

<p>1 Thursday, 12 April 2018</p> <p>2 (10.00 am)</p> <p>3 MR SKELTON: Sir, may I call Dr Wilmshurst back to give</p> <p>4 evidence.</p> <p>5 THE CORONER: Yes.</p> <p>6 DR PETER WILMSHURST (affirmed)</p> <p>7 Questions from MR SKELTON</p> <p>8 MR SKELTON: Dr Wilmshurst, thank you for returning to the</p> <p>9 court to give evidence. You have provided</p> <p>10 a supplementary report for the court, which I think you</p> <p>11 have in front of you open by the looks of it, tab 25 in</p> <p>12 bundle 1 of the supplementary bundle.</p> <p>13 <b>A. Yes.</b></p> <p>14 Q. Thank you.</p> <p>15 Can I start by just reminding all those present what</p> <p>16 your expertise is, you are a cardiologist by profession?</p> <p>17 <b>A. Yes.</b></p> <p>18 Q. And, by definition, a physician as well?</p> <p>19 <b>A. Yes, well not all cardiologists are accredited in</b></p> <p>20 <b>general medicine but I am, yes.</b></p> <p>21 Q. Yes.</p> <p>22 You are not a toxicologist?</p> <p>23 <b>A. No.</b></p> <p>24 Q. Ultimately on a question of toxicological expertise you</p> <p>25 will defer to those with that expertise?</p> <p style="text-align: center;">Page 1</p>	<p>1 <b>converted to histamine if the bacteria are present if</b></p> <p>2 <b>the temperature is not kept low enough, in other words</b></p> <p>3 <b>if the fish is not kept at near zero degrees Centigrade.</b></p> <p>4 Q. Histamine is a naturally occurring chemical in the human</p> <p>5 body as well?</p> <p>6 <b>A. It is.</b></p> <p>7 Q. But at certain levels it becomes toxic?</p> <p>8 <b>A. Yes, it is present in small amounts as a transmitter.</b></p> <p>9 Q. You provide a number of papers appended to your</p> <p>10 supplementary opinion. Can I just take you to one of</p> <p>11 them first, which is the WHO report. This is the joint</p> <p>12 report under tab 27 from the Food and Agricultural</p> <p>13 Organisation of the United Nations and the World Health</p> <p>14 Organisation.</p> <p>15 <b>A. Yes.</b></p> <p>16 Q. It is from July 2012 and, within that report, page 380</p> <p>17 of our internal referencing, you can see described</p> <p>18 scombrototoxin fish poisoning, SFP, and it gives</p> <p>19 an introduction to it and says it is also known as</p> <p>20 histamine fish poisoning, which ties in with what you</p> <p>21 have been saying about the cause of the toxicity.</p> <p>22 <b>A. That is what is thought to be the case, because there</b></p> <p>23 <b>are certain other toxins present which may also</b></p> <p>24 <b>contribute.</b></p> <p>25 Q. Yes.</p> <p style="text-align: center;">Page 3</p>
<p>1 <b>A. Yes.</b></p> <p>2 Q. Your report deals with an issue of potential food</p> <p>3 poisoning in Paris on the night of 9 November 2012, the</p> <p>4 night before Mr Perepilichnyy died?</p> <p>5 <b>A. Yes.</b></p> <p>6 Q. You describe a certain type of fish called the scombroid</p> <p>7 family of fish, which include tuna and mackerel and the</p> <p>8 like, which can cause a particular type of reaction from</p> <p>9 bacterial infection?</p> <p>10 <b>A. Yes.</b></p> <p>11 Q. Can you just explain from a medical perspective what the</p> <p>12 bacteria produce that causes the potentially toxic</p> <p>13 reaction?</p> <p>14 <b>A. What the bacteria?</b></p> <p>15 Q. Sorry, what the bacteria on the fish produce, the rotten</p> <p>16 fish, which causes the reaction?</p> <p>17 <b>A. Certain fish, pelagic fish of the scombroid type, so</b></p> <p>18 <b>that is mackerel and tuna and a few other fish, and also</b></p> <p>19 <b>salmon which is a different class of fish, they have --</b></p> <p>20 <b>pelagic fish are ones that swim long distances as</b></p> <p>21 <b>opposed to reef fish. The pelagic fish have in place of</b></p> <p>22 <b>lactate -- when we exercise and build up an oxygen debt</b></p> <p>23 <b>we produce lactate, they use histidine to buffer that</b></p> <p>24 <b>and histidine is converted to histamine by bacteria that</b></p> <p>25 <b>are naturally occurring on the fish, so histidine is</b></p> <p style="text-align: center;">Page 2</p>	<p>1 <b>A. Yes.</b></p> <p>2 Q. Under paragraph 2.3.1 on page 380 you see "Symptoms" and</p> <p>3 the first thing it says is:</p> <p>4 "A variety of symptoms have been observed among</p> <p>5 humans, poisoned individuals may show one or more of the</p> <p>6 symptoms and the severity of the response to the</p> <p>7 contaminated fish may vary."</p> <p>8 You don't have to show the whole panoply of symptoms</p> <p>9 that we are going to come on to, you need one or two</p> <p>10 that may be diagnostic or indicative of a possibility of</p> <p>11 scombroid fish poisoning, presumably with a history of</p> <p>12 having eaten scombroid fish by definition?</p> <p>13 <b>A. Or salmon --</b></p> <p>14 Q. Or salmon?</p> <p>15 <b>A. -- which is not a scombroid fish.</b></p> <p>16 Q. As you say, although the focus seems to be more on the</p> <p>17 scombroid?</p> <p>18 <b>A. Yes.</b></p> <p>19 Q. Salmon does produce -- at the same level?</p> <p>20 <b>A. I don't know.</b></p> <p>21 Q. Thank you.</p> <p>22 THE CORONER: Can I ask this, you told us about mackerel,</p> <p>23 tuna and salmon, I know this is a different category but</p> <p>24 do prawns come into this all?</p> <p>25 <b>A. I don't know, but I suspect not because it is -- you</b></p> <p style="text-align: center;">Page 4</p>

<p>1 <b>don't get it off reef fish which swim in a small area,</b>  2 <b>it is the fish that swim long distances that ...</b>  3 THE CORONER: Thank you.  4 MR SKELTON: To read on, they say in several reports  5 exacerbation of asthma and more serious cardiac  6 manifestations were reported, and you can see the  7 references there. We will come to the cardiac issue in  8 due course, because that obviously is getting into  9 an area where you are certainly highly qualified to  10 discuss cardiac consequences.  11 The symptoms typically develop rapidly, from five  12 minutes to two hours after ingestion of the spoiled  13 fish, with a usual duration of 8 to 12 hours and with  14 symptoms usually no longer observed after 24 hours.  15 It is a rapid onset and rapid resolution poisoning  16 ordinarily?  17 <b>A. Yes.</b>  18 Q. "Although symptoms may persist for up to several days  19 there are no known long term sequelae, and it is  20 considered to be rarely if ever fatal."  21 <b>A. Yes, I mean it is rarely fatal but it is not not -- when</b>  22 <b>you say rarely, if ever, I mean there are cases of</b>  23 <b>people who died of it, so --</b>  24 Q. I will take you on to some of your other reports,  25 because I just wanted to see some of the cases where it</p> <p style="text-align: center;">Page 5</p>	<p>1 <b>A. That, yes, it can be, or it can be just swelling.</b>  2 <b>I mean if you get it on the vocal chords of course you</b>  3 <b>have problems breathing or your tongue can swell or you</b>  4 <b>can just get patches of swelling on the skin.</b>  5 Q. Hypotension, that is low blood pressure?  6 <b>A. Yes.</b>  7 Q. Headache, tachycardia, an abnormally high cardiac heart  8 rate?  9 <b>A. Yes.</b>  10 Q. Gastrointestinal symptoms, abdominal cramps, diarrhoea  11 vomiting. Neurological symptoms, pain, itching, which  12 I think is something you recall when you suffered this?  13 <b>A. Yes, I am not sure that itching is neurological, I think</b>  14 <b>it is cutaneous if you see what I mean, it is part of if</b>  15 <b>you get hives, they are itchy, if you get urticaria, it</b>  16 <b>is often itchy.</b>  17 Q. It is not part of the central nervous system, it is  18 a skin related symptom you would say?  19 <b>A. Yes.</b>  20 Q. And other symptoms or potential symptoms, oral burning  21 sensation, peppery test, nausea and swelling of the  22 tongue?  23 <b>A. Yes, the peppery taste though I think is when you eat</b>  24 <b>the fish, that is -- I mean it is not as -- from my</b>  25 <b>personal experience, it doesn't linger, it is when you</b></p> <p style="text-align: center;">Page 7</p>
<p>1 has arisen as being of a fatal consequence and your  2 views on that. For present purposes, are you happy with  3 that as a generalisation about --  4 <b>A. As generalisation, yes.</b>  5 Q. Diagnosis under paragraph 2.3.2 is said to be largely  6 dependent on the symptomatology, time of onset, history  7 of food allergy and the consumption of contaminated  8 fish. It can be confirmed by detecting high levels of  9 histamine in the implicated food, meal remnants or  10 a similar product obtained from the same source.  11 I think you would add to that, would you, that if  12 you checked the patient, you would ordinarily expect to  13 find high levels of histamine as well?  14 <b>A. And histamine metabolised, yes.</b>  15 Q. The metabolised -- because the body, as again we will  16 come to on, rapidly metabolises histamine down into  17 metabolites and then away through the excretion?  18 <b>A. Yes.</b>  19 Q. The common symptoms are listed in a table 2.1 on that  20 same page, first cardiovascular, so flushing, a rash and  21 urticaria, if I am pronouncing that correctly.  22 <b>A. Urticaria, yes.</b>  23 Q. That is a certain type of rash, isn't it?  24 <b>A. Yes, it is a slightly raised sort of fleshy boggy rash.</b>  25 Q. Sometimes called hives?</p> <p style="text-align: center;">Page 6</p>	<p>1 <b>eat the fish that it tastes peppery or metallic, it is</b>  2 <b>not you retain a peppery taste.</b>  3 Q. That is not what it says here, but that is what you  4 think from your own personal experience?  5 <b>A. Yes, and also from reading I think.</b>  6 Q. I think it is fair to say, but you can correct me if  7 I am wrong, that some of the other papers that you  8 include within your supplementary material mention the  9 same sorts of symptoms broadly speaking?  10 <b>A. Yes.</b>  11 Q. So the rash, the vomiting, diarrhoea in some cases,  12 a feeling of nausea and other matters --  13 <b>A. Yes.</b>  14 Q. -- that are listed here?  15 <b>A. Yes.</b>  16 Q. Histamine is the primary cause of those symptoms,  17 an abnormally high level of histamine?  18 <b>A. Yes.</b>  19 Q. Can I ask you just to explain your view as to the effect  20 of high levels of histamine on the heart which is  21 something that you talk about by reference to a paper by  22 Wolff and Levi, which is to be found under tab 26,  23 please.  24 <b>A. Well, I think, essentially, it can do all sorts of</b>  25 <b>things to the heart. It often causes a tachycardia, the</b></p> <p style="text-align: center;">Page 8</p>

1 heart rate to go fast but part of that may be because of  
 2 the vasodilatation you get and the drop in blood  
 3 pressure, so you sometimes get a reflex tachycardia  
 4 because your blood pressure is low your heart rate  
 5 speeds up. But histamine has direct effects on the  
 6 heart, it can cause the atria to go fast, increase  
 7 automatic rhythmicity of the heart of the atria or the  
 8 ventricle, so it can make them go fast but it also has  
 9 an effect on the AV node where it can slow conduction  
 10 through the AV node so that although the atria are going  
 11 fast the ventricles are going slow, because the purpose  
 12 of the AV node is to regulate the heart rate so that if  
 13 the atria go berserk so to speak, as happens in atrial  
 14 fibrillation when they are depolarising all the time,  
 15 that doesn't get transmitted to the ventricles and the  
 16 ventricles continue at a more life-sustaining rate.

17 THE CORONER: AV standing for?

18 A. Sorry, atrioventricular node.

19 MR SKELTON: It is probably helpful first to go back to what  
 20 you just said and just to break it down into the various  
 21 concepts, but also as we are going along it would be  
 22 helpful for you to explain probably some of the basics  
 23 of the cardiological terms you are talking about.

24 A. Okay.

25 Q. Can I go back first of all because we looked at the WHO

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1 report which said about hypotension and tachycardia, you  
 2 dealt with tachycardia, but the hypotension, would that  
 3 be a cardiac-related cause or is that a systemic  
 4 consequence of the histamine, through example through  
 5 vasodilatation and so on?

6 A. Vasodilatation is a systemic affect. But it also can be  
 7 localised, and quite strange in a sense, so when I had  
 8 scombrototoxin poisoning I was bright red from the head  
 9 down to my waist, but the rest of my body was the normal  
 10 sort of pasty colour.

11 Q. Healthy pasty?

12 A. Yes, but it was not a sort of line -- it was a line of  
 13 demarcation but irregularly round the body, it was quite  
 14 bizarre but that vasodilatation drops your blood  
 15 pressure and the heart rate may respond to that.

16 Would it help if I explained the conduction normally  
 17 in the heart? In that, I mean, heart cells have -- they  
 18 are joined to each other so that when one contracts, or  
 19 one depolarises, that causes it to contract but it also  
 20 passes on the depolarisation to the neighbouring heart  
 21 muscle cells, which then depolarise and then contract,  
 22 so they transmit, but the rhythmicity of the heart  
 23 starts in a small part of the heart normally called the  
 24 sinoatrial node which is, we like to think of, as the  
 25 top right-hand corner of the heart, which has the most

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1 rapid automatic depolarisation rate, so that will  
 2 depolarise and trigger a heartbeat. Then it spreads  
 3 through the atria and when it reaches the AV node it is  
 4 transmitted through the atrioventricular node to the  
 5 ventricles, because there is a fibrous band separating  
 6 the atria and the ventricles, so normally contraction  
 7 only gets to the ventricles via the AV node through  
 8 a small part. That has the function of stopping the  
 9 ventricles going at 600 per minute if the atria go  
 10 haywire, which they do quite commonly in atrial  
 11 fibrillation which is a common rhythm disturbance which  
 12 increases with age and at the age of 70 1 in 20 of us  
 13 have it, by the age of 80 1 in 10 of us have it.

14 If you didn't have the AV node you would die  
 15 a minute after you went into atrial fibrillation.

16 Q. How is the fibrillation related to atrial flutter?

17 A. They are both fast rhythms. Atrial flutter can  
 18 deteriorate into atrial fibrillation but essentially the  
 19 rate in atrial flutter is about 300 per minute and it is  
 20 a circuit, it is semi-organised in the sense that it is  
 21 a circuit around the atria at about 300 per minute.

22 Atrial fibrillation is a disorganised rhythm, but if  
 23 you wanted to know how fast it was, it would be about  
 24 600 per minute, which of course is incompatible with  
 25 life if that goes to the ventricles and you get

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1 ventricular fibrillation, which of course you die from.

2 Q. Yes.

3 You were beginning to talk about the effect of  
 4 histamine on the AV node, can I just take you to the bit  
 5 of the paper that starts to talk about that and see if  
 6 it is enlightening or you may feel that you would like  
 7 to explain it in your own words, given that I think the  
 8 paper is fairly abstruse for the layman.

9 Page 352, "Arrhythmogenic effects of histamine on  
 10 the AV node", is that broadly speaking what you are  
 11 talking about? There are other effects?

12 A. Yes. Yes.

13 Q. Could you explain what that is.

14 A. Essentially what they are saying is that its effect on  
 15 the AV node is to slow conduction through the AV node so  
 16 that you can -- although histamine can cause the heart  
 17 to go fast by direct effects on the atria and on the  
 18 ventricles, it actually slows conduction through the AV  
 19 node, so it tends to slow the ventricular rate.

20 Unless you have a direct effect on the ventricles,  
 21 you may get slowing of the heart rate. What I am trying  
 22 to say is that the effects of histamine will vary from  
 23 time to time. In some people it may increase the heart  
 24 rate, in others it may slow it right down and it is not  
 25 really predictable.

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1 Q. This paper is effectively reviewing a lot of the  
 2 literature, isn't it?  
 3 **A. Yes.**  
 4 Q. It is collating a vast amount of previously done  
 5 research into an analysis of the effect of histamine,  
 6 broadly speaking, on cardiac function.  
 7 **A. That's right.**  
 8 Q. Do the underlying paper, if you are in any way familiar  
 9 with them, actually explain that histamine can be fatal  
 10 in terms of cardiac function? I hadn't appreciated that  
 11 being a conclusion from the paper itself, from this  
 12 paper?  
 13 **A. Well, no. Well, I don't know if it actually says that**  
 14 **but the -- I mean to a cardiologist, if you slow AV**  
 15 **conduction, then it is clear that you can slow the heart**  
 16 **rate right down and people can die. I mean when that**  
 17 **happens in life, in extreme circumstances, we call that**  
 18 **heart block and that requires a pacemaker if you are**  
 19 **going to survive.**  
 20 Q. I understand that theoretically of course if you have  
 21 a cardiac dysfunction, a dysfunction of the atria or the  
 22 ventricles, that can be fatal but I wondered from the  
 23 literature that you have seen, whether it has been  
 24 fatal?  
 25 **A. I don't know if anyone -- no, I don't know that I have**

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1 **seen that.**  
 2 Q. No, I haven't seen it in the papers that you have given,  
 3 as far as I am aware but it may be that the underlying  
 4 literature that feeds into those papers does demonstrate  
 5 that. I don't know whether you can assist on that?  
 6 **A. No, I mean most of this is experimental work. I guess**  
 7 **there is not a lot of work, except of course in this,**  
 8 **the report you gave me earlier, which describes the two**  
 9 **Australian women who died in Mali -- Bali rather.**  
 10 **I mean they died and it seems to me likely that part of**  
 11 **the reason they died is because of the fact that they**  
 12 **had cardiac arrhythmias and died. One of them they**  
 13 **tried to resuscitate, so she obviously had**  
 14 **a cardiopulmonary arrest.**  
 15 Q. May I leave that paper to one side for the moment?  
 16 **A. Sure.**  
 17 Q. I only say that because it has not been introduced by me  
 18 as counsel to the Inquest, it is being introduced by  
 19 an interested person. I am not yet clear the basis on  
 20 which it is going to be put to you. It may be I need to  
 21 revisit the questions.  
 22 **A. Yes.**  
 23 Q. Going back to my question of whether you were aware of  
 24 fatalities, leaving aside that paper the answer I think  
 25 is no?

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1 **A. No, I was aware of those cases.**  
 2 Q. You were aware of those cases?  
 3 **A. I was aware of those cases, the two deaths in Bali and**  
 4 **the two Australians. Yes, I was aware of it before**  
 5 **I read ...**  
 6 Q. The paper that you refer to which I think is by  
 7 Borysiewicz, which is under tab 42, again deals with  
 8 this atrial flutter issue, scombrotoxic atrial flutter?  
 9 **A. Yes.**  
 10 Q. I think what you say in your report is it provides  
 11 a mechanism by which scombrotoxic poison may cause  
 12 a lethal cardiac arrhythmia?  
 13 **A. Yes.**  
 14 Q. Again you are raising it as a theoretical possibility,  
 15 although in fact in that case the patient I don't think  
 16 died, did he?  
 17 **A. No, but he had the arrhythmia for four days.**  
 18 Q. They had found it and they monitored him and then he  
 19 recovered and was discharged?  
 20 **A. Yes. That's right.**  
 21 Q. He could have died from it you are saying but he didn't?  
 22 **A. Yes, I mean people don't usually die of atrial flutter.**  
 23 **But there is the potential. The point I think I was**  
 24 **trying to make in my report was that although it would**  
 25 **seem that the effect of histamine had worn off, because**

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1 **it doesn't usually, you know the reports say it doesn't**  
 2 **last for four days, the arrhythmia persisted and atrial**  
 3 **arrhythmias are self perpetuating, we often have to put**  
 4 **people to sleep and shock them out of the arrhythmia or**  
 5 **give them a drug to get them out of it because it self**  
 6 **perpetuates.**  
 7 Q. Are you clear that the ongoing cause of that flutter --  
 8 for four days after the histamine has presumably been  
 9 excreted or it has been metabolised, let's put it that  
 10 way -- is the original poisoning?  
 11 **A. I was as convinced as they are, I mean if they are**  
 12 **convinced it was scombrotoxin poisoning that led to it,**  
 13 **then I think that the fact it was self perpetuating is**  
 14 **quite easy to understand, because we know that if -- the**  
 15 **more common situation when people get a toxin causing**  
 16 **an atrial arrhythmia is an alcoholic binge and that is**  
 17 **known in America as the "holiday heart syndrome", people**  
 18 **have an alcoholic binge, they go into atrial**  
 19 **fibrillation, and although they are sober the next day**  
 20 **their atrial fibrillation may persist for weeks or**  
 21 **months or until they come into hospital and we give them**  
 22 **a drug to get them out of it.**  
 23 **The trigger, alcohol, which acts by releasing**  
 24 **catecholamines we think in that case, because it puts**  
 25 **your adrenaline and similar catecholamine levels up,**

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<p>1 triggers the atrial fibrillation and even though the</p> <p>2 alcohol level has gone down hours later or the next day,</p> <p>3 you stay in atrial fibrillation because atrial</p> <p>4 arrhythmias are self perpetuating.</p> <p>5 In fact -- well, perhaps I shouldn't say that</p> <p>6 someone else has given me another thing they plan to</p> <p>7 adduce of another case of atrial tachycardia triggered</p> <p>8 by scombrototoxin.</p> <p>9 Q. Can I just be clear about your scientific degree of</p> <p>10 confidence when you make the conclusion --</p> <p>11 A. Yes.</p> <p>12 Q. -- this is obviously a single paper about a single</p> <p>13 patient and the authors of the paper say:</p> <p>14 "In our patient the histamine like toxin may have</p> <p>15 induced atrial flutter which persisted after the other</p> <p>16 effects of the toxin had disappeared."</p> <p>17 A. Yes.</p> <p>18 Q. That "may" doesn't imply, certainly to my reading,</p> <p>19 certainty but they are raising it as a possibility?</p> <p>20 A. That's right.</p> <p>21 Q. And it is no more than that?</p> <p>22 A. No, that's right.</p> <p>23 Q. But --</p> <p>24 A. Sorry, I would say, it is consistent with also the work</p> <p>25 that we know experimentally, if you see what I mean,</p> <p style="text-align: center;">Page 17</p>	<p>1 increases in a normal manner to whatever is, you know,</p> <p>2 the maximum they can achieve, perhaps 180, I don't know,</p> <p>3 but with flutter, you would get great sudden changes in</p> <p>4 heart rate variability you could imagine, and quite</p> <p>5 significant increases in the heart rate. Doubling</p> <p>6 instantly or --</p> <p>7 Q. You raise that there is a possible interaction if food</p> <p>8 poisoning did occur here --</p> <p>9 A. Yes.</p> <p>10 Q. -- with exercise, which could be potentially fatal, but</p> <p>11 you don't raise that probability, do you, as</p> <p>12 I understand it?</p> <p>13 A. No, I am just trying to think of a mechanism that might</p> <p>14 account for it, that is all.</p> <p>15 Q. The papers that we have all seen indicated that</p> <p>16 histamine testing is the primary means of clinical</p> <p>17 diagnosis in the patient. The history is obviously</p> <p>18 relevant but definitive diagnosis of what is actually</p> <p>19 causing the symptoms is a histamine test of some kind.</p> <p>20 Can I just ask you about how that works. Histamine</p> <p>21 is a rapidly metabolised product.</p> <p>22 A. Hmm?</p> <p>23 Q. Its half life -- there has been some discussion I know</p> <p>24 in your further letter about the half life of histamine.</p> <p>25 Is there a definitive recognition of the half life or</p> <p style="text-align: center;">Page 19</p>
<p>1 because in the other paper, the experimental paper, it</p> <p>2 produced those sort of arrhythmias, experimentally.</p> <p>3 Q. It is a coherent theory that makes sense based on other</p> <p>4 research but hasn't been conclusively proven?</p> <p>5 A. No, it is very difficult to prove these things.</p> <p>6 Q. May I ask about the interaction with exercise, which is</p> <p>7 something which obviously is pertinent to this</p> <p>8 particular case because Mr Perepilichnyy was exercising</p> <p>9 at the time that he collapsed and died.</p> <p>10 A. Hmm.</p> <p>11 Q. What is your view as to the effect potentially of the</p> <p>12 atrial flutter caused by the fish poisoning, if that is</p> <p>13 indeed what he suffered, on exercise?</p> <p>14 A. Well, I am only thinking that when you exercise you</p> <p>15 release catecholamines which have cardiac effects and of</p> <p>16 course you vasodilate but I am just speculating, so</p> <p>17 there are potentials for interaction. Catecholamines</p> <p>18 may increase the conduction through the AV node, so it</p> <p>19 will increase the -- if you have atrial flutter with</p> <p>20 block, you could imagine that if you had an increased</p> <p>21 level of adrenaline, the block would decrease and heart</p> <p>22 rate would increase, that is what normally happens with</p> <p>23 exercise but when you have atrial flutter, the degree of</p> <p>24 block is far more unpredictable. I mean normally when</p> <p>25 people exercise, their heart rate progressively</p> <p style="text-align: center;">Page 18</p>	<p>1 does one simply recognise it is short, a matter of</p> <p>2 minutes?</p> <p>3 A. I think -- I mean I don't know, the toxicologist may</p> <p>4 have a better answer but I wouldn't argue about how many</p> <p>5 minutes, it is a matter of minutes anyway, not hours.</p> <p>6 Q. A matter of minutes. If you could explain the term</p> <p>7 "half life" again?</p> <p>8 A. Half life is, well, these were determined as far as</p> <p>9 I know, and perhaps the toxicologists are better</p> <p>10 qualified than me, but half life is if you inject a drug</p> <p>11 or a substance, it doesn't have to be a drug and you see</p> <p>12 what the peak level is, the time it takes to drop to</p> <p>13 half that concentration is the half life.</p> <p>14 Normally, or often with substances, the drop will be</p> <p>15 exponential, so that if the half life were one minute,</p> <p>16 at one minute there is only half as much of the</p> <p>17 substance and at two minutes there is a quarter of the</p> <p>18 substance and at, you know, as you went on, you would</p> <p>19 decrease by half each minute.</p> <p>20 Q. So --</p> <p>21 A. So an exponential curve, that is if --</p> <p>22 Q. In your case when you suffered scombroid fish poisoning,</p> <p>23 you in fact were tested on a few occasions and during</p> <p>24 the early tests your own tests were abnormal?</p> <p>25 A. Yes, but that wasn't for histamine.</p> <p style="text-align: center;">Page 20</p>

5 (Pages 17 to 20)

<p>1 Q. What was it for?</p> <p>2 <b>A. N-methylhistamine and one of the other metabolites.</b></p> <p>3 Q. You are looking for the metabolites in order to infer</p> <p>4 the histamine had been there?</p> <p>5 <b>A. Yes. Yes.</b></p> <p>6 <b>The point about the metabolites is that they persist</b></p> <p>7 <b>longer than the histamine itself. If you label</b></p> <p>8 <b>histamine with a radioactive isotope, you can find that</b></p> <p>9 <b>still in the body 24 hours later but it is presumably in</b></p> <p>10 <b>the metabolite not the histamine.</b></p> <p>11 Q. Can I just look at where you discuss your own samples</p> <p>12 which you submitted in a -- or at least you relied on in</p> <p>13 a paper in the BMJ.</p> <p>14 Is paper putting it a bit highly, it is more</p> <p>15 an article of --</p> <p>16 <b>A. It is what they call "a filler". It was I mean they</b></p> <p>17 <b>just put little things in that are pithy really, but</b></p> <p>18 <b>they are often -- yes.</b></p> <p>19 Q. Under tab 37 you will see your report entitled "Comment</p> <p>20 on the email from Professor Egner". To be clear,</p> <p>21 Professor Egner had made a comment about the possibility</p> <p>22 of testing for it in Mr Perepilichnyy's body, given the</p> <p>23 half life of histamine. You are commenting on this very</p> <p>24 issue which is whether or not this testing can be</p> <p>25 meaningful and within what window?</p> <p style="text-align: center;">Page 21</p>	<p>1 <b>remember precisely, but about half an hour or an hour</b></p> <p>2 <b>later I started to feel a bit dizzy and hot, in fact</b></p> <p>3 <b>I went to the toilet then but just to pass water and</b></p> <p>4 <b>I thought, you know, this isn't right so I went home.</b></p> <p>5 <b>When I arrived home my wife said, "Look in the mirror,</b></p> <p>6 <b>you are all red" and I was red from my top to my waist</b></p> <p>7 <b>roughly and I thought, well, this -- some sort of</b></p> <p>8 <b>allergic reaction so I took an antihistamine and I sat</b></p> <p>9 <b>around for a bit and a bit later I went to bed so</b></p> <p>10 <b>I passed urine again, so that would be the meal at 8.00,</b></p> <p>11 <b>symptoms around 9.00ish, these are approximate, midnight</b></p> <p>12 <b>I go to bed, I have had the antihistamine so I am</b></p> <p>13 <b>already feeling somewhat better.</b></p> <p>14 <b>But next morning I thought this is a bit odd and</b></p> <p>15 <b>I will collect urine so I collected my first urine</b></p> <p>16 <b>sample in a pot. The collection was from about midnight</b></p> <p>17 <b>to about 7.00 or 8.00 am wherever I got up, I can't</b></p> <p>18 <b>remember precisely, so the urine I collected was for the</b></p> <p>19 <b>period 4 hours to say 12 hours after eating the tuna and</b></p> <p>20 <b>then it had in that sample -- so it wasn't immediately,</b></p> <p>21 <b>I didn't start the urine sample until four hours after.</b></p> <p>22 Q. And then 36 hours?</p> <p>23 <b>A. Sorry.</b></p> <p>24 Q. Then 36 hours?</p> <p>25 <b>A. Yes, I took another sample at 36 hours. You can see on</b></p> <p style="text-align: center;">Page 23</p>
<p>1 <b>A. Yes, I think one of the main points I tried to make was</b></p> <p>2 <b>that half life, when you have injected the drug, has no</b></p> <p>3 <b>relevance in a sense to what the concentrations that are</b></p> <p>4 <b>present when you have taken the substance orally and it</b></p> <p>5 <b>takes a long time to get in the body because, you know,</b></p> <p>6 <b>if I gave you victim B12 now, you wouldn't absorb it for</b></p> <p>7 <b>several hours because it is right at the bottom end of</b></p> <p>8 <b>your gut that you absorb that, so, you know, it -- if it</b></p> <p>9 <b>takes hours to get in and you know histamine, I don't</b></p> <p>10 <b>know how long it takes to get in but clearly the</b></p> <p>11 <b>symptoms go on for hours, so it cannot be like an IV</b></p> <p>12 <b>injection where you get a peak and then it is gone in</b></p> <p>13 <b>a few minutes, because the symptoms are going on for</b></p> <p>14 <b>hours.</b></p> <p>15 <b>In fact they don't start immediately, you know,</b></p> <p>16 <b>30 minutes, two hours before the onset, so there is</b></p> <p>17 <b>obviously an uptake curve as well as the disappearance</b></p> <p>18 <b>curve so they are superimposed, a curve of uptake and</b></p> <p>19 <b>a curve of disappearance.</b></p> <p>20 Q. Looking at your own curve of disappearance on page 538,</p> <p>21 can you just explain the results there. First of all,</p> <p>22 the timing of the tests that you conducted on yourself</p> <p>23 and the degree of abnormality of the result?</p> <p>24 <b>A. Yes, well, so I had been out for meal and I had a tuna</b></p> <p>25 <b>steak, with I can't remember, salad and, I can't</b></p> <p style="text-align: center;">Page 22</p>	<p>1 <b>those that my N-methylhistamine level was over 5,000.</b></p> <p>2 Q. That, to be clear, is a metabolite of histamine?</p> <p>3 <b>A. Yes, that is the main metabolite of histamine.</b></p> <p>4 Q. You tested that and the initial results were?</p> <p>5 <b>A. 5,167.</b></p> <p>6 Q. Grossly abnormal?</p> <p>7 <b>A. Yes, and the normal is up to 150.</b></p> <p>8 Q. Yes.</p> <p>9 That is within the 4 to 12 hours and after 36 hours</p> <p>10 it is down within?</p> <p>11 <b>A. Within the normal range.</b></p> <p>12 Q. Normal 107, the normal range being 0 to 150?</p> <p>13 <b>A. Yes. Of the other metabolite which is produced by</b></p> <p>14 <b>a different enzyme, I think monoamine oxidase produces</b></p> <p>15 <b>this other variant, you can see that was also raised</b></p> <p>16 <b>more than ten fold.</b></p> <p>17 Q. The normal range being 0.9 to 1.9. The abnormal result</p> <p>18 in your first sample being 24.3?</p> <p>19 <b>A. Yes.</b></p> <p>20 Q. Then the second sample being just above --</p> <p>21 <b>A. Normal range, 2.5.</b></p> <p>22 Q. Yes, so there had been actually a rather rapid change</p> <p>23 within the period between 12 hours and 36 hours, in both</p> <p>24 samples?</p> <p>25 <b>A. Yes.</b></p> <p style="text-align: center;">Page 24</p>

<p>1 Q. In both cases of the metabolites?</p> <p>2 <b>A. Absolutely.</b></p> <p>3 Q. They were close to normal -- one was normal and the</p> <p>4 second one was close to normal after 36 hours?</p> <p>5 <b>A. Yes.</b></p> <p>6 <b>But I also supplied some other papers in the --</b></p> <p>7 <b>a paper in the New England Journal.</b></p> <p>8 Q. Yes, there is a paper that I would like to you look at</p> <p>9 because it may deal with the same subject but it may be</p> <p>10 that you need to explain it, if you would. That is the</p> <p>11 Morrow paper under tab 38, because that has some</p> <p>12 tabulated results in.</p> <p>13 <b>A. Yes.</b></p> <p>14 Q. It explains in the abstract that the highest morbidity</p> <p>15 world wide from fish poisoning results from the</p> <p>16 ingestion from the ingestion of spoiled scombroid fish,</p> <p>17 such as tuna and mackerel and its cause is not clear.</p> <p>18 The purpose of this paper -- well it speculates:</p> <p>19 "Histamine could be responsible because spoiled</p> <p>20 scombroid fish contained large quantities of histamine,</p> <p>21 whether histamine is the causative toxin however has</p> <p>22 remained in question. To address this issue we</p> <p>23 investigated whether histamine homeostasis is altered in</p> <p>24 poisoned people."</p> <p>25 The methods by which they did that were that the</p> <p style="text-align: center;">Page 25</p>	<p>1 Q. Yes.</p> <p>2 <b>A. -- they -- you will see the first voiding, so that is</b></p> <p>3 <b>the first sample of urine after people, I presume,</b></p> <p>4 <b>arrived at hospital. Their first urine sample had</b></p> <p>5 <b>grossly elevated levels of both N-methylhistamine and</b></p> <p>6 <b>histamine, but the next samples are not at 24 hours,</b></p> <p>7 <b>I think that is important to point out, they are 24-hour</b></p> <p>8 <b>collections started after that first voiding.</b></p> <p>9 Q. Yes.</p> <p>10 <b>A. So they are the collection of urine from the first</b></p> <p>11 <b>voiding for the next --</b></p> <p>12 Q. Periodic testing over each 24 hours for --</p> <p>13 <b>A. No, they collect the whole urine for 24 hours, I think</b></p> <p>14 <b>that is what they did, they preserved the whole urine so</b></p> <p>15 <b>it is the average of what was in the urine over</b></p> <p>16 <b>24 hours, because they collected every drop of urine for</b></p> <p>17 <b>24 hours.</b></p> <p>18 <b>You would expect, had you collected them say at</b></p> <p>19 <b>hourly intervals, you would find a high level which</b></p> <p>20 <b>would gradually decrease, I anticipate, over that</b></p> <p>21 <b>period, although that may not entirely be true, because</b></p> <p>22 <b>the first samples may actually be before the peak levels</b></p> <p>23 <b>had arisen because you are still absorbing histamine</b></p> <p>24 <b>from your gut.</b></p> <p>25 <b>So you may in the first couple of hours get it rise</b></p> <p style="text-align: center;">Page 27</p>
<p>1 urinary excretion of histamine and its metabolite</p> <p>2 N-methylhistamine was measured in three persons who had</p> <p>3 scombroid fish poisoning after the ingestion of marlin.</p> <p>4 That is what they are testing.</p> <p>5 Just on page 544, there may be other aspects of this</p> <p>6 paper you feel are pertinent but I wanted to ask you</p> <p>7 about the tabulated results -- they are in graph form in</p> <p>8 fact -- within those tables.</p> <p>9 It is figure 1, it is called on page 544 and it is</p> <p>10 call urinary excretion of N-methylhistamine, histamine</p> <p>11 and PGD-M. What is PGD-M?</p> <p>12 <b>A. I don't know.</b></p> <p>13 <b>I would have to look at the paper but I didn't think</b></p> <p>14 <b>it was ...</b></p> <p>15 Q. The graphs appear to show grossly abnormal results</p> <p>16 within the first 24-hour period, decreasing very</p> <p>17 rapidly, certainly becoming normal within 14 days?</p> <p>18 <b>A. Yes.</b></p> <p>19 Q. But it is not precisely clear when they became abnormal</p> <p>20 at least from this paper from that graph, because the</p> <p>21 graph has a large window for 24 hours and then a very</p> <p>22 truncated window for the 14 days?</p> <p>23 <b>A. Yes, well the first thing to say is if you look at say</b></p> <p>24 <b>the first two panels of the graph, which are</b></p> <p>25 <b>N-methylhistamine and histamine --</b></p> <p style="text-align: center;">Page 26</p>	<p>1 <b>a bit and then fall, but this is speculation but I mean</b></p> <p>2 <b>I would expect that is what has happened. It isn't at</b></p> <p>3 <b>24 hours, it is the whole urine.</b></p> <p>4 Q. The collection over the 24-hour period averaged in terms</p> <p>5 of its results?</p> <p>6 <b>A. Yes.</b></p> <p>7 Q. In terms of allowing us to understand the window within</p> <p>8 which one is likely to find an abnormal result, does</p> <p>9 this assist, significantly?</p> <p>10 <b>A. No, not exactly. I mean the earlier the better,</b></p> <p>11 <b>I guess. I don't know that it does necessarily --</b></p> <p>12 <b>I mean I think that, you know, it might be that at</b></p> <p>13 <b>24 hours the level was actually normal for both of those</b></p> <p>14 <b>at 24 hours, but the overall was raised because at 2 and</b></p> <p>15 <b>4 hours, the contribution of urine from 2 to 4 hours was</b></p> <p>16 <b>very high and it had already dropped to normal by</b></p> <p>17 <b>24 hours, so you cannot really say.</b></p> <p>18 Q. Is it reasonable to conclude that if testing is done</p> <p>19 within the first 24 hours or within the window when the</p> <p>20 food poisoning is in its florid manifestation, that you</p> <p>21 are likely to find abnormal levels of histamine or its</p> <p>22 metabolites?</p> <p>23 <b>A. I think you would have to ask the toxicologists for the</b></p> <p>24 <b>precise timing I think for that.</b></p> <p>25 Q. Okay.</p> <p style="text-align: center;">Page 28</p>

1 In light of that answer, I presume you are unable to  
 2 express a view about whether or not, if  
 3 Mr Perepilichnyy's urine had been tested for histamine  
 4 or metabolites four days after he died, which is when it  
 5 was collected, it would have been abnormal?  
 6 **A. Well, if the urine is in the bladder, it wasn't -- no,  
 7 I think the answer is I can't but I would say that if  
 8 the urine is in the bladder, he hasn't been producing it  
 9 four days after, you know, three days after he died, he  
 10 stopped producing urine when he died.**  
 11 Q. At the point of death, yes.  
 12 **A. What was in the bladder was what was there at the time,  
 13 what he had excreted at the time of death, but --**  
 14 Q. Are you able -- sorry, carry on.  
 15 **A. But I was going to say, whether other factors would  
 16 affect that, whether bacterial action would affect that,  
 17 I cannot say. When I suggested it was tested, I just  
 18 thought that maybe if there was a phenomenally high  
 19 level it may give you some indication but I don't know,  
 20 I mean other people would have to provide an answer.  
 21 It may be even if he had scombroid poisoning, then  
 22 the level would have dropped to normal by 18 hours in  
 23 his case anyway.**  
 24 Q. It could have done. So an abnormal result may not  
 25 necessarily have ruled out the possibility that he had

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1 suffered it, even if it had been tested at the time of  
 2 death?  
 3 **A. Either way it may not have.**  
 4 Q. Can I ask you in that context, I think you mentioned  
 5 when you said bacterial affects, I think you mean the  
 6 putrefaction issue, so if the sample is taken four days  
 7 after death when the body is already starting to go  
 8 through a process, a pathological process, albeit that  
 9 he was 1in a preserved state for that period of time,  
 10 that could have changed the results in a way you cannot  
 11 say?  
 12 **A. No, I can't say. It would depend on whether there was  
 13 histidine in the body and whether there were bacteria  
 14 that converted histidine to histamine, I would imagine.  
 15 Because, you know, they are in fish these particular  
 16 bacteria but whether they occur in the human bladder  
 17 I would have some doubt about but someone else would  
 18 give you the answer to that I am afraid.**  
 19 Q. If you are qualified to give this answer please give it,  
 20 but if you are not please do say but is histamine and  
 21 its metabolites, are they stable post mortem? Or are  
 22 they -- leaving aside issues of bacterial intervention  
 23 on putrefaction and so on, are they intrinsically stable  
 24 chemically or are they likely to deteriorate to the  
 25 point they cannot be tested after a certain period of

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1 storage?  
 2 **A. I don't know.**  
 3 Q. Thank you.  
 4 Going back to the question of whether or not --  
 5 **A. Sorry, could I just say, it does occur to me of course  
 6 that I suspect on first principles the histamine may  
 7 well be stable because it is produced by bacteria and in  
 8 fish that are dead, if you see what I mean. So if it is  
 9 staying stable in fish that are dead, then I suppose it  
 10 may stay stable in people who are dead. I don't know.**  
 11 Q. There is a live action going on with the bacteria at  
 12 that point though, isn't there?  
 13 **A. Yes. Yes.**  
 14 Q. Turning to Mr Perepilichnyy's signs and symptoms prior  
 15 to his death.  
 16 **A. Yes.**  
 17 Q. May I attempt to summarise some of them as they came out  
 18 of the evidence of Ms Medynska, I don't know whether you  
 19 have had the chance to see a transcript of that yet,  
 20 I doubt it?  
 21 **A. I did.**  
 22 Q. That is very helpful, this morning.  
 23 Her evidence was that he may have eaten some kind of  
 24 fish on the night of 9 November, but she couldn't be  
 25 clear about it. She thought he may have had some sushi

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1 rolls or tempura, but wasn't sure. They didn't share  
 2 their food, so he only ate it himself.  
 3 He said at the time some of the food tasted bad and  
 4 sent some of it back. Possibly two dishes, certainly  
 5 one, as far as she can recall.  
 6 Although it could have been prawns rather than fish.  
 7 What she was clear about, although she didn't see  
 8 it, she heard it, was that he vomited three times over  
 9 the course of an hour with an interval of several  
 10 minutes in between bouts of vomiting. She also said  
 11 that afterwards when he returned from the bathroom,  
 12 although he cleaned himself up, he had a red face and  
 13 red eyes to some extent.  
 14 However, he said he felt better afterwards and  
 15 didn't want to go and see a doctor. He didn't complain  
 16 to her at least of headaches or weakness that night.  
 17 They went to bed and when they woke up, he appeared  
 18 well and rested. They had breakfast and he had  
 19 breakfast of hot chocolate and boiled eggs, they  
 20 departed, he came home, and I think you are already  
 21 familiar with the evidence of how he appeared on the day  
 22 of his death which is that he appeared generally fine to  
 23 those that encountered him. He ate lunch with his wife  
 24 or in his house that she had prepared him and then of  
 25 course he went on a run.

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1 That is a short summary of the factual evidence.  
 2 Some of it may be more complicated and you are familiar  
 3 with the evidence on the day of his death from lots of  
 4 different people but broadly speaking that is a summary  
 5 of the evidence focusing on her testimony yesterday.  
 6 In terms of the possibility of food poisoning, it is  
 7 fair to say that complaining of food tasting bad,  
 8 sending food back and then vomiting would ordinarily  
 9 lead to an inference, fairly powerful inference, that  
 10 food poisoning had occurred?  
 11 **A. Yes. Possibly, yes. That is right.**  
 12 **I mean often with food poisoning the food doesn't**  
 13 **taste bad, of course. You know, most people who get**  
 14 **most types of food poisoning don't think the food tastes**  
 15 **bad, they just eat it but the thing about scombroid**  
 16 **poisoning is people commonly think the food is bad and**  
 17 **they specifically complain that it either tastes peppery**  
 18 **or metallic.**  
 19 **When I had it I thought there was a lot of pepper on**  
 20 **it but I ate it because I quite like pepper. Someone**  
 21 **with me in my party also had it and thought it was too**  
 22 **peppery and didn't eat it and didn't get the same**  
 23 **severity of symptoms as me, so we both thought -- it was**  
 24 **the only other person in the party who had tuna and it**  
 25 **was a departmental meal, so the other person who had the**

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1 **tuna also felt it tasted peppery but many times people**  
 2 **get food poisoning they don't complain that it tastes**  
 3 **of -- other types of food poisoning, they don't complain**  
 4 **that the food tastes bad.**  
 5 Q. You are not qualified to give a view about the  
 6 toxicologist matters ultimately, as you accepted earlier  
 7 you are not an expert in that field, but I think you  
 8 accept that it is certainly highly consistent with food  
 9 poisoning that you start to vomit shortly after eating  
 10 a meal?  
 11 **A. Yes.**  
 12 Q. As to whether or not it is scombroid poisoning, in the  
 13 absence of knowing precisely what he ate, that is  
 14 difficult to draw a conclusion about, isn't it?  
 15 **A. Yes. I mean if he didn't eat appropriate, or**  
 16 **inappropriate, food he cannot have scombroid.**  
 17 Q. Tuna, mackerel or salmon as you say?  
 18 **A. There are a few other things, you know, but less --**  
 19 **those sort of fish, yes.**  
 20 Q. His symptoms are consistent to the extent that he had  
 21 rapid onset symptoms?  
 22 **A. Yes.**  
 23 Q. They included vomiting, which is one of the symptoms  
 24 listed?  
 25 **A. Yes, in many types of food poisoning the vomiting is**

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1 **much later.**  
 2 Q. You don't need the panoply of symptoms to draw  
 3 an inference that the diagnosis is made out? As the WHO  
 4 report made clear, one or more of the symptoms can be  
 5 consistent with the diagnosis?  
 6 **A. Yes, I mean and the other thing is the redness which she**  
 7 **describes.**  
 8 Q. Yes, although retching into a toilet bowl for an hour  
 9 presumably can lead to a degree of redness of the face  
 10 and possibly red eyes as well, can't it?  
 11 **A. I think in some of the reports she described redness,**  
 12 **the upper part of the body I think.**  
 13 Q. She did, I think it is fair to say, I will be corrected,  
 14 that she didn't describe that in any detail in her  
 15 evidence yesterday, she was careful in fact to pull back  
 16 from giving a description about the body. But she  
 17 certainly said he was red in the face and certainly some  
 18 redness to his eyes?  
 19 **A. I suppose it depends how long it lasted, is the other**  
 20 **thing. If you vomit of course you can be red in the**  
 21 **face but I wouldn't expect that to last for necessarily**  
 22 **for very long, whereas if it was scombroid poisoning, it**  
 23 **might last, you know, for hours or longer.**  
 24 Q. She said he looked well the next day?  
 25 **A. Yes, but that is eight hours later or something.**

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1 Q. Yes.  
 2 But he didn't complain of some of the other signs  
 3 and symptoms which I took you to earlier which was for  
 4 example diarrhoea, although he may have had that but she  
 5 certainly wasn't aware of that as a possibility,  
 6 headaches, he wasn't sweating as far as she could tell,  
 7 she wasn't aware of a rash. So some of the other things  
 8 that have taken you to were not there, but that again is  
 9 not determinative because you don't need to have the  
 10 entire panoply?  
 11 **A. I didn't have them all when I had it, you know, I only**  
 12 **had a few symptoms.**  
 13 Q. When one compares those, what we do know that he had,  
 14 can one say reliably from your perspective that it  
 15 cannot have been another form of food poisoning, such as  
 16 staphylococcal infection?  
 17 **A. I think that is a bit unlikely -- if you are saying**  
 18 **could staphylococcal infection from that meal,**  
 19 **30 minutes after onset, I think that was probably a bit**  
 20 **rapid actually for staphylococcal.**  
 21 Q. Are you starting to edge out of your expert comfort zone  
 22 in terms --  
 23 **A. No, no, I probably see more of that, people with**  
 24 **infectious diseases than the toxicologists. I see**  
 25 **people on the medical take who come in with D&V yes, so,**

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1 **no, no, you know most of the bacterial forms of**  
 2 **gastroenteritis. I am not saying it couldn't have been**  
 3 **a meal earlier but I don't think it is a meal 30 minutes**  
 4 **before that gives you staphylococcal vomiting and, yes.**  
 5 Q. I mean in fact he could have had food poisoning that had  
 6 a delayed reaction, as many other poisonous bacterial --  
 7 **A. Yes, but I think it unlikely, I mean he could have had**  
 8 **salmonella from a meal the day before, but then he**  
 9 **wouldn't have been well the next day.**  
 10 Q. He wouldn't have resolved as rapidly as he did?  
 11 **A. No.**  
 12 Q. That tends towards the scombroid diagnosis from your  
 13 perspective, does it?  
 14 **A. Yes.**  
 15 Q. The rapid resolution?  
 16 **A. Yes, because most of these other things would make you**  
 17 **very unwell, E. coli or a viral gastroenteritis, they**  
 18 **would make you very unwell and you wouldn't be very well**  
 19 **and attempting to go jogging the next day with most of**  
 20 **them, I imagine.**  
 21 Q. Is it fair to say that you conclude it is probable that  
 22 he suffered food poisoning or are you simply raising it  
 23 as a possibility?  
 24 **A. I am just raising it as a possibility. You know, other**  
 25 **people can comment on.**

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1 **It is just when I read the description from the**  
 2 **French police, the statement from the French police, the**  
 3 **thing that struck me was Japanese meal, probably fish,**  
 4 **vomiting half an hour, an hour later -- sorry, doesn't**  
 5 **like the food, something about the taste is not right,**  
 6 **sends it back. An hour or so later he is vomiting and**  
 7 **then he looks red in the face, that sounded to me a bit**  
 8 **like what I had experienced, so I thought I ought to**  
 9 **raise it, really.**  
 10 Q. Not just that, it actually sits with the symptoms as  
 11 described in the literature?  
 12 **A. Yes, yes, of course. When I got it, I obviously looked**  
 13 **up whether my symptoms were consistent with the**  
 14 **literature.**  
 15 Q. Yes, why then are you not able to say that it is likely  
 16 that he suffered food poisoning in those circumstances?  
 17 **A. I think -- well I think there is a strong possibility.**  
 18 **Okay, if you said to me, do I think it is more than**  
 19 **50 per cent chance I would say, yes, probably. If he**  
 20 **had fish. If he had appropriate fish, I would say it is**  
 21 **more than 50 per cent likely that that was what he**  
 22 **suffered that day.**  
 23 Q. As to whether or not it caused his death, that is  
 24 another issue?  
 25 **A. Yes.**

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1 Q. If one posits that he did have it, did have that  
 2 poisoning, are you able to say whether it is more than  
 3 possible, ie probable, that that caused his death?  
 4 **A. No, I can't say that.**  
 5 Q. Are you able to say that it is likely that it made  
 6 a contribution to his death in any form?  
 7 **A. Well, if one accepted that he had scombroid fish**  
 8 **poisoning that night, then it becomes a real -- you know**  
 9 **if someone dies the next day, after having a condition**  
 10 **18 hours earlier which can occasionally be fatal, then**  
 11 **I think if you cannot find any other reason I think that**  
 12 **becomes the number one suspect so to speak. Unless you**  
 13 **can find some other reason.**  
 14 **You know, it become as bit tenuous to say you have**  
 15 **two illnesses, one of which might be fatal, and then you**  
 16 **are trying to find something else that actually caused**  
 17 **death 18 hours later.**  
 18 Q. There is a danger again there that you are not just  
 19 straying outside of medical territory but into forensic  
 20 territory?  
 21 **A. Yes, absolutely.**  
 22 Q. Or indeed when you referred to Occam's razor in your  
 23 original supplementary report, which I think is almost  
 24 a metaphysical dictum that one looks for the simplest  
 25 explanation as most likely in circumstances where the

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1 more complex explanations are inherently less probable?  
 2 **A. It is what we use all the time in medicine, I think.**  
 3 Q. It is always subject, isn't it, to information being  
 4 gathered which supports or undermines the theory?  
 5 **A. Absolutely, yes. Which is why I have -- I mean in my**  
 6 **report I have suggested other things like, you know,**  
 7 **checking in Paris whether there were people admitted to**  
 8 **hospital. I don't know if that is possible but the**  
 9 **public health doctors in Paris might be able to say that**  
 10 **night two other people came in from the Buddha-Bar with**  
 11 **what turned out to be scbrotoxin poisoning, that would**  
 12 **make it interesting, wouldn't it, not interesting but**  
 13 **much more probable, particularly if --**  
 14 Q. In the circumstances where you know there is data or  
 15 relevant information missing, so for example we don't  
 16 have any information as to the other diners in the  
 17 Buddha-Bar in Paris that night and we don't have any  
 18 information now that we can tell whether or not he was  
 19 poisoned with cyanide for example, which had a window of  
 20 opportunity to be tested and wasn't tested for.  
 21 In those circumstances where you have those  
 22 unknowns, is it safe to apply Occam's razor as  
 23 a principle in drawing a deduction about the cause of  
 24 death?  
 25 **A. No, I suppose not. The big problem is there is so much**

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<p>1 <b>unknown, isn't there, it seems to me.</b></p> <p>2 Q. Likewise the diners having symptoms themselves would not</p> <p>3 necessarily explain or make it inherently likely that he</p> <p>4 died of scombroid poisoning?</p> <p>5 <b>A. No, no, that is true.</b></p> <p>6 Q. They might go to the fact of him having this poisoning</p> <p>7 but not the death?</p> <p>8 <b>A. Absolutely.</b></p> <p>9 Q. Can I just recap in terms of where you are in your</p> <p>10 conclusions?</p> <p>11 <b>A. Yes.</b></p> <p>12 Q. If he ate fish that night, which is a question of fact,</p> <p>13 not for you, you think it is likely that he appears to</p> <p>14 have suffered some form of food poisoning of the</p> <p>15 scombroid variety?</p> <p>16 <b>A. Yes.</b></p> <p>17 Q. It is possible, but you cannot say it is probable, that</p> <p>18 that had an effect afterwards which contributed towards</p> <p>19 his death?</p> <p>20 <b>A. Yes. It is possible.</b></p> <p>21 Q. Possible, but you cannot say probable?</p> <p>22 <b>A. No, no. No, no. No, that is right.</b></p> <p>23 Q. That applies not simply to as it were the binary</p> <p>24 question of whether or not it was the cause of his death</p> <p>25 but also to whether or not it was contributive or</p> <p style="text-align: center;">Page 41</p>	<p>1 somebody deliberately setting out to poison somebody or</p> <p>2 something, but incidental or natural food poisoning, can</p> <p>3 you simply eat something, other possibilities we heard</p> <p>4 as to what he was eating, it was maybe something</p> <p>5 vegetable or prawns or something. To use the</p> <p>6 vernacular, people talk about something disagreeing with</p> <p>7 them, is there another category of food poisoning which</p> <p>8 for whatever reason disagrees with you, an hour later</p> <p>9 you might be sick and then before long you are ...</p> <p>10 <b>A. Yes, I mean you can eat something that is a sort of</b></p> <p>11 <b>chemical irritant to your stomach and I guess the</b></p> <p>12 <b>commonest example is alcohol. People often drink</b></p> <p>13 <b>alcohol, get a bit of indigestion and are sick, aren't</b></p> <p>14 <b>they, that sort of thing.</b></p> <p>15 <b>Yes, you could have a sort of chemical irritant of</b></p> <p>16 <b>the stomach I guess and get over that.</b></p> <p>17 Q. Could that be caused, if for example, I mean there is</p> <p>18 something the matter with the prawns or the vegetable,</p> <p>19 if they are just off or not clean or --</p> <p>20 <b>A. Well, usually if prawns are off, you get, you know,</b></p> <p>21 <b>an infection, which would persist I think, and you would</b></p> <p>22 <b>probably get diarrhoea as well as vomiting I guess and</b></p> <p>23 <b>it may be still there the next day, I would have</b></p> <p>24 <b>thought.</b></p> <p>25 THE CORONER: Anyway, irritant of some kind?</p> <p style="text-align: center;">Page 43</p>
<p>1 contributory to his death?</p> <p>2 <b>A. Yes.</b></p> <p>3 Q. In other words, one of a number of factors, it is</p> <p>4 possible it was one of a number of factors but not</p> <p>5 probable?</p> <p>6 <b>A. Hmm, yes.</b></p> <p>7 Q. In your original answers in the joint statement, indeed</p> <p>8 this is something you repeat in your latest evidence,</p> <p>9 you express the view that if toxicological causes of</p> <p>10 death have been excluded to the satisfaction of the</p> <p>11 court, the only tenable diagnosis is sudden arrhythmic</p> <p>12 death syndrome?</p> <p>13 <b>A. Yes.</b></p> <p>14 Q. Do you stand by that view?</p> <p>15 <b>A. Yes.</b></p> <p>16 MR SKELTON: Thank you.</p> <p>17 THE CORONER: Can you just help with this, just on food</p> <p>18 poisoning, you have told us about scombroid poisoning</p> <p>19 depending upon as you have said what he ate. Then you</p> <p>20 have talked about other things like E. coli or</p> <p>21 salmonella which you indicate you would expect to last</p> <p>22 for longer.</p> <p>23 <b>A. Yes.</b></p> <p>24 THE CORONER: Just in terms of naturally occurring food</p> <p>25 poisoning, if you understand what I mean by that, so not</p> <p style="text-align: center;">Page 42</p>	<p>1 <b>A. I guess so, yes.</b></p> <p>2 THE CORONER: Yes.</p> <p>3 Questions from MR MOXON BROWNE</p> <p>4 MR MOXON BROWNE: Dr Wilmshurst, you may remember</p> <p>5 I represent one of Mr Perepilichnyy's life insurers in</p> <p>6 this case.</p> <p>7 <b>A. Yes.</b></p> <p>8 Q. Just picking up what the coroner was saying, it seems</p> <p>9 likely that Mr Perepilichnyy ate something which in</p> <p>10 popular language disagreed with him on the night before</p> <p>11 his debt?</p> <p>12 <b>A. Yes.</b></p> <p>13 Q. That could have been because someone malevolently put</p> <p>14 poison in his food, possible?</p> <p>15 <b>A. You would have to ask a toxicologist about that.</b></p> <p>16 Q. Okay. I am suggesting that as one possibility.</p> <p>17 Another is that he had scombroid fish poisoning, if</p> <p>18 he ate some pelagic fish, that is a possibility that you</p> <p>19 have identified?</p> <p>20 <b>A. Yes.</b></p> <p>21 Q. There is a third possibility I think, which the coroner</p> <p>22 has identified, which is that he simply contracted some</p> <p>23 form of food poisoning which did not have a histamine</p> <p>24 base?</p> <p>25 <b>A. Yes.</b></p> <p style="text-align: center;">Page 44</p>

<p>1 Q. Those, I am suggesting, are the three. 2 You didn't attend Ms Medynska's evidence yesterday, 3 I don't think? 4 <b>A. No, but I was sent the transcripts.</b> 5 Q. You had a look at that, yes? 6 <b>A. Yes.</b> 7 Q. Good. 8 Just on a point of detail, I recall that Ms Medynska 9 told us that Mr Perepilichnyy, when he came out of the 10 bathroom having been sick, was wearing a dressing gown 11 which concealed his chest? 12 <b>A. Right.</b> 13 Q. I recall that she didn't readily find the English word 14 for dressing gown and that the translator had to help 15 her, I remember that. 16 <b>A. Right.</b> 17 Q. I think the oral evidence in this case, at least, would 18 indicate that she didn't see his chest. Just bear that 19 in mind. 20 One of the papers that you refer to in your report 21 is this very long, I think it is called a final report 22 from the World Health Organisation, that you have 23 already been taken to. 24 <b>A. Yes.</b> 25 Q. I want to pick it up on page 14, internal pagination, it</p> <p style="text-align: center;">Page 45</p>	<p>1 <b>I pointed out, because there are cases that I know of,</b> 2 <b>because I looked up on the internet, the two cases in</b> 3 <b>Bali, so a mother and daughter who died. I think it is</b> 4 <b>sometimes fatal.</b> 5 Q. I appreciate that. 6 <b>A. I think the other point they make is that people often</b> 7 <b>confuse scombroid fish poisoning with allergic</b> 8 <b>reactions, which can be fatal.</b> 9 Q. That is what happened to the ladies in Bali, didn't it, 10 they had an allergic reaction, they didn't die from 11 a cardiac arrhythmia, did they? 12 <b>A. I don't know. When you say allergic reaction, scombroid</b> 13 <b>fish poisoning is not an allergic reaction.</b> 14 Q. No, I know. 15 <b>A. Yes.</b> 16 Q. We will look at the report of how they came to die in 17 a minute. 18 <b>A. Yes.</b> 19 Q. The paper goes on to give support for the proposition 20 that people rarely if ever die from scombrotoxin fish 21 poisoning. Did you look at that material in order to 22 find out what the quality of the evidence was? 23 <b>A. No, I didn't look at all the evidence, no.</b> 24 Q. You have said in your report that scombrotoxic fish 25 poisoning can be fatal and indeed you also specifically</p> <p style="text-align: center;">Page 47</p>
<p>1 is at page 380 I think in bundle 3. 2 <b>A. Yes.</b> 3 Q. Sorry, in bundle 1. 4 <b>A. Yes.</b> 5 Q. You have already been taken by Mr Skelton to a passage 6 at the foot of page 380 about symptoms, which I think 7 you rehearse in your report, in the particular context 8 that the symptoms although usually having a duration of 9 no more than 8 to 12 hours do sometimes persist for 10 longer. That was the point you were drawing from the 11 material you quoted? 12 <b>A. Yes, I mean I was just quoting what they said, yes.</b> 13 Q. Yes. 14 Then over the page it goes on: 15 "There are no known long term sequelae, SFP [which 16 is of course scombrotoxin fish poisoning] is considered 17 to be rarely if ever fatal." 18 Then it gives the data that supports that 19 contention. 20 <b>A. Hmm.</b> 21 Q. You did quote from the immediately preceding material 22 under that paragraph but you didn't actually quote that 23 observation, but I assume that you did read it? 24 <b>A. Yes. But I also knew that -- yes. Well, it is rarely</b> 25 <b>fatal but it isn't entirely -- it is not never fatal, as</b></p> <p style="text-align: center;">Page 46</p>	<p>1 say that it can cause lethal, which I think means the 2 same as fatal, cardiac arrhythmias. Your expressed view 3 in your report was perhaps a little bit inconsistent 4 with what is said here, that it is rarely if ever fatal. 5 I would have thought that given that inconsistency, 6 that you might have wanted to look at the background 7 evidence, see if you were right or not? 8 <b>A. Yes, I think ...</b> 9 <b>I don't actually -- I am trying to think of</b> 10 <b>an example but the fact that not many people win the</b> 11 <b>National Lottery, you know, if you have someone win the</b> 12 <b>National Lottery, the fact that any one individual has</b> 13 <b>a very low chance of winning the National Lottery,</b> 14 <b>doesn't mean that no one will win the National Lottery,</b> 15 <b>if you see what I mean.</b> 16 <b>If there are people who have died from it, then</b> 17 <b>there are people who have died from it. If you are</b> 18 <b>thinking that maybe someone died from it, then the</b> 19 <b>question about it being rare doesn't apply in that</b> 20 <b>instance, if you see what I mean.</b> 21 Q. Have you since writing your report, had an opportunity 22 to consider that data, both from America and Japan -- 23 <b>A. Sorry?</b> 24 Q. Have you had an opportunity to consider the data that is 25 referred to, page 381, at the top, that is to say the</p> <p style="text-align: center;">Page 48</p>

<p>1 data from the Centre for Disease Control in relation to                  2 America and the data from Japan, the Japanese Ministry                  3 of Health, have you had an opportunity to look at those                  4 papers?                  5 <b>A. No, I haven't.</b>                  6 Q. Sorry about that, because I did make some effort to make                  7 that available for you but you didn't look at it?                  8 <b>A. Sorry, I haven't been sent it.</b>                  9 Q. You haven't been? I'm sorry that --                  10 <b>A. I mean -- yes, sorry, is that the thing you sent me this</b>                  11 <b>morning?</b>                  12 Q. No.                  13 <b>A. When I came in at 9.30 someone gave me a document.</b>                  14 Q. No, I am not referring to that.                  15 <b>A. That is the only document I have seen.</b>                  16 Q. I am sorry about that.                  17 Can we just have a quick look at some of the                  18 material, can I take to you bundle 3. Perhaps we can                  19 pick it up at page 239.                  20 This is a paper which is referred to in the paper                  21 that you exhibited to your report showing some of the                  22 statistics from the American experience of scombrototoxin                  23 poisoning. It is put out by people who are called                  24 I think it is CDC, Centre for --                  25 <b>A. Disease Control.</b></p> <p style="text-align: center;">Page 49</p>	<p>1 Q. If you look, please, at page 271, we will see this is                  2 a similar report which in fact covers the period 1998 to                  3 2002, so it is the next four-year period. We will see                  4 the data at page 281. Again, it is more or less exactly                  5 in the middle of the page this time. Scombrototoxin, 118                  6 outbreaks, 463 cases, fatalities 0. We haven't come                  7 across a fatality yet?                  8 <b>A. No, no.</b>                  9 Q. As far as that particular series of data goes, that runs                  10 out at that point, so we have got to 2002, we will come                  11 back to that. While we are in the bundle, can we just                  12 look at the situation in Japan, that is at page 321.                  13 Japan is of course I think we may agree at least                  14 anecdotally a country where a great deal of fish is                  15 eaten?                  16 <b>A. Yes.</b>                  17 Q. The abstract from an article by Toga Yamamoto and others                  18 says this:                  19 "Histamine food poisonings are allergy like food                  20 poisonings caused by the ingestion of spoiled fish,                  21 containing markedly elevated histamine levels. We                  22 examined histamine food poisonings in Japan from 1998 to                  23 2008 [so that is a 10-year period] in average 8 food                  24 poisonings and 150 cases were reported annually and                  25 there was no fatality."</p> <p style="text-align: center;">Page 51</p>
<p>1 Q. -- Disease Control, and I think MMWR stands for                  2 morbidity and mortality weekly reports, which I think is                  3 a record that toxicologists amongst others look at.                  4 If you would go forward, please, to page 246, we can                  5 see the data for scombrototoxin at table 1. This is in                  6 the period 1993 to 1997. It is a sort of summary of                  7 that four-year period. It is just below the middle of                  8 the page, under the rubric "Chemical", we have heavy                  9 metals, monosodium glutamate, mushroom poisoning and                  10 then scombrototoxin, 69 outbreaks, 297 cases, zero                  11 fatalities. What they are saying is nobody in America                  12 died from this affliction in that four-year period?                  13 <b>A. No one diagnosed with the disease died. The majority of</b>                  14 <b>people with it, or many people think that the majority</b>                  15 <b>of people who have it are misdiagnosed as allergy.</b>                  16 Q. Yes, that is I am sure an absolutely fair point but what                  17 I am really looking at is what the scientific data is,                  18 that is what we have to go on?                  19 <b>A. Of course this is three years or just after the work of</b>                  20 <b>Morrow, isn't it, so it is 20 years ago?</b>                  21 Q. Yes, well, I'm sorry that you haven't had an opportunity                  22 to look at this before but we are going to very quickly                  23 and economically work our way forward into more recent                  24 times.                  25 <b>A. Okay.</b></p> <p style="text-align: center;">Page 50</p>	<p>1 As far as the data goes, and going at least over                  2 a 10-year period, ending in 2008, nobody has died in                  3 Japan either?                  4 <b>A. No one they know of, no.</b>                  5 Q. No.                  6 Then, if we can broaden it out, because this is                  7 really a very -- this is not a rapier-like point that                  8 I am making but perhaps a more general one. Can we look                  9 at the paper you were provided with this morning, which                  10 is called "Histamine (scombroid) fish poisoning:                  11 a comprehensive review" by Feng and others, which was                  12 published in 2015. Would you like to pick it up from,                  13 and I apologise to you personally, Dr Wilmshurst that                  14 you only got this this morning, that was something for                  15 which I was responsible and I am sorry.                  16 Look under -- it is a word I find difficult to                  17 pronounce -- "epidemiology", which is on the second                  18 page.                  19 <b>A. Yes, I have that.</b>                  20 Q. The first paragraph, you have had an opportunity to look                  21 at this I expect this morning:                  22 "Since 1980 fish consumption in the US has                  23 dramatically increased ..."                  24 Then in the middle of that paragraph, it is a point                  25 you are making I think:</p> <p style="text-align: center;">Page 52</p>

1 "Cases of histamine fish poisoning are still vastly  
 2 underreported due to misdiagnosis and inherent barriers  
 3 more recently between 2009 and 2012 ..."  
 4 We are coming up now into the more recent past:  
 5 "... 40 outbreaks involving 136 people in  
 6 California, Hawaii and New York. Of note, there has  
 7 never been a death due to histamine fish poisoning  
 8 reported in the USA."  
 9 That is a generalised remark but you have no reason  
 10 to doubt that, have you?  
 11 **A. No.**  
 12 Q. Then it goes on to deal with the worldwide experience:  
 13 "Outside the US histamine fish poisoning is most  
 14 frequently reported in Japan and the UK. In fact the  
 15 largest outbreak ever recorded involving 2,656 people  
 16 was recorded in Japan and then cases have been  
 17 documented in Australia, Bermuda, Canada, China,  
 18 Czech Republic ..."  
 19 I am still only at C, there must be at least a dozen  
 20 if not 20 different countries and it says:  
 21 "... only one death has been noted worldwide."  
 22 That is the broad summary of the position, actually  
 23 as far as the data goes, people don't die as a result of  
 24 scombroid fish poisoning.  
 25 **A. Mostly. I mean only one death, so you cannot say they**

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1 **don't die. They die rarely I guess, you could say.**  
 2 Q. Hmm.  
 3 If we, with that in mind, can go back to your  
 4 report, which is at page 347 arrive it, of bundle 1.  
 5 You say on the last paragraph on the second page:  
 6 "Scombrototoxin poisoning can be fatal and can cause  
 7 lethal cardiac arrhythmias."  
 8 You have made the point that "can be fatal" is  
 9 pretty accurate, because apparently there has been one  
 10 case worldwide in the last 20 years or so, but how about  
 11 "can cause lethal cardiac arrhythmias", what is the data  
 12 for that proposition?  
 13 **A. Well the paper by Wolff and Levi showed arrhythmias that**  
 14 **are potentially lethal.**  
 15 Q. Yes, but scombrototoxin poisoning is not considered at all  
 16 in the paper?  
 17 **A. Oh, no, sorry, okay. Yes. Sorry, I beg your pardon.**  
 18 **Okay, histamine poisoning can cause arrhythmias that**  
 19 **are lethal.**  
 20 Q. Yes, I don't think there is any doubt about that, it is  
 21 a question of whether people who suffer scombrototoxin  
 22 fish poisoning can develop cardiac arrhythmias, you  
 23 state as a fact that they can but there doesn't seem to  
 24 be any evidence for that at all?  
 25 **A. No, I take your point. I should have said:**

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1 **"Scombrototoxin poisoning can be fatal. Histamine can**  
 2 **cause lethal or potentially lethal cardiac arrhythmias."**  
 3 Q. Thank you.  
 4 **A. Okay.**  
 5 Q. You have mentioned the case of the two ladies from  
 6 Australia who died in Bali.  
 7 **A. Yes.**  
 8 Q. Which is an instance or an event which has been very  
 9 widely reported in the scientific press. I would  
 10 suggest because it was an entirely unique event. There  
 11 has been lots and lots written about it.  
 12 **A. It was unique in that two of them died. It cannot be**  
 13 **unique if someone else has died previously technically,**  
 14 **I suppose.**  
 15 Q. If you would like to look, please, at something that is  
 16 called "The Office of the State Coroner findings of  
 17 investigation", which is in bundle 3 at page 322.  
 18 I think you are going to tell me that you haven't had  
 19 an opportunity to consider this before?  
 20 **A. No. Sorry, I saw that at 9.30, when I arrived, I was**  
 21 **given it.**  
 22 Q. I apologise.  
 23 **A. No, no.**  
 24 Q. That is not something which I am going to put my hands  
 25 up to, because I did try.

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1 This is not in fact an Inquest, because there were  
 2 jurisdictional problems, as I understand it, because the  
 3 deaths occurred in Bali --  
 4 **A. Yes.**  
 5 Q. -- but as I understand it it was the next best thing, it  
 6 was an investigation by a coroner and it was into the  
 7 deaths of people called Bischoff and there was  
 8 Mrs Bischoff and her daughter Ms Bischoff. The  
 9 investigation was apparently held in March 2015 and it  
 10 relates the story of these two ladies in Bali who had  
 11 a fish supper in December 2013 and developed symptoms  
 12 from which both, sadly, died.  
 13 The first point you will have noted is that both  
 14 ladies suffered from asthma, didn't they? That is  
 15 right, isn't it?  
 16 **A. Hang on, no -- if you say so, I will just look. They**  
 17 **had a history of asthma did they? Yes.**  
 18 Q. Yes.  
 19 If we look on page 325 -- there is no internal  
 20 pagination, but if we look at page 325 -- we can pick it  
 21 up, I think at the third paragraph, "Histological  
 22 examination of the lungs showed moderate to severe  
 23 changes of asthma and examination of the upper  
 24 aerodigestive tract showed changes consistent with  
 25 an acute anaphylactic reaction".

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1 An anaphylactic reaction is an allergic reaction to  
 2 histamine, isn't it, it is not a result of histamine  
 3 poisoning in the sense that we have been using that word  
 4 here?  
 5 **A. Well, histamine -- an anaphylactic reaction is not --**  
 6 **histamine is part of the anaphylactic reaction, so**  
 7 **an allergic reaction is -- anaphylaxis is an allergic**  
 8 **reaction, of which histamine is a component part. Yes.**  
 9 Q. Yes.  
 10 **A. But all the literature points, as far as I can see, that**  
 11 **the difficulty is distinguishing the difference between**  
 12 **an allergic reaction from endogenous and exogenous**  
 13 **histamine.**  
 14 Q. Yes, I understand that. We are admonished at intervals  
 15 throughout the literature not to get in a muddle between  
 16 on the one hand an allergic reaction to histamine and on  
 17 the other hand poisoning by histamine which is brought  
 18 into the body.  
 19 **A. Yes, yes.**  
 20 Q. In the fourth paragraph, the 4 February, Dr Olumbe,  
 21 chief forensic pathologist, met with family members and  
 22 advised that they had formed the opinion that the cause  
 23 of Noelene and Yvana's deaths was an allergic-type  
 24 reaction caused by food they had eaten, especially fish  
 25 or by the so-called scombroid syndrome, also called

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1 histamine fish poisoning, or a combination of these  
 2 causes. This was confirmed in subsequent  
 3 correspondence, Dr Olumbe's report noted that the  
 4 allergic reaction present is likely to have been  
 5 anaphylaxis, which occurs when the body's own cells  
 6 [this is the endogenous histamine] release histamine and  
 7 other chemicals in response to an external allergic  
 8 trigger. The autopsy showed clear evidence of allergy  
 9 or asthma, anaphylaxis can be resistant to treatment."  
 10 Then at the foot of the page, penultimate paragraph:  
 11 "On 28 February, Dr Olumbe issued a certificate  
 12 listing the cause of death for Noelene as an allergic  
 13 type reaction with underlying conditions of asthma and  
 14 obesity. Dr Olumbe issued a certificate for Yvana  
 15 listing the cause of death as an allergic-type  
 16 reaction."  
 17 There is no suggestion anywhere, is there, that  
 18 either lady died as a result of a cardiac arrhythmia?  
 19 **A. Well, you don't know -- the terminal events, you don't**  
 20 **know what the terminal event is. I mean in asthma, if**  
 21 **you say people have asthma, the terminal event is often**  
 22 **cardiac arrhythmia.**  
 23 Q. Dr Wilmshurst, it is a trite observation isn't it that  
 24 everybody's heart stops when they die but there is  
 25 nothing here about cardiac arrhythmia being the cause of

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1 death, is there?  
 2 If there is, point it out to me.  
 3 **A. No, but how would anyone know, in the sense that**  
 4 **unless -- the first lady, as I recall, had CPR, she went**  
 5 **into a cardiac arrest, so that is a cardiac arrhythmia.**  
 6 Q. If the heart stops that, is certainly an arrhythmia,  
 7 yes.  
 8 **A. As someone who is also accredited in intensive care,**  
 9 **I am not quite sure what point you are trying to make**  
 10 **because -- yes, everyone's heart stops terminally, of**  
 11 **course, that is right. But I -- what I don't know, and**  
 12 **I don't know from this, is exactly what -- it seems**  
 13 **rather illogical. They talk about the changes of asthma**  
 14 **in the airways or the lungs but it doesn't say what**  
 15 **changes.**  
 16 **If you have an acute asthmatic attack, you don't**  
 17 **necessarily see very much in the airways but you see**  
 18 **more chronic changes from people who have got chronic**  
 19 **asthma and it is conceivable, in fact the literature**  
 20 **suggests that people who have a history of asthma have**  
 21 **worse reactions with scombroid toxins.**  
 22 **In fact, although I have a history of asthma,**  
 23 **I didn't have any respiratory effects whatsoever when**  
 24 **I had scombroid poisoning.**  
 25 Q. It sounds as though you had quite a bad go?

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1 **A. Yes, well the levels were quite high but what is**  
 2 **remarkable, if you are saying these are two women who**  
 3 **for the very first time both had an allergic reaction to**  
 4 **fish, that would be remarkable, wouldn't it? Are they**  
 5 **both eating fish knowing they have an allergy?**  
 6 Q. I don't think they are allergic to fish, with respect,  
 7 Dr Wilmshurst. I think what the report shows is that  
 8 they are allergic -- because of their asthmatic  
 9 condition they are allergic to histamine, and if  
 10 histamine comes into the body from pelagic --  
 11 **A. No, you cannot be allergic to histamine. You cannot be**  
 12 **allergic to histamine. Histamine is a naturally**  
 13 **occurring substance, it is in everyone's body. You**  
 14 **cannot be allergic to it. It is not the is the right**  
 15 **sort of molecule, you can be allergic to large molecules**  
 16 **like proteins and some polysaccharides, but you cannot**  
 17 **be allergic to histamine.**  
 18 Q. Can you help us with what you think Dr Olumbe was  
 19 referring to when he said in his death certificate that  
 20 the cause of death was "an allergic-type reaction with  
 21 the underlying condition of asthma". Allergic to what?  
 22 **A. I have no idea. He said an allergic-type reaction, if**  
 23 **it was an allergy or an allergic reaction, it would be**  
 24 **"an allergic reaction". He said an "allergic-type**  
 25 **reaction", I don't know if that is his shorthand for the**

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1 **fact that it is scombrotxin poisoning because, as**  
 2 **people have said, scombrotxin poisoning looks exactly**  
 3 **like, or can look exactly like an allergic reaction,**  
 4 **because the mechanism is the same.**  
 5 Q. If we can just stand back from this, the point I am  
 6 putting to you is that as far as the literature goes,  
 7 and I accept it may well be incomplete, there haven't  
 8 really been any deaths recorded as a result of eating  
 9 scombroid fish, save for these Bischoff ladies. In  
 10 their case it is not at all clear that the cause of  
 11 death was anything to do with a cardiac arrhythmia, as  
 12 opposed to the fact that they had asthma and were in one  
 13 way or another vulnerable to this poison or to this  
 14 substance?  
 15 **A. Well, I would have to have a look at this a bit more**  
 16 **carefully.**  
 17 Q. Yes.  
 18 **A. I don't really know. I mean the first lady is found, we**  
 19 **don't know what the ECG showed when they arrived, which**  
 20 **is something like four hours, five hours after she has**  
 21 **eaten, it seems, we don't know but she unconscious, we**  
 22 **don't know what rhythm it says, she had various**  
 23 **seizures, we don't know what caused the seizures. Is**  
 24 **that because she is anoxic, hypoxic, because she has**  
 25 **airways obstruction that is causing her gases, you know**

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1 **amount of oxygen and CO2 in her blood to be abnormal.**  
 2 **Is it because she has arrhythmias? She has a cardiac**  
 3 **arrest and CPR, unless you know you cannot say that she**  
 4 **hasn't had an arrhythmia.**  
 5 Q. No, I appreciate there are many uncertainties and I am  
 6 not seeking to make more than a general point that it  
 7 appears that the only recorded case of people dying  
 8 after eating scombroid fish is by no means clear that  
 9 that was as a result of a cardiac arrhythmia, it may  
 10 have been but it is not evidence for it, this case --  
 11 **A. No, no, no, I accept that.**  
 12 Q. I go back to your report and I am afraid there is to  
 13 really no way round this but your statement that  
 14 scombrotxin fish poisoning causes fatal cardiac  
 15 arrhythmias was way overstated, it is not something you  
 16 should have said.  
 17 **A. Where was that?**  
 18 Q. It is on the second page of your report.  
 19 **A. No, I said it can be fatal. No, I think I just**  
 20 **corrected it, I have said, "Scombroid poisoning can be**  
 21 **fatal [stop]. And it can cause lethal or potentially**  
 22 **lethal arrhythmias".**  
 23 Q. Yes, well where is the evidence that it can cause lethal  
 24 cardiac arrhythmias?  
 25 **A. The evidence from Wolff, in that it causes -- sorry,**

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1 **histamine can cause lethal arrhythmias.**  
 2 Q. But not scombrotxin poisoning?  
 3 **A. No, okay, but since scombrotxin poisoning is caused by**  
 4 **histamine, we are just talking about -- so histamine**  
 5 **injections, so if you inject enough histamine you could**  
 6 **presumably kill someone or if you took it by mouth you**  
 7 **could presumably kill someone.**  
 8 Q. Not apparently if you come by it by eating bad fish, it  
 9 has never happened?  
 10 **A. There are three people who have died from scombrotxin**  
 11 **poisoning, aren't there? Now we have said, the one**  
 12 **previously and two in this case.**  
 13 MR MOXON BROWNE: Sir, I am told by Mr Skelton that we need  
 14 a break and I am happy to sheath my rapier at this  
 15 point.  
 16 THE CORONER: Let's just see, does anybody else have any  
 17 questions for the doctor?  
 18 We are just going to have a break now for the  
 19 benefit of the stenographers.  
 20 **A. Sure.**  
 21 THE CORONER: Is that all right?  
 22 **A. Sure.**  
 23 THE CORONER: Thank you very much.  
 24 (11.35 am)  
 25 (A short adjournment)

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1 (11.57 am)  
 2 THE CORONER: We obviously have a lot to get through today  
 3 and I have certainly taken the point about the deaths or  
 4 lack of them some while ago. I am on that.  
 5 Anyway, who is next?  
 6 Questions from MR STRAW  
 7 MR STRAW: Dr Wilmshurst, with no disrespect to your  
 8 expertise as a cardiologist, I need to be clear about  
 9 scombroid food poisoning, is it right that the question  
 10 of whether scombroid food poison something contributed  
 11 to Mr Perepilichnyy's death is outside your expertise?  
 12 **A. Yes.**  
 13 Q. I think you have no particular expertise in the symptoms  
 14 or pathology of toxins; is that correct?  
 15 **A. Yes.**  
 16 Q. You are reliant on the opinions of other experts in  
 17 respect of the toxicological causes of cardiac  
 18 arrhythmia?  
 19 **A. Sorry?**  
 20 Q. You are reliant on the opinions of other experts in  
 21 respect of the toxicological causes of cardiac  
 22 arrhythmia?  
 23 **A. Not entirely. I mean it depends which toxin you are**  
 24 **talking about, I mean I deal with toxicological, some**  
 25 **toxins causing cardiac arrhythmias and that is part of**

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<p>1 <b>my job, digoxin, I deal with that, beta blockers, drugs</b></p> <p>2 <b>causing cardiac arrhythmias.</b></p> <p>3 Q. The reason I ask is from your first report at</p> <p>4 paragraph 30, you say, "I am reliant on the opinions of</p> <p>5 other experts for the exclusion of toxicology causes of</p> <p>6 cardiac arrhythmias and pulmonary oedema".</p> <p>7 <b>A. Sorry, I was thinking more of -- on many toxins I am</b></p> <p>8 <b>reliant on but there are some toxins like medical toxins</b></p> <p>9 <b>I have knowledge of. I would, in fact, deal with many</b></p> <p>10 <b>of those like digoxin or beta blockers, yes, but if you</b></p> <p>11 <b>are talking about --</b></p> <p>12 Q. Scombroid in particular.</p> <p>13 <b>A. Yes, I am reliant on the literature, really, there, yes.</b></p> <p>14 <b>I mean if I had someone with an arrhythmia who had</b></p> <p>15 <b>scombroid poisoning I would check the literature, that</b></p> <p>16 <b>what anyone would do in that situation.</b></p> <p>17 Q. The conclusion in your joint expert report with</p> <p>18 Professor Sheppard, you have already been taken to one</p> <p>19 of them, which was that in order to come to a diagnosis</p> <p>20 of SADS, other possible explanations have to be totally</p> <p>21 excluded?</p> <p>22 <b>A. Correct.</b></p> <p>23 Q. The last question of your report --</p> <p>24 <b>A. To the satisfaction of the court, excluded.</b></p> <p>25 Q. Yes.</p> <p style="text-align: center;">Page 65</p>	<p>1 rely on is itchiness?</p> <p>2 <b>A. Well, that was not -- no, it was just a little -- it was</b></p> <p>3 <b>just a little filler we put in. The point about</b></p> <p>4 <b>itchiness was that I saw subsequently, as I did on my</b></p> <p>5 <b>medical takes, often people who were admitted with</b></p> <p>6 <b>allergic reactions, urticaria. They said:</b></p> <p>7 <b>"The first symptom I noticed, actually, when I got</b></p> <p>8 <b>this, was my palms and the soles of my feet were very</b></p> <p>9 <b>itchy."</b></p> <p>10 <b>That was the very first symptom. I thought this was</b></p> <p>11 <b>really strange and I looked at them and my palms were</b></p> <p>12 <b>bright red and when I got home I took my socks off, the</b></p> <p>13 <b>soles of my feet, my feet, were bright red. When I next</b></p> <p>14 <b>saw people come in with allergic reactions, urticaria,</b></p> <p>15 <b>I just said to them, I think it was four or five, I said</b></p> <p>16 <b>which, you know, and people with urticaria are itchy and</b></p> <p>17 <b>they are itchy because they are excreting endogenous</b></p> <p>18 <b>histamine not exogenous histamine, which has been taken</b></p> <p>19 <b>in.</b></p> <p>20 <b>I said: which was the bit that was most itchy? And</b></p> <p>21 <b>they said palms, soles or both palms and soles. It was</b></p> <p>22 <b>just an interesting little point that we were trying to</b></p> <p>23 <b>make. In fact it shows that histamine, however you have</b></p> <p>24 <b>it, whether it is taken in or internally produced,</b></p> <p>25 <b>produces the same sorts of symptoms and can be very</b></p> <p style="text-align: center;">Page 67</p>
<p>1 The last answer of your report, which is</p> <p>2 question 54, you say:</p> <p>3 "We are unwilling to speculate about causes of death</p> <p>4 when the possibility of undetected poisons is raised,</p> <p>5 because it is outside our expertise."</p> <p>6 Do you stand by that conclusion?</p> <p>7 <b>A. Yes.</b></p> <p>8 Q. You are not saying to the court then are you that in</p> <p>9 your expert opinion, scombroid poisoning is a possible</p> <p>10 cause of death, therefore SADS is not the cause of</p> <p>11 death?</p> <p>12 <b>A. No, no. I would perhaps like to be clear. I mean</b></p> <p>13 <b>I gave evidence last year and then I was sent further</b></p> <p>14 <b>documents, which were essentially two statements made by</b></p> <p>15 <b>Ms Medynska. When I read them I thought, "Gosh, this</b></p> <p>16 <b>sounds a bit like the scombroid poisoning I had". That</b></p> <p>17 <b>was -- therefore, you know, I have a duty to tell the</b></p> <p>18 <b>court, I raised that possibility. All I did was to</b></p> <p>19 <b>raise that possibility.</b></p> <p>20 Q. You make clear in your report, "I am not a toxicologist</p> <p>21 but I do know something about scombrotxin food</p> <p>22 poisoning because I experienced it once"?</p> <p>23 <b>A. Yes.</b></p> <p>24 Q. It is right isn't it that in your notes for the British</p> <p>25 Medical Journal, the primary or the first symptom you</p> <p style="text-align: center;">Page 66</p>	<p>1 <b>difficult to distinguish. That is the point we are</b></p> <p>2 <b>making.</b></p> <p>3 <b>In fact if you go to -- the point I made I think in</b></p> <p>4 <b>the report was that if you go to patient literature,</b></p> <p>5 <b>people who have had urticaria and get recurrent</b></p> <p>6 <b>urticaria, one of the things they describe is the</b></p> <p>7 <b>itchiness of the palms or soles but it is actually not</b></p> <p>8 <b>in medical textbooks. That was the point I was making,</b></p> <p>9 <b>I was just trying to point out a symptom that was well</b></p> <p>10 <b>recognised by patients and doctors had never recognised,</b></p> <p>11 <b>really. That was the point.</b></p> <p>12 Q. Okay.</p> <p>13 A couple of questions on the relationship between</p> <p>14 histamine and scombroid fish poisoning, could you turn,</p> <p>15 please, to bundle 1. Hopefully you have that there.</p> <p>16 Bundle 1, page 381.</p> <p>17 <b>A. Yes.</b></p> <p>18 Q. This is the World Health Organisation article that you</p> <p>19 have been referred to already. Do you see in</p> <p>20 paragraph 2.3.4, middle of the page, and about four</p> <p>21 lines down, it says:</p> <p>22 "However, oral administration of pure histamine at</p> <p>23 the same dose as that found in spoiled fish does not</p> <p>24 elicit the same toxicological affects as those seen in</p> <p>25 scombroid fish poisoning."</p> <p style="text-align: center;">Page 68</p>

<p>1 <b>A. Yes.</b></p> <p>2 Q. It is right, is it not, that in that section it puts</p> <p>3 forward a number of theories as to the relationship</p> <p>4 between histamine poisoning on the one hand and</p> <p>5 scombroid fish poisoning on the other?</p> <p>6 <b>A. Hmm.</b></p> <p>7 Q. Correct? For example there may be potentiators or</p> <p>8 enzymes involved between the two of them?</p> <p>9 <b>A. Yes.</b></p> <p>10 Q. The other articles that you put forward explain other</p> <p>11 theories about the relationship between them?</p> <p>12 <b>A. Yes, but I think I mentioned before when earlier on,</b></p> <p>13 <b>I said that there may be other substances in fish and</b></p> <p>14 <b>two of them are named here, that may play a part, yes,</b></p> <p>15 <b>that's right.</b></p> <p>16 Q. Would it be fair to say that the relationship between</p> <p>17 scombroid on the one hand and histamine on the other,</p> <p>18 and the differences between the symptoms caused by the</p> <p>19 two of them, is a complex issue which is really a matter</p> <p>20 for a toxicologist, it is outside your expertise?</p> <p>21 <b>A. Yes.</b></p> <p>22 Q. Just turning to your more recent report, the one dated</p> <p>23 9 April, please.</p> <p>24 <b>A. Where is that?</b></p> <p>25 Q. I will hopefully be able to ask you these questions</p> <p style="text-align: center;">Page 69</p>	<p>1 <b>A. I also note that I was also given another report that</b></p> <p>2 <b>also mentions atrial arrhythmias or atrial tachycardia,</b></p> <p>3 <b>I was given it today, this Feng et al paper, which also</b></p> <p>4 <b>talks about atrial arrhythmias.</b></p> <p>5 Q. If we can stick with the Borysiewicz one for the moment.</p> <p>6 <b>A. Sure.</b></p> <p>7 Q. That is the one you rely on in your report, Borysiewicz</p> <p>8 and Krikler. That was the case, wasn't it, with the man</p> <p>9 who came with a history of four days of palpitations</p> <p>10 after eating the mackerel?</p> <p>11 <b>A. Yes.</b></p> <p>12 Q. And his heart rate was around 150 a minute?</p> <p>13 <b>A. Yes.</b></p> <p>14 Q. You explained earlier that that is a self-perpetuating</p> <p>15 mechanism probably?</p> <p>16 <b>A. Yes.</b></p> <p>17 Q. So his heart rate would have continued at that fairly</p> <p>18 high rate throughout the four-day period?</p> <p>19 <b>A. Not necessarily, because the atria are going in a cycle</b></p> <p>20 <b>at 300 a minute. If you have 2 to 1 block, it is</b></p> <p>21 <b>transmitted as 150 but the block in the atrioventricular</b></p> <p>22 <b>node can vary, so when you are asleep you often get</b></p> <p>23 <b>a higher block, so everyone's heart rate slows down, so</b></p> <p>24 <b>his may have gone to 4 to 1 block when he was asleep and</b></p> <p>25 <b>it may have slowed to 75, I don't know. But if he had</b></p> <p style="text-align: center;">Page 71</p>
<p>1 without referring to the report but if you would like</p> <p>2 it, please let me know and I will give you the page</p> <p>3 number.</p> <p>4 You put forward what might be a mechanism as to how</p> <p>5 scombroid fish poisoning may lead to cardiac</p> <p>6 arrhythmias; is that correct?</p> <p>7 <b>A. If it is the one I think it is, yes.</b></p> <p>8 Q. If you are not sure, let me take you to it, it is</p> <p>9 page 539 in that bundle.</p> <p>10 <b>A. You might as well, just double check which one we are</b></p> <p>11 <b>talking about.</b></p> <p>12 <b>Because I have recently done two reports, haven't I?</b></p> <p>13 Q. Yes, so this is the most recent one on 9 April.</p> <p>14 <b>A. Yes, okay.</b></p> <p>15 Q. 539, it is section 3, "Cardiac arrhythmias and scombroid</p> <p>16 toxin poisoning", do you see that there?</p> <p>17 <b>A. Yes.</b></p> <p>18 Q. You put forward there, don't you, a mechanism which you</p> <p>19 say may be a way by which scombrotxin poisoning could</p> <p>20 lead to cardiac arrhythmia?</p> <p>21 <b>A. Yes, I think I also say it is rather speculative.</b></p> <p>22 Q. I was going to take you to that, at the end you say it</p> <p>23 is speculative.</p> <p>24 <b>A. I am just trying to fit it together.</b></p> <p>25 Q. Of course.</p> <p style="text-align: center;">Page 70</p>	<p>1 <b>been anxious and adrenaline had, you know, kicked in, it</b></p> <p>2 <b>could have conceivably have gone higher.</b></p> <p>3 Q. Right. But you would expect that during the day, when</p> <p>4 he was awake, that he would have -- focusing on the word</p> <p>5 self-perpetuating, I am trying to understand how that</p> <p>6 would work, you would expect when he was awake, he would</p> <p>7 have a raised heart rate and the continuous history of</p> <p>8 palpitations?</p> <p>9 <b>A. Yes, because he had symptoms of palpitations but we see</b></p> <p>10 <b>people who come in with atrial flutter and they feel</b></p> <p>11 <b>well and you do an ECG and they have got flutter and</b></p> <p>12 <b>they have got a higher grade block, so they have got 4</b></p> <p>13 <b>to 1 block and their rate is 75 a minute and they don't</b></p> <p>14 <b>notice it.</b></p> <p>15 <b>The atria is the self-perpetuating bit, the</b></p> <p>16 <b>conduction through the AV node, the atrioventricular</b></p> <p>17 <b>node, can vary. And we recognise that.</b></p> <p>18 Q. In your recent report, you also refer to -- can you have</p> <p>19 a look, please, at 540, towards the bottom of the page,</p> <p>20 the third and second paragraph from the bottom, you</p> <p>21 mention alcohol.</p> <p>22 <b>A. Yes.</b></p> <p>23 Q. Are you aware of the evidence that Ms Medynska gave</p> <p>24 about how much alcohol Mr Perepilichnyy had while he was</p> <p>25 in Paris?</p> <p style="text-align: center;">Page 72</p>

1 **A. Yes. I mean I was trying to work out when -- he seemed**  
 2 **to drink more than I drink, so that is too much really,**  
 3 **isn't it.**  
 4 Q. I can tell you exactly what she said, how much she said  
 5 he drank. She said on 8 November, between 3.00 and  
 6 4.00 pm he had just under one bottle of wine. For  
 7 dinner they shared a bottle. The next day, on  
 8 9 November, between 3.00 and 4.00 pm he had about one  
 9 glass and for dinner they shared a bottle again.  
 10 **A. Okay. So on the 8th, he had 12 units and on the next**  
 11 **day they shared a bottle and he had one glass, so six**  
 12 **units, something.**  
 13 Q. Can I understand, are you suggesting in this section  
 14 that his use of alcohol during that period could have  
 15 caused his death?  
 16 **A. No. No, I am not. But alcohol -- actually I wasn't**  
 17 **quite -- I mean he seemed -- I mean he was having**  
 18 **a weekend break, so people often drink more alcohol**  
 19 **don't they on those sort of occasions. I am just saying**  
 20 **that it was -- when you drink alcohol you increase your**  
 21 **catecholamine release, so you increase adrenaline. I am**  
 22 **not saying that that was enough to cause his death. No,**  
 23 **I am not saying that. I am saying that I don't know**  
 24 **what effect the amount of alcohol he had might interact**  
 25 **with the histamine but it actually sounds as if he**

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1 **didn't actually have that much alcohol at the time he**  
 2 **had the fish -- sorry, when I say histamine, assuming**  
 3 **for the moment that he did have scombroid fish**  
 4 **poisoning. With that merely it sounds like he had half**  
 5 **a bottle, which is four units, so -- earlier I wasn't**  
 6 **sure how much it was, so -- or the timing of the amounts**  
 7 **of alcohol.**  
 8 Q. Because please do say if I have this wrong but as far as  
 9 I can see there is nothing in the literature which says  
 10 that that sort of intake of alcohol combined with  
 11 scombroid poisoning can cause death?  
 12 **A. No, it is speculation.**  
 13 MR STRAW: Yes.  
 14 That is everything, thanks very much.  
 15 Questions from MR BEGGS  
 16 MR BEGGS: Dr Wilmshurst, if we go back to basics, for the  
 17 scombrototoxin theory to have purchase in this case, we  
 18 first have to establish that Mr Perepilichnyy, excuse  
 19 me, ate the relevant fish?  
 20 **A. Correct.**  
 21 Q. The relevant fish include, as I understand it, tuna,  
 22 mackerel and did you say salmon?  
 23 **A. Salmon, and a few other things like mahi-mahi and**  
 24 **various other things.**  
 25 Q. Just to deal with that, if we go back to the best

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1 account that we have from Ms Medynska last July -- I say  
 2 best because it is perhaps nearest in time -- she  
 3 describes that she ate sashimi, which we know on any  
 4 definition online includes salmon, tuna, mackerel and  
 5 maki, which likewise can wrap those self same fish and  
 6 perhaps the learned coroner will take it from me that if  
 7 you look at the Buddha-Bar's website, it is quite clear  
 8 that tuna is the predominant fish, which is not unusual  
 9 for such bars but also this, she describes in a non-led  
 10 way, it is her spontaneous evidence, that he didn't like  
 11 the taste and she makes the perhaps important nuanced  
 12 point that he was someone that did a lot of fine dining  
 13 and he knew about food, if it wasn't right.  
 14 **A. Hmm.**  
 15 Q. This is beginning to sound like the sort of scenario  
 16 that you describe happening to yourself, isn't it, he  
 17 didn't like the taste?  
 18 **A. That is what sprung to my mind.**  
 19 Q. Exactly.  
 20 **A. Why I raised the issue.**  
 21 Q. Indeed, because of his high standards he sent some of  
 22 the food back and complained?  
 23 **A. Yes.**  
 24 Q. Then, just to take it a bit further, she also describes  
 25 him as a short time later when they returned to the

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1 hotel room as vomiting noisily three times. That again  
 2 seems to be at least consistent with the sort of  
 3 poisoning you are positing?  
 4 **A. Yes.**  
 5 Q. This perhaps importantly, that when he came out of the  
 6 toilet, last year, she said, he came out with a red  
 7 face.  
 8 Pausing there, it is important to note that no one  
 9 led her into saying that. Do you see?  
 10 **A. Hmm.**  
 11 Q. We can perhaps assume that she is not an expert in this  
 12 form of rare poisoning, and indeed last month she went  
 13 further, un-led, and said that he came out with a red  
 14 upper body, which seems to me quite similar to the  
 15 experience you had?  
 16 **A. Yes, that is why I thought this sounds very familiar to**  
 17 **me. That is why I raised the issue for the court.**  
 18 Q. For what it is worth, she also described that they  
 19 didn't participate in any, as she put it, making love  
 20 that evening, which may also be consistent with having  
 21 eaten disagreeable food, for otherwise he might well  
 22 have been so inclined. Do you see?  
 23 **A. Yes.**  
 24 Q. Looking at all those things together, she seems to be  
 25 describing almost exactly the factual circumstances you

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<p>1 describe with your experience, is that fair?</p> <p>2 <b>A. Well, it is sufficiently like it that I thought I ought</b></p> <p>3 <b>to raise it as a possibility for the court to consider.</b></p> <p>4 Q. All that you were doing by raising this potential</p> <p>5 causative factor was merely indicating that it may be</p> <p>6 synergistic to the arrhythmia caused by running?</p> <p>7 <b>A. Yes.</b></p> <p>8 Q. I wonder if there is one other potential factor that may</p> <p>9 have contributed and that is the small amounts of</p> <p>10 sildenafil which were found in his system on death.</p> <p>11 Pausing there, that particular medicine can affect the</p> <p>12 heart, can't it?</p> <p>13 <b>A. Yes. It can affect the heart, although there is</b></p> <p>14 <b>contradictory -- perhaps the toxicologists should say</b></p> <p>15 <b>more about that, but my reading is that it can affect</b></p> <p>16 <b>the heart but more importantly it affects your blood</b></p> <p>17 <b>vessels and dilates them, so it could have a synergistic</b></p> <p>18 <b>effect with any other substance, whether it was</b></p> <p>19 <b>a vasodilator like alcohol, like histamine. Of course</b></p> <p>20 <b>the low level at the time of death, one presumes would</b></p> <p>21 <b>have been a higher level 18 hours earlier.</b></p> <p>22 MR BEGGS: Yes, thank you very much.</p> <p>23 MR SKELTON: No further questions from me, sir.</p> <p>24 THE CORONER: Thank you very much indeed.</p> <p>25 <b>A. Thanks very much.</b></p> <p style="text-align: center;">Page 77</p>	<p>1 oxidase?</p> <p>2 <b>A. Monoamine oxidase inhibitors, that's correct.</b></p> <p>3 Q. Which are antidepressants?</p> <p>4 <b>A. They are antidepressants, old fashioned antidepressants,</b></p> <p>5 <b>yes.</b></p> <p>6 Q. You additionally, as I understand it, said that some</p> <p>7 medication can be formulated to have a delayed reaction?</p> <p>8 <b>A. That's correct.</b></p> <p>9 Q. That may apply to some form of poison, a medication --</p> <p>10 <b>A. The pharmaceutical preparation could be made to have</b></p> <p>11 <b>a delayed action in the same way that medicines are made</b></p> <p>12 <b>to have a delayed action.</b></p> <p>13 Q. Thank you.</p> <p>14 The critical issue for today is whether or not</p> <p>15 Mr Perepilichnyy was poisoned in Paris, either</p> <p>16 deliberately or accidentally. You will have heard and</p> <p>17 sat through this morning's evidence about the potential</p> <p>18 for accidental poisoning via the ingestion of fish.</p> <p>19 <b>A. Correct.</b></p> <p>20 Q. In circumstances where the poison had some form of</p> <p>21 delayed effect, in that it manifested itself fatally</p> <p>22 the next day when Mr Perepilichnyy was out jogging in</p> <p>23 the afternoon. That is the critical issue we are</p> <p>24 investigating today in your evidence.</p> <p>25 <b>A. I understand.</b></p> <p style="text-align: center;">Page 79</p>
<p>1 MR SKELTON: Sir, the next witness is Professor Ferner.</p> <p>2 The witnesses have been previously sworn in this</p> <p>3 court, as you will appreciate, so for the most part we</p> <p>4 are not re-swearing them.</p> <p>5 THE CORONER: Let's do it just for the avoidance of doubt.</p> <p>6 PROFESSOR ROBIN FERNER (sworn)</p> <p>7 Questions from MR SKELTON</p> <p>8 MR SKELTON: Professor Ferner, you have given evidence</p> <p>9 previously on a variety of matters relevant to</p> <p>10 Mr Perepilichnyy's death. You have also produced</p> <p>11 a supplementary piece of evidence, a report dated</p> <p>12 27 March this year, which you can find in the bundle,</p> <p>13 I hope it is in front of you, at tab 29.</p> <p>14 <b>A. I have, yes.</b></p> <p>15 Q. Just to summarise at least some of the evidence that you</p> <p>16 gave previously if I may, please correct me if I am not</p> <p>17 summarising it correctly, you said in your evidence last</p> <p>18 year that some poisons can be intrinsically delayed in</p> <p>19 their effect, such as paracetamol?</p> <p>20 <b>A. Correct.</b></p> <p>21 Q. You also said some may be state dependent, in that they</p> <p>22 require something else to happen for them to become</p> <p>23 toxic?</p> <p>24 <b>A. Correct.</b></p> <p>25 Q. An example of that I think you gave is monoamine</p> <p style="text-align: center;">Page 78</p>	<p>1 Q. I will not take you, unless I need to, through the</p> <p>2 summary I gave to Dr Wilmshurst a short while ago about</p> <p>3 the evidence of Ms Medynska and the additional evidence</p> <p>4 about Mr Perepilichnyy's appearance, signs and symptoms</p> <p>5 over the period from his dinner on the night of the 9th</p> <p>6 to his fatal collapse on the afternoon. You heard that</p> <p>7 summary I think today. It included in particular</p> <p>8 a history of vomiting on, it seems, three occasions --</p> <p>9 after eating, and having complained about food and other</p> <p>10 matters.</p> <p>11 Would you like me to summarise that for you?</p> <p>12 <b>A. No, as you may know, sir, I was here yesterday, so</b></p> <p>13 <b>I heard the evidence. I had one or two difficulties</b></p> <p>14 <b>with the evidence.</b></p> <p>15 <b>Firstly, I think I am right in saying that</b></p> <p>16 <b>Ms Medynska heard a sound that she attributed to</b></p> <p>17 <b>vomiting.</b></p> <p>18 Q. Correct, she didn't see it.</p> <p>19 <b>A. She didn't see vomiting and she didn't enquire as to</b></p> <p>20 <b>whether vomiting had taken place --</b></p> <p>21 Q. Correct.</p> <p>22 <b>A. -- but I am sure that is well known.</b></p> <p>23 <b>The second is that in answer to your question, she</b></p> <p>24 <b>said he was -- looked clean and a little bit red,</b></p> <p>25 <b>a little bit red eyes and red face.</b></p> <p style="text-align: center;">Page 80</p>

<p>1 Q. Yes.</p> <p>2 <b>A. That was at one point, when he came out of the lavatory,</b></p> <p>3 <b>the bathroom as she called it, but the next morning she</b></p> <p>4 <b>says his eyes were very red, if I have understood the</b></p> <p>5 <b>evidence from yesterday. I'm sorry, I haven't made</b></p> <p>6 <b>a note of the page on which that evidence was recorded.</b></p> <p>7 THE CORONER: We can check but are you saying your</p> <p>8 understanding is she is saying when he wakes up at</p> <p>9 5.00/6.00, that he has got very red eyes then.</p> <p>10 <b>A. I think that is what she said and I found that difficult</b></p> <p>11 <b>to fit in with the previous evidence. For one obvious</b></p> <p>12 <b>reason, sir that one would expect the symptoms to be</b></p> <p>13 <b>abating rather than being exacerbated.</b></p> <p>14 MR SKELTON: "The next day when I saw him he was still very</p> <p>15 red eyes."</p> <p>16 <b>A. Yes. His eyes were a little bit red at one point.</b></p> <p>17 Q. A little bit red when he came out of the bathroom, it</p> <p>18 seems and the next day she says he was still very red</p> <p>19 eyes -- you will appreciate a tension to some extent</p> <p>20 between the two of those, because the "still" implies it</p> <p>21 is at the same level and the "very red eyes" would imply</p> <p>22 it was worse, it would seem but that may be a problem</p> <p>23 with the language?</p> <p>24 <b>A. I just call attention to the fact that I heard the</b></p> <p>25 <b>evidence and I was not absolutely clear.</b></p> <p style="text-align: center;">Page 81</p>	<p>1 infection.</p> <p>2 On page 483, paragraphs 24 and 25, you mentioned</p> <p>3 possibility of bacterial contamination in the form of</p> <p>4 staphylococcal toxin?</p> <p>5 <b>A. Absolutely. I stand by that. I think there may have</b></p> <p>6 <b>been some confusion, infection by staphylococci takes</b></p> <p>7 <b>time to happen, but if food is contaminated with</b></p> <p>8 <b>staphylococci bugs, then they can produce a toxin which</b></p> <p>9 <b>is not degraded by heat and which causes within a short</b></p> <p>10 <b>period vomiting, which subsides quite quickly. So</b></p> <p>11 <b>staphylococcal food poisoning, which I have seen on the</b></p> <p>12 <b>general medical take is not caused by staphylococci but</b></p> <p>13 <b>by the toxin that they elaborate.</b></p> <p>14 Q. As you say, the toxin can remain in the food</p> <p>15 notwithstanding the cooking process?</p> <p>16 <b>A. Correct. The same is true, incidentally, of histamine.</b></p> <p>17 Q. It is a rapid onset poison, food poison?</p> <p>18 <b>A. Correct and the same is true of bacillus cereus, which</b></p> <p>19 <b>classically occurs in reheated rice which is not</b></p> <p>20 <b>synonymous with but sounds as if it might be relevant to</b></p> <p>21 <b>Chinese and Japanese meals.</b></p> <p>22 Q. Again, you heard the evidence of the food which</p> <p>23 Mr Perepilichnyy consumed. It was not clear whether he</p> <p>24 consumed fish, although he may have done, it is fair to</p> <p>25 say, and he may have consumed prawns as well and he may</p> <p style="text-align: center;">Page 83</p>
<p>1 Q. Can I just, unless you need to be taken to the theories</p> <p>2 first, can I just ask you off the bat, the significance</p> <p>3 of the very red eyes the next morning is what from your</p> <p>4 perspective?</p> <p>5 <b>A. It doesn't quite fit with scombrototoxic fish poisoning.</b></p> <p>6 THE CORONER: Just spell it out for us, because?</p> <p>7 <b>A. Dr Wilmshurst has not described whether his eyes were</b></p> <p>8 <b>red or not when he had it but none of the literature</b></p> <p>9 <b>talks about red eyes, suffused conjunctively in the</b></p> <p>10 <b>technical term, and the cases that I have diagnosed have</b></p> <p>11 <b>not had red eyes, that is not to say that you cannot</b></p> <p>12 <b>have red eyes but it doesn't seem to be a particular</b></p> <p>13 <b>feature of this condition. So it just weighs slightly</b></p> <p>14 <b>in the balance against this being scombrototoxic fish</b></p> <p>15 <b>poisoning.</b></p> <p>16 Q. Yes, if the red eyes are connected with -- in any way</p> <p>17 connected to any form of poisoning?</p> <p>18 <b>A. Correct.</b></p> <p>19 Q. Which is not clear?</p> <p>20 <b>A. I think clarity is not something that is manifest in</b></p> <p>21 <b>this case.</b></p> <p>22 Q. No. Delicately put if I may say so.</p> <p>23 Can I ask you about the possible types of food</p> <p>24 poisoning that he may have suffered, which you discuss</p> <p>25 in your report as by reference to other forms of</p> <p style="text-align: center;">Page 82</p>	<p>1 have consumed rice.</p> <p>2 <b>A. Correct.</b></p> <p>3 Q. Is it your view then that the staphylococcal toxin could</p> <p>4 have arisen in respect of the fish or the prawns?</p> <p>5 <b>A. Yes.</b></p> <p>6 Q. And the bacillus cereus could have arisen in respect of</p> <p>7 the rice, would that have arisen in respect of the fish</p> <p>8 and seafood as well?</p> <p>9 <b>A. It is classically associated with rice, but my</b></p> <p>10 <b>understanding is that maki rolls contain rice, maybe</b></p> <p>11 <b>I have misunderstood.</b></p> <p>12 Q. I think that is correct, they are a small wrap of rice</p> <p>13 with some other vegetable, seafood or fish inside.</p> <p>14 I think I can give that evidence.</p> <p>15 <b>A. Sorry, I am --</b></p> <p>16 THE CORONER: Does that just mean apart from the reheating</p> <p>17 process, otherwise what does it mean, just the food is</p> <p>18 off, old?</p> <p>19 <b>A. It means it has had the opportunity to be contaminated</b></p> <p>20 <b>with a bacterium which makes the toxin.</b></p> <p>21 THE CORONER: How does that happen?</p> <p>22 <b>A. Well the staphylococcal toxin is on people's hands --</b></p> <p>23 THE CORONER: It could be in the preparation --</p> <p>24 <b>A. -- in a --</b></p> <p>25 THE CORONER: -- of the food, the cooking?</p> <p style="text-align: center;">Page 84</p>

<p>1 <b>A. Yes, absolutely. Correct.</b></p> <p>2 MR SKELTON: The other infection, the bacillus cereus?</p> <p>3 <b>A. I am not sure that this is not a relatively common</b></p> <p>4 <b>bacterium but which thrives in particular circumstances</b></p> <p>5 <b>of temperature, so that if you heated the rice and then</b></p> <p>6 <b>it cools down, the bacillus has an opportunity to</b></p> <p>7 <b>multiply.</b></p> <p>8 Q. Taking those two forms of food poisoning, is it your</p> <p>9 view that the signs and symptoms which he displayed,</p> <p>10 which is the rapid onset vomiting and the rapid</p> <p>11 resolution, apparent resolution, leaving aside the red</p> <p>12 eyes for the moment which persisted, are consistent with</p> <p>13 those two forms of poisoning?</p> <p>14 <b>A. Yes.</b></p> <p>15 Q. Are there any signs or symptoms which you would view as</p> <p>16 being inconsistent with those symptoms when you are</p> <p>17 weighing them in the balance?</p> <p>18 <b>A. Well it comes back to this question of how red</b></p> <p>19 <b>Mr Perepilichnyy was and how extensive the redness was,</b></p> <p>20 <b>because certainly the clinical diagnosis depends on</b></p> <p>21 <b>those features you have mentioned and which</b></p> <p>22 <b>Dr Wilmshurst suffered, the pounding headache, the</b></p> <p>23 <b>flushing from vasodilation, sometimes light</b></p> <p>24 <b>headedness – I don't need to rehearse the symptoms</b></p> <p>25 <b>which you have read out – and nausea and vomiting are</b></p> <p style="text-align: center;">Page 85</p>	<p>1 <b>as a consequence.</b></p> <p>2 Q. As far as scombroid fish is concerned, we obviously</p> <p>3 don't know whether he consumed that form of fish, it</p> <p>4 would appear?</p> <p>5 <b>A. No. I take the point that Japanese restaurants commonly</b></p> <p>6 <b>serve tuna, mackerel, and, for all I know, mahi-mahi.</b></p> <p>7 Q. Yes likewise we don't have the benefit of histamine or</p> <p>8 histamine metabolite testing prior to his death or</p> <p>9 indeed in the post mortem period of time?</p> <p>10 <b>A. No, although that would not distinguish between</b></p> <p>11 <b>scombrototoxic fish poisoning and an allergic reaction.</b></p> <p>12 Q. An allergic reaction to?</p> <p>13 <b>A. Well, something he was allergic to. Now, we don't know</b></p> <p>14 <b>what he was allergic to but you may recall when I gave</b></p> <p>15 <b>evidence previously there was some discussion of him</b></p> <p>16 <b>perhaps being allergic to penicillin or to procaine, and</b></p> <p>17 <b>he may have been allergic therefore to other things.</b></p> <p>18 Q. I asked Dr Wilmshurst about the post mortem testing, and</p> <p>19 the opportunity to test for histamine or metabolites.</p> <p>20 He gave the evidence to the best of his knowledge it was</p> <p>21 a relatively stable chemical, they were stable chemicals</p> <p>22 but there may be other factors in the post mortem period</p> <p>23 which could impact on the validity of testing when it</p> <p>24 comes to a diagnostic tool.</p> <p>25 <b>A. Yes, I agree with Dr Wilmshurst. I am not an expert on</b></p> <p style="text-align: center;">Page 87</p>
<p>1 <b>less common.</b></p> <p>2 Q. I think you would accept the redness, at least the</p> <p>3 redness that manifested itself just after</p> <p>4 Mr Perepilichnyy came out of the bathroom, could also be</p> <p>5 consistent with retching for a protracted period of</p> <p>6 time?</p> <p>7 <b>A. Consistent with him having washed his hair under a hot</b></p> <p>8 <b>shower.</b></p> <p>9 Q. Presumably the redness of his eyes could have been</p> <p>10 a response to putting him under that pressure?</p> <p>11 <b>A. Correct. If it is of diagnostic significance then it is</b></p> <p>12 <b>not of absolute diagnostic significance.</b></p> <p>13 Q. Leaving aside scombroid fish poisoning, which we will</p> <p>14 come on to in more detail in a moment --</p> <p>15 <b>A. Thank you.</b></p> <p>16 Q. -- and leaving aside the possibility of deliberate</p> <p>17 poisoning, are there any other conceivable causes of</p> <p>18 vomiting profusely late at night and then apparently</p> <p>19 recovering within a short period of time, for example</p> <p>20 migraines?</p> <p>21 <b>A. The answer to that is yes. In addition to that, the</b></p> <p>22 <b>learned coroner has said that food sometimes tastes off.</b></p> <p>23 <b>It is not necessarily poisonous or infected but it still</b></p> <p>24 <b>doesn't taste very nice and people react badly to food</b></p> <p>25 <b>that tastes off and they vomit or make themselves vomit</b></p> <p style="text-align: center;">Page 86</p>	<p>1 <b>the stability of methylhistamine in urine. I think he</b></p> <p>2 <b>said if it is present in large quantities, that is not</b></p> <p>3 <b>necessarily diagnostic but I think it would help the</b></p> <p>4 <b>court actually if it was present in large quantities,</b></p> <p>5 <b>high concentrations.</b></p> <p>6 Q. The question I think is the reliability of that result</p> <p>7 in terms of proving or disproving a theory of poisoning,</p> <p>8 if the sample itself is taken four days post mortem and</p> <p>9 has since been stored for a protracted period of time.</p> <p>10 <b>A. There are two questions.</b></p> <p>11 <b>One is whether at the moment he died</b></p> <p>12 <b>Mr Perepilichnyy's urine contained more methylhistamine</b></p> <p>13 <b>than normal.</b></p> <p>14 Q. Yes.</p> <p>15 <b>A. Which if he had had moderately severe scombrototoxic fish</b></p> <p>16 <b>poisoning the night before, I think is likely.</b></p> <p>17 Q. Because the 24-hour window that we have seen, indeed</p> <p>18 Dr Wilmshurst's 24-hour window, makes it likely that the</p> <p>19 histamine metabolises --</p> <p>20 <b>A. Yes, it is not certain, as you established earlier, sir,</b></p> <p>21 <b>that time course is not known.</b></p> <p>22 Q. No.</p> <p>23 <b>A. But the urinary excretion probably carries on for some</b></p> <p>24 <b>time. We don't know when Mr Perepilichnyy last emptied</b></p> <p>25 <b>his bladder of course, so we don't know how much urine</b></p> <p style="text-align: center;">Page 88</p>

<p>1 <b>there was in his bladder but let us say that there was</b></p> <p>2 <b>some and it showed a high concentration of</b></p> <p>3 <b>methylhistamine. That would support a diagnosis of</b></p> <p>4 <b>scombrotic fish poisoning or of allergy, and I will</b></p> <p>5 <b>come back to that.</b></p> <p>6 <b>If the concentration is low, it doesn't exclude it,</b></p> <p>7 <b>it just makes it less likely. That is my view.</b></p> <p>8 THE CORONER: I think you said there were two questions, one</p> <p>9 is whether at the moment he died he had a raised level.</p> <p>10 <b>A. I did, sir.</b></p> <p>11 THE CORONER: Were you just going to make a point about</p> <p>12 whether testing of what we have would be reliable in</p> <p>13 telling us -- I just didn't want.</p> <p>14 <b>A. That was exactly the point I was going to make --</b></p> <p>15 THE CORONER: I would like to know --</p> <p>16 <b>A. -- and I am not in a position to answer it.</b></p> <p>17 THE CORONER: You are not in a position?</p> <p>18 <b>A. No, I think that is a question for Dr Perry or one of</b></p> <p>19 <b>the laboratory doctors to see what the post mortem</b></p> <p>20 <b>stability of methylhistamine in urine will be, because</b></p> <p>21 <b>there are two delays. There is the delay before the</b></p> <p>22 <b>sample was taken and after Mr Perepilichnyy died and</b></p> <p>23 <b>then there was the storage.</b></p> <p>24 <b>Sorry, if I have --</b></p> <p>25 THE CORONER: No, no, I wanted your view.</p> <p style="text-align: center;">Page 89</p>	<p>1 described not all of them are in fact particularly</p> <p>2 toxic.</p> <p>3 <b>A. Correct.</b></p> <p>4 Q. Can I just ask you to explain, take us through those</p> <p>5 chemicals, you will find them on page 506 of your report</p> <p>6 and try and apply the possibility of their usage in the</p> <p>7 context of Mr Perepilichnyy's case.</p> <p>8 Are you in this case presenting them as the</p> <p>9 possibilities of delayed action poisons that could have</p> <p>10 administered in Paris and become symptomatic in London.</p> <p>11 Also bearing in mind the initial presentation, they are</p> <p>12 consistent with an initial reaction or are you leaving</p> <p>13 that aside as a separate issue?</p> <p>14 <b>A. No, the problem that I sought to solve was a poison</b></p> <p>15 <b>which initially causes vomiting, where there is then</b></p> <p>16 <b>an asymptomatic period of a period without symptoms and</b></p> <p>17 <b>where there is then cardiac arrhythmia. That is</b></p> <p>18 <b>a difficult question and only one substance came to my</b></p> <p>19 <b>mind immediately and that was colchicine, which we will</b></p> <p>20 <b>have to come back.</b></p> <p>21 <b>I then looked through TOXBASE, which is the UK</b></p> <p>22 <b>national poisons information services database --</b></p> <p>23 Q. Yes.</p> <p>24 <b>A. -- looking for those compounds which are said to cause</b></p> <p>25 <b>vomiting and then for those which cause arrhythmia and</b></p> <p style="text-align: center;">Page 91</p>
<p>1 MR SKELTON: Yes, that may be something we will have to pick</p> <p>2 up at another time but as we understood it, Dr Perry</p> <p>3 referred to Professor Egner and Professor Egner's views</p> <p>4 were disputed by Dr Wilmshurst, so we have a certain</p> <p>5 circularity of expert view.</p> <p>6 <b>A. I think if I may I will stand aside.</b></p> <p>7 Q. A wise decision.</p> <p>8 Other possibilities, just before we leave that,</p> <p>9 could you describe any other possibilities that may be</p> <p>10 the cause of sudden onset vomiting over a short-lived</p> <p>11 period?</p> <p>12 <b>A. Well, a large number of substances commonly cause</b></p> <p>13 <b>vomiting and overdoses of many substances like</b></p> <p>14 <b>paracetamol, which you mentioned earlier, will or may</b></p> <p>15 <b>cause vomiting early on.</b></p> <p>16 Q. What about Viagra?</p> <p>17 <b>A. I don't know. I don't believe it is a major adverse</b></p> <p>18 <b>effect of Viagra/sildenafil.</b></p> <p>19 Q. Turning then to the possibility of deliberate poisoning.</p> <p>20 <b>A. Thank you.</b></p> <p>21 Q. In your report you refer to a number of chemicals in</p> <p>22 appendix 3.</p> <p>23 <b>A. Yes.</b></p> <p>24 Q. Which you go through and analyse or at least present</p> <p>25 their symptoms prior to fatality. Although I think you</p> <p style="text-align: center;">Page 90</p>	<p>1 <b>making an assessment of whether the arrhythmia was</b></p> <p>2 <b>delayed after vomiting.</b></p> <p>3 <b>This is a database exercise but the database is</b></p> <p>4 <b>searched by words, so if the correct word is not chosen</b></p> <p>5 <b>in the search, then the substance will not be</b></p> <p>6 <b>identified, so it is limited to that degree.</b></p> <p>7 Q. Can I seek to clarify your view as to whether or not</p> <p>8 they are a likely candidate for Mr Perepilichnyy's</p> <p>9 death.</p> <p>10 So first of all, taking the first one, chlorophenoxy</p> <p>11 herbicides?</p> <p>12 <b>A. I think I can take this shortly, that I don't think any</b></p> <p>13 <b>of these that I have identified is likely for two</b></p> <p>14 <b>reasons.</b></p> <p>15 <b>I think there would probably be other features or</b></p> <p>16 <b>a large dose would have to be given, which is the case</b></p> <p>17 <b>with chlorophenoxy herbicide.</b></p> <p>18 Q. None of them is likely, just to be clear, that includes:</p> <p>19 chlorophenoxy herbicides; colchicine; MAOI, which is the</p> <p>20 monoamine oxidase inhibitors that we have already</p> <p>21 touched upon.</p> <p>22 <b>A. Yes, I qualify that by saying of course if he did have</b></p> <p>23 <b>tyramine-containing foods at lunchtime, then that</b></p> <p>24 <b>becomes more of a possibility. There is one piece of</b></p> <p>25 <b>evidence which I reminded myself of which was that</b></p> <p style="text-align: center;">Page 92</p>

<p>1 Mrs Perepilichnyy had at one time said that he was fond 2 of chocolate. 3 Q. Yes? 4 <b>A. Dark chocolate is a food rich in tyramine.</b> 5 <b>So that is at least in theory the circumstance in</b> 6 <b>which monoamine oxidase inhibitors could cause serious</b> 7 <b>arrhythmias.</b> 8 Q. Presumably death from the consumption of dark chocolate 9 is a very rare occurrence indeed? 10 <b>A. Unless you are taking a monoamine oxidase inhibitor.</b> 11 Q. In which taste it is an interactive? 12 <b>A. It is an interaction and it is less common than blue</b> 13 <b>cheese or chianti, both of which contain tyramine.</b> 14 Q. That is MAOI. 15 Phosphorous in white -- 16 <b>A. Again, I think that is unlikely. It would be quite</b> 17 <b>difficult to administer phosphorous in someone, though</b> 18 <b>I suppose it is not impossible.</b> 19 Q. Just to be clear, I think we need to be clear on what 20 you can say with some confidence about the probabilities 21 and what you can say about the possibilities. 22 Chlorophenoxy herbicides, are you able to say 23 whether that is a likely or unlikely? 24 <b>A. Unlikely, but not impossible.</b> 25 Q. Thank you.</p> <p style="text-align: center;">Page 93</p>	<p>1 <b>would be possible. I am not saying it is likely, I am</b> 2 <b>just saying ...</b> 3 Q. Phosphorous I think you said was unlikely? 4 <b>A. I think it is unlikely.</b> 5 Q. Sodium fluoride poisoning, which is on page 509. 6 <b>A. Again, unlikely, not impossible.</b> 7 Q. Why? 8 <b>A. Why is it unlikely? Because I think again you would</b> 9 <b>have little in the way of an asymptomatic period. It is</b> 10 <b>possible, it is recorded, but it is not what I would</b> 11 <b>expect of a fatal dose of sodium fluoride.</b> 12 Q. And the -- 13 THE CORONER: It is that period that we know about without 14 symptoms, that is what causes you -- that is a problem 15 there? 16 <b>A. That worries me.</b> 17 MR SKELTON: Yes, the symptoms that are listed there, after 18 ingestion include: nausea; dysphagia, so a problem 19 eating; hypersalivation, so too much saliva; vomiting; 20 abdominal pain; diarrhoea; and then it says headache, 21 shortness of breath and fatigue may occur. 22 Leukocytosis, what is that? 23 <b>A. An increase in white cell count in the blood.</b> 24 Q. Presumably that is something that needs to be found on 25 investigation rather than --</p> <p style="text-align: center;">Page 95</p>
<p>1 Likewise MAOI? 2 <b>A. Colchicine I think --</b> 3 Q. I am coming back to colchicine, if I may. 4 <b>A. MAOI, possible, dependent on the last meal or snack.</b> 5 THE CORONER: Possible but just -- herbicides you said 6 unlikely but not impossible. MAOI you say possible -- 7 in terms of likely or unlikely. 8 <b>A. It depends on whether he took tyramine-containing foods</b> 9 <b>with or after his lunch.</b> 10 MR SKELTON: If he did, if he ate some chocolate. 11 <b>A. Then it is possible and more likely than chlorophenoxy</b> 12 <b>herbicides. But none of these -- as I think I said in</b> 13 <b>the preamble -- is likely, more likely than not.</b> 14 Q. How would the MAOI be administered were it not taken 15 voluntarily by someone? 16 <b>A. Orally. You would sprinkle it on their food I suppose.</b> 17 Q. It is a tasteless compound that could be added to food 18 without the person realising they are ingesting it? 19 <b>A. I can't tell you what it tastes like but I haven't heard</b> 20 <b>of anyone complaining of the taste of monoamine oxidase</b> 21 <b>inhibitor tablets.</b> 22 Q. No. 23 <b>A. If indeed Mr Perepilichnyy did take for example</b> 24 <b>sildenafil, then presumably he did take tablets from</b> 25 <b>time to time and so substituting one tablet for another</b></p> <p style="text-align: center;">Page 94</p>	<p>1 <b>A. Correct.</b> 2 Q. Liver dysfunction, fever, haemorrhagic gastroenteritis, 3 hypotension, respiratory failure, pulmonary oedema and 4 coma may rarely occur, it says? 5 <b>A. Correct.</b> 6 Q. That goes on the category of unlikely but it remains 7 a possibility and in terms of administration, just to 8 clarify? 9 <b>A. Sodium fluoride salt could be hidden away as sodium</b> 10 <b>chloride.</b> 11 Q. Then the remaining two are colchicine and scombroid fish 12 poisoning, and we return to those in more detail. 13 Could you first of all say what colchicine is? 14 <b>A. It is a plant alkaloid.</b> 15 Q. It says naturally occurring alkaloid? 16 <b>A. Yes, it occurs in the autumn crocus.</b> 17 Q. You raise it as a possibility in your report. Can 18 I just take you to that passage if I may, page 485. 19 <b>A. Thank you.</b> 20 Q. "Agents such as colchicine could in theory cause 21 gastrointestinal upset, followed by a latent period, 22 followed by sudden death from heart rhythm disturbance." 23 <b>A. Yes.</b> 24 Q. "There is often a delay between the reported onset of 25 the symptoms in colchicine poisoning and admission to</p> <p style="text-align: center;">Page 96</p>



<p>1 hospital."</p> <p>2 Then you list the toxicity phases, 1, 2, and 3, the</p> <p>3 first being the first 24 hours, the second two to seven</p> <p>4 days and the third seven days onwards.</p> <p>5 <b>A. Correct.</b></p> <p>6 Q. Looking at those in respect of Mr Perepilichnyy, he</p> <p>7 obviously satisfies certainly one of the symptoms within</p> <p>8 the 24-hour period, which is vomiting?</p> <p>9 <b>A. Yes.</b></p> <p>10 Q. We don't know or have any information to the effect of</p> <p>11 his satisfying any of the others, save that he clearly</p> <p>12 was not anorexic in the sense that he ate it seems</p> <p>13 a normal breakfast the next day?</p> <p>14 <b>A. Yes, I don't think that excludes it actually.</b></p> <p>15 Q. But had he been anorexic, it would have tended to</p> <p>16 support?</p> <p>17 <b>A. He seemed to be anorexic on the night he developed the</b></p> <p>18 <b>vomiting, because he didn't eat very much at the</b></p> <p>19 <b>Buddha-Bar if I have understood it.</b></p> <p>20 Q. He ordered several dishes, it is not clear exactly how</p> <p>21 much he consumed and he sent one or two of them back and</p> <p>22 he said it tasted bad.</p> <p>23 <b>A. Yes.</b></p> <p>24 Q. But he certainly ate breakfast the next day, it seems,</p> <p>25 on Ms Medynska's evidence?</p> <p style="text-align: center;">Page 97</p>	<p>1 symptoms make it a possibility but it is unlikely?</p> <p>2 <b>A. Correct.</b></p> <p>3 THE CORONER: It is another one where you say cannot rule it</p> <p>4 out. Possible but unlikely?</p> <p>5 <b>A. Sir, that is exactly what I say and I think there</b></p> <p>6 <b>a lesson to be drawn, which I had tried to point, is at</b></p> <p>7 <b>paragraph 33, that agents like this exist. In other</b></p> <p>8 <b>words, amongst the agents whose toxic properties we</b></p> <p>9 <b>know, there are some which cause vomiting, where there</b></p> <p>10 <b>is a quiet period, if I can call it that, and which may</b></p> <p>11 <b>then cause cardiac arrhythmia and death.</b></p> <p>12 MR SKELTON: Can I ask you just to look at Dr Kite's letter</p> <p>13 dated 29 March, which you will find under tab 34,</p> <p>14 please.</p> <p>15 <b>A. Thank you.</b></p> <p>16 Q. As you mentioned, it is a naturally occurring alkaloid</p> <p>17 and therefore enquiries were made again of Kew to see if</p> <p>18 any matches had been found in the existing samples. The</p> <p>19 answer to that is -- I will read out the substance of</p> <p>20 the letter:</p> <p>21 "Further to your email of 27 March 2008 [that is</p> <p>22 back to the solicitor to the inquest] requesting that</p> <p>23 the LCMS analyses of samples be examined manually for</p> <p>24 the presence of colchicine. I can confirm that I have</p> <p>25 undertaken such manual inspection of the original LCMS</p> <p style="text-align: center;">Page 99</p>
<p>1 <b>A. Yes, he was not anorexic for 24 hours, I accept that.</b></p> <p>2 Q. The more severe symptoms it seems develop over the</p> <p>3 subsequent days, manifesting by some quite serious</p> <p>4 systemic derangement, so renal failure?</p> <p>5 <b>A. Yes.</b></p> <p>6 Q. Rhabdomyolysis?</p> <p>7 <b>A. Rhabdomyolysis is breakdown of muscle.</b></p> <p>8 Q. How will that appear, a generalised weakness?</p> <p>9 <b>A. Generalised weakness is possible, muscle pain is</b></p> <p>10 <b>possible, a common manifestation is darkening of the</b></p> <p>11 <b>urine because myoglobin in the urine, myoglobin is the</b></p> <p>12 <b>compound released from the muscles, is a dark colour, it</b></p> <p>13 <b>is related to haemoglobin.</b></p> <p>14 <b>But, sorry, this is an exhaustive list of symptoms</b></p> <p>15 <b>and signs, it is not necessary to have any or all of</b></p> <p>16 <b>these other than cardiac arrhythmia.</b></p> <p>17 Q. The earlier one, cardiac arrhythmia and cardiovascular</p> <p>18 collapse, that is after 24 hours or is the timeframe</p> <p>19 itself subject to some flexibility?</p> <p>20 <b>A. I am sure it is. I said in theory because I haven't</b></p> <p>21 <b>myself treated a patient with colchicine poisoning but</b></p> <p>22 <b>the cardiac arrhythmia is due to reaction of the</b></p> <p>23 <b>alkaloid and I would expect it to be possible at any</b></p> <p>24 <b>time after ingestion.</b></p> <p>25 Q. What you say on page 486-paragraph 40 is that his</p> <p style="text-align: center;">Page 98</p>	<p>1 analyses of AWF/32, 33, 34, 35, 39 and found no trace of</p> <p>2 this compound."</p> <p>3 Does that definitively rule it out?</p> <p>4 <b>A. It makes colchicine poisoning per se very unlikely.</b></p> <p>5 <b>What it doesn't do, because this was based on the mass</b></p> <p>6 <b>spectrometry, it doesn't rule out the possibility of</b></p> <p>7 <b>related compounds whose mass spectre were not in the</b></p> <p>8 <b>library of Kew or were not known to Dr Kite, but that is</b></p> <p>9 <b>for him to discuss.</b></p> <p>10 Q. Yes, but as far as you were concerned?</p> <p>11 <b>A. This means that colchicine of the sort we give to</b></p> <p>12 <b>patients was not in Mr Perepilichnyy's blood at the time</b></p> <p>13 <b>it was analysed at Kew. My understanding is that</b></p> <p>14 <b>alkaloids are relatively stable. Dr Kite will have to</b></p> <p>15 <b>answer the question you put to me, whether it is</b></p> <p>16 <b>impossible that he was given colchicine.</b></p> <p>17 Q. Thank you.</p> <p>18 May I go back to the issue of scombroid fish</p> <p>19 poisoning, you mentioned earlier that his symptoms were</p> <p>20 consistent with it, save for the persistence of red eyes</p> <p>21 the next day.</p> <p>22 <b>A. Correct.</b></p> <p>23 Q. On the basis that that doesn't appear to have been</p> <p>24 reported in the various literature, various records and</p> <p>25 reports that we have seen.</p> <p style="text-align: center;">Page 100</p>

<p>1 <b>A. Correct.</b></p> <p>2 Q. But that doesn't necessarily rule it out?</p> <p>3 <b>A. No, as I said in my report and it is still true, I think</b></p> <p>4 <b>it is quite likely that he had scombroid fish poisoning,</b></p> <p>5 <b>scombrototoxic fish poisoning. We don't have, as in</b></p> <p>6 <b>Dr Wilmshurst's case, anyone else who appears to have</b></p> <p>7 <b>been affected but that too is unclear.</b></p> <p>8 <b>If he did have scombroid fish poisoning, it seems to</b></p> <p>9 <b>have abated quite quickly so that the next morning he is</b></p> <p>10 <b>well.</b></p> <p>11 Q. Can I start to draw your conclusions from the various</p> <p>12 threads that you have discussed?</p> <p>13 <b>A. Please.</b></p> <p>14 THE CORONER: Just before you do, but you have said there</p> <p>15 are some possible things but you think, having looked at</p> <p>16 them, that they are unlikely as to, in terms of</p> <p>17 deliberate substances that have poisoned him, looking at</p> <p>18 the chronology of the thing, but you say you think</p> <p>19 scombroid food poisoning quite likely.</p> <p>20 Is what you are saying that in your view the</p> <p>21 likelihood is that actually the Paris thing, episode, is</p> <p>22 an innocent episode of food poisoning?</p> <p>23 <b>A. I think that is the most likely explanation, whether it</b></p> <p>24 <b>was due to scombrototoxin or to another toxin.</b></p> <p>25 THE CORONER: Sorry, Mr Skelton.</p> <p style="text-align: center;">Page 101</p>	<p>1 There were others action for example organophosphate</p> <p>2 poisons which may act very swiftly and cannot be ruled</p> <p>3 out?</p> <p>4 <b>A. And cyanide for example.</b></p> <p>5 Q. Likewise with a delayed-action poison, again except for</p> <p>6 the ones that were ruled out, for example paracetamol?</p> <p>7 <b>A. Yes.</b></p> <p>8 Q. From a medical perspective and a toxicological</p> <p>9 perspective two possibilities remained, death from</p> <p>10 a cardiac cause or deliberate poisoning?</p> <p>11 <b>A. I think I said in my original report that those two</b></p> <p>12 <b>possibilities are not mutually exclusive.</b></p> <p>13 Q. You did raise the possibility of an allergic reaction to</p> <p>14 penicillin for example?</p> <p>15 <b>A. Yes, leaving that aside --</b></p> <p>16 Q. Yes.</p> <p>17 <b>A. -- as we have discussed in the case of colchicine, there</b></p> <p>18 <b>are poisons that predispose you to heart rhythm</b></p> <p>19 <b>disturbance. I think Dr Wilmshurst confirmed that this</b></p> <p>20 <b>morning when he was talking about digoxin for example.</b></p> <p>21 Q. That is in one of the categories I have just given you,</p> <p>22 isn't it, there is a cardiac cause, an independent</p> <p>23 cardiac cause from a structural abnormality which has</p> <p>24 not been picked up on post mortem or some form of</p> <p>25 poisoning are the primary possibilities?</p> <p style="text-align: center;">Page 103</p>
<p>1 MR SKELTON: Thank you, sir, and I will come back to the</p> <p>2 overall conclusions as well to make sure we fully</p> <p>3 understand them and to give the professor an opportunity</p> <p>4 just to make absolutely clear his views, his final</p> <p>5 opportunity.</p> <p>6 THE CORONER: Thank you.</p> <p>7 MR SKELTON: Previously you said if someone dies suddenly</p> <p>8 within an hour of being well, it is possible they were</p> <p>9 killed by a delayed action poison.</p> <p>10 <b>A. Correct.</b></p> <p>11 Q. You also said that Mr Perepilichnyy's clinical features,</p> <p>12 as you then understood them, were non-specific?</p> <p>13 <b>A. That is at the time that he died?</b></p> <p>14 Q. Yes.</p> <p>15 <b>A. Correct.</b></p> <p>16 Q. You felt able to rule out the likelihood of a cumulative</p> <p>17 poison?</p> <p>18 <b>A. Correct, and that was the conclusion of the experts</b></p> <p>19 <b>together.</b></p> <p>20 THE CORONER: Yes.</p> <p>21 MR SKELTON: Yes. As I understood your evidence you were</p> <p>22 unable to express a view as to when it was likely,</p> <p>23 ie a greater than 50 per cent chance, that he was killed</p> <p>24 by a swiftly acting poison except for the ones that were</p> <p>25 ruled out by testing.</p> <p style="text-align: center;">Page 102</p>	<p>1 <b>A. I don't wish to quibble. I don't think you interpolated</b></p> <p>2 <b>the word "independent" in your first question.</b></p> <p>3 Q. You gave the view that the determination of which was</p> <p>4 the more likely was dependent on an assessment of</p> <p>5 external circumstances?</p> <p>6 <b>A. Correct.</b></p> <p>7 Q. Which is a matter for the court?</p> <p>8 <b>A. Absolutely.</b></p> <p>9 Q. Can I just then get to the point of whether or not all</p> <p>10 of those views remain the same now or whether or not to</p> <p>11 some extent you have crystallised or changed your views</p> <p>12 further?</p> <p>13 <b>A. No, I haven't changed my views at all. I think it is</b></p> <p>14 <b>still unclear and it is still for the court to decide on</b></p> <p>15 <b>the external factors.</b></p> <p>16 Q. First of all, I think you said that earlier in answer to</p> <p>17 the questions of the learned coroner you thought some</p> <p>18 form of food poisoning was now likely to have occurred?</p> <p>19 <b>A. Well, I think he may have had food poisoning in Paris.</b></p> <p>20 <b>But I don't think it had any material --</b></p> <p>21 Q. Can I come on to the precise mechanism, how it might</p> <p>22 affect it first, afterwards?</p> <p>23 <b>A. Of course.</b></p> <p>24 Q. If he did suffer food poisoning as a matter of fact,</p> <p>25 Dr Wilmshurst for example posited a theory, based on his</p> <p style="text-align: center;">Page 104</p>

<p>1 understanding of how it might affect the heart and his</p> <p>2 understanding of how that effect can be fatal, albeit</p> <p>3 without necessarily the full support of the recorded</p> <p>4 literature, as we have seen. He posited a theory that</p> <p>5 that food poisoning could lead to cardiac arrhythmia and</p> <p>6 could cause death.</p> <p>7 Do you agree with that as a possibility?</p> <p>8 <b>A. I am not sure that I do. For the reasons that have been</b></p> <p>9 <b>rehearsed. As far as I understand it, there is only one</b></p> <p>10 <b>case in the literature, which was Borysiewicz and</b></p> <p>11 <b>Krikler, which points to an arrhythmia as a direct</b></p> <p>12 <b>consequence of scombrototoxic fish poisoning. That was</b></p> <p>13 <b>an arrhythmia which in spite of what Dr Wilmshurst sees</b></p> <p>14 <b>as a cardiologist, from the point of view of a general</b></p> <p>15 <b>physician atrial flutter or atrial fibrillation, these</b></p> <p>16 <b>are very common heart rhythm disturbances, I think</b></p> <p>17 <b>Dr Wilmshurst quoted some numbers, and they don't</b></p> <p>18 <b>generally cause sudden death.</b></p> <p>19 <b>Firstly, they commonly make you feel unwell, and we</b></p> <p>20 <b>don't believe that Mr Perepilichnyy felt unwell.</b></p> <p>21 <b>Secondly, the link with scombrototoxic fish poisoning</b></p> <p>22 <b>is tenuous.</b></p> <p>23 <b>Thirdly, even if he did, even if Mr Perepilichnyy</b></p> <p>24 <b>did develop scombrototoxic fish poisoning and did develop</b></p> <p>25 <b>atrial flutter as a consequence, it would be extremely</b></p> <p style="text-align: center;">Page 105</p>	<p>1 <b>your question.</b></p> <p>2 Q. It is not a trap.</p> <p>3 THE CORONER: I think it was a genuine offer.</p> <p>4 <b>A. No, there is nothing I wish to add, thank you.</b></p> <p>5 MR SKELTON: I had summarised your previous conclusions</p> <p>6 giving you an opportunity to endorse them.</p> <p>7 <b>A. I endorse them.</b></p> <p>8 MR SKELTON: Thank you.</p> <p>9 THE CORONER: I am just wondering whether we might.</p> <p>10 Is that the end of your questions, I am only</p> <p>11 wondering Mr Skelton whether we might just if we did</p> <p>12 press on a bit we might just then when we did break off</p> <p>13 have a better idea just of quite how we are going to</p> <p>14 structure the rest of the day. That is slightly it</p> <p>15 depends.</p> <p>16 MR SKELTON: Yes, sir.</p> <p>17 THE CORONER: Mr Moxon Browne, any idea how long you are</p> <p>18 likely to be.</p> <p>19 MR MOXON BROWNE: I have no questions.</p> <p>20 MR SKELTON: Sir, I have been given I am sure a very</p> <p>21 reliable indication that questions will last about</p> <p>22 15 minutes for this witness.</p> <p>23 THE CORONER: Shall we see if that is true?</p> <p>24</p> <p>25</p> <p style="text-align: center;">Page 107</p>
<p>1 <b>surprising that he died suddenly while running from that</b></p> <p>2 <b>arrhythmia.</b></p> <p>3 Q. Are you actually ruling it out as a possibility or</p> <p>4 rather diminishing it to a vanishingly small</p> <p>5 possibility?</p> <p>6 <b>A. I don't think anything can be ruled out on the data that</b></p> <p>7 <b>we have about the circumstances and nature of</b></p> <p>8 <b>Mr Perepilichnyy's illness.</b></p> <p>9 Q. So it is possible but highly unlikely, is that a fair</p> <p>10 summary?</p> <p>11 <b>A. That would be my view.</b></p> <p>12 Q. Again, picking up on the questions from the learned</p> <p>13 coroner earlier, the presence of food poisoning is</p> <p>14 a coincidental finding when it comes to -- it is likely</p> <p>15 to be a coincidental finding when it comes to the cause</p> <p>16 of Mr Perepilichnyy's death?</p> <p>17 <b>A. Yes.</b></p> <p>18 Q. Incidental and coincidental?</p> <p>19 <b>A. Yes.</b></p> <p>20 Q. Based on what you have heard from Ms Medynska and based</p> <p>21 on what you have heard from Dr Wilmshurst, is there</p> <p>22 anything you would like to add to the conclusions you</p> <p>23 have previously expressed about the cause of</p> <p>24 Mr Perepilichnyy's death?</p> <p>25 <b>A. I don't think so. I fear that I am missing the point of</b></p> <p style="text-align: center;">Page 106</p>	<p>1 Questions from MS HILL</p> <p>2 MS HILL: Professor Ferner, just a very few questions from</p> <p>3 me, if I may.</p> <p>4 Is the net result of your evidence that as far as</p> <p>5 your previous evidence is concerned, where you were</p> <p>6 taken through on the last occasion a series of possible</p> <p>7 poisons, they all remain, to put it in layman's terms,</p> <p>8 still in play?</p> <p>9 <b>A. Correct.</b></p> <p>10 Q. What you have said in your appendix 3 is to draw the</p> <p>11 court's attention to several further possibilities?</p> <p>12 <b>A. Some further possibilities, yes, to account for the</b></p> <p>13 <b>illness in Paris --</b></p> <p>14 THE CORONER: For Paris, is that was part of it, but you</p> <p>15 have given us your view about that.</p> <p>16 <b>A. Correct.</b></p> <p>17 MS HILL: I think when you gave evidence on the last</p> <p>18 occasion you were asked about the possibility of</p> <p>19 a factual scenario where Mr Perepilichnyy might have</p> <p>20 been poisoned in Paris. Is this right, that you remain</p> <p>21 of the view that that remains possible?</p> <p>22 <b>A. It is possible but unlikely for the reasons we have</b></p> <p>23 <b>rehearsed this morning.</b></p> <p>24 Q. You were asked some questions on the last occasion about</p> <p>25 nerve agents and their possibility. Is that something</p> <p style="text-align: center;">Page 108</p>

<p>1 you could give further evidence about today or would you 2 defer to Dr Rice on that issue? 3 <b>A. I would absolutely defer to Dr Rice.</b> 4 Q. Is there anything generally that you have heard in light 5 of the most recent material that would change your 6 evidence that you gave on the last occasion about that 7 group? 8 <b>A. There is nothing that would change my evidence and as 9 far as I know nothing new has emerged about the Korean 10 murder attributed to a nerve agent called VX. 11 Perhaps I should say nothing in the public domain 12 has emerged.</b> 13 MS HILL: Thank you. 14 THE CORONER: Thank you. 15 Questions from MS BARTON 16 MS BARTON: I am asking questions on behalf of Surrey Police 17 and I just want to clarify one or two issues with you if 18 I may. 19 In the course of the hearing last year, 20 Dr Fegan-Earl, the pathologist, described the series of 21 tests carried out in this case on the samples as being 22 one of the most exhaustive toxicological analyses he has 23 ever seen, would you agree with that? 24 <b>A. I didn't hear him say that, but if that is what he said 25 then I am happy to accept it.</b></p> <p style="text-align: center;">Page 109</p>	<p>1 <b>A. -- sorry, as independent cardiac cause, I think.</b> 2 Q. Your view is that they are not more likely than the 3 independent cardiac cause? 4 <b>A. That is not my view. I am not able to express a view, 5 but I did hear Professor Sheppard and Dr Wilmshurst give 6 evidence and their evidence, I think, was that in 7 70 per cent of cases that they attribute to sudden acute 8 cardiac death no cause is found. Well that is not quite 9 the same as saying there is no cause.</b> 10 Q. As far as you are concerned, with the evidence that you 11 have heard and have had access to, are you able to say 12 what is more likely than not to have been the cause of 13 death? 14 <b>A. No. And if I were, I am sure it would be helpful for 15 the proceedings.</b> 16 Q. As far as you are concerned, can I just deal with the 17 organophosphate point, you would defer, would you, to 18 Dr Rice on that? 19 <b>A. Yes. Insofar as he is privy to information which I will 20 not have seen.</b> 21 Q. Yes. As far as the colchicine point is concerned, you 22 raised that as a possible toxin that fit with the 23 clinical symptoms? 24 <b>A. Yes.</b> 25 Q. You are aware that as far as the samples that are</p> <p style="text-align: center;">Page 111</p>
<p>1 Q. Do you agree that as far as you are concerned, there has 2 been exhaustive toxicological analysis in this case? 3 <b>A. There has been very detailed toxicological analysis but, 4 as we have discussed, it is not exhaustive and cyanide 5 is a case in point.</b> 6 Q. It is exhaustive insofar as toxins can be tested for in 7 the samples that are available at this stage, that is 8 right, isn't it? 9 <b>A. Well, we have discussed that too, I think, and the 10 answer is it has been very extensive.</b> 11 Q. Yes. 12 It is right, isn't it, that as a result of the 13 extensive testing, no known toxins have been found in 14 any of the samples? 15 <b>A. That is my understanding.</b> 16 Q. You have posited a number of possibilities which arise 17 from the evidence that is available and the clinical 18 evidence that is available? 19 <b>A. Of course.</b> 20 Q. Yes. None of those possibilities are in your view 21 likely? 22 <b>A. That is true but the question is not whether they are 23 likely, it is whether they are more likely than cardiac 24 arrhythmia --</b> 25 Q. Yes.</p> <p style="text-align: center;">Page 110</p>	<p>1 available have been concerned, they have been tested and 2 they do not contain colchicine? 3 <b>A. Correct.</b> 4 MS BARTON: Thank you. 5 THE CORONER: I don't think you ever put that as more 6 than -- leaving just aside that it has always been in 7 your possible but unlikely in any event. 8 <b>A. Correct.</b> 9 THE CORONER: Yes. 10 MR SKELTON: Sir, I think that concludes, within time, 11 Professor Ferner's evidence. 12 THE CORONER: Thank you very much. I am grateful. 13 <b>A. Thank you, sir.</b> 14 MR SKELTON: Sir, I think the estimates I have been given 15 mean that we will finish on time, happily, so it may be 16 that we can have an hour lunch break. 17 THE CORONER: We will certainly do that. I am grateful to 18 everyone and I know how difficult it is, but you have 19 the estimates you need from everybody. 20 MR SKELTON: I have, thank you. 21 THE CORONER: Thank you all. 22 Whatever that is, 2.10. 23 MR SKELTON: Sir, may we release the two witnesses? 24 THE CORONER: Unless they wish to stay but thank you both 25 very much indeed.</p> <p style="text-align: center;">Page 112</p>

<p>1 (1.10 pm) 2 (The Luncheon Adjournment) 3 (2.15 pm) 4 THE CORONER: Mr Wastell I was going to say whoever out of 5 you or Mr Skelton is dealing with the witnesses I am 6 very content and indeed I think it is helpful, I am 7 happy for people to do a summary of where we are so far 8 before going into new material, I find it helpful but 9 you take your own course. 10 MR WASTELL: Thank you, sir. 11 DR GEOFFREY KITE (sworn) 12 Questions from MR WASTELL 13 MR WASTELL: Dr Kite, as you know I ask questions on behalf 14 of the coroner. If you could remember as far as 15 possible to keep your voice up, that would be helpful, 16 we will let you know if it drops. 17 THE CORONER: I think it is an even -- it has a higher 18 ceiling probably than where we were and there is a 19 background hum. 20 Is that switched on that? Maybe. 21 Anyway, we will see how we get on. Yes. 22 MR WASTELL: Dr Kite in terms of your position at Kew, can 23 you remind the court, are you still a laboratory manager 24 responsible for operating the liquid chromatography mass 25 spectrometer.</p> <p style="text-align: center;">Page 113</p>	<p>1 correct? 2 <b>A. Yes.</b> 3 Q. Then behind tab 34, a final letter dated 29 March this 4 year? 5 <b>A. That's correct, yes.</b> 6 Q. As a matter of generality, do you stand by the 7 professional opinions you have expressed in those 8 documents subject to any clarification today? 9 <b>A. Yes, I do.</b> 10 Q. Before I turn to the matters you have covered in those 11 reports, can I set them in some context, please. 12 <b>A. Hmm.</b> 13 Q. I am going to deal first of all with the headlines of 14 your conclusions and then delve into the detail a little 15 bit. 16 It was your testing at Kew, indeed you, who first 17 raised the possibility of a toxic alkaloid in 18 Mr Perepilichnyy's stomach being gelsemicine or having 19 the same molecular formula as alkaloids from that 20 species. Is that right? 21 <b>A. That's correct.</b> 22 Q. Following your testing and analysis at Kew, can you just 23 please confirm your overall conclusions to the best of 24 your professional opinion. 25 First, as far as you are concerned, have you, or to</p> <p style="text-align: center;">Page 115</p>
<p>1 <b>A. Yes, I am.</b> 2 Q. By way of your qualifications, you are a botanist by 3 background, that is your degree and PhD, is that right? 4 <b>A. Correct, yes.</b> 5 Q. I think as you say last time you were funnelled into 6 chemical analysis since joining Kew? 7 <b>A. In 1986, yes.</b> 8 Q. How long are the worked with the mass spectrometer? 9 <b>A. That would be 32 years.</b> 10 Q. Since the last hearing you have produced a number of 11 short reports dealing with discrete questions asked of 12 you. I want to just identify those. In front of you 13 there is a bundle. Behind tab 30, in the bottom right 14 hand corner should be page 511. 15 <b>A. Yes.</b> 16 Q. Is that a report produced by you dated 12 July 2017? 17 <b>A. It is, yes.</b> 18 Q. Then there should be three letters from you, I should 19 say behind tab 31 there is some data I think provided by 20 you. 21 <b>A. Yes.</b> 22 Q. Then behind tab 32 there is a letter dated 12 March from 23 you. 24 <b>A. That's correct, yes.</b> 25 Q. Then 33, another letter dated 14 March this year,</p> <p style="text-align: center;">Page 114</p>	<p>1 the best of your knowledge has anyone else, found a rare 2 and deadly toxic alkaloid, namely gelsemicine, in 3 Mr Perepilichnyy's stomach or indeed traces of such 4 a compound? 5 <b>A. No.</b> 6 Q. To what standard of proof do you reach that conclusion? 7 <b>A. Beyond reasonable doubt.</b> 8 Q. Second, as far as you are concerned -- 9 THE CORONER: Hold on, sorry, just a minute. 10 You have not found it, or traces of it, and as far 11 as you are aware, nor has anybody else and you have 12 reached that conclusion beyond reasonable doubt? 13 Just hold on. 14 Yes. 15 MR WASTELL: Secondly, as far as you are concerned, have you 16 or to the best of your knowledge anyone else, found 17 a toxic alkaloid or a trace of such an alkaloid from the 18 gelsemium species of plants in Mr Perepilichnyy's 19 stomach? 20 <b>A. No, we haven't found anything.</b> 21 Q. To what standard of proof do you reach that conclusion? 22 <b>A. Beyond reasonable doubt.</b> 23 Q. Has it ever been your opinion, you who raised the 24 possibility of gelsemium, that you had found such 25 an alkaloid or traces of such an alkaloid in his</p> <p style="text-align: center;">Page 116</p>

<p>1 stomach?</p> <p>2 <b>A. No, because in the original report I eliminated that</b></p> <p>3 <b>possibility.</b></p> <p>4 Q. Say that again, in the original report?</p> <p>5 <b>A. In the original report I eliminated that possibility.</b></p> <p>6 Q. You eliminated that possibility?</p> <p>7 <b>A. In the first report that was written.</b></p> <p>8 Q. That was in 2013?</p> <p>9 <b>A. Yes.</b></p> <p>10 Q. Third, as far as you are concerned, have you, or to the</p> <p>11 best of your knowledge has anyone else, found traces of</p> <p>12 any plant toxin identifiable in databases or the</p> <p>13 spectral library at Kew in Mr Perepilichnyy's stomach?</p> <p>14 <b>A. No, we haven't found any trace of the toxins that we</b></p> <p>15 <b>have looked for in the lists provided.</b></p> <p>16 Q. To what standard of proof do you reach that conclusion?</p> <p>17 <b>A. That is beyond reasonable doubt.</b></p> <p>18 Q. Fourthly, as far as you are concerned, have you or to</p> <p>19 the best of your knowledge has anyone else, found traces</p> <p>20 of a plant toxin identifiable in databases or the</p> <p>21 separately library at Kew, in any of the other samples</p> <p>22 from Mr Perepilichnyy, namely the duodenum, jejunum,</p> <p>23 ileum, blood or urine?</p> <p>24 <b>A. No, we haven't.</b></p> <p>25 Q. To what standard do you reach that conclusion?</p> <p style="text-align: center;">Page 117</p>	<p>1 the Dictionary of Natural Products as having the formula</p> <p>2 C20H26N2O4?</p> <p>3 <b>A. No.</b></p> <p>4 Q. And of course nothing to do with scotamine A?</p> <p>5 <b>A. No.</b></p> <p>6 Q. To be clear, to what standard of proof do you reach that</p> <p>7 conclusion?</p> <p>8 <b>A. Beyond reasonable doubt.</b></p> <p>9 Q. Do you consider it unusual or surprising to have</p> <p>10 a compound in the stomach sample that you haven't gone</p> <p>11 on to identify?</p> <p>12 <b>A. No.</b></p> <p>13 Q. How many other unidentified compounds are there likely</p> <p>14 to have been in the stomach sample?</p> <p>15 <b>A. The computerised data extraction identified over 300.</b></p> <p>16 Q. Over 300?</p> <p>17 <b>A. Yes.</b></p> <p>18 Q. Thank you, Dr Kite.</p> <p>19 Having dealt with the headline conclusions, I am now</p> <p>20 going to just delve into the detail as to how you</p> <p>21 reached them, if I may, before coming to the further</p> <p>22 work that you have done since the last hearing.</p> <p>23 It is right, isn't it, that originally in May 2013,</p> <p>24 you came to analyse samples from Mr Perepilichnyy's</p> <p>25 blood, and his stomach and higher intestinal tract and</p> <p style="text-align: center;">Page 119</p>
<p>1 <b>A. Same, beyond reasonable doubt.</b></p> <p>2 Q. Fifthly, following testing of a compound that has become</p> <p>3 the focus of some considerable attention over the years,</p> <p>4 do you consider that that compound has the molecular</p> <p>5 formula C20H26N2O4?</p> <p>6 <b>A. Are you referring to what has been called the unknown?</b></p> <p>7 <b>Is that what you are referring to, that compound?</b></p> <p>8 Q. Yes, what has been referred to as the unknown compound</p> <p>9 that you have done a series of tests on over the years?</p> <p>10 <b>A. No, I believe the molecular form of that is half of</b></p> <p>11 <b>that, basically.</b></p> <p>12 Q. Being C10H13NO2?</p> <p>13 <b>A. I will just check that. (Pause)</b></p> <p>14 <b>C10H13NO2.</b></p> <p>15 Q. Just to be clear, your conclusion is that the unknown,</p> <p>16 unidentified compound has that molecular formula?</p> <p>17 <b>A. Yes.</b></p> <p>18 Q. To what standard of proof do you reach that conclusion?</p> <p>19 <b>A. Beyond reasonable doubt.</b></p> <p>20 Q. Does it therefore follow that, if you are right that the</p> <p>21 formula is C10H13NO2, then that compound, which has been</p> <p>22 the focus of an assertive link to gelsemium, in fact has</p> <p>23 nothing to do with gelsemicine?</p> <p>24 <b>A. Yes, it has nothing to do with it.</b></p> <p>25 Q. Nothing to do with the other four alkaloids listed in</p> <p style="text-align: center;">Page 118</p>	<p>1 later his urine using LCMS, liquid chromatography mass</p> <p>2 spectrometry, to see whether any plant toxins were</p> <p>3 present when compared to your own database and spectral</p> <p>4 library, yes?</p> <p>5 <b>A. Yes.</b></p> <p>6 Q. You did detect a compound in that sample from what was</p> <p>7 left of Mr Perepilichnyy's stomach, AWF/32, that</p> <p>8 appeared to you to have the same mass within five parts</p> <p>9 per million, and so the same molecular formula as</p> <p>10 gelsemicine, do I have that right?</p> <p>11 <b>A. Yes.</b></p> <p>12 Q. That was on the basis of an assumption, wasn't it?</p> <p>13 <b>A. It was done by data mining, which was literally looking</b></p> <p>14 <b>for any ions produced in the analysis which</b></p> <p>15 <b>mathematically matched the ions predicted that the</b></p> <p>16 <b>compound on the list of toxins would have produced.</b></p> <p>17 Q. On the last occasion you explained to us that you made</p> <p>18 an assumption in equating that ion with the molecular</p> <p>19 formula, C20H26N2O4, that you have now told us beyond</p> <p>20 doubt it was not?</p> <p>21 <b>A. Yes, I originally assigned that ion to a protonated ion.</b></p> <p>22 Q. To be clear, that means charged with hydrogen?</p> <p>23 <b>A. Hydrogen ion, yes.</b></p> <p>24 Q. Also that it was one compound, is that right?</p> <p>25 <b>A. Yes.</b></p> <p style="text-align: center;">Page 120</p>

<p>1 Q. You told the court last time that that assumption was 2 probably wrong. You have done some further work to look 3 at that, which we will turn to shortly. Is that right? 4 <b>A. Yes.</b> 5 Q. The consequence of not challenging that assumption at 6 the time, of adopting that assumption, was that you 7 continued down the path of the assumption that this ion 8 was one molecule, didn't you? 9 <b>A. Yes.</b> 10 Q. That meant that gelsemicine and potentially other 11 alkaloids from the gelsemium species became relevant? 12 <b>A. I think we did the further work on the request of the</b> 13 <b>courts. I was still satisfied right from the beginning</b> 14 <b>that it was not gelsemicine; we were responding to</b> 15 <b>requests from the court.</b> 16 Q. Just before we focus on that, you also I think found 17 an ion with a similar mass to gelsemicine in the urine 18 sample, didn't you? 19 <b>A. That was a very, very trace ion.</b> 20 Q. Just explain again why you have discounted that in your 21 evidence to us before? 22 <b>A. We could get no further evidence on that, it is at such</b> 23 <b>low levels we cannot even prove what type of ion it is.</b> 24 Q. Could you assign a molecular formula to it? 25 <b>A. No.</b></p> <p style="text-align: center;">Page 121</p>	<p>1 identify them? 2 <b>A. It means we have not gone on to identify them.</b> 3 Q. Did any of them match a plant toxin? 4 <b>A. No.</b> 5 Q. Did any of them warrant further study by you? 6 <b>A. No.</b> 7 Q. You look at biological material as I understand it in 8 your job? 9 <b>A. Yes.</b> 10 Q. When you look at that material, let's say a plant, 11 through the LCMS, will you typically have many compounds 12 that you don't identify? 13 <b>A. Yes, I mean the 300 components in a biological sample is</b> 14 <b>not unusual. In fact it is quite low. We would be</b> 15 <b>dealing with 500 to 1,000 or even more in an average</b> 16 <b>plant.</b> 17 Q. Do you have any experience before this case of looking 18 at stomach contents? 19 <b>A. Sorry?</b> 20 Q. Do you have any experience before this case of looking 21 at stomach contents? 22 <b>A. I have looked at livestock stomach contents and some</b> 23 <b>human, so not a great deal.</b> 24 Q. Given that experience, not a great deal of experience, 25 but given that experience, again, would you find,</p> <p style="text-align: center;">Page 123</p>
<p>1 Q. Can we ignore that ion in the urine, Dr Kite? 2 <b>A. My belief is you can ignore it, yes.</b> 3 Q. The compound that became the focus of so much attention, 4 the unknown compound, how abundant was it in the sample 5 you looked at? 6 <b>A. It was about just under ten times less than the most</b> 7 <b>abundant compound.</b> 8 <b>I should clarify that, that is the ion which I now</b> 9 <b>believe the compound to be, if you refer to the actual</b> 10 <b>ion 359, that is about 100 times less --</b> 11 Q. Yes, because it is your evidence in the joint statement 12 that the half of the ion is ten times more prevalent 13 than the putative single larger ion? 14 <b>A. Yes.</b> 15 Q. The ion that you have now identified as a cluster of 16 two, was present as I understand your evidence just now, 17 in 100th of the levels of the most abundant compound? 18 <b>A. Yes.</b> 19 Q. Now, it has been referred to as the unidentified 20 compound or the unknown compound. 21 But as you have just explained to us, there were 22 approximately 300 other compounds that are unidentified? 23 <b>A. Yes.</b> 24 Q. Does "unidentified" here mean incapable of 25 identification or just that you have not gone on to</p> <p style="text-align: center;">Page 122</p>	<p>1 typically, a large number of -- 2 <b>A. Yes.</b> 3 Q. -- unidentified compounds? 4 <b>A. Yes.</b> 5 Q. To take an example, of a hitherto unidentified compound 6 in Mr Perepilichnyy's biological samples, did you look 7 at AWF/33 this year again, the duodenum sample? 8 <b>A. Yes.</b> 9 Q. Did you identify the third most dominant compound in 10 that sample? 11 If you need your notes -- 12 <b>A. Are we referring to phenylalanine?</b> 13 Q. Yes, it is behind tab 32, your report of 12 March. 14 <b>A. Yes.</b> 15 Q. Paragraph 4 on page 527. 16 <b>A. Yes, most of the major components in the sample were</b> 17 <b>amino acids. For reasons we might go on to we confirmed</b> 18 <b>unambiguously that the third most dominant component was</b> 19 <b>the amino acid phenylalanine.</b> 20 Q. How common is phenylalanine? 21 <b>A. Very common.</b> 22 Q. Give us some context to that? 23 <b>A. It is in every living organism, I should imagine, it is</b> 24 <b>an amino acid in protein.</b> 25 Q. Up to that point had you identified phenylalanine in</p> <p style="text-align: center;">Page 124</p>

<p>1 AWF/33?</p> <p>2 <b>A. I had what we in our business call annotate it, matched</b></p> <p>3 <b>our database of phenylalanine but we hadn't run it</b></p> <p>4 <b>against the standard.</b></p> <p>5 Q. Turning back then to the compound that you did decide to</p> <p>6 focus on at the request of the court, on the basis of</p> <p>7 the assumption that it was a single molecule, not</p> <p>8 a combination of two, you told us last time that you</p> <p>9 used extracts taken from the gelsemium species to look</p> <p>10 at whether an ion observed at m/z 359 could be due to --</p> <p>11 the ion, sorry, the ion you were assuming was one, could</p> <p>12 be due to protonated gelsemicine or any alkaloid you</p> <p>13 could find in those samples. That is the way you went</p> <p>14 about trying to analyse whether or not it was</p> <p>15 gelsemicine?</p> <p>16 <b>A. Yes.</b></p> <p>17 Q. Is that right?</p> <p>18 <b>A. Yes.</b></p> <p>19 Q. You looked ultimately at samples from the gelsemium</p> <p>20 species from elegans and sempervirens; is that right?</p> <p>21 <b>A. Yes.</b></p> <p>22 Q. You looked at samples of the root, fruit and leaves from</p> <p>23 both species?</p> <p>24 <b>A. Yes.</b></p> <p>25 Q. Comparing those samples to the ion in Mr Perepilichnyy's</p> <p style="text-align: center;">Page 125</p>	<p>1 Q. The conclusion that you reached, as you expressed last</p> <p>2 time, was that the ion in the stomach, assuming it to be</p> <p>3 one, not two, was not present in any of the extracts</p> <p>4 from the gelsemium species that you looked at. Do</p> <p>5 I have that right?</p> <p>6 <b>A. Yes, I did actually look for m/z 180 in the gelsemium</b></p> <p>7 <b>species and it wasn't present.</b></p> <p>8 Q. M/z 180, that is the half?</p> <p>9 <b>A. That is the half, yes.</b></p> <p>10 Q. In terms of your conclusion as to whether it came from</p> <p>11 the gelsemium species more generally, so not just the</p> <p>12 extracts you looked at, what was your conclusion?</p> <p>13 <b>A. Sorry, can you rephrase that?</b></p> <p>14 Q. Yes. You compared the ion in the stomach, assuming it</p> <p>15 was one not two, with the extracts from the gelsemium</p> <p>16 species and you reached the conclusions you have told</p> <p>17 us, you couldn't find it in the gelsemium species?</p> <p>18 <b>A. No.</b></p> <p>19 Q. The questions were put to you last time, what if it was</p> <p>20 from gelsemium rankinii or from a mutation of the</p> <p>21 gelsemium species that you didn't look at. My question</p> <p>22 to you was, did you reach a conclusion about whether,</p> <p>23 assuming the ion was one not two, it was likely to have</p> <p>24 come from the gelsemium species, full stop?</p> <p>25 <b>A. It is unlikely.</b></p> <p style="text-align: center;">Page 127</p>
<p>1 stomach or the compound that you were assuming was</p> <p>2 a single compound, what in broad terms was the result of</p> <p>3 that analysis?</p> <p>4 <b>A. Well there was no isomer, no alkaloid with the same</b></p> <p>5 <b>molecular weight as gelsemicine that had the same</b></p> <p>6 <b>elution time as the unknown that was in the stomach</b></p> <p>7 <b>contents.</b></p> <p>8 Q. You explained last time that you obviously didn't just</p> <p>9 look at elution times?</p> <p>10 <b>A. Also it didn't match the fragmentation pattern either.</b></p> <p>11 Q. The fragmentation pattern is what you call the MS/MS?</p> <p>12 <b>A. Yes, how it fragments.</b></p> <p>13 Q. You described last time that is the fingerprint of</p> <p>14 a compound; is that right?</p> <p>15 <b>A. Yes. Yes.</b></p> <p>16 Q. In broad terms you looked at samples from both the</p> <p>17 stomach and the gelsemium species to see whether you</p> <p>18 could match ions of similar masses?</p> <p>19 <b>A. Yes.</b></p> <p>20 Q. And broadly, could you?</p> <p>21 <b>A. No. Having looked at all the gelsemium species, we</b></p> <p>22 <b>extracted all the masses of compounds that we found in</b></p> <p>23 <b>those gelsemium species, so it is all compounds, and</b></p> <p>24 <b>tried to find any of them in the gut contents and we</b></p> <p>25 <b>could not find any.</b></p> <p style="text-align: center;">Page 126</p>	<p>1 Q. Out of interest, again assuming it was one not two, you</p> <p>2 matched it to six compounds in the Dictionary of Natural</p> <p>3 Products, didn't you?</p> <p>4 <b>A. I believe so.</b></p> <p>5 Q. Five from the gelsemium species and one from</p> <p>6 scotanamine A, which was added latterly?</p> <p>7 <b>A. That's correct, yes.</b></p> <p>8 Q. Does the Dictionary of Natural Products contain all</p> <p>9 natural compounds?</p> <p>10 <b>A. It probably doesn't. Because natural compounds have</b></p> <p>11 <b>been discovered all the time and there is a delay in</b></p> <p>12 <b>which they appear in Dictionary of Natural Products.</b></p> <p>13 Q. The example you gave us last time was cholic acid,</p> <p>14 I don't know if you recall giving that evidence, cholic</p> <p>15 acid found in bile was something that you had discovered</p> <p>16 wasn't in the Dictionary of Natural Products?</p> <p>17 <b>A. Not as a plant compound, no. No.</b></p> <p>18 Q. By the time of the last hearing you had swept all of</p> <p>19 that to one side, hadn't you, because you had reached</p> <p>20 the view that you were confident that it was a cluster</p> <p>21 of molecules and not a whole molecule?</p> <p>22 <b>A. Yes.</b></p> <p>23 Q. Just remind the coroner, the court and the media the</p> <p>24 reasons for reaching that conclusion as of June last</p> <p>25 year?</p> <p style="text-align: center;">Page 128</p>



<p>1 <b>A. As we looked into this in more detail we noticed the ion</b>  2 <b>at 180 and the mathematical relationship between that</b>  3 <b>ion and the ion at 359 suggested the 359 could be</b>  4 <b>a cluster of the 180. How an ion at 359 fragments, it</b>  5 <b>fragments exactly in half, suggesting it was a cluster</b>  6 <b>with no intermediate fragments between 359 and 180,</b>  7 <b>ie a cluster of two molecules just falling apart.</b>  8 Q. In summary, if I understand your evidence correctly,  9 mathematically it splits into two?  10 <b>A. Yes, more or less.</b>  11 Q. More or less?  12 <b>A. For a proton it is not mathematically in two, you have</b>  13 <b>to take away a proton, half it and add a proton. Yes.</b>  14 Q. If you are looking at the molecules one is half of the  15 other.  16 Secondly, looking at the putative fragment. There  17 was no ions in between the smaller one and the larger  18 one?  19 <b>A. No.</b>  20 Q. Thirdly, that it co-eluted, the 180 co-eluted with the  21 larger 359?  22 <b>A. That is what we had to look into after the last Inquest.</b>  23 Q. You already had evidence that it co-eluted?  24 <b>A. We had evidence that it co-eluted in the solvent system,</b>  25 <b>the one solvent system that we had used, yes.</b></p> <p style="text-align: center;">Page 129</p>	<p>1 <b>A. The results were the elution times were always</b>  2 <b>identical.</b>  3 Q. The elution time between the ion at 180 and the putative  4 ion at 359?  5 <b>A. Yes.</b>  6 Q. What did that enable you to conclude?  7 <b>A. I concluded from that that we are dealing with two</b>  8 <b>ionisation products and one compound.</b>  9 Q. You, in your report, suggest that you took some -- you  10 also saw that amino acids present in the stomach  11 exhibited similar ionisation behaviour?  12 <b>A. Yes.</b>  13 Q. Why is that relevant, can you just help me?  14 <b>A. Just to show it was not unusual on our system that</b>  15 <b>cluster ions form.</b>  16 Q. You say unequivocal proof that m/z 359 is a cluster ion,  17 can only come from identifying compound, but earlier you  18 told me you reached the conclusion to the standard of  19 being sure, so beyond reasonable doubt.  20 What are you referring to there when you refer to  21 unequivocal proof?  22 <b>A. My understanding of beyond reasonable doubt is there is</b>  23 <b>still a little bit of doubt --</b>  24 Q. Unreasonable doubt I think we would say.  25 <b>A. I mean if you run a standard there would be no doubt at</b></p> <p style="text-align: center;">Page 131</p>
<p>1 Q. You went on in your report, we will turn to that now,  2 your more recent report, to run an experiment to see if  3 you could take your probable or confident cluster theory  4 any further?  5 <b>A. Yes.</b>  6 Q. Just explain to the coroner, this is your report behind  7 tab 30, and section 1, what the experiment you ran was?  8 Before telling us the results, what was the test, what  9 was the experiment to test the hypothesis?  10 <b>A. The hypothesis was that could these be two compounds,</b>  11 <b>the 180 and the 359, could they be two compounds?</b>  12 <b>We just changed the chromatography conditions in</b>  13 <b>five different conditions and it is highly unlikely the</b>  14 <b>two compounds would have exactly the same elution time</b>  15 <b>under five different chromatography conditions -- not</b>  16 <b>impossible but highly unlikely.</b>  17 Q. Yes.  18 You did your mass spectrometry, if I can put it so  19 bluntly, using five different conditions of the column  20 and/or the solvent in the column --  21 <b>A. Yes.</b>  22 Q. -- leading up to the mass spectrometer, so the liquid  23 chromatography part, is that right?  24 <b>A. Yes.</b>  25 Q. The results were what?</p> <p style="text-align: center;">Page 130</p>	<p>1 <b>all, if you saw the cluster being formed there is no --</b>  2 Q. Would it be fair to say that would be categorical,  3 certain scientific identification?  4 <b>A. Yes.</b>  5 Q. Is there any reason, now that you have identified this  6 compound as C10H13NO2, is there any reason to focus on  7 that compound any more in your opinion?  8 <b>A. No. It is another unknown.</b>  9 Q. Have you examined it to see whether or not it matches  10 any plant toxins in the database or spectral library?  11 <b>A. Yes.</b>  12 Q. Does it?  13 <b>A. No.</b>  14 Q. Professor Cowan, who we will hear from in a moment, has  15 found that there are 89 compounds in the Dictionary of  16 Natural Products with that molecular formula and 11 in  17 the Human Metabolome Database but 3,346 in ChemSpider.  18 Although you have given your evidence about not  19 needing to identify it, you have I think looked at the  20 11 in the Human Metabolome Database, haven't you?  21 <b>A. Yes, I have.</b>  22 Q. What were the results of that?  23 <b>A. I wasn't convinced that it was any of those 11</b>  24 <b>compounds.</b>  25 Q. How did you go about comparing the two?</p> <p style="text-align: center;">Page 132</p>

<p>1 <b>A. I was looking at the fragmentation spectrum reproduced</b>  2 <b>in the Human Metabolome Database.</b>  3 Q. Against?  4 <b>A. Against the fragments that we observed.</b>  5 Q. Did any of them match?  6 <b>A. No. I mean most – the only caveat on that is most of</b>  7 <b>the spectra of those compounds are computer generated,</b>  8 <b>not like observed in real life and generally computer</b>  9 <b>generated spectra predict more fragments than you</b>  10 <b>observe in real life. The important thing is are they</b>  11 <b>the same. If you are seeing a fragment at a different</b>  12 <b>mass that the computer has not predicted, then it is</b>  13 <b>more likely than not not that compound.</b>  14 Q. Is that the standard to which you reached the conclusion  15 that it is not one of the 11, the balance of  16 probabilities?  17 <b>A. Also from the fact that I had uncovered a compound that</b>  18 <b>it could be.</b>  19 Q. Let's leave that to one side for the moment.  20 The standard to which you have reached the  21 conclusion that it is not one of the 11 in the Human  22 Metabolome Database is what, balance of probabilities?  23 <b>A. Balance of probabilities.</b>  24 Q. Balance of probabilities?  25 <b>A. Yes.</b></p> <p style="text-align: center;">Page 133</p>	<p>1 and NATOG on the right?  2 <b>A. That's correct, yes.</b>  3 Q. We see for example 180.1027 is the whole ion, is that  4 right?  5 <b>A. No, NATOG is the ion at 365, because that is the sugar</b>  6 <b>attachment.</b>  7 Q. Sorry, 356.  8 <b>A. 356.</b>  9 Q. That fragments into 180.1027?  10 <b>A. Yes so the immediate fragmentation is the sugar being</b>  11 <b>removed to leave a fragment of 180.1027.</b>  12 Q. That has fragments at 138.0918 and 121.0647?  13 <b>A. Yes, and a couple more as well.</b>  14 Q. If we look to the left, taking figure 5, the high  15 resolution collision cell MS/MS of the unidentified  16 compound, the top graph below figure 5, we see there, do  17 we, a fragment at 138.0913?  18 <b>A. Yes.</b>  19 Q. And a fragment at 121.0647?  20 <b>A. Yes.</b>  21 Q. What are the other two numbers on that graph?  22 <b>A. 103.0541, 93.0698. They all matched exactly, within the</b>  23 <b>error of the machine.</b>  24 Q. Yes, I see.  25 <b>A. Yes.</b></p> <p style="text-align: center;">Page 135</p>
<p>1 Q. Thank you.  2 Have you identified that compound to your  3 satisfaction on the balance of probabilities?  4 <b>A. Not to my satisfaction. I have identified a candidate</b>  5 <b>that it could be.</b>  6 MR MOXON BROWNE: I didn't hear that.  7 MR WASTELL: He identified a candidate that it could be.  8 MR MOXON BROWNE: That it could be, yes.  9 MR WASTELL: Looking at your report, behind tab 30,  10 page 517, I am going to call it NATOG, your candidate.  11 <b>A. No, NATOG is a glycoside of the candidate.</b>  12 Q. Is it once the glycoside is split off?  13 <b>A. Once you split the sugar off of NATOG, what you have</b>  14 <b>left is at candidate.</b>  15 Q. Is that NAT, NA or NATO? Perhaps it does not matter.  16 <b>A. I guess you would just call it NAT.</b>  17 Q. Why are you putting that forward as a candidate?  18 <b>A. Because there is a paper published by Globish et al in</b>  19 <b>2013 who showed the fragmentation spectra of NATOG, and</b>  20 <b>once the glucose is removed the fragmentation of what is</b>  21 <b>left has the same fragments as in our unknown compound.</b>  22 Q. If we turn over the page to 518 and 519.  23 <b>A. Yes.</b>  24 Q. Are those the graphical representations of the  25 fragmentation of the unidentified compound on the left,</p> <p style="text-align: center;">Page 134</p>	<p>1 Q. That, to a layman, would look like it is a very good  2 identification. Why are you putting as a candidate not  3 a likely candidate?  4 <b>A. Well a candidate is N-acetyltyramine, it could also be</b>  5 <b>O-acetyltyramine, with the acetyl group in a different</b>  6 <b>place on the molecule.</b>  7 Q. I am not sure I follow. Help me again, if I look at the  8 numbers and compare the two graphs, they look strikingly  9 similar to me. Why are you only putting this forward as  10 a possible candidate and not a likely identification?  11 <b>A. To summarise, I have looked at various derivatives of</b>  12 <b>tyramine and they all have this fragmentation, so I am</b>  13 <b>pretty confident it is a derivative of tyramine. Fairly</b>  14 <b>confident it is an acetyl derivative of tyramine.</b>  15 Q. A derivative of tyramine?  16 THE CORONER: How do you spell that?  17 <b>A. T-Y-R-A-M-I-N-E.</b>  18 MR WASTELL: What is tyramine?  19 <b>A. It is an amine that is widely distributed, i think it is</b>  20 <b>in cheese and meat.</b>  21 THE CORONER: Cheese and meat.  22 <b>A. And various other, it is widely distributed, I believe</b>  23 <b>it is implicated in migraines for people susceptible to</b>  24 <b>those things.</b>  25 MR WASTELL: To what standard of proof do you reach the</p> <p style="text-align: center;">Page 136</p>

<p>1 conclusion that the ion is a derivative of tyramine?</p> <p>2 <b>A. I think that is beyond reasonable doubt.</b></p> <p>3 Q. Beyond reasonable doubt.</p> <p>4 Can I just turn then to your more recent letters,</p> <p>5 finally.</p> <p>6 Behind tab 32 is your letter of 12 March 2018. You</p> <p>7 were asked to look at data mining on the duodenal</p> <p>8 contents sample AWF/33, can you just summarise for the</p> <p>9 coroner what you did and what the results were?</p> <p>10 <b>A. Yes, so this, again, is this mathematical matching</b></p> <p>11 <b>between ions detected by the mass spectrometer and ions</b></p> <p>12 <b>predicted by a presented list. I used two lists this</b></p> <p>13 <b>time, the previously used list, which was the list</b></p> <p>14 <b>derived of the most poisonous compound from plants and</b></p> <p>15 <b>fungi according to Wink and van Wyk, that is where the</b></p> <p>16 <b>original list was derived from.</b></p> <p>17 Q. In descending order of toxicity, as I recall.</p> <p>18 <b>A. No, it is just a list. That book categorised plant</b></p> <p>19 <b>compounds into levels of toxicity, 1, 2, 3 and 4, 1</b></p> <p>20 <b>being the one that could potentially kill you and the</b></p> <p>21 <b>others causing illness. The list comprised of all the</b></p> <p>22 <b>number 1s.</b></p> <p>23 Q. The fatal toxins?</p> <p>24 <b>A. Yes.</b></p> <p>25 Q. Sorry, I interrupted you, you looked at the Wink and</p> <p style="text-align: center;">Page 137</p>	<p>1 <b>A. You have to examine manually each match and come to the</b></p> <p>2 <b>conclusion whether or not it is meaningful for or not.</b></p> <p>3 <b>I believe --</b></p> <p>4 Q. You say --</p> <p>5 <b>A. -- five of the matches were due to mismatches. You</b></p> <p>6 <b>could assign what the ion was and it was a mismatch</b></p> <p>7 <b>between the list -- ie one was a protonated molecular,</b></p> <p>8 <b>one was an ammoniated molecule and so you are comparing</b></p> <p>9 <b>apples with pears, they both have to be the same.</b></p> <p>10 Q. Just to be clear, the way that the spectrometer is</p> <p>11 assigned or the data mining is assigned a protonated ion</p> <p>12 or an ion to the compound doesn't match to the database,</p> <p>13 one has assigned ammonia the other has assigned hydrogen</p> <p>14 for example?</p> <p>15 <b>A. It has just matched numbers, one number is protonated</b></p> <p>16 <b>and the other number is ammoniated, therefore they</b></p> <p>17 <b>cannot be the same molecule.</b></p> <p>18 Q. Of the nine, five you push to one side because it has</p> <p>19 the wrong ion added?</p> <p>20 <b>A. The other four had the correct ion, but I was able to</b></p> <p>21 <b>find published fragmentation spectra of all of those and</b></p> <p>22 <b>they didn't match, so I eliminated those ones as well.</b></p> <p>23 Q. Four you identified as passing the correct ion test?</p> <p>24 <b>A. Passing the correct ion test.</b></p> <p>25 Q. Then you looked at the MS/MS, ie the fingerprint of the</p> <p style="text-align: center;">Page 139</p>
<p>1 van Wyk database?</p> <p>2 <b>A. I used that list. Additionally, I extracted from the</b></p> <p>3 <b>Dictionary of Natural Products, because they have</b></p> <p>4 <b>a field saying "Hazard of toxicity" and the comment</b></p> <p>5 <b>would be like, "Toxin, poison" and I did a search term</b></p> <p>6 <b>of "poison* wildcard toxic* wildcard" but not</b></p> <p>7 <b>"non-toxic" and that extracted I think over 350</b></p> <p>8 <b>compounds from the Dictionary of Natural Products.</b></p> <p>9 Q. Yes.</p> <p>10 <b>A. So we used those as a search list as well in addition to</b></p> <p>11 <b>the Wink list and then did this mathematical matching</b></p> <p>12 <b>and I believe there were five mathematical matches --</b></p> <p>13 <b>no, sorry, nine was it.</b></p> <p>14 Q. Nine, I think you say, middle of 526. Let's be clear,</p> <p>15 you are looking at the duodenal contents now, not the</p> <p>16 stomach and you have been asked to rerun the data</p> <p>17 mining?</p> <p>18 <b>A. Yes.</b></p> <p>19 Q. You do your looking at the mass and compare it with the</p> <p>20 most toxic, fatally toxic plant toxins from Wink and</p> <p>21 van Wyk plus a search of the Dictionary of Natural</p> <p>22 Products toxic but not non-toxic?</p> <p>23 <b>A. Yes.</b></p> <p>24 Q. You come up with nine matches, just explain what happens</p> <p>25 with those?</p> <p style="text-align: center;">Page 138</p>	<p>1 compound, against some standard reference tools and they</p> <p>2 didn't match. Have I understood that correctly?</p> <p>3 <b>A. Yes.</b></p> <p>4 Q. You rule those out?</p> <p>5 <b>A. I ruled those out.</b></p> <p>6 Q. To what standard of proof?</p> <p>7 <b>A. Beyond reasonable doubt.</b></p> <p>8 Q. One of them I think if we look at your paragraph 4, you</p> <p>9 looked at in slightly more detail which was the</p> <p>10 potential that it was anesthezin?</p> <p>11 <b>A. Yes.</b></p> <p>12 Q. In fact what was it?</p> <p>13 <b>A. That was a phenylalanine.</b></p> <p>14 Q. You did that by looking at the MS/MS fingerprint of the</p> <p>15 compound, did you.</p> <p>16 <b>A. I mean phenylalanine is a common compound, so it is on</b></p> <p>17 <b>the shelf. It seemed reasonable to run it as a standard</b></p> <p>18 <b>to prove the phenylalanine was phenylalanine and not</b></p> <p>19 <b>this compound.</b></p> <p>20 Q. Can I then just deal with the last topic in your report</p> <p>21 of 12 March.</p> <p>22 Further mass spectrometry testing on AWF/33, I think</p> <p>23 the proposition that was being tested with you is</p> <p>24 whether further testing on the duodenum for plant</p> <p>25 compounds or compounds found in plants would be</p> <p style="text-align: center;">Page 140</p>

<p>1 worthwhile. You say:</p> <p>2 "The chromatographic profile of components in</p> <p>3 an unknown plant or plant extract revealed by LCMS</p> <p>4 analysis can be compared with an extract of an authentic</p> <p>5 sample of the plant that the unknown is suspected to be.</p> <p>6 But such an approach can only show the chromatic profile</p> <p>7 is or is not in accordance with the authentic sample,</p> <p>8 unless the plant in question contains a compound only</p> <p>9 found in that species, in which case the detection of</p> <p>10 that compound is strong evidence for identification."</p> <p>11 Just breaking that down, if you have a plant extract</p> <p>12 that you are trying to identify, do I understand you to</p> <p>13 be saying that unless it has a particular marker,</p> <p>14 running it against an authentic sample only takes you</p> <p>15 some of the way?</p> <p>16 <b>A. Yes.</b></p> <p>17 Q. If it has a marker then you have strong evidence that</p> <p>18 the two are the same?</p> <p>19 <b>A. Yes.</b></p> <p>20 Q. Here we are not talking about plant extracts being</p> <p>21 compared with plant reference material, are we, we are</p> <p>22 talking about samples from intestine, stomach, blood or</p> <p>23 urine?</p> <p>24 <b>A. Yes, it would be complicated by all the digestive</b></p> <p>25 <b>products of whatever else had been eaten. This</b></p> <p style="text-align: center;">Page 141</p>	<p>1 Q. That tells you the inability to identify what is in the</p> <p>2 stomach, duodenum, ileum et cetera. That doesn't tell</p> <p>3 you whether or not you can say whether or not sorrel is</p> <p>4 in the stomach or the other parts of the gut, does it?</p> <p>5 <b>A. No. We analysed what we presume is sorrel in the first</b></p> <p>6 <b>report from the jar and sorrel seems to contain very</b></p> <p>7 <b>common compounds that are in lots of different plants.</b></p> <p>8 Q. Did it have one of these markers that you describe?</p> <p>9 <b>A. No.</b></p> <p>10 Q. No.</p> <p>11 <b>A. I am not aware of a marker in sorrel that would</b></p> <p>12 <b>identify --</b></p> <p>13 Q. You did find didn't you, I am going to ham this, but</p> <p>14 quercetin 3-O rhamonosyl galactoside?</p> <p>15 <b>A. That was a major component.</b></p> <p>16 Q. That was the major component --</p> <p>17 <b>A. Yes.</b></p> <p>18 Q. -- of sorrel both in the Kew library and the jar that</p> <p>19 you were looking at?</p> <p>20 <b>A. Yes, we had previously analysed sorrel as part of some</b></p> <p>21 <b>investigation or other, so it was on our archive and</b></p> <p>22 <b>that was also the major component in our archived file</b></p> <p>23 <b>as well.</b></p> <p>24 Q. Am I right that you didn't find that in any of the</p> <p>25 biological samples?</p> <p style="text-align: center;">Page 143</p>
<p>1 <b>technique would only even have a chance of working if</b></p> <p>2 <b>the plant, one plant, was the predominant component of</b></p> <p>3 <b>the stomach contents.</b></p> <p>4 Q. What do you mean "predominant component"?</p> <p>5 <b>A. The most abundant.</b></p> <p>6 Q. The most abundant?</p> <p>7 <b>A. Yes.</b></p> <p>8 Q. Am I right in recalling your evidence from 2013 that the</p> <p>9 most abundant compounds you found in the stomach,</p> <p>10 duodenum, ileum, and jejunum were amino acids?</p> <p>11 <b>A. Yes.</b></p> <p>12 Q. Two problems as I understand your evidence.</p> <p>13 1 is it not being the dominant compound.</p> <p>14 2 being the digestive process on the compounds in</p> <p>15 the gut.</p> <p>16 Is that right?</p> <p>17 <b>A. Yes. More or less it would have to be, if there was no</b></p> <p>18 <b>unique compound, it would have to be a single plant</b></p> <p>19 <b>being eaten, not a mixture like a salad, because</b></p> <p>20 <b>therefore you would have all the compounds mixed</b></p> <p>21 <b>together and you would --</b></p> <p>22 Q. You would find a melange of compounds with the compounds</p> <p>23 from the biology, from the body, and they would all be</p> <p>24 mixed in together?</p> <p>25 <b>A. Yes.</b></p> <p style="text-align: center;">Page 142</p>	<p>1 <b>A. Yes, we didnt find it.</b></p> <p>2 Q. Yes you didn't find it?</p> <p>3 <b>A. We did not find it.</b></p> <p>4 Q. As I understand the explanation you gave on the last</p> <p>5 occasion, you said, I think, that it was unsurprising to</p> <p>6 you, is that right, that you didn't find it in the --</p> <p>7 <b>A. Yes, it would have hydrolysed in the acid conditions in</b></p> <p>8 <b>the stomach, the sugar would have been cleaved off to</b></p> <p>9 <b>leave quercetin.</b></p> <p>10 Q. If that is right, you would be left with quercetin,</p> <p>11 wouldn't you?</p> <p>12 <b>A. Yes.</b></p> <p>13 Q. Does quercetin break down further?</p> <p>14 <b>A. Unlikely, under acidic conditions. It is more likely to</b></p> <p>15 <b>be absorbed into the body.</b></p> <p>16 Q. Well, if somebody has eaten sorrel recently, within two</p> <p>17 to three hours, caeteris paribus -- all other conditions</p> <p>18 equal -- would you expect to find quercetin in samples</p> <p>19 from the stomach?</p> <p>20 <b>A. Yes, if they had eaten a reasonable amount to make it</b></p> <p>21 <b>detectable.</b></p> <p>22 Q. You didn't find it in this case. Logically I think the</p> <p>23 reasons for that would be firstly because it was never</p> <p>24 there, do you agree with that?</p> <p>25 <b>A. That is one possibility, yes.</b></p> <p style="text-align: center;">Page 144</p>

<p>1 Q. Secondly, because it was there but it had been removed 2 somehow?</p> <p>3 <b>A. That is a possibility.</b></p> <p>4 Q. Thirdly, that it was there but it was not found by you, 5 is that a possibility?</p> <p>6 <b>A. If that means the same as it was below the level of 7 which we could detect it, then yes.</b></p> <p>8 Q. You couldn't detect it?</p> <p>9 <b>A. Things can drop to a level below which you can no longer 10 detect them, but they are still there.</b></p> <p>11 Q. Finally, is this a possibility, that it was there but it 12 had been absorbed in some way out of the biological 13 samples?</p> <p>14 <b>A. It is a possibility. It was detected in AWF/35, at low 15 level.</b></p> <p>16 Q. Higher up the gut I think?</p> <p>17 <b>A. Yes.</b></p> <p>18 Q. Let's just focus on the stomach or the duodenum. 19 Are you able to help us with in circumstances where 20 somebody ate sorrel, but then vomited and had their 21 stomach contents or a large portion of their stomach 22 contents removed by a pathologist, as to whether you 23 would be likely to find quercetin in what remained of 24 the stomach sample, is that within your expertise?</p> <p>25 <b>A. It then could be doubtful whether you would detect it</b></p> <p style="text-align: center;">Page 145</p>	<p>1 common, but at the same time, they are found in sorrel 2 and if you in some test don't find either quercetin or 3 the galactoside, then that is inconsistent with the 4 presence of sorrel. Presence doesn't prove it is there, 5 but absence is something that needs to be explained?</p> <p>6 <b>A. Yes, yeah.</b></p> <p>7 Q. You agree with that?</p> <p>8 <b>A. Yes.</b></p> <p>9 Q. You have previously made the point that in the acid 10 conditions of the stomach, the quercetin and the 11 glycoside, which is sugar I think, decouple and leave 12 you just with quercetin?</p> <p>13 <b>A. Yes.</b></p> <p>14 Q. So the presence of the glycoside, it having been 15 subjected to acid in the stomach is not in any way odd 16 or significant but you would agree that the absence of 17 quercetin in any part of the system -- leaving aside the 18 tail end of the ileum -- is something that needs to be 19 explained?</p> <p>20 <b>A. Assuming there was a significant amount of the plant 21 material there to begin with.</b></p> <p>22 Q. Yes. We have had some evidence about that, that 23 Mr Perepilichnyy was fed the whole jar, which we are 24 told was I think 330 grams, that is a third of a kilo. 25 I don't think he ate it all but I think the evidence was</p> <p style="text-align: center;">Page 147</p>
<p>1 <b>given if he has vomited and removed the contents and 2 they have also been removed.</b></p> <p>3 Q. Is that within your expertise or is that something for 4 the coroner?</p> <p>5 <b>A. I think that is something for the coroner.</b></p> <p>6 MR WASTELL: Thank you. I have no further questions. 7 Questions from MR MOXON BROWNE</p> <p>8 MR MOXON BROWNE: Dr Kite, you may recall that I represent 9 one of Mr Perepilichnyy's life insurers in this case and 10 we have spoken before.</p> <p>11 <b>A. Yes.</b></p> <p>12 Q. If I may say so, I can on this occasion hear you very 13 much better than I could on the last occasion whether 14 your voice has strengthened or whether there are better 15 acoustics here I do not know. But do try to keep your 16 voice up, because I am struggling a little bit. 17 Can we pick up where we left off which is on this 18 question of sorrel. You obviously examined a jar marked 19 "sorrel" which was said to be the same as that which was 20 fed to Mr Perepilichnyy on the last lunchtime of his 21 life. You found very common constituents, both 22 quercetin and also a quercetin glycoside, which has also 23 got the name rhamonosyl in it, I think?</p> <p>24 <b>A. Yes.</b></p> <p>25 Q. They are not markers for sorrel because they are so</p> <p style="text-align: center;">Page 146</p>	<p>1 that he is said to have eaten most of it, so a good old 2 consumption of either sorrel or at least something that 3 came out of a jar marked "sorrel".</p> <p>4 <b>A. We would need to know if the sorrel he ate was like raw 5 sorrel or had it been cooked in some way which could 6 have removed the constituents before he ate the plant 7 material.</b></p> <p>8 Q. I didn't hear that?</p> <p>9 <b>A. I would need to know whether he ate sorrel leaves that 10 had not been processed in any way or maybe they had been 11 boiled or something which might have removed a lot of 12 the constituents and therefore reduced the levels.</b></p> <p>13 Q. Yes, I understand but we were told it was in a soup, so 14 certainly heated as I understand it, whether it was 15 boiled I don't know.</p> <p>16 <b>A. But also he has eaten the soup as well, yes.</b></p> <p>17 Q. But certainly to a layman, it does seem strange that 18 somebody who has eaten sorrel as the main constituent of 19 a soup, maybe as much as a third of the kilo, that there 20 should be no trace of it whatever in his system some 21 three hours later?</p> <p>22 <b>A. You would expect to see some evidence.</b></p> <p>23 Q. That is what I think Professor Simmonds told us and you 24 would agree with that?</p> <p>25 <b>A. Yes.</b></p> <p style="text-align: center;">Page 148</p>

<p>1 Q. But there was none in the stomach, there was none in the 2 duodenum, and there was none in the jejunum? 3 <b>A. No.</b> 4 Q. Nor was there any in the blood or in the urine? 5 <b>A. No.</b> 6 Q. I think it is an everyday experience that the 7 consumption of asparagus in let's say a soup, maybe 8 a third of a kilo of asparagus in a soup, will show up 9 in the urine within an hour or two, it is a common 10 experience, it has a distinctive smell. Is asparagus 11 something that moves very rapidly through the system in 12 that way? 13 <b>A. I wouldn't know.</b> 14 Q. You wouldn't know, okay, but that at least helps us to 15 picture the way in which food moves around the body. 16 Here we have a body without any trace of quercetin just 17 two or three hours after consumption. 18 Can you provide any explanation for that, apart from 19 the fact that what he ate was not in fact sorrel? 20 <b>A. No, all I can say is what I found in the extract, it is 21 not -- I don't think it is my job to surmise why it 22 wasn't there.</b> 23 Q. All you can say is it wasn't? 24 <b>A. It wasn't there.</b> 25 Q. Well that is I am sure an entirely proper scientific</p> <p style="text-align: center;">Page 149</p>	<p>1 <b>the initial report referred to the ion which had mapped 2 and I said that that was not gelsemicine.</b> 3 Q. Could you say that again? 4 <b>A. In the original report we examined the peak that was 5 generating this ion and in my original report I said 6 I eliminated the possibility of that being gelsemicine.</b> 7 Q. Yes, you did and you have given the reason for that and 8 that is, I don't think that has ever been challenged. 9 The point I am making is that at that time you had not 10 eliminated, either with any certainty or indeed with any 11 degree of consideration, that it might be one of the 12 isomers of gelsemicine? 13 <b>A. That is true, yes.</b> 14 Q. That is right. It was only after you did a number of 15 further tests that you came to the conclusion that it 16 was at least unlikely that it was one of the known 17 isomers, because again you couldn't match the 18 fragmentation pattern? 19 <b>A. Yes, that's correct.</b> 20 Q. But, here I am assuming for the moment, and I hope you 21 will come along with me in the assumption, that what we 22 are talking about, is a monomer and not a dimer, that 23 did not preclude the possibility that there was in fact 24 an isomer out there that had not found its way into the 25 Dictionary of Natural Products?</p> <p style="text-align: center;">Page 151</p>
<p>1 answer. 2 Very well, can we turn to the question of -- I am 3 going to call it, if you will forgive me, the unknown 4 ion, I know that you feel very close to in fact being 5 able to identify it but for ease of reference I am going 6 to call it the unknown ion. 7 I think you told us that back in 2013 you had really 8 eliminated the possibility that this ion was what I call 9 gelsemicine? 10 <b>A. Yes.</b> 11 Q. That is right, isn't it, and you said that to the 12 coroner, a view you reached beyond reasonable doubt. At 13 risk of oversimplifying, the basis for that conclusion 14 was that you got some gelsemicine from a gelsemium 15 sempervirens plant, you subjected it to collision energy 16 and the fragmentation pattern was different from the 17 suspect ion. 18 <b>A. Yes.</b> 19 Q. And that enabled you to come to a conclusion about that. 20 I do not think you have said, but correct me if I am 21 wrong, that you at that time came to the conclusion that 22 the suspect ion had nothing to do with gelsemium at all, 23 because there was always the possibility that it might 24 be one of the isomers? I am going back to 2013. 25 <b>A. You are phrasing that -- I think I said that we never --</b></p> <p style="text-align: center;">Page 150</p>	<p>1 <b>A. Yes, that is right, it didn't.</b> 2 Q. That was always a possibility? 3 <b>A. Always a possibility, yes.</b> 4 Q. Just as a point of detail, I think you said to 5 Mr Wastell a moment ago that there were six substances 6 in the Dictionary of Natural Products. The five isomers 7 of gelsemicine but also the scope -- 8 <b>A. I have forgotten what it was called.</b> 9 Q. The one that begins with S. 10 I think what you omitted to say, there may have been 11 a bit of confusion, that of course had not been 12 identified back in 2013. At that time you were just 13 looking at the five? 14 <b>A. Yes.</b> 15 Q. That is an illustration of the way in which scientists 16 can find -- I think that if one looks at the history of 17 gelsemium, as we have all been doing, they are found 18 virtually on an annual basis. That is right? 19 <b>A. I imagine the more people look, the more they will find.</b> 20 Q. The more they look, the more they will find. It is 21 something that comes under examination in cancer 22 research for example, it is so poisonous that amongst 23 other things it kills cancer cells. 24 Yes, so just on the assumption -- I appreciate it is 25 not your opinion -- that it is a monomer, really all we</p> <p style="text-align: center;">Page 152</p>

<p>1 can say is, on the one hand its atomic weight exactly 2 matches the isomers of gelsemium, but of those 3 identified in the Dictionary of Natural Products it is 4 not there? 5 <b>A. That's correct, yes.</b> 6 Q. Right. 7 Just moving forward to the question of whether and 8 how sure one can be that it is dimer and not a monomer, 9 I would like to take you to a comment on your report 10 from Professor Cowan and see whether or not you agree 11 with it. I think you probably will. 12 It is in bundle 1 at page 340. If we can just set 13 the scene -- 14 Tab 22, I am told. 15 <b>A. I have found it, yes.</b> 16 Q. Just if we can set the scene for this, the basis upon 17 which you have come to the conclusion with increasing 18 confidence that what we are looking at is a dimer and 19 not a monomer, is that under a range of matrix 20 conditions and solvent conditions you get a repeated 21 co-elution of the two ions, whether you use this 22 solvent, that solvent or another solvent, always they 23 come up together. That is really the basis upon which 24 you have become increasingly confident that what we have 25 here is a dimer?</p> <p style="text-align: center;">Page 153</p>	<p>1 I think that is the point you were making before, 2 because it always happens in the different solvents that 3 is what it looks like. 4 Then it goes on: 5 "However, as he acknowledges, he cannot be certain 6 whether m/z 180.1019 is the protonated compound and 7 m/z 359.1865 is the protonated dimer of that same 8 compound or whether m/z 180.1019 is a fragment ion from 9 a different protonated compound at m/z 359.1965. 10 I am suggesting that making all due allowance for 11 the coarseness of my analogy, what he is saying is you 12 cannot be sure whether you have a big toffee broken in 13 two or whether you have two toffees stuck together. 14 What you can be sure of is that they all come from the 15 same factory? 16 <b>A. Yes, you cannot be 100 per cent, as I was explaining 17 just now, you cannot be 100 per cent certain but you 18 have a very high -- based on my experience and the 19 evidence, a very high certainty.</b> 20 Q. We can explore this and if I am allowed to I propose to 21 do so very briefly with Professor Cowan. He seemed to 22 be slightly more doubtful, that is why I am drawing your 23 attention to this and he says at the bottom of that 24 paragraph: 25 "In my opinion, Dr Kite correctly explains</p> <p style="text-align: center;">Page 155</p>
<p>1 <b>A. No, that was to show that it was one compound, these 2 ions were coming from one compound.</b> 3 Q. Yes. 4 <b>A. It doesn't prove there is a dimer.</b> 5 Q. If we can take my much derided toffee analogy for the 6 moment, we have a jar of toffees. Some of them weigh 7 exactly 100 grams and some of them weigh exactly 8 50 grams. The problem we have to address is whether the 9 bigger toffees are two smaller toffees stuck together or 10 whether the bigger toffees have a tendency to crack in 11 a certain way producing two smaller toffees. That is 12 what we have to address? 13 <b>A. Yes.</b> 14 Q. You know that it has to be one or the other, if the two 15 different types of toffee, the two different ions, are 16 co-eluting in the different matrixes? 17 <b>A. Yes.</b> 18 Q. That is what we have? 19 <b>A. Yes.</b> 20 Q. This is what Professor Cowan said: 21 "Dr Kite has quite appropriately undertaken some 22 experiments in an attempt to disassociate the purported 23 dimer. The results that he has stated provide strong 24 evidence that the ions of m/z 180.1019 and m/z 359.1965 25 come from one compound."</p> <p style="text-align: center;">Page 154</p>	<p>1 unequivocal proof that 359.1965 is a cluster ion can 2 only come from identifying the compound. I would wish, 3 as it appears does Dr Kite, to obtain authentic 4 reference material to obtain such proof of identity." 5 I don't know whether you would agree with that or do 6 you think he has been a bit cautious? 7 <b>A. I would agree with that, yes.</b> 8 Q. You would agree, good? 9 <b>A. I agree that eliminates all uncertainty.</b> 10 THE CORONER: I think you said without it there is very high 11 certainty is the phrase you just used, is that right? 12 <b>A. Yes.</b> 13 MR MOXON BROWNE: I think, probably finally, just looking at 14 the history of this, it did take quite a long time to 15 explore the possibility that what we have called the 16 unknown ion might come from one of the isomers of 17 gelsemicine, it took actually years rather than merely 18 months? 19 <b>A. I don't know about years. I seem to remember we had 20 a few instrument breakdown problems whilst we were 21 trying to answer the question.</b> 22 Q. I don't know whether you remember but this Inquest was 23 due to start in May 2015 and it was adjourned, and 24 I think you were privy to this, in fact on the 25 application of Mr Perepilichnyy's family, because of</p> <p style="text-align: center;">Page 156</p>

1 a report produced by Professor Simmonds that said that  
 2 she thought that further testing about gelsemium and  
 3 gelsemicine was justified. Do you remember that?  
 4 **A. Yes, I remember seeing her report, yes.**  
 5 Q. She drew attention to some factors which were very  
 6 widely reported in the press at the time, perhaps  
 7 understandable, she said that gelsemium was a known  
 8 poison used by Russian and Chinese assassins and she  
 9 also said that she thought it was well worth exploring  
 10 further that possibility because of the extreme toxicity  
 11 of this compound.  
 12 THE CORONER: It has gone on being reported,  
 13 notwithstanding --  
 14 MR MOXON BROWNE: Yes, it has.  
 15 THE CORONER: -- the further work that has been done and the  
 16 old stuff keeps being reported, not where we are now.  
 17 MR MOXON BROWNE: No, I just thought it might be helpful to  
 18 remind ourselves what the genesis of that was.  
 19 THE CORONER: It has been made plain today where we are now.  
 20 MR MOXON BROWNE: I was on a different point --  
 21 THE CORONER: I know, I am on that point.  
 22 MR MOXON BROWNE: -- which is why it was that that those  
 23 reports emerged.  
 24 I don't think it is the case -- I don't think you  
 25 are suggesting it was the case -- that back in 2013

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1 matters appeared as clear as they do today to yourself  
 2 and to Professor Simmonds?  
 3 **A. Certainly they are clearer now, yes, because we have**  
 4 **done so much work on gelsemicine and gelsemium.**  
 5 Q. For example you were proceeding in 2013 until  
 6 comparatively recently on the basis that what we were  
 7 looking at was a monomer and not a dimer?  
 8 **A. Yes.**  
 9 MR MOXON BROWNE: Yes, thank you.  
 10 Questions from MR STRAW  
 11 MR STRAW: Dr Kite, could you please have a look at  
 12 bundle 1, which should be in front of you, at page 527.  
 13 **A. Yes.**  
 14 Q. The top of that page, point 2, is a section where you  
 15 describe why you think there is little merit in  
 16 performing mass spectrometry tests on AWF/33, which is  
 17 the top of the intestine, is that correct?  
 18 **A. Yes.**  
 19 Q. We have seen the first part of that paragraph was read  
 20 out to you. I would like to read the rest of it before  
 21 coming back and just asking a few questions on that.  
 22 Starting from about eight lines down, I think is  
 23 where we got to, you say:  
 24 "Thus this approach [in other words mass  
 25 spectrometry tests on AWF/33] is unlikely to be of value

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1 in the analysis of gut contents unless a considerable  
 2 quantity of one plant had been consumed. Furthermore  
 3 the chromatographic profile of the compounds can be  
 4 changed by the digestive process. If the plants  
 5 suspected of being consumed contained a compound unique  
 6 to that species, then a targeted analysis of this  
 7 compound could be undertaken. In the LCMS analysis of  
 8 AWF/33 the chromatographic profile major peaks is mainly  
 9 due to amino acids, most of the numerous other  
 10 components being minor in comparison. Thus I confirm  
 11 that there is little merit in this approach. Regarding  
 12 the suspected plant fragments removed from AWF/33, not  
 13 only will these be contaminated with general gut  
 14 contents but they will have been subjected to the  
 15 digestive process which could have removed or broken  
 16 down some of the chemical components. Considering both  
 17 this and the above, any LCMS analysis of the fragments  
 18 removed from AWF/33 is highly unlikely to identify the  
 19 fragments."  
 20 You were addressing there mass spectrometry on the  
 21 top of the intestine, AWF/33, but presumably the same  
 22 sort of thing would apply to the stomach and the lower  
 23 down of the intestine as well and to the urine?  
 24 **A. Yes.**  
 25 Q. Going back to where I started:

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1 "This approach is unlikely to be of value in the  
 2 analysis of the gut contents unless a considerable  
 3 quantity of one plant had been consumed."  
 4 Does it follow then that if Mr Perepilichnyy had  
 5 consumed only a small quantity of a highly toxic plant,  
 6 then it is unlikely that that would have been detected  
 7 on this analysis?  
 8 **A. This analysis refers to looking at what we call the**  
 9 **chromatographic profile, you will see these in various**  
 10 **reports, the peaks, so it is looking at that profile of**  
 11 **peaks. Obviously if that profile of peaks submerges**  
 12 **into a very complex matrix, you can no longer see it**  
 13 **unless you somehow try to extract it. It all becomes**  
 14 **very dubious.**  
 15 **That is a different process to looking for**  
 16 **a targeted one compound, that is a different process.**  
 17 **What is referring to here is just looking at that**  
 18 **profile of peaks and saying: does that profile of peaks**  
 19 **look the same as in this plant?**  
 20 Q. Yes.  
 21 **A. You have to be able to see that profile of peaks and we**  
 22 **cannot see the profile of peaks in any of these samples**  
 23 **because they are dominated by amino acids and there are**  
 24 **so many peaks there, they have all just merged into**  
 25 **a wobbly line.**

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<p>1 Q. That process would be unlikely to identify a toxic plant 2 of which Mr Perepilichnyy had only consumed a small 3 amount, a very small amount? 4 <b>A. We would use a different approach of looking for the 5 toxic compound, which is basically what we have been 6 doing in here under a number of analyses.</b> 7 Q. You explain, don't you, that for your conclusion at the 8 end of it that any LCMS analysis of the fragments 9 removed is highly unlikely to identify the fragments. 10 Am I right in saying that you give two reasons for that, 11 the first is that the compounds may have been 12 contaminated by other gut contents? 13 <b>A. Well, it would almost certainly be contaminated by gut 14 contents and I would be reluctant in the (Inaudible) 15 case I had it, I would be reluctant to wash off the gut 16 contents because you wouldn't know what you would be 17 washing off, so you would have to live with the 18 contamination.</b> 19 Q. The second reason why it is highly unlikely to identify 20 the fragment is that the digestive process may have 21 removed or broken down some of the components? 22 <b>A. Yes, so the profile of peaks would have changed.</b> 23 Q. Again, the facts that no toxic plant was identified in 24 his samples doesn't show, does it, that he didn't ingest 25 that compound?</p> <p style="text-align: center;">Page 161</p>	<p>1 (3.28 pm) 2 (A short adjournment) 3 (3.40 pm) 4 PROFESSOR DAVID COWAN (affirmed) 5 Questions from MR WASTELL 6 MR WASTELL: Professor Cowan can you remind the court of 7 your expertise? I think you are an expert in 8 pharmaceutical toxicology, is that right? 9 <b>A. That's correct, yes.</b> 10 Q. You have particular expertise in mass spectrometry? 11 <b>A. My career has been largely involved in identifying 12 components in bodily fluids, particularly urine samples, 13 using mass spectrometry as the analytical technique.</b> 14 Q. Since the last hearing you have produced a number of 15 short reports, can I just identify those? 16 <b>A. Yes.</b> 17 Q. In the bundle in front of you, behind tab 21, you should 18 see there a report of yours from 13 July 2017, do you 19 see that? 20 <b>A. Yes, I have that.</b> 21 Q. Then behind tab 22, a report from you dated 22 25 August 2017? 23 <b>A. Yes.</b> 24 Q. Lastly, behind tab 36, I hope, some detail about 11 25 compounds from the Human Metabolome Database, is that</p> <p style="text-align: center;">Page 163</p>
<p>1 <b>A. Could you rephrase that question? I mean we have looked 2 for specific toxic compounds, we haven't actually done 3 this chromatographic profiling thing, all our tests have 4 been looking for single compounds. It doesn't matter if 5 that single compound was a pure compound and had been 6 administered or it had come from the plants, because we 7 were just looking for the single compound.</b> 8 THE CORONER: You had been using a different process? 9 <b>A. Yes.</b> 10 MR STRAW: The point about the digestive process could 11 remove or break down elements, that applies to both 12 processes. 13 <b>A. Yes, some toxic compounds could be broken down by the 14 digestive process, yes.</b> 15 Q. There could have been a toxic plant he consumed but it 16 removed or broken down before you came to test it? 17 <b>A. That is possibility, yes.</b> 18 Q. The fact that you didn't detect the toxic compound 19 doesn't show he didn't ingest it? 20 <b>A. Yes.</b> 21 MR STRAW: Thank you. 22 MR WASTELL: Sir, unless you have any questions. 23 THE CORONER: No. 24 MR WASTELL: Thank you, Dr Kite. 25 THE CORONER: Thank you very much.</p> <p style="text-align: center;">Page 162</p>	<p>1 produced by you? 2 <b>A. Yes, it is.</b> 3 Q. Do you stand by the professional opinions you have 4 expressed in those documents, subject to any 5 clarification today? 6 <b>A. I beg your pardon.</b> 7 Q. Do you stand by the opinions you have expressed in those 8 reports -- 9 <b>A. Yes, I do.</b> 10 Q. -- subject to your evidence today? 11 I only really want to deal with one matter with you. 12 That is the issue dealt with in your report from August, 13 behind tab 22, page 340. The issue of the likelihood 14 that the unidentified compound, assumed originally to be 15 of mass 359, was a dimer, two molecules together, or 16 one? 17 <b>A. Yes.</b> 18 Q. You were present in court to hear Dr Kite's explanation 19 a moment ago I believe; is that right? 20 <b>A. That's correct, yes.</b> 21 Q. You have reviewed the further analysis that he did last 22 year? 23 <b>A. Yes.</b> 24 Q. Identifying the co-elution of the 180 and the 359 ions 25 in five different combinations of solvents and column?</p> <p style="text-align: center;">Page 164</p>

<p>1 <b>A. Yes.</b></p> <p>2 Q. And also the observation about dimerisation in the amino</p> <p>3 acids present in the stomach contents?</p> <p>4 <b>A. Yes.</b></p> <p>5 Q. Having reviewed that evidence, you say in your report</p> <p>6 that you agree that unequivocal proof that it is</p> <p>7 a cluster ion can only come from identifying the</p> <p>8 compound, but do you agree with the proposition that it</p> <p>9 is likely to be a cluster of two compounds?</p> <p>10 <b>A. I reread what I had written during the cross-examination</b></p> <p>11 <b>of Dr Kite. I see that what I put, "The results as here</b></p> <p>12 <b>stated provide strong evidence that the ions at m/z 180</b></p> <p>13 <b>and m/z 359 come from one compound".</b></p> <p>14 Q. Yes.</p> <p>15 <b>A. Perhaps I should have clarified that point and that is</b></p> <p>16 <b>that it is a monomer, so I think I can say that there is</b></p> <p>17 <b>strong evidence that it is a monomer and that is more</b></p> <p>18 <b>likely than not. I have also done some work on</b></p> <p>19 <b>phenylalanine in my laboratory and shown that it can</b></p> <p>20 <b>indeed dimerise, the smaller molecular can go into</b></p> <p>21 <b>a bigger molecular when subjected to these conditions.</b></p> <p>22 Q. Yes. Critical point here, when you say "it is</p> <p>23 a monomer", what are you referring to by "it"?</p> <p>24 <b>A. Sorry, in this case, a molecule of mass 179, which will</b></p> <p>25 <b>give an ion at 180.</b></p> <p style="text-align: center;">Page 165</p>	<p>1 splitting of the compound in two and the lack of ion in</p> <p>2 between as a reason?</p> <p>3 <b>A. Because one is looking at a large range of unknowns, one</b></p> <p>4 <b>has to consider many different possibilities. I think</b></p> <p>5 <b>that is where the discussion has been taking place.</b></p> <p>6 <b>I have always been convinced that the evidence was</b></p> <p>7 <b>not good for gelsemicine, so I have said that</b></p> <p>8 <b>consistently in my statements.</b></p> <p>9 Q. Yes.</p> <p>10 <b>A. But one could consider molecules that could split in the</b></p> <p>11 <b>middle and give fragments that would be equivalent to</b></p> <p>12 <b>the 179, that is given the 180 ion. That is why</b></p> <p>13 <b>I didn't want to go 100 per cent and I believe that is</b></p> <p>14 <b>why Dr Kite does not want to go 100 per cent.</b></p> <p>15 <b>But it is unlikely to get compounds like that and as</b></p> <p>16 <b>he has shown with the change in the chromatographic</b></p> <p>17 <b>conditions, the fact that you constantly get the two</b></p> <p>18 <b>ions coming at exactly the same time is persuasive</b></p> <p>19 <b>evidence that the molecule is the same and that it is</b></p> <p>20 <b>that monomer structure.</b></p> <p>21 Q. Yes, now, Dr Kite put it -- I will be corrected if I am</p> <p>22 wrong -- that, as I understood his evidence, that he was</p> <p>23 reaching that conclusion beyond reasonable doubt but not</p> <p>24 unequivocal scientific proof?</p> <p>25 <b>A. Okay.</b></p> <p style="text-align: center;">Page 167</p>
<p>1 Q. To be clear, you conclude that it is indeed a cluster of</p> <p>2 two smaller molecules?</p> <p>3 <b>A. That there is a greater likelihood that it is a cluster</b></p> <p>4 <b>of two molecules.</b></p> <p>5 Q. Just explain to the coroner why you reach that view?</p> <p>6 <b>A. Sir, I think one of the most persuading factors for me</b></p> <p>7 <b>was when I was able to do an independent experiment in</b></p> <p>8 <b>my laboratory using phenylalanine, so looking back on</b></p> <p>9 <b>that data which I hadn't previously been able to do, and</b></p> <p>10 <b>seeing that in the mass spectrometry conditions that we</b></p> <p>11 <b>use and Dr Kite also uses, we do indeed see this higher</b></p> <p>12 <b>mass ion. Since I knew I had the authentic compound,</b></p> <p>13 <b>the fact that that gave the dimer persuaded me that that</b></p> <p>14 <b>was indeed what we were seeing in this case as well.</b></p> <p>15 Q. Yes, and although it was put to Dr Kite, by counsel for</p> <p>16 Legal &amp; General that the elution, the co-elution, was</p> <p>17 the reason for reaching the conclusion that it is</p> <p>18 a cluster, in fact there is quite a few more limbs or</p> <p>19 premises in the argument, aren't there?</p> <p>20 <b>A. Yes, exactly that.</b></p> <p>21 Q. There is the dimerisation of amino acids in the stomach,</p> <p>22 as you have just identified that your own experiments</p> <p>23 determined?</p> <p>24 <b>A. Yes.</b></p> <p>25 Q. Also, did you hear Dr Kite refer to the mathematical</p> <p style="text-align: center;">Page 166</p>	<p>1 Q. Do you agree with that or are you somewhere different on</p> <p>2 the scale of probability?</p> <p>3 <b>A. I believe we are both more comfortable if we had the</b></p> <p>4 <b>authentic material. The reason we say that is it is not</b></p> <p>5 <b>only the mass spectrometry, it is also the</b></p> <p>6 <b>chromatography, the separation. We have some separation</b></p> <p>7 <b>evidence but the higher standard of separation evidence</b></p> <p>8 <b>is when you know you have an authentic standard and you</b></p> <p>9 <b>run it through and you get the same time as well as the</b></p> <p>10 <b>same spectrum. I would not go quite so far as Dr Kite</b></p> <p>11 <b>on that.</b></p> <p>12 Q. You heard Dr Kite say that he was sure that he had</p> <p>13 identified it as a derivative of tyramine, I hope I am</p> <p>14 getting that right. Have you done any analysis of that?</p> <p>15 <b>A. No, because there he actually matched the retention time</b></p> <p>16 <b>as well as the mass spectrum.</b></p> <p>17 Q. Have you assessed that conclusion and the experiment --</p> <p>18 <b>A. Because he had the tyramine compound as authentic</b></p> <p>19 <b>standard and ran it on chromatographic conditions, he</b></p> <p>20 <b>could then match it as I have understood it.</b></p> <p>21 Q. Do you agree with his conclusion that it is?</p> <p>22 <b>A. Yes.</b></p> <p>23 Q. That it is beyond doubt -- if I could --</p> <p>24 <b>A. Because running the standard and the unknown at the same</b></p> <p>25 <b>time is what I have to do in my work to identify</b></p> <p style="text-align: center;">Page 168</p>

<p>1       <b>compounds.</b></p> <p>2       Q. You agree beyond doubt it is a derivative of tyramine?</p> <p>3       <b>A. Yes. Yes.</b></p> <p>4       MR WASTELL: Thank you, I have no further questions.</p> <p>5               Questions from MR MOXON BROWNE</p> <p>6       MR MOXON BROWNE: Professor Cowan, you have helped explain</p> <p>7       the degree of probability or certainty that you</p> <p>8       entertain that what we are looking at here is a cluster</p> <p>9       ion, or what I have called two toffees stuck together,</p> <p>10       rather than a monomer, one big toffee.</p> <p>11       <b>A. Yes.</b></p> <p>12       Q. I appreciate and accept the way in which you have</p> <p>13       expressed that, but if we can just for a moment</p> <p>14       assume -- against your pretty strong conviction -- that</p> <p>15       in fact what we are looking at is a single large toffee,</p> <p>16       it would be accurate to describe it as it has I think</p> <p>17       always been described as an unknown. We don't know what</p> <p>18       it is, if it is a monomer?</p> <p>19       <b>A. I'm just trying to work through the logic.</b></p> <p>20       Q. Sorry.</p> <p>21       <b>A. I am just trying to work through the logic of what you</b></p> <p>22       <b>have told me. We have the two pieces stuck together so</b></p> <p>23       <b>that is what you are describing at the monomer?</b></p> <p>24       Q. No, I am not.</p> <p>25       <b>A. You are not?</b></p> <p style="text-align: center;">Page 169</p>	<p>1       the fragmentation pattern?</p> <p>2       <b>A. No, I don't think I am saying that.</b></p> <p>3       Q. I think you say that would be something easy to do?</p> <p>4       <b>A. If I have understood you correctly, to get a certainty,</b></p> <p>5       <b>I would wish to have the pure compound --</b></p> <p>6       Q. Yes.</p> <p>7       <b>A. -- and then match it with retention time as well as the</b></p> <p>8       <b>mass spectrum, but I can deduce that it is different by</b></p> <p>9       <b>some mass spectral properties.</b></p> <p>10       Q. I think you say that is not something that is</p> <p>11       particularly difficult to do and in fact we have now</p> <p>12       heard from Dr Kite that he has done that very thing, as</p> <p>13       far as he can --</p> <p>14       <b>A. Yes.</b></p> <p>15       Q. -- because he has looked at some fragmentation data --</p> <p>16       <b>A. Yes.</b></p> <p>17       Q. -- and he has made the caveat that some of it is</p> <p>18       computer derived rather than empirically derived, as</p> <p>19       I understand it, but he has concluded that none of these</p> <p>20       jumps to the eye as a match when you consider the</p> <p>21       fragmentation data?</p> <p>22       <b>A. Yes.</b></p> <p>23       Q. He has done the very thing you said could be done and he</p> <p>24       has said, "Well, we haven't got a match here".</p> <p>25       <b>A. Let me clarify.</b></p> <p style="text-align: center;">Page 171</p>
<p>1       Q. I am assuming that 359.1965 is a single ion.</p> <p>2       <b>A. Okay.</b></p> <p>3       Q. I know you don't think is that is the case and I am not</p> <p>4       going to argue with you but just assuming that for</p> <p>5       a moment, then we don't know what it is?</p> <p>6       <b>A. True.</b></p> <p>7       Q. Let's move from there to some proposition that you are</p> <p>8       much more comfortable with, which is in fact it is</p> <p>9       a cluster ion, it is two toffees stuck together?</p> <p>10       <b>A. Okay.</b></p> <p>11       Q. You looked in the Human Metabolome Database to see what</p> <p>12       the matches might be --</p> <p>13       <b>A. Yes.</b></p> <p>14       Q. -- for that single toffee and we have your results, if</p> <p>15       you wouldn't mind looking at them quickly, at page 536</p> <p>16       of bundle 1.</p> <p>17       <b>A. Yes.</b></p> <p>18       Q. They include a variety of substances?</p> <p>19       <b>A. Yes.</b></p> <p>20       Q. Some of them we have been told I think are commonly</p> <p>21       found in foodstuffs, salsolinol and I think maltozaxine</p> <p>22       I think is found within foodstuffs and we also have the</p> <p>23       so-called recreational drug MDMA. These are matches,</p> <p>24       but as you have pointed out it is not difficult to say</p> <p>25       whether or not that is what our toffee is by examining</p> <p style="text-align: center;">Page 170</p>	<p>1       <b>One can look at not just the database but often mass</b></p> <p>2       <b>spectral libraries, which he has done, and from that see</b></p> <p>3       <b>how the molecules fragment and say it is not one of</b></p> <p>4       <b>those. So I agree with him.</b></p> <p>5       Q. Yes. I think that there are not any matches at all,</p> <p>6       there are 89 matches in the Dictionary of Natural</p> <p>7       Products. Is that right?</p> <p>8       <b>A. Yes, in fact it has increased to 90 because the database</b></p> <p>9       <b>has now been expanded.</b></p> <p>10       Q. Has anyone suggesting, by anyone I mean either you or</p> <p>11       Dr Kite, that we have a match there?</p> <p>12       <b>A. I just could equivocate about what we mean by a match,</b></p> <p>13       <b>in terms of the accurate mass determined in his analysis</b></p> <p>14       <b>and the exact mass as being given by the database</b></p> <p>15       <b>entries, but that is only part of an identification</b></p> <p>16       <b>story.</b></p> <p>17       Q. Yes, I appreciate that, I am just wondering whether any</p> <p>18       such identification has been made?</p> <p>19       <b>A. I think I don't follow when you say "identification",</b></p> <p>20       <b>because of the requirement for identification, I would</b></p> <p>21       <b>normally require the retention time as well as the mass</b></p> <p>22       <b>spectrum.</b></p> <p>23       Q. Do you have MS data that matches or indeed a retention</p> <p>24       time that matches?</p> <p>25       <b>A. No, I am relying on the data as provided by Dr Kite.</b></p> <p style="text-align: center;">Page 172</p>

<p>1 Q. I don't think he has suggested that the answer is to be 2 found in the Dictionary of Natural Products. 3 <b>A. If it is of help to the court, I think we are both of 4 the view that we have some unknown components in the 5 stomach and other body contents.</b> 6 Q. Yes. 7 <b>A. Yes.</b> 8 Q. A candidate has been put forward, which is I think 9 a metabolite of a substance that we have called NATOG, 10 which might be called NAT, but I don't think that, as 11 I understood it, that Dr Kite is very emphatic in that 12 identification. Is that your understanding? 13 <b>A. That is my understanding, yes.</b> 14 Q. Would it be fair to say that whether this is a monomer 15 or a dimer, whether it is a one big toffee or two small 16 ones, we don't know what it is? 17 <b>A. But that is a different question. 18 Whether it is a monomer, which I think is more 19 likely, we don't know what the monomer is, we haven't 20 proved that and if it were to be a dimer, which I think 21 is unlikely but possible, again, we don't know what it 22 is.</b> 23 Q. I think the answer to my question is probably yes? 24 <b>A. Yes, fine, good.</b> 25 Q. I think you were following the questioning of Dr Kite</p> <p style="text-align: center;">Page 173</p>	<p>1 retrieved from the upper part of the gut and therefore 2 may relate to Mr -- 3 <b>A. I think that goes beyond my expertise, it is on drugs, 4 not on DNA analysis.</b> 5 Q. I was not really talking about DNA testing, I was 6 talking about any testing on that material. 7 <b>A. Right.</b> 8 Q. Do you know what at that material was? Have you seen 9 any evidence? 10 <b>A. I do not know what that material was.</b> 11 Q. So we have an unknown there as well? 12 <b>A. Yes.</b> 13 MR MOXON BROWNE: Thank you. 14 Questions from MR STRAW 15 MR STRAW: Professor Cowan, just one very minor area. The 16 ChemSpider database -- 17 <b>A. Yes.</b> 18 Q. -- you mentioned last time you gave evidence that if 19 this, what we have been calling an unidentified ion, was 20 a monomer with mass 359.1165 and so on, you noted that 21 that matches 4,979 different items on the ChemSpider 22 database and I think you said we don't know whether they 23 are toxic or not. Do you recall that? 24 <b>A. Sorry, did you say whether they are toxic or not?</b> 25 Q. Yes, we don't have information about their toxicity?</p> <p style="text-align: center;">Page 175</p>
<p>1 about the vegetable material that was retrieved from the 2 digestive tract? 3 <b>A. Yes.</b> 4 Q. Which was subjected, under Professor Simmonds's 5 supervision, to DNA testing. We don't know what that is 6 either? 7 <b>A. Did you say DNA testing?</b> 8 Q. Yes. 9 <b>A. I don't think I have understood your point, the 10 question.</b> 11 Q. Did you not know that Professor Simmonds had subjected 12 vegetable material retrieved from the upper digestive 13 tract to DNA testing? 14 <b>A. Yes, I had read that, yes.</b> 15 Q. But she was not able to make an identification by that 16 means. 17 <b>A. I understand, yes.</b> 18 Q. Yes. 19 Therefore, as far as you are aware, no 20 identification has been made or as I understand it, 21 could now be made of what that material is? 22 <b>A. Are you asking me about whether the deceased had taken 23 sorrel or --</b> 24 Q. Well, we have some vegetable material which we have seen 25 in jars and the question is what is it, because it is</p> <p style="text-align: center;">Page 174</p>	<p>1 <b>A. I had not gone through all of those compounds and looked 2 up their toxicity, that is correct.</b> 3 Q. Thank you. 4 I would like to look, please, at if the unidentified 5 ion is a monomer with mass 180, you mentioned last time 6 that there were some 3,346 items on the ChemSpider 7 database that it matches, is it still the position that 8 it could be one of those ions? 9 <b>A. Yes, that would be a possibility.</b> 10 Q. Do you know anything about the toxicity of those 3,346 11 ions? 12 <b>A. No, I do not.</b> 13 Q. Nothing about that, so some of them could be toxic but 14 you just don't know? 15 <b>A. That is correct, yes.</b> 16 MR STRAW: Thank you. 17 MR SKELTON: Sir, I think that concludes, subject to your 18 own questions, the evidence of Dr Cowan. 19 THE CORONER: Yes. 20 Thank you. 21 <b>A. Thank you.</b> 22 <b>DR PAUL RICE (sworn)</b> 23 <b>Questions from MR SKELTON</b> 24 MR SKELTON: Dr Rice, thank you for returning to court to 25 give evidence.</p> <p style="text-align: center;">Page 176</p>

<p>1 May I, as we have done with the other witnesses, 2 just re-establish for the benefit of those here your 3 expertise. 4 You are a toxicologist whose specialist area I think 5 is chemical and biological agents? 6 <b>A. Correct.</b> 7 Q. As far as the identification of poisonous plant 8 alkaloids goes I think you would defer, is it right, to 9 the expertise of Dr Kite and Professor Simmonds? 10 <b>A. Most definitely.</b> 11 Q. May I just recap some of the evidence you gave to us 12 in June 2017, please. 13 In respect of the principal categories of chemical 14 agents, you describe three such categories, toxic gases, 15 blister agents and nerve agents. 16 <b>A. That's correct, yes.</b> 17 Q. Some of those categories or some agents within those 18 categories can now be ruled out by the testing that has 19 been done and you have seen some of the tests? 20 <b>A. That's correct, yes.</b> 21 Q. Some of those chemicals cannot now be ruled out, because 22 the window for testing has been closed? 23 <b>A. Indeed.</b> 24 Q. For example, cyanides and azides? 25 <b>A. That's correct, yes.</b></p> <p style="text-align: center;">Page 177</p>	<p>1 <b>A. Yes, I did.</b> 2 Q. Can I just remind you of what you said in that regard, 3 please? 4 <b>A. Of course.</b> 5 Q. You described it in these terms, and I am looking at 6 page 171 of the transcript dated 19 June 2017. 7 You said: 8 "The classic features that you see are basically 9 an overstimulation of the nervous system initially, so 10 your eyes would start running, your nose would start 11 running, you would start coughing up secretions. You 12 would lose the ability to control your bladder and your 13 bowels and then eventually as the nervous system becomes 14 more exhausted because of this hyperactivity initially, 15 you then get a blockade of various nerve functions, so 16 you would eventually see a slowing of the heart, 17 a reduction of the blood pressure, the overstimulation 18 of the brain may cause the patient to actually seize, so 19 as have epileptic seizures but eventually all neural 20 activity would be blocked and most importantly the brain 21 stem, which controls your respiration so classically 22 death from organophosphates, and particularly the nerve 23 agents, occurs because you stop breathing." 24 <b>A. That is entirely correct.</b> 25 Q. Is there anything you want to add to that evidence in</p> <p style="text-align: center;">Page 179</p>
<p>1 Q. I think you also said in your evidence that it is 2 unlikely that you would now be able to do any scientific 3 testing to detect nerve agents? 4 <b>A. That's correct, because the key enzyme that is inhibited 5 by those materials would have broken down by now, so 6 yes.</b> 7 Q. In respect of nerve agents, your evidence, I think, was 8 that they are organophosphates as a category? 9 <b>A. Yes.</b> 10 Q. They include VX and Novichok, for example? 11 <b>A. For example, yes.</b> 12 Q. You also indicated to the court that there is open 13 source material available to the effect that the Russian 14 state has access to nerve agents? 15 <b>A. Correct.</b> 16 Q. You also said in your evidence that there are some 17 poisons that are going to be impossible to detect? 18 <b>A. Yes.</b> 19 Q. And they include nerve agents? 20 <b>A. That's correct.</b> 21 Q. You also gave evidence that there may be some foreign 22 states that may seek to make such poisons? 23 <b>A. That is also correct.</b> 24 Q. In your evidence, you described what was called I think 25 a cholinergic crisis?</p> <p style="text-align: center;">Page 178</p>	<p>1 terms of a description of the classic cholinergic crisis 2 that results from nerve agent poisoning? 3 <b>A. No, I think that is a good summary of the mechanism and 4 it also explains the signs and symptoms of poisoning 5 that one would see.</b> 6 Q. Turning then to your views in respect of 7 Mr Perepilichnyy, I think you have been here all day and 8 heard the evidence of Dr Wilmshurst and 9 Professor Ferner. 10 <b>A. Yes, I have.</b> 11 Q. You will have heard, I think, the summary of the 12 relevant factual evidence which was being examined by 13 them with a view to taking or drawing conclusions about 14 whether or not he suffered some form of delayed action 15 poison or food poisoning. 16 Professor Ferner's view was that it was likely that 17 Mr Perepilichnyy suffered some form of food poisoning, 18 although it was not possible to say what, but he was 19 unable to say that this was likely to have caused his 20 death. 21 From your perspective, do you accept that view? 22 <b>A. I think that is a reasonable view based on the evidence 23 I have heard, yes.</b> 24 Q. As far as the delayed action poison is concerned, 25 Professor Ferner said it was possible that that could</p> <p style="text-align: center;">Page 180</p>

<p>1 have been administered to Mr Perepilichnyy, but cannot 2 say that it was likely to have occurred? 3 <b>A. I would also agree with that.</b> 4 Q. May I now turn to your specific area of expertise and in 5 particular the use of nerve agents, if I may. As I have 6 established, and as you have agreed, the scientific 7 window for testing definitively for the use of nerve 8 agents is now definitively closed? 9 <b>A. I would suggest so, yes, because of the reasons I have 10 already suggested.</b> 11 Q. In those circumstances, the use of such an agent cannot 12 100 per cent be ruled out scientifically in 13 Mr Perepilichnyy's case? 14 <b>A. No, I don't believe it can.</b> 15 Q. You said last time in the context of the cholinergic 16 crisis, which you describe as the classic presentation 17 of nerve agent poisoning, that on your understanding of 18 the factual evidence given to this court, 19 Mr Perepilichnyy did not display those classic symptoms. 20 <b>A. That what I said, yes, and I would stand by that.</b> 21 Q. They include the secretions and the like -- 22 <b>A. Yes.</b> 23 Q. -- that I just described? 24 <b>A. Yes.</b> 25 Q. You therefore concluded that in your view it was</p> <p style="text-align: center;">Page 181</p>	<p>1 MR SKELTON: Thank you. 2 THE CORONER: No one? 3 All right, thank you very much. 4 <b>A. Thank you very much indeed.</b> 5 MR SKELTON: Sir, that concludes -- 6 THE CORONER: Can I just say. 7 Mr Beggs, I know your solicitors have forwarded 8 recently copies of ... 9 I want to raise it. 10 You have forwarded copies of articles which I think 11 it has subsequently been agreed have not been accurate 12 in terms of the reports they have given as to some of 13 the evidence in the Inquest. Mr Moxon Browne perfectly 14 understandably has, I think helpfully actually explained 15 how that may have come about but really what I did want 16 to say to you is we have the evidence we have had today 17 and is there anything more you want me to say or do 18 about that or not? 19 MR BEGGS: Well one would hope that the inaccuracies which 20 had been replete will abate almost immediately. 21 If I may say so, they could have been corrected many 22 weeks before this week based on the evidence, even from 23 last June but there does appear to be a will on the part 24 of some newspapers to correct their articles. 25 THE CORONER: I have seen some responses which have been</p> <p style="text-align: center;">Page 183</p>
<p>1 unlikely on the balance of probabilities that he was 2 killed by a nerve agent? 3 <b>A. That's correct, and I stand by that.</b> 4 Q. Does that conclusion apply to all forms of nerve agent, 5 including, for example, Novichok? 6 <b>A. Yes, if we are talking about the group of agents called 7 Novichok, then my knowledge of those would not change my 8 overall opinion that I expressed in June.</b> 9 Q. Widening your view, not simply to include nerve agents 10 but to include poisons more generally or a hostile 11 poisoning, leaving aside the issue of food poisoning. 12 Your view as expressed to the court last time was that 13 you couldn't rule it out as a possibility? 14 <b>A. No.</b> 15 Q. However, presented with the choice between a potential 16 cardiac cause, arrhythmic cardiac cause, or poisoning, 17 based on your analysis of the factual evidence, you took 18 the view that it was more likely that he died of natural 19 causes than was poisoned? 20 <b>A. Yes, because of the lack of evidence of a poisoning.</b> 21 Q. Do you stand by that conclusion? 22 <b>A. I do.</b> 23 Q. Do you have anything to add to the evidence you have 24 given today? 25 <b>A. No, I don't believe I do.</b></p> <p style="text-align: center;">Page 182</p>	<p>1 entirely in line with what you say. 2 MR BEGGS: Can we repeat our thanks to Mr Suter's efforts in 3 that regard as well, thank you. 4 THE CORONER: Yes, all right. 5 Ms Hill, I know we have to come back, I think 6 everybody is content that we read those paragraphs but 7 we can -- it may be tomorrow is the day, because we also 8 have just a little bit of work to do. There have been 9 in the course of correspondence, perfectly properly, 10 a number of issues and questions have been raised and we 11 just need to see where we are with those and resolving 12 them. Tomorrow is probably the time for that. 13 MS HILL: Certainly, sir, I would appreciate the time. 14 THE CORONER: If everybody is happy, there is your three 15 paragraphs to deal with, but anyway we can perhaps just 16 deal with that tomorrow. 17 MR SKELTON: We have some -- live. 18 MS HILL: If you don't mind, sir, I would rather roll up 19 that up with some further issues for tomorrow. It is 20 a related matter, so I would rather do that tomorrow. 21 THE CORONER: Absolutely, but not forgotten and all 22 understood. 23 MR SKELTON: Sir, we have some live evidence tomorrow, we 24 have some evidence to read and then we have a general 25 sweep up of where we are up to with our other</p> <p style="text-align: center;">Page 184</p>

1 investigations, some of which are drawing to  
 2 a conclusion.  
 3 THE CORONER: Yes, all right.  
 4 Thank you all very much. 10.00 tomorrow.  
 5 (4.11 pm)  
 6 (The Inquest adjourned until 10.00 am the following day)  
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