl, who I shall call Holly. She was removed from her mother at birth but returned to her care at the age of six weeks under supervision and since July has lived with her mother at home. It is now agreed that although the threshold for intervention is crossed on the basis of the past history and future risk, Holly will remain in her mother's care with support provided by the local authority, by other agencies and by her father and maternal grandmother. The only legal issue is whether the arrangement should be underpinned by a care order or a supervision order.

3. The reason why this hearing has involved five days of evidence is because there is also an underlying factual issue. Has the mother been using drugs, albeit at a low level, during the past two years? She adamantly denies doing so and, with one significant exception, the other evidence supports her. The exception is a body of scientific information from hair strand tests taken over the two-year period, which are interpreted by the testing organisations as showing low-level cocaine use for at least some of the time. That has been challenged by the mother and I have heard from five expert witnesses: one from each of the three testing organisations, one on behalf of the mother, and one jointly instructed.

4. Although the issues are now relatively narrow, it was not always so. Holly was removed at birth because of a positive hair strand test which, set against the background history, led the local authority to argue that she would not be safe in her mother's care. Even after she was returned home, the local authority's final case was that she should be removed again and placed for adoption: this plan only changed two days before the hearing began. It is therefore necessary to consider how this sequence of events came about.

## Background

5. The mother, now in her early 30s, has a long history of drug abuse. She spent time in local authority care as a teenager, left school without qualifications and by the age of 21 was using heroin and crack cocaine. In 2007, she underwent detoxification and a 26-week therapeutic rehabilitation programme, but in 2009 she relapsed and by 2011, she was again receiving treatment for use of cannabis, crack cocaine and cocaine. Predictably, this drug use contributed to her life being chaotic and her parenting unreliable.

6. Holly is the mother's fourth child from three different fathers. The oldest, a girl, now aged seven, was made the subject of a special guardianship order in favour of her maternal grandmother in 2012. This child knows her mother and sees her regularly. The second child, a boy now aged five, was born from an abusive relationship between the mother and a man with drug and alcohol problems. In his first weeks, the child became the subject of care proceedings that ended with the making of a supervision order in July 2012. In June 2014, these parents had a second son. He and his brother, now aged three, were removed from the mother's care in July 2015 under a police protection order after she was found with them in the street, incapable after taking cannabis, alcohol and cocaine. Home conditions were squalid. New care proceedings were taken and in May 2016, the court heard a substantial amount of evidence, including from Holly's Children's Guardian, who then acted for the boys and advocated their return to their mother. The magistrates accepted that the mother had kept off drugs since January 2016, but they did not accept that she was honest about her use in the later part of 2015 and found that the risk of relapse was too high. The boys were made the subject of care and placement orders, and in October 2016 they were placed together for adoption. Adoption proceedings, recently issued, will continue in the local court.

7. Between the removal of the boys and the hearing in May 2016, the mother had undergone hair strand testing carried out by Alere Toxicology in August 2015 (covering the previous three months when she had admittedly been taking drugs), in February 2016 (covering the previous three months), and in May 2016 (covering the previous two months). The first two tests produced several positive results for cocaine and BE at low or very low levels.

8. The mother has always accepted using cannabis regularly in the period before the boys were removed. By that stage, it had become her drug of choice, which she supplemented from time to time with alcohol and cocaine, particularly when under stress. The 2015 Alere tests showed low to medium quantities of cannabis derivative, and the December 2016 Lextox test showed low findings of cannabinol for just two months (April/May 2016), but all other tests have been negative for cannabis.

9. Meanwhile, in around April 2016, the mother had become pregnant with Holly after a one-off encounter with the father. He has participated in these proceedings, and sees Holly two or three times a week with the mother's support. They remain friends, and his involvement is seen by all as a good thing.

10. During her pregnancy, the mother made practical preparations for the baby's arrival. She was fully cooperative with the health services and with the local authority. Information from the antenatal services, from the drug support project WDP, and from Narcotics Anonymous was strongly positive. The mother places particular value on her advanced progress in the 12-step recovery programme.

11. On 5 December, a urine drug screening test was negative. However, on 7 December, the mother underwent a hair strand test approximately covering the period April–November. On 16 December, this test was reported as showing the

presence of cocaine and a metabolite of cocaine (benzoylecgonine or BE) at a low or very low level. On the same day, the social worker visited and found the house to be clean and the mother to look well and healthy.

12. On 23 December, an independent social worker (who knew the mother from the proceedings about the boys) recommended that she had made sufficient change to meet the needs of the expected baby, provided that the hair test results could be explained. However, following further communications from Lextox, she amended this view, stating that the changes that had been made were superficial and that the mother's lack of honesty would make it difficult to monitor the baby's needs and leave it at risk of significant harm.

13. Throughout this process, the mother was adamant that she had not been using drugs since the boys were removed in July 2015, but she acknowledged why the local authority would be concerned by the test results. Four days after Holly was born, an interim care order was made by the magistrates and she was removed into foster care on the basis that she was at imminent risk of harm. Contact was allowed four times a week.

14. On 1 February, a further hair strand test was taken, covering the period since March 2016. This was analysed by DNA Legal, who reported that it broadly showed the presence of cocaine and BE at a medium to low level throughout the period. Although theoretically reporting on the same period as Lextox, the concentrations found by DNA Legal were significantly higher than the earlier test.

15. On 22 February, Dr Hugh Rushton, a trichologist (expert in hair science) instructed on behalf of the mother, reported. He was critical of the processes and opinions of the testing organisations and advised that the findings may be due to environmental contamination. He said that there was no unequivocal evidence to definitively support the view that the mother had knowingly used cocaine over the testing period.

16. On 3 March, the matter came before HH Judge Mayer, who ordered that Holly should be returned to her mother's care. She made an interim supervision order and directed that the issue about the validity of the drug testing should be transferred to High Court level.

17. For the next four months, the mother and Holly lived with an older friend of the family, and in early July they moved back into the mother's own accommodation.

18. Since Holly's return, the mother's care has been at least adequate; there have been some quite limited concerns, about which advice has been given. Overall, the mother has shown commitment to her daughter and they are close.

19. The mother is frequently seen by her drug support worker and participates at Narcotics Anonymous and Alcoholics Anonymous. Her drug support worker Ms LB gives her random drug/urine tests. These would be likely to detect significant (as opposed to slight) drug use in the previous three days or so. 57 tests were

carried out during the 24 weeks after Holly's return (March to July), and all were negative.

20. On 17 July, a final set of hair strand tests were taken on the same day by each of the three testing organisations. These covered the first six months of 2017, and allow direct comparison between the three processes. The results showed the presence of very small amounts of cocaine and low levels of BE. Again, the mother denied taking drugs of any kind during 2017.

21. In summary, there is no doubt that the mother was in a dismal state two years ago, to the point where she was quite incapable of looking after any child. It is now accepted that she has turned her life around to the point that she is now capable of looking after one child with support. She says that she has achieved this by avoiding damaging relationships and by complete abstinence from drugs and alcohol. The local authority argues that the hair strand testing shows that complete abstinence has not been achieved, which raises the level of risk that Holly will get caught up in future drug use of the kind seen in the past. It also argues that the hair strand tests show that the mother has not been telling the truth and consequently that she cannot be fully trusted.

**The hearing**

22. At the case management stage, the three testing organisations were invited to intervene in the proceedings, and accepted the invitation. Over the first four days of the hearing, I heard from

Angharad John, Senior Reporting Scientist (Lextox)
Richard Poulton, Toxicologist (Alere)
Dr Salah Breidi, Forensic Toxicologist (DNA Legal)
Dr Hugh Rushton (Trichologist)
Dr Andrew McKinnon (Forensic Toxicologist)

23. Then, without involvement from the interveners, evidence was given over the course of one day by

Ms TB, Holly's social worker since July
The mother
Ms LB, the mother's key worker at WDP
Mr Simmonds, the Children's Guardian

24. The evidence of these later witnesses can be shortly summarised:

<u>Ms TB</u>

She has been Holly's social worker since July. The state of the home is good. Holly has been making progress with significant support being given to the mother. That support will be continued until local authority is sure that progress will be sustained: in the past, support was given with the boys, but it was not sustained. The local authority cannot ignore the history of how the mother

struggled with her older children. A care order is the most appropriate outcome. If the mother had taken drugs in 2016, that would be very significant and would provide further evidence of the need for the local authority to share parental responsibility, and to give Holly the resources and priority that would result, particularly if the mother moved to live nearer to her own mother. Ms TB said that the change of care plan was a matter of fine balance, and accepted that they had not been a professionals meeting or liaison with the drugs counsellor Ms LB before the original care plan was formed in August. She presented a detailed support plan that, she said, would have effect whether the court made a care order or a supervision order.

The mother

She said that she hoped to move to live nearer her own mother when the proceedings were over. She was happy in most ways with the proposed support plan, but said that there were times in the recent past when she had felt burdened with assistance. She was anxious about the consequences of a care order, given the local authority's past planning. While she described herself as *"fighting for the boys"*, she realistically accepted that it's *"all about [Holly]"*. She described her drug habit up to July 2015 as involving daily use of cannabis with much less frequent use of cocaine. She had not knowingly taken cocaine since becoming pregnant with Holly. In May 2016, she had twice slept with a man that she met through NA, but did not continue with this when she realised that he showed signs of using himself. She confirmed her written evidence about the possibility of contamination through her home furnishings and through the level of contact she had with known users as a support worker at NA. She said that she felt proud of herself and the people around her for the progress that she made in coming off drugs. It is frustrating that her account is not accepted on the basis of the hair strand tests. She can't explain them and doesn't understand why she has traces in her hair; she is not happy with it and does not think the tests are reliable. She accepted that in the past she had gone downhill when faced with difficult life events, but in the last two years she had withstood a family bereavement, the orders in relation to the boys, the removal of Holly and the local authority's original adoption plan, and kept strong through all of that. When she felt tempted, she contacted her NA sponsor. She agreed that it was a risky decision to have taken up with someone with a drug habit, but said that she wanted to feel loved, not just part of a programme. She also accepted that she should have been more frank with the local authority about an occasion on which a friend had been meant to stay the night, but did not. She said it would be stupid to go back to drugs as she would risk losing Holly; but, she said, she knew she would not lose her for *"one blip"* and that she would admit that if it had happened. She said that she hadn't taken drugs and didn't know how they were getting into her hair.

Ms LB

She is a practitioner of 14 years' experience who has been the mother's key worker at WDP for the past eight months. She spoke of her own experience and that of her manager, who had known the mother for longer. She considered the

mother to be is a very good stage in her recovery and, but these proceedings, ready for discharge from the service. Her level of engagement was absolutely excellent and she now fully recognise the effect of parental substance misuse. She often visited the mother at home to administer urine tests and had seen an excellent mother/child relationship and nothing untoward. She had been very shocked by the result of the hair strand tests, given that her own very frequent screenings, many of which were at short notice, had all been negative. The mother was able to discuss her issues with her, and what most makes her feel low is not being believed. Ms LB expressed some concern about the turnover of social workers that the mother had experienced since the later stages of her pregnancy, and also about the unusual lack of consultation on the part of the local authority.

The Children's Guardian

Mr Simmonds is a very experienced Guardian, who has also known the mother through the proceedings about the boys. In these proceedings, he takes a similarly positive view. Since he first met her in 2015, she has become a changed person. She has shown him that she can sustain change, not get involved in an abusive relationship, reflect on her failings with her older children and appear to remain clear of drugs. She has done this despite a number of difficult recent events in her life and has built a good support network around her. On a fine balance, he favours the making of a supervision order. A care order with placement at home is unusual for a child of this age, and there might be issues about it running on unnecessarily. He is also concerned about the message that a care order sends to the mother, who he described as being in many ways a remarkable woman. If there is a supervision order, the local authority should methodically plan reviews in order to decide whether it needs to be renewed. He further considers that a high turnover of social workers may lead to inconsistent planning, even though the mother herself can be worked with and is able to be reflective. Finally, the Guardian accepted that the court had yet to make a decision about the mother's more recent drug use or abstinence, but believes that the decision about the legal order should take account of all the aspects of the situation, and not be decided by that matter alone.

**Hair strand testing**

25. Any assessment of a family situation, whether carried out by the court or by other professionals, involves the gathering and analysis of a range of information. Most of the information is factual, and in some cases it will be interpreted by experts, who will express an opinion. That will be the case when scientific investigations such as hair strand tests are carried out. These tests can provide important information, but in order for that to be of real use, the expert must (a) describe the process, (b) record the results, and (c) explain their possible significance, all in a way that can be clearly understood by those likely to rely on the information. If these important requirements are not met, there is a risk that the results will acquire a pseudo-certainty, particularly because (unlike most other forms of information in this field) they appear as numbers.

26. Hair strand testing has been considered in several previous cases:

In *Re F (Children)(DNA Evidence)* [2008] 1 FLR 328, a case involving DNA testing, Mr Anthony Hayden QC said this, amongst other things, at paragraph 32:

> *"The reports prepared for the court by the… experts should bear in mind that they are addressing lay people. The report should strive to interpret their analysis in clear language. While it will usually be necessary to recite the tests undertaken and the likely ratios derived from them, care should be given to explain those results within the context of their identified conclusions."*

In *London Borough of Richmond v B* [2010] EWHC 2903 (Fam), a case about hair strand testing for alcohol, Moylan J said this at paragraph 10, referring to the practice direction that became PD12B:

> *"10. I have referred to the Practice Direction because some of the expert evidence which has been produced in this case appears to have been treated as though it was not expert evidence. It may well be that results obtained from chemical analysis are such as to constitute, essentially, factual rather than opinion evidence because they are not open to evaluative interpretation and opinion. Although I would add that it is common for such analysis to have margins of reliability. However, the Practice Direction applies to all expert evidence and it will be rare that the results themselves are not used and interpreted for the purposes of expert opinion evidence."*

And further, at paragraph 22:

> *"When used, hair tests should be used only as part of the evidential picture. Of course, at the very high levels which can be found (multiples of the agreed cut off levels) such results might form a significant part of the evidential picture. Subject to this however, both Professor Pragst and Mr O'Sullivan agreed that "You cannot put everything on the hair test"; in other words that the tests should not be used to reach evidential conclusions by themselves in isolation of other evidence. I sensed considerable unease on the part of Professor Pragst at the prospect of the results of the tests being used, other than merely as one part of the evidence, to justify significant child care decisions;"*

*Bristol City Council v The Mother and others* [2012] EWHC 2548 (Fam), Baker J was concerned with testing for cocaine and opiates. In that case, an unidentified human error in the process led to a false positive report. At paragraph 25, Baker J endorsed these four propositions:

> *"(1) The science involved in hair strand testing for drug use is now well-established and not controversial.*
>
> *(2) A positive identification of a drug at a quantity above the cut-off level is reliable as evidence that the donor has been exposed to the drug in question.*
>
> *(3) Sequential testing of sections is a good guide to the pattern of use*

*revealed.*

*(4) The quantity of drug in any given section is not proof of the quantity actually used in that period but is a good guide to the relative level of use (low, medium, high) over time."*

Baker J declined to go further, saying this at paragraph 25:

> *"The jurisdiction of the family courts is to determine specific disputes about specific families. It is not to conduct general inquiries into general issues. Occasionally, a specific case may demonstrate the need for general guidance, but the court must be circumspect about giving it, confining itself to instances where it is satisfied that the circumstances genuinely warrant the need for such guidance and, importantly, that is fully briefed and equipped to provide it."*

Most recently, Hayden J returned to the subject in *London Borough of Islington v M & R* [2017] EWHC 364 (Fam), a case of hair strand testing for drugs. He said this at paragraph 32:

> *"It is particularly important to emphasise that each of the three experts in this case confirmed that hair strand testing should never be regarded as determinative or conclusive. They agree, as do I, that expert evidence must be placed within the context of the broader picture, which includes e.g. social work evidence; medical reports; the evaluation of the donor's reliability in her account etc. These are all ultimately matters for the Judge to evaluate."*

I also note that in that case there was the difference in approach between the experts about how to treat positive findings falling below the cut-off levels set by the Society of Hair Testing (SoHT) – see paragraphs 46-51. This difference was replayed in the evidence at this hearing.

27. These decisions have helped me in approaching the issues raised in this case.

28. I next set out twelve propositions agreed between the expert witnesses from whom I have heard:

(1) Normal hair growth comprises a cycle of three stages: active growing (anagen), transition (catagen) and resting (telogen). In the telogen stage can remain on the scalp for 3-4 (or even 5 or 6) months before being shed. Approximately 15% of hair is not actively growing; this percentage can decrease during pregnancy.

(2) Human head hair grows at a relatively constant rate, ranging as between individuals from 0.6 cm (or, in extreme cases, as low as 0.5 cm) to 1.4 cm (or, in extreme cases, up to 2.2 cm) per month. If the donor has a growth rate significantly quicker or slower than this, there is scope both for inaccuracy in the approximate dates attributed to each 1 cm sample and for confusion if overlaying supposedly corresponding samples harvested

significant periods apart.

(3) The hair follicle is located approximately 3-5 mm beneath the surface of the skin; hence it takes approximately 5-7 days the growing hair to appear above the scalp and can take approximately 2-3 weeks to have grown sufficiently to be included in a cut hair sample.

(4) After a drug enters the human body, it is metabolised into its derivative metabolites. The parent drug and the metabolites are present in the bloodstream, in sebaceous secretions and in sweat. These are thought to be three mechanisms whereby drugs and their metabolites are incorporated into human scalp.

(5) The fact that a portion of the hair is in a telogen stage means that even after achieving abstinence, a donor's hair may continue to test positive for drugs and/or their metabolites for a 3-6 month period thereafter.

(6) Hair can become externally contaminated (e.g. through passive smoking or drug handling). Means of seeking to differentiate between drug ingestion and external contamination include:

(i) washing hair samples before testing to remove surface contamination

(ii) analysing the washes

(iii) testing for the presence of the relevant metabolites and establishing the ratio between the parent drug and the metabolite

(iv) setting threshold levels.

(7) Decontamination can produce variable results as it depends upon the decontamination solvent used.

(8) The SoHT has set recommended cut-offs of cocaine and its metabolites in hair to identify use:

(i) cocaine: 0.5 ng/mg

(ii) metabolites BE, AEME, CE and NCOC: 0.05 ng/mg

(9) Cocaine (COC) is metabolized into benzoylecgonine (BE or BZE), norcocaine (NCOC) and, if consumed, together with alcohol (ethanol), cocaethylene (CE). The presence of anydroecgonine methyl ester (AEME) in hair is indicative of the use of crack smoke cocaine.

(10) Cocaine is quickly metabolised in the body: therefore, in the bloodstream the concentration of cocaine is usually lower than that of BE. However, cocaine is incorporated into hair to a greater degree than BE: therefore, the concentration of cocaine in the hair typically exceeds that of BE. Norcocaine is a minor metabolite and its concentration in both blood and hair is usually much lower than either cocaine or BE.

(11) Some metabolites can be produced outside the human body. In particular, cocaine will hydrolyse to BE on exposure to moisture to variable degree, although high levels of BE as a proportion of cocaine would not be expected. It is very unlikely that NCOC will be found in the environment. The fact that cocaine metabolites can be produced outside the body raises the possibility that their presence is due to exposure: this is not the case with cannabis, whose metabolite is produced only inside the body.

(12) Having washed the hair before testing, analysis of the wash sample can allow for comparison with the hair testing results. There have been various studies aimed at creating formulae to assist in differentiating between active use and external contamination. In particular:

(i) Tsanaclis et al. propose that if the ratio of cocaine in the washing to that in the hair is less than 1:10, this indicates drug use.

(ii) Schaffer proposed "correcting" the hair level for cocaine concentration by subtracting five times the level detected in the wash.

The underlying fundamentals are that if external contamination has occurred (and therefore a risk of migration into the hair giving results that would appear to be positive) this is likely to be apparent from the amount of cocaine identified in the wash relative to that extracted from the hair.

29. The ability to work in this field requires the drug testing organisations to be accredited and validated to the required standard. Each of the organisations concerned in these proceedings has the necessary accreditation and regularly submits its procedures for external validation. Each of them has provided very full information and I am satisfied that they have done everything they can to help the court.

30. Before coming to areas of disagreement between the scientific witnesses, I summarise the results of the very extensive testing in this case very broadly, the full details being set out in a schedule. The estimated period assumes hair growth at 1 cm per month. Figures in bold indicate findings at or above the SoHT cut-offs.

| Test date | Tester | Est. period | COC range | BE range | NCOC |
|---|---|---|---|---|---|
| 8.15 | Alere | 4.15 – 7.15 (3cm) | **1.18**-0.44 | **0.97-0.46** | - |
| 2.16 | Alere | 11.15 - 2.16 (3cm) | **0.54**-0.26 | **0.12-0.14** | - |
| 5.16 | Alere | 1.16 – 4.16 (3 cm) | 0.19-0.11 | - | - |
| 12.16 | Lextox | 3.16 – 11.16 (8cm) | **0.87**-0.26 | **0.21-0.06** | - |
| 2.17 | DNA | 2.16 – 1.17 (12 cm) | **1.5**-0.42 | **0.52-0.24** | <0.02 |
| 7.17 | DNA | 1.17 – 7.17 (6 cm) | **0.52**-0.11 | **0.13-0.07** | <0.005 |
| 7.17 | Alere | 1.17 – 7.17 (6 cm) | 0.44-0.11 | **0.17-0.08** | - |
| 7.17 | Lextox | 1.17 – 7.17 (6 cm) | 0.26-0.07 | **0.09-0.05** | - |

31. This chart is a crude compression of 47 hair section tests for the purpose of this judgment. It does not contain the full sequential information on which the testers base their interpretations.

32. Where descriptions of the above level of findings are given, they are said to be low or medium to low.

33. Where the washings have been analysed, they did not detect cocaine, BE or NCOC, except that DNA Legal reported cocaine at 0.06 in the 12 cm strand, without identifying what sections this related to.

34. When it came to interpreting these results, the witnesses from the testing organisations (Ms John, Mr Poulton and Dr Breidi) gave the opinion that, taken in isolation, they were likely to result from the active use of cocaine, rather than from external contamination. The exception to this was that Dr Breidi did not reach this conclusion in relation to the 2017 results because of their lower levels – only one of the 18 sections reported cocaine at above the cut-off, and that section was only just above it (0.52). In contrast, Dr Rushton was not satisfied that the results establish active drug use at all, while Dr McKinnon's conclusion was that they may or may not.

35. The evidence of the expert witnesses in this case ranged over a number of

topics, including:

(1) The significance, if any, of the variability of the results as between the different laboratories.

(2) The nature and significance of industry guidelines.

(3) The significance of findings of cocaine or its metabolites below cut-off levels.

(4) The significance of the comparison between wash samples and test samples.

36. When considering these matters, Dr McKinnon's observations are useful:

*"There has been much scientific debate about the interpretation of hair tests. Developments in analytical methodology have proceeded faster than the ability to accurately interpret the findings. Although it is now possible to detect extremely low levels of drugs in hair, this has raised problems because the lower the drug level, the more difficult it becomes to distinguish whether it has arisen from ingestion or exposure. This has been a particular issue with cocaine."*

37. In relation to the *variability of results*, the tables provided by Mr Poulton at [C164z-164ac] illustrate that the range of results obtained by the different laboratories varies quite considerably. Notably, the DNA Legal results for 2016 were in some cases two or three times higher than those found by the other organisations. This is then reflected in the fact that DNA Legal reported findings in the low to medium range, while the others reported only low findings. However, direct comparison between the test results is to some extent confounded by the fact that hair was taken at different times, and that the assumed 1 cm growth rate may not be correct. It is also important to remember that the results may be affected by differences in laboratory equipment and differences in the way the hair is washed before analysis.

38. The testing carried out in July 2017, allows for the most direct comparison as the hair was all harvested at the same time. Even so, as an example of variability, two laboratories showed a cocaine result relating to the month of April at 0.11 and 0.17 (well below the cut-off), while the third showed it as 0.52 (just above the cut-off).

39. Dr Rushton said that these disparities are significant and that they can increase with low-level findings. In response, the witnesses for the testers claim a generally good degree of consistency. For example, the July test results covering three months found cocaine to be present below the cut-off in all but one case, and BE at or above the cut-off in all cases. Dr McKinnon considered that the differences could be due to analytical variation, timing and methodology. He shared Dr Rushton's concerns to some extent, but regarded them as a fact of life.

40. In my view, the variability of findings from hair strand testing does not call into question the underlying science, but underlines the need to treat numerical data with proper caution. The extraction of chemicals from a solid matrix such as human hair is inevitably accompanied by margins of variability. No doubt our understanding will increase with developments in science but, as matters stand, the evidence in this case satisfies me that these testing organisations approach their task conscientiously. Also, as previous decisions remind us, a test result is only part of the evidence. A very high result may amount to compelling evidence, but in the lower range numerical information must be set alongside evidence of other kinds. Once this is appreciated, the significance of variability between one low figure and another falls into perspective. I therefore accept the approach of the testing experts and of Dr McKinnon in preference to that of Dr Rushton on this issue. His approach requires an exactitude that can never be achieved in practice in the present day.

41. I must say something about the reporting of test results as being within the high/medium/low range. In fairness to the testing organisations, this practice has developed at the request of clients wishing to understand the results more easily. The danger is that the report is too easily taken to be conclusive proof of high/medium/low use, when in fact the actual level of use may be lower or higher than the description. You cannot read back from the result to the suspected use. Two people can consume the same amount of cocaine and give quite different test results. Two people can give the same test result and have consumed quite different amounts of cocaine. This is the consequence of physiology: there are variables in relation to hair colour, race, hair condition (bleaching and straightening damages hair), pregnancy and body size. Then there are the variables inherent in the testing process. Dr McKinnon explained that there is therefore only a broad correlation between the test results and the conclusions that can be drawn about likely use and that it should be recognised that in some cases (of which this is in his opinion, one) there will be scope for reasonable disagreement between experts.

42. Furthermore, the evidence in this case shows that even as between leading testing organisations, the descriptions are applied to different numerical values. DNA adopts the figures set out in the relevant studies, while the two other organisations divide their own historic positive laboratory results into thirds (Alere) or use the interquartile range for medium (Lextox).

| **Cocaine** | **Low** | **Medium** | **High** |
|---|---|---|---|
| **DNA Legal** | 0.5 – 0.89 | 0.89 – 18.9 | 18.9< |
| **Lextox** | 0.5 – 1.23 | 1.23 – 10.19 | 10.19< |
| **Alere** | 0.5 – 1.69 | 1.69 – 6.14 | 6.14< |

43. So it can be seen that there is variability in descriptions that are intended only to assist. As a case in point, the DNA Legal high figure for 2016 (1.50), which was itself significantly higher than that reported by the other testers, would only be described as falling into the medium range by two of the three organisations.

44. Regarding *industry guidelines*, the main guidelines are those published by the SoHT based on research: Cooper, Kronstrand & Kintz Forensic Sci Int 2012. These guidelines appear to state that a positive test requires at least a concentration of the parent drug at greater than the cut-off level and the identification of one of the metabolites. Dr Rushton drew attention to other guidelines issued by an American body, the Substance Abuse and Mental Health Services Administration (SAMHSA) and by the European Workplace Drug Testing Society (EWDTS). He suggested that there were *"agreed international guidelines"* that required the discovery of cocaine and two metabolites, in each case above the cut-off level, before a test can be considered positive. He went further, saying that for his part he would also need to have a negative wash result before the test could be taken to indicate use rather than exposure. This position was not supported by the other expert witnesses.

45. I do not recognise Dr Rushton's description of *"agreed international guidelines"*: the current industry standard in this country is found in the guidelines issued by the SoHT. It may be that these guidelines will be changed in time, possibly even in the direction of the more rigorous requirements of the other organisations. But in the meantime, it is not appropriate to require compliance with a higher set of standards.

46. There was similar disagreement between Dr Rushton and the other witnesses in relation to *the significance of findings below the cut-off level*. He was not prepared to entertain a positive finding that takes account of any data falling below the cut-off level. The other witnesses considered that all information should be taken into account, but giving due regard to whether or not results passed the cut-off level or not.

47. Having considered the evidence in this case, I arrive at the same conclusion as Hayden J in *Re R*, where (at paragraph 50) he preferred *"a real engagement with the actual findings"* to *"a strong insistence on a 'clear line' principle of interpretation"*. I accept the evidence of the witnesses for the testing companies that when one analyses thousands of tests, patterns can emerge that help when drawing conclusions. It would be artificial to require valid data to be struck from the record because it falls below a cut-off level when it may be significant in the context of other findings. That would elevate useful guidelines into iron rules and, as Dr McKinnon says, increase the number of false negative reports. What can, however, be said is that considerable caution must be used when taking into account results that fall below the cut-off level

48. As to *the significance of comparing wash samples and test samples*, there were a range of views. The testing companies asserted that this provided a further safeguard against a false positive. In broad terms, they adopted the Tsanaclis wash protocol and were amenable to applying the Schaffer ratio. Dr McKinnon, however, noted the variability in approach between the laboratories; for example, two of the laboratories follow the Tsanaclis method, while the third (DNA) uses a different washing agent. Dr Rushton was critical of the status of the science underlying the Tsanaclis/Schaffer approach, saying that it had not been adopted by international bodies or replicated and that he could not endorse the approach

taken by the testing organisations when they did not publish their data for peer review.

49. Once again, I felt that Dr Rushton was requiring more from the process than it can be expected to provide. The desire to know more is natural, but it cannot lead to paralysis until we know everything. In this instance, the testing organisations are voluntarily applying an additional safeguard over and above the SoHT requirements and cannot be criticised for doing so.

50. There was also discussion of whether wash samples should routinely be analysed. Of the three testers, only DNA Legal undertakes this. The others retain the washes for a year to allow for later analysis if required. There was some support from Dr McKinnon and Dr Rushton for routine analysis to be adopted; as against that, Mr Poulton suggested that the washes can be analysed wherever the tester feels that more information is needed.

51. This in my view is a question for determination by experts working in the field, not by the court. I can, however, see that the analysis and wash samples may be particularly helpful in cases where the hair strand results fall into the low or very low range, or where the outcome is for some other reason likely to be contentious. I also consider that, were it possible, it would be more helpful for wash results to be reported in relation to individual sections of hair rather than to the whole strand.

52. The mother's hair is, as it happens, very long. During the hearing, I asked whether there was any possibility of cross-contamination of newer hair by old, drug-affected hair, perhaps if the hair was piled up wet after washing. None of the witnesses suggested that this could produce the sort of testing results that were found.

53. In relation to the disputed issues, I have rejected a number of the arguments presented by Dr Rushton. His long expertise in trichology does not significantly extend into toxicology, and his insistence on his point of view overlooked many of the realities that allow science to grapple with everyday problems. While Ms John, Mr Poulton and Dr Breidi have enormous experience of giving opinions on hair strand tests in their professional life, and Dr McKinnon at least some, Dr Rushton has never done so, and has only been asked for his opinion in a few cases as an expert witness. He was markedly unwilling to entertain one obvious explanation for the test results, namely that the mother may have been taking cocaine. In particular, under examination by Ms Cook QC for Alere, he was prepared to accept that the test results from samples obtained in August 2015 suggested use, but unwilling to say the same for comparable results obtained in December 2016; the difference being that the mother had admitted use in the first case, but not in the second. He was also prepared to express the view that the 2017 results positively excluded the use of cocaine. Nor did he acknowledge that the testing organisations are operating within recognised industry standards, which are set in order to minimise so far as possible both false positives and false negatives.

54. I accept that Dr Rushton has asked some good questions, and has done so fearlessly, but for the most part I am not able to accept the answers that he gives. All in all, I do not consider that his criticisms of hair testing science, or of the activities of the companies concerned in this case, were made out to any significant extent.

55. Dr McKinnon was by contrast a notably cautious witness, but to the extent that he felt able to express an opinion, I found his evidence could be depended upon.

56. I found the evidence of Ms John, Mr Poulton and Dr Breidi to be evidence-based and carefully considered. They have a combination of expertise and experience that enabled them to deal satisfactorily with the issues under consideration. Mr Poulton made a point that they each made in their different ways: *"Knowing a typical result comes with experience. Experience is the key. Knowing when further work is necessary, looking at the patterns – this is probably the most valuable part of what we can contribute".*

**Report writing and reading**

57. The parties have made suggestions as to how the presentation of reports might be developed so as to be most useful to those working in the field of family justice. I will record some of these suggestions and some of my own. Before doing so, I note that each of the testing organisations already produces reports that contain much of the necessary information in one shape or another. It is also important to stress the responsibility for making proper use of scientific evidence falls both on the writer and the reader. The writer must make sure as far as possible that the true significance of the data is explained in a way that reduces the risk of it becoming lost in translation. The reader must take care to understand what is being read, and not jump to a conclusion about drug or alcohol use without understanding the significance of the data and its place in the overall evidence.

58. Comment was made during the evidence that certain courts, and in particular Family Drug and Alcohol Courts, are very familiar with the methodology of hair strand testing and the way in which reports are laid out. The objective must be for all participants in the system, professional and non-professional, to develop a similar competence, even though they do not read as many reports as the FDAC does.

59. There are currently nine accredited hair strand testing organisations working in the family law area. It is not for the court hearing one case to dictate the way reports are written by those who have intervened in this case or by others who have not taken part, but I include the following seven suggestions in case they are helpful.

(1) Use of high/medium/low descriptor:

This is in my view useful, provided it is accompanied by:

- A numerical description of the boundaries between high/ medium/low, with an explanation of the manner in which the boundaries are set should be stated.

- A clear statement that the description is of the level of substance found and not of the level of use, though there may a broad correlation.

- A reminder that the finding from the test must always be set alongside other sources of information, particularly where the results are in the low range.

(2) Reporting of data below the cut-off range:

There is currently inconsistency as between organisations on reporting substances detected between the lower limit of detection (LLoD) and the lower limit of quantification (LLoQ), and those between the LLoQ and the cut-off point.

I would suggest that reports record all findings, so that:

- a finding below the LLoQ is described as *"detected, but so low that it is not quantifiable"*

- A result falling below the cut-off level is given in numerical form

and that this data is accompanied by a clear explanation of the reason for the cut-off point and the need for particular caution in relation to data that falls below it.

(3) Terminology

Efforts to understand the significance of tests are hampered by the lack of a common vocabulary to describe results in the very low ranges, Descriptions such as *"positive"*, *"negative"*, *"indicates that" and "not detected"* can be used and understood vaguely or incorrectly. The creation of a common vocabulary across the industry could only be achieved by a body such as the SoHT. In the absence of uniformity, reporters should define their terms precisely so that they can be accurately understood.

(4) Expressions of probability:

The Family Court works on the civil standard of proof, namely the balance of probabilities. It would therefore help if opinions about testing results

could be expressed in that way. For example:

*"Taken in isolation, these findings are in my opinion more likely than not to indicate ingestion of [drug]."*

*"Taken in isolation, these findings are in my opinion more likely than not to indicate that [drug] has not been ingested because…."*

*"Taken in isolation, these findings are in my opinion more likely to indicate exposure to [drug] than ingestion."*

(5) Where there is reason to believe that environmental contamination may be an issue, this should be fully described, together with an analysis of any factors that may help the reader to distinguish between the possibilities.

(6) The FAQ sheet accompanying the report (which might better be described as *"Essential Information"*), might be tailored to give information relevant to the particular report, and thereby make it easier to assimilate.

(7) When it is known that testing has been carried out by more than one organisation, the report should explain that the findings may be variable as between organisations.

**Conclusions on the findings sought by the local authority**

60. In summary, these relate to

A. The mother's neglectful parenting of the three older children (admitted)

B. Her long-standing history of drug and alcohol misuse up to July 2015 (admitted)

C. Her continued use of cocaine, albeit at a low and/or infrequent level

i. between July 2015 and December 2016, including at times when she was pregnant, and

ii. between January and July 2017, when she was under close scrutiny because of these proceedings, when she had the care of Holly, when she was providing urine tests, and when she knew that she would be the subject of further hair strand tests.

D. Her repeated lying to professionals and the court about her use of cocaine.

61. The burden of proof is on the local authority, which must prove its allegations

on the balance of probabilities. As Ms Markham QC and Miss Tompkins rightly say, the presence of an ostensibly positive hair strand test does not reverse the burden of proof.

62. My conclusion, taking account of all the evidence, both scientific and nonscientific, is that the local authority has made out its case in relation to A, B, C(i) and D. The evidence as a whole drives me to the conclusion that the mother regrettably used cocaine at a relatively low and infrequent level during the latter part of 2015 and during 2016 and that she has not told the truth about that. As to C(ii), there is much weaker scientific evidence of continuing limited cocaine use after Holly's birth. Given my finding in relation to earlier use, I cannot discount the possibility that the mother is not telling the truth about that either, but taking the evidence as a whole, I am not satisfied the local authority has proved its case in respect of that period.

63. I arrive at my conclusion in relation to drug use in 2015 and 2016 for essentially the reasons set out in the closing submissions of Mr Tyler QC and Ms James. Although there is considerable evidence of the mother's attempts to get help and to rid herself of drug use, the almost continuous array of test results showing cocaine and BE significantly above the threshold cannot adequately be explained by inadvertent exposure. In addition, the wash samples were either negative or produced a minimal cocaine reading far below the amount that would suggest that the much higher readings from inside the hair matrix arose from exposure. I accept the evidence on behalf of the interveners that this pattern is much more consistent with use than exposure, although exposure (including perhaps from knowing drug use) may also have been a contributor. I also note, though it cannot be conclusive, that the readings are not in some cases dissimilar to those found in the August 2015 testing that covered a period when the mother was admittedly using cocaine. Finally, with regard to the scientific evidence on this issue, I find that the conclusions of the interveners' witnesses tip the scales against the arguments of Dr Rushton and the uncertainty of Dr McKinnon.

64. In reaching this conclusion, I must give my assessment of the mother as a witness. There were many appealing aspects of her evidence, and I do not doubt her good intentions when it comes to kicking drugs. However, the undoubted presence of cocaine and its metabolites can only come from use or exposure, and none of the possibilities for innocent exposure in this case can be accepted as producing these readings. Much though I would wish to take the mother at her word, I regret that I cannot do so and I find that on the balance of probabilities she found herself falling into occasional but repeated low level cocaine use during the later part of 2015 and through 2016.

65. However, the evidence in relation to 2017 leads me to a different conclusion. Following Holly's birth, there has been very regular urine testing and continuous face-to-face contact between the mother and a wide range of professionals and others concerned for Holly's welfare. Scarcely a day will have passed without contact of this kind and no one has noticed the slightest suggestion of drug use. The results of the July testing are with one marginal exception below or far below the cut-off limit for cocaine. The interpretations of the toxicologists vary: Mr

Poulton thought the results in isolation represented likely use, Dr Breidi considered them to be the residual results of earlier use in 2016, while Ms John and Dr McKinnon could not choose between these possibilities. The local authority has put the arguments very fairly when seeking a finding on this issue and, taking the evidence as a whole, I am not satisfied that it has made out its case in relation to recent use of cocaine. It follows that on balance I am prepared to accept the mother's evidence that she has been free of drugs since Holly was born.

66. I agree with the parties that these findings do not call into question the decision that Holly should remain in her mother's care. By the same token, I am doubtful that the evidence that was available in January was in truth sufficient to justify the very severe order of the removal of a baby at birth.

**Conclusion on the form of order**

67. I remind myself of the analysis in *Re O* [2001] EWCA Civ 16, which speaks for supervision orders to be made where they are proportionate to the level of risk. The closing submissions of Mr Parker and Mr Lamb for the Guardian contain a useful summary of the practical considerations regarding monitoring, support and duration. As to the wider considerations, it is common ground that in Holly's case we are not dealing with harm in the past, but with the risk of future harm, and that the situation is well contained under the current interim supervision order.

68. The local authority emphasises the mother's vulnerability and the troubling history of abstinence and relapse in relation to the older children. It agrees to include a provision in the care plan that confirms that written notice would be given of any intention to remove Holly unless she was at risk of immediate physical harm.

69. In my view, neither a care order nor a supervision order would be a wrong choice in this case. Each has advantages and disadvantages. Holly's placement with her mother will not succeed if the mother at some point and for some reason slips back into her old ways. Everyone in this courtroom sincerely hopes that she doesn't, and if she can remain abstinent there is every chance that she won't. Against a background of this kind, the opportunity for a child to be brought up by her mother is a precious thing and the best order in my view is the one that gives this outcome the best chance. Where the glass can fairly be seen as being half empty or half full, the court order should tell the mother that Holly's future is her responsibility and that, while help is available on all sides, this is only going to work if she makes it work.

70. I am also influenced by the possibility of some unintended disadvantages from the local authority sharing parental responsibility. The care planning in this case has been suboptimal, with a high turnover of social workers and poor consultation. I think that the mother's self-confidence needs to be built up and that this is more likely to happen if she no longer has to share parental responsibility with the local authority. The local authority commendably says that

its support services will be essentially the same, whether or not there is a care order. The making of a supervision order is time-limited, for one or for three years. In practice, either good progress will continue to be made and statutory intervention will reduce and cease or the mother will relapse, there will be further proceedings, and Holly will almost inevitably be removed from her care for good and all.

71. On the facts of this case, I do not see a care order as conferring benefits that outweigh those arising under a supervision order. I will therefore make a supervision order in favour of the local authority for 12 months, trusting that it will be reviewed in 9 months to decide whether an extension will be necessary.

72. That concludes the proceedings in relation to Holly. I am aware that a final decision remains to be made about the future of the boys. That decision will be taken by HH Judge Mayer, based on the evidence before her. Nothing in this judgment is intended to influence her decision; in particular, the fact that the mother is retaining Holly under the lesser form of statutory order does not in any way imply a view on the part of this court that she is presently capable of looking after more than one child.

73. I thank all the parties and the interveners for their assistance, and I wish Holly and both her parents well for the future.

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