

| | |
|--|--|
| <p>1 Monday, 19 June 2017</p> <p>2 (10.30 am)</p> <p>3 MR SKELTON: Sir, our first witness today is</p> <p>4 Professor Cowan.</p> <p>5 THE CORONER: Yes.</p> <p>6 PROFESSOR DAVID COWAN (affirmed)</p> <p>7 Questions from MR SKELTON</p> <p>8 MR SKELTON: Professor Cowan, could you state your full name</p> <p>9 to the court, please.</p> <p>10 A. My name is David Anthony Cowan.</p> <p>11 Q. In your report, you describe your expertise as</p> <p>12 pharmaceutical toxicology?</p> <p>13 A. That is correct.</p> <p>14 Q. In particular you have an interest in mass spectrometry?</p> <p>15 A. Yes, for much of my career I have worked using mass</p> <p>16 spectrometry as an analytical technique.</p> <p>17 Q. Much of your work it appears is directed towards drugs</p> <p>18 testing, particularly in sport, is that correct?</p> <p>19 A. Yes, I am the director of the Drug Control Centre, which</p> <p>20 analyses samples collected from sports competitors.</p> <p>21 Q. To what extent do you work on poisons that kill human</p> <p>22 beings as opposed to improve performance?</p> <p>23 A. I do not look at the clinical effects of poisons but</p> <p>24 I do look at the biological effects of poisons, most of</p> <p>25 the time I am dealing with compounds that are prohibited</p> <p style="text-align: center;">Page 1</p> | <p>1 type of technique that is used and the kind of results</p> <p>2 that are produced and what one gains from those results.</p> <p>3 Firstly liquid chromatography, can you explain what that</p> <p>4 is in short terms?</p> <p>5 A. Maybe by way of preamble it is worth saying that the</p> <p>6 chromatography is coupled to this second part, the mass</p> <p>7 spectrometer, it is very important the two are connected</p> <p>8 to each other.</p> <p>9 Q. The LCMS, as we have been using for short.</p> <p>10 A. The reason I say that is because we will actually</p> <p>11 separate the components of a mixture in a liquid</p> <p>12 chromatograph. The time that the component comes out of</p> <p>13 the liquid chromatograph into the mass spectrometer is</p> <p>14 a very important piece of information.</p> <p>15 The liquid chromatograph itself consists of</p> <p>16 a column, it is a tube which is filled with particles,</p> <p>17 the surface of the particles are coated. Sometimes, as</p> <p>18 in this case, with an organic material that tends to</p> <p>19 dissolve materials like mixing things into a fat. The</p> <p>20 liquid that passes through the column will then try to</p> <p>21 remove those materials which are attached into the fatty</p> <p>22 layer and push it down the column.</p> <p>23 The stationary phase are the fatty layer in the tube</p> <p>24 and the liquid is pushing the material that comes out of</p> <p>25 the fat along the tube.</p> <p style="text-align: center;">Page 3</p> |
| <p>1 in support rather than looking more generally but from</p> <p>2 time to time I am asked to consider analysing samples</p> <p>3 collected from deceased individuals.</p> <p>4 Q. In terms of your expertise where it comes to particular</p> <p>5 plant toxins, plant poisons, do you have any particular</p> <p>6 expertise in that?</p> <p>7 A. No, I do not.</p> <p>8 Q. You defer to the experts from Kew when it comes to --</p> <p>9 A. I would consider Kew to be the experts.</p> <p>10 Q. Thank you. You have produced a report to the court. Do</p> <p>11 you have a copy of that in front of you?</p> <p>12 A. My report?</p> <p>13 Q. Yes. For reference it will be found in bundle 2,</p> <p>14 file 2, under tab 76. I am going to use the internal</p> <p>15 pagination.</p> <p>16 The report runs to 12 pages, although in fact behind</p> <p>17 it there are many many pages including 500 plus</p> <p>18 definitions which were very useful but thankfully not</p> <p>19 entirely relevant to this evidence today.</p> <p>20 Dr Kite, as you are probably aware, gave evidence</p> <p>21 last week and I believe you are aware of his evidence?</p> <p>22 A. Yes.</p> <p>23 Q. He explained the techniques to some extent but it might</p> <p>24 be helpful to hear from you because you also explain</p> <p>25 them at the beginning of your report. Basically the</p> <p style="text-align: center;">Page 2</p> | <p>1 The effect of that is called partitioning where,</p> <p>2 dependent on the chemical composition, the material will</p> <p>3 either stay longer in the fat or longer in the liquid.</p> <p>4 If it spends more time in the liquid, it will come out</p> <p>5 more rapidly. If it is more dissolved in the fat it</p> <p>6 will come out more slowly.</p> <p>7 These are the features that enable us to tell</p> <p>8 something about the structure of a compound, not in</p> <p>9 detail but in generality.</p> <p>10 Q. Then the mass spectrometry part?</p> <p>11 A. But then we put into the mass spectrometer, which</p> <p>12 sometimes I describe as a glorified weighing machine</p> <p>13 insofar as it can give us the mass of a whole molecule,</p> <p>14 that is one inherent part of a compound, the smallest</p> <p>15 part of the compound that we can consider and it can</p> <p>16 enable us either to simply give a mass to the nearest</p> <p>17 integer, for example carbon dioxide might be 44, or it</p> <p>18 can give us that mass far more accurately and tell us</p> <p>19 that it is CO2 for carbon dioxide.</p> <p>20 As we go up in the mass scale, if we have the mass</p> <p>21 to a sufficient degree of accuracy, we can get out the</p> <p>22 exact elemental composition of the compound that we are</p> <p>23 looking at. That is the compound that has come out or</p> <p>24 eluted from the liquid chromatograph.</p> <p>25 Q. What we are looking at here though is tandem mass</p> <p style="text-align: center;">Page 4</p> |

| | |
|--|--|
| <p>1 spectrometry, which gives us MS/MS data, could you 2 explain what that is, please?</p> <p>3 A. In the mass spectrometer we have to actually ionise the 4 molecule, we have to put either positive charge on it or 5 a negative charge.</p> <p>6 We do that usually by a technique called soft 7 ionisation, because what it tends to do is to give us 8 the whole molecule, generally with one mass unit figure, 9 but it gives us the whole intact molecule rather than 10 fragments. Sometimes we also want to see the fragments, 11 again using a common description I may say the arms and 12 legs of the molecule, breaking off bits and pieces of 13 the molecule. In the same way as one may break off the 14 handle of a cup and recognise that it came from a cup. 15 We might be able to knock off parts of the molecule that 16 will help us to define the whole structure of the 17 molecule.</p> <p>18 Q. How is that deduction made from the fragments?</p> <p>19 A. For example, if you lose 15 mass units, the only 20 normally conceived reason for that is a methyl group. 21 If it loses 18, the most common reason is loss of water.</p> <p>22 From that one can start to build up, not just that 23 elemental composition, the number of carbon, hydrogens, 24 oxygens, nitrogens in the molecule but also possible to 25 see where the different functional groups are attached</p> <p style="text-align: center;">Page 5</p> | <p>1 identity of the compound.</p> <p>2 Q. It approaches the identification from two angles to give 3 confirmatory -- to make you more confident about the 4 conclusion?</p> <p>5 A. The power of mass spectrometry is the vast amount of 6 information that it gives us.</p> <p>7 Q. Thank you. You make the point within your report and it 8 is towards the end and in fact the very last paragraph. 9 I just want to establish this right from the start, it 10 is paragraph 49, you say:</p> <p>11 "It is now highly unlikely, even with further 12 additional or different analysis, to be able to 13 determine the identity of this compound."</p> <p>14 I am talking about the compound found by Dr Kite, 15 which as you know has been the subject of quite some 16 discussion during the course of this Inquest. Why do 17 you take that view?</p> <p>18 A. Yes, so reading through the documentation that was given 19 to me, there seemed to be some knowns but a number of 20 unknowns as well. It was very clear that the sample now 21 is many years old. I am not clear exactly how the 22 sample had been stored, so whether there had been any 23 either enzymatic or chemical modification of the 24 original molecule, and also considering just how 25 difficult it is to look at a biological sample and to</p> <p style="text-align: center;">Page 7</p> |
| <p>1 to the molecule.</p> <p>2 Q. To what extent does the machine itself start to do the 3 calculations with the fragments to tell you what the 4 result is?</p> <p>5 A. I am not sure if I understood your question.</p> <p>6 Q. You put the data, you have data about the original mass 7 and you have data about the fragments and you then need 8 to draw conclusions from that data.</p> <p>9 A. If I describe MS/MS, which I think was your original 10 question, then we having formed the whole molecule, we 11 then collide the molecule into a gas and put energy into 12 it to make it break off the bits and pieces. By 13 breaking off those bits and pieces we now have the 14 ability to measure the mass or indeed the accurate mass 15 of the whole molecule and also the fragments.</p> <p>16 Q. The "accurate mass" is a term of art in your world for 17 the mass as empirically found by --</p> <p>18 A. Using accurate mass allows us to give that empirical 19 formula.</p> <p>20 Q. Sorry, I interrupted you. You were continuing to 21 describe how you process the data?</p> <p>22 A. It is very helpful if I can get the elemental 23 composition of the whole molecule and also the elemental 24 composition of the fragments because it helps to assure 25 me of the overall compound that I am looking at, the</p> <p style="text-align: center;">Page 6</p> | <p>1 actually get out the identity, that is not just the 2 elemental composition but what is the actual chemical, 3 how are those different elements combined into one 4 chemical structure.</p> <p>5 Q. Your view in conclusion is that it is highly unlikely at 6 this stage that one could be able to identify it 7 reliably from a scientific perspective?</p> <p>8 A. Exactly that.</p> <p>9 Q. May we turn then to what Dr Kite did find.</p> <p>10 The first issue of course, which you are aware of, 11 is whether or not this is a single molecule or a cluster 12 that has been found.</p> <p>13 A. Yes.</p> <p>14 Q. He found an original ion, C20H27N2O4.</p> <p>15 If you want to refer to your report you start to 16 talk about this on page 4.</p> <p>17 A. Page 4?</p> <p>18 Q. Yes.</p> <p>19 Eluting at 6.9 minutes.</p> <p>20 A. Thank you.</p> <p>21 Q. From that one can derive a molecular composition by 22 taking away a hydrogen atom?</p> <p>23 A. That's correct, yes.</p> <p>24 Q. You are happy with?</p> <p>25 A. Yes, that I am happy with that. I suppose I should be</p> <p style="text-align: center;">Page 8</p> |

| | |
|---|---|
| <p>1 exact and say you actually remove a proton. The reason</p> <p>2 I say that is accurate mass is so accurate the hydrogen</p> <p>3 atom and the proton have a very slight difference in</p> <p>4 mass, but I say that just to give to the court just how</p> <p>5 exact this technique can be.</p> <p>6 Q. Yes. Dr Kite said last week in evidence that having</p> <p>7 considered all of the data that he produced, and gone</p> <p>8 back to look at it --</p> <p>9 A. Yes.</p> <p>10 Q. -- he took the view that on balance he thinks it was</p> <p>11 a cluster rather than a single molecule.</p> <p>12 The reasons he gave were: the mathematical formula;</p> <p>13 the coelution time of the ions, they coelute at the same</p> <p>14 time; and the MS/MS spectrum which he found which he</p> <p>15 said didn't show intermediate ions, it simply broke down</p> <p>16 to 180 so you didn't find anything in between which</p> <p>17 might give you an idea that you are dealing with</p> <p>18 a cluster which is just simply broken as opposed to</p> <p>19 a different form of mass.</p> <p>20 Those were his conclusions. Could you give me your</p> <p>21 view on that issue, please?</p> <p>22 A. Yes. The difficulty I have with that -- it is</p> <p>23 a possibility, certainly -- and from what I read from</p> <p>24 the transcript, I saw in particular that in some of his</p> <p>25 experiments he started from a mass in the mass spectrum</p> <p style="text-align: center;">Page 9</p> | <p>1 Technically you call it a "dimer" when two molecules are</p> <p>2 joined together in a relatively loose complex, and when</p> <p>3 that happens one expects that it might break into single</p> <p>4 molecules as it goes through the liquid chromatograph.</p> <p>5 If it does that it is unlikely you will see a very sharp</p> <p>6 single peak. It will tend to show two but in that case</p> <p>7 I would expect to see the dimer, both molecules, and the</p> <p>8 single molecule in the mass spectrum and he doesn't</p> <p>9 inform us about that.</p> <p>10 That was one of the reasons why I didn't form a very</p> <p>11 firm view as he had.</p> <p>12 Q. I detected that you were tentatively deferring to him</p> <p>13 when it came to the likelihood or not. You can form</p> <p>14 a view about the possibility. Do you defer to his</p> <p>15 expertise with plant alkaloids on the likelihood or can</p> <p>16 you not express a view on that?</p> <p>17 A. The way we would do a forensic identification is to</p> <p>18 obtain either if we have it or to try to obtain,</p> <p>19 suitable reference material and then run</p> <p>20 contemporaneously the sample and a standard and look to</p> <p>21 see equivalence or lack of equivalence of retention time</p> <p>22 and equivalence or lack of equivalence of the mass</p> <p>23 spectrum.</p> <p>24 If they are equivalent then that is both retention</p> <p>25 time, the full molecule and the fragmentation under</p> <p style="text-align: center;">Page 11</p> |
| <p>1 from 250 in order to get very good mass accuracy but</p> <p>2 when he reduced that lower mass that gave him the</p> <p>3 opportunity to observe the 180 in more detail.</p> <p>4 Q. Yes.</p> <p>5 A. I think that was one important element that persuaded</p> <p>6 him.</p> <p>7 I think the other one, as you say, because there was</p> <p>8 little fragmentation between this bigger species and</p> <p>9 180 --</p> <p>10 Q. Yes.</p> <p>11 A. -- he was persuaded that rather than having</p> <p>12 a symmetrical molecule joined together it was only one</p> <p>13 half of that whole molecule.</p> <p>14 I could not form a strong as strong a conclusion as</p> <p>15 he did, but I do accept that he is experienced with</p> <p>16 using his instrument, I am merely looking at the data</p> <p>17 provided to me in.</p> <p>18 Q. To some extent he was going on intuition as well and</p> <p>19 I think he quite liked the mathematical simplicity of</p> <p>20 what he had found, which from his view as someone who is</p> <p>21 experienced as putting plant materials through mass</p> <p>22 spectrometry for years was significant, to find that,</p> <p>23 particularly the peak, the particular peak he found,</p> <p>24 isolated peak, he found of significance?</p> <p>25 A. Yes. I could also see the persuasion of that.</p> <p style="text-align: center;">Page 10</p> | <p>1 MS/MS, data like that would give us beyond reasonable</p> <p>2 doubt that that was the substance. That is what -- it</p> <p>3 would normally be accepted by scientists and by the</p> <p>4 courts.</p> <p>5 Where we don't have that reference material then we</p> <p>6 can start to make some assumptions and deductions,</p> <p>7 especially by looking at the data as Dr Kite had.</p> <p>8 I think it is very helpful that because of his</p> <p>9 knowledge and experience of looking at plant alkaloids</p> <p>10 he would know generally how those molecules behave.</p> <p>11 Q. Yes, he also I think said you could use a different</p> <p>12 solvent to see if --</p> <p>13 A. That would be my preferred way if I wanted to actually</p> <p>14 separate a dimer from a monomer, for example it might</p> <p>15 dimerise in water but less dimerise in a more organic</p> <p>16 more lipid type of solvent like ether.</p> <p>17 Q. Yes. We have of course been drawn into the debate about</p> <p>18 the molecule or the cluster by Dr Kite's analysis.</p> <p>19 Can I now sort of move on to try and work out and</p> <p>20 put in context whether in fact that is an important</p> <p>21 differentiation for the purposes of this Inquest.</p> <p>22 First of all, I think you say in your report that</p> <p>23 from your own knowledge or checking on the database that</p> <p>24 there are 4,979 compounds with the composition of what</p> <p>25 we hypothesise is the large molecule, that is</p> <p style="text-align: center;">Page 12</p> |

| | |
|--|--|
| <p>1 paragraph 14 of your report, page 3.</p> <p>2 A. Thank you.</p> <p>3 Q. Could you describe where you get that data from and</p> <p>4 explain what kind of compounds you are referring to?</p> <p>5 A. Yes. The Royal Society of Chemistry very helpfully</p> <p>6 collate a database of compounds and one can readily</p> <p>7 search that database, putting in a variety of</p> <p>8 information.</p> <p>9 In this case, what I put in was the elemental</p> <p>10 composition and I asked the database to tell me how many</p> <p>11 compounds it could find, it had on its database, that</p> <p>12 were different compounds with that same elements</p> <p>13 composition. These will be from a whole variety of</p> <p>14 chemical sources.</p> <p>15 It is not specific to plant alkaloids it is just on</p> <p>16 the array of permutations that one could get from that</p> <p>17 elemental composition, of joining the carbon, hydrogens,</p> <p>18 nitrogens and oxygens together in a variety of different</p> <p>19 ways.</p> <p>20 Q. These are actual compounds as opposed to theoretical?</p> <p>21 A. These are actual compounds, not theoretical they are</p> <p>22 actual compounds.</p> <p>23 Q. Do they include synthetic compounds?</p> <p>24 A. They will do definitely, yes.</p> <p>25 Q. Can one say anything about the break down of the 4,000</p> <p style="text-align: center;">Page 13</p> | <p>1 Q. The reason there are fewer is it a trite point, that you</p> <p>2 are actually dealing with fewer atoms in the structure</p> <p>3 so --</p> <p>4 A. Yes, going back to my original example of carbon dioxide</p> <p>5 44, typically there are four different compositions you</p> <p>6 can have at that mass and as you go up the number</p> <p>7 increases exponentially, it just increases and increases</p> <p>8 more and more rapidly.</p> <p>9 Q. Can you give any evidence or is it for the plant</p> <p>10 specialists about the plant alkaloids, particularly when</p> <p>11 it comes to gelsemium?</p> <p>12 A. The benefit of looking at a plant alkaloid is you would</p> <p>13 know generically the type of compounds the particular</p> <p>14 plant produces, so one will look for related compounds</p> <p>15 generally. That is what would be known with respect to</p> <p>16 a particular plant, so if one is looking at gelsemium,</p> <p>17 one would expect to find certain alkaloids.</p> <p>18 I hope I answered your question.</p> <p>19 Q. Yes, although I think a point which Professor Simmonds</p> <p>20 no doubt does make in her written evidence is one does</p> <p>21 not know all the alkaloids necessarily from this</p> <p>22 particular plant?</p> <p>23 A. As I see, that is the problem. I don't know what had</p> <p>24 been taken so I have an unknown situation, how to</p> <p>25 identify the different components I have in the samples</p> <p style="text-align: center;">Page 15</p> |
| <p>1 plus, almost 5,000, in terms of naturally occurring ones</p> <p>2 or ones found --</p> <p>3 A. No, I didn't search to actually group it in that way.</p> <p>4 It is more a chemical database than one about biological</p> <p>5 activity that. I am not sure how readily one could do</p> <p>6 that sub search.</p> <p>7 Q. What about toxicity, can one say anything about that,</p> <p>8 even at the most basic level of generalisation?</p> <p>9 A. Yes, some of the compounds can be totally innocuous, one</p> <p>10 could take large quantities without having any harmful</p> <p>11 effect or it could be that some of them will be toxic</p> <p>12 but I did not search the database to look for that.</p> <p>13 Q. Does the same answer with a different figure apply to</p> <p>14 the so-called cluster molecule --</p> <p>15 A. Yes.</p> <p>16 Q. -- which I think you give data on as well as being 3,346</p> <p>17 different compounds.</p> <p>18 A. Yes.</p> <p>19 Q. Exactly the same analysis?</p> <p>20 A. It's exactly the same search that I did, I put in the</p> <p>21 two different elements compositions and that was the</p> <p>22 number that were available on the database today.</p> <p>23 There probably are more permutations than are down</p> <p>24 there but these are the ones that are listed on the</p> <p>25 database.</p> <p style="text-align: center;">Page 14</p> | <p>1 provided to me. I think that was the task faced by Kew.</p> <p>2 Q. Yes. Can I take you to some data that really we have</p> <p>3 been focusing on over the last few days, particularly</p> <p>4 with Dr Kite, in respect of the four isomers that he</p> <p>5 analysed. You will find this in bundle 1 at tab 46,</p> <p>6 please.</p> <p>7 MR MOXON BROWNE: Page?</p> <p>8 MR SKELTON: Page 276, it is attachment 2.</p> <p>9 A. Which tab?</p> <p>10 Q. Tab 46, it should be the last page in there.</p> <p>11 A. Yes.</p> <p>12 Q. I would like to get your views really on the</p> <p>13 significance of this finding when it comes to ruling out</p> <p>14 whether or not the chemicals found in gelsemium elegans</p> <p>15 and gelsemium sempervirens, any of them are the same as</p> <p>16 the compound found in Mr Perepilichny's stomach, that</p> <p>17 is the key question I think you are able to address.</p> <p>18 A. Yes, I found that helpful insofar as it persuaded me</p> <p>19 that the alkaloids like gelsemicine, which are</p> <p>20 considered to be extremely toxic, actually appears in</p> <p>21 the mass spectrum of the data produced by Kew is correct</p> <p>22 in what he has in his table --</p> <p>23 Q. Yes.</p> <p>24 A. -- and particularly that it is different from this</p> <p>25 earlier eluting peak that came from the deceased. That</p> <p style="text-align: center;">Page 16</p> |

4 (Pages 13 to 16)

| | |
|--|---|
| <p>1 is that they are different compounds.</p> <p>2 Q. Would you be able to explain by reference to the data</p> <p>3 that we have seen here, so in particular the values that</p> <p>4 you can see -- we are looking for example at isomer 4,</p> <p>5 you see the mass to ion ratio although as I understood</p> <p>6 it that was a term that one should not necessarily be</p> <p>7 using but perhaps I have overread the appendices to your</p> <p>8 report but just M/Z data. Then there is the retention</p> <p>9 time and then there is the MS ...</p> <p>10 A. Yes, I beg your pardon, first we have this M+H, the</p> <p>11 protonated ion, with this exact mass, this was the basis</p> <p>12 of Dr Kite's search. I am looking for this alkaloid,</p> <p>13 I know what its elemental composition is, just searching</p> <p>14 through all of the retention data, how often do I find</p> <p>15 that peak? That was the general basis of his search,</p> <p>16 whenever he found that elemental composition then he</p> <p>17 noted that data.</p> <p>18 When he went on to do MS/MS, so if we look at the</p> <p>19 right-hand isomer 4 at the bottom of the table, so for</p> <p>20 gelsemium sempervirens root bark, seed, fruit wall and</p> <p>21 so on.</p> <p>22 Then we see good similarity in the data, the</p> <p>23 accurate mass, that is the 359.19 something, something.</p> <p>24 Q. Yes.</p> <p>25 A. The retention time also being similar, much later than</p> <p style="text-align: center;">Page 17</p> | <p>1 out something on MS/MS whether you need to start looking</p> <p>2 at the retention time. You gave an answer, well, that</p> <p>3 does make sense in the context of it probably being</p> <p>4 gelsemicine.</p> <p>5 A. Sorry, yes.</p> <p>6 THE CORONER: Can you hold that thought. I will tell you</p> <p>7 why. Because I am going to break off so people can do</p> <p>8 it as they wish or don't, but there is a minute's</p> <p>9 silence at 11.00.</p> <p>10 All right, so we will just break now.</p> <p>11 (10.55 am)</p> <p>12 (A short adjournment)</p> <p>13 (11.10 am)</p> <p>14 THE CORONER: Sorry, Mr Skelton.</p> <p>15 MR SKELTON: Thank you, sir.</p> <p>16 Professor Cowan, you were slowly but inexorably</p> <p>17 taking us through your analysis of isomer 4 in</p> <p>18 particular. I think you had started to deal with the</p> <p>19 mass, which you were explaining had some variation</p> <p>20 page 276.</p> <p>21 A. Thank you.</p> <p>22 Q. Under tab 46.</p> <p>23 A. Looking at isomer 4, the right-hand column in the table</p> <p>24 on page 276, I see that the size of the protonated whole</p> <p>25 molecule is shown as 359.1977, 359.1966, a slight</p> <p style="text-align: center;">Page 19</p> |
| <p>1 the peak observed from the stomach contents of the</p> <p>2 deceased.</p> <p>3 Q. Yes.</p> <p>4 A. Also the MS/MS data being significantly different,</p> <p>5 insofar as it is showing a large 328 rather than a 180</p> <p>6 that he obtained from the stomach content.</p> <p>7 Q. Yes. In his evidence, Dr Kite sort of put a hierarchy</p> <p>8 to some extent -- perhaps "hierarchy" is not quite the</p> <p>9 right word but the analysis went through several stages</p> <p>10 in terms of identifying a compound. I think he put the</p> <p>11 MS/MS data actually ultimately above retention time as</p> <p>12 being of significance. If you have checked the MS/MS</p> <p>13 data you don't need to move on to the retention time if</p> <p>14 there is not a match?</p> <p>15 A. Yes, I agree with the value of the MS/MS data but I see</p> <p>16 that he says "Probably gelsemicine", he doesn't say</p> <p>17 definitively it is gelsemicine.</p> <p>18 MR MOXON BROWNE: Which one is probably gelsemium?</p> <p>19 MR SKELTON: Isomer 4, I think you mean isomer 4 where you</p> <p>20 see on the table he says "Probably gelsemicine", which</p> <p>21 is a judgment he has made.</p> <p>22 Is what you meant, Professor Cowan?</p> <p>23 A. Sorry, I didn't follow.</p> <p>24 Q. In your last answer I asked you about the sort of</p> <p>25 whether MS/MS starts as one of the -- if you can rule</p> <p style="text-align: center;">Page 18</p> | <p>1 variation in that in the subsequent numbers but</p> <p>2 relatively small, which is consistent with the accuracy</p> <p>3 of a mass spectrometer of that type. The sort of</p> <p>4 variation that one would expect to see were it still to</p> <p>5 have the elemental composition as put forward by</p> <p>6 Dr Kite, that is the C20H27, or H28, N2O4, H28 insofar</p> <p>7 as it is protonated.</p> <p>8 Q. Yes.</p> <p>9 A. Furthermore, the retention time, that is the time that</p> <p>10 this peak came out of the liquid chromatograph into the</p> <p>11 mass spectrometer, that characteristic time has some</p> <p>12 variability to it, the biggest being of the order of</p> <p>13 11.51 through to 13.03. Quite a lot of variation in</p> <p>14 this case but variation depends on the equipment used,</p> <p>15 the pumping system, how accurate it is in pumping the</p> <p>16 liquid through the liquid chromatograph. Dr Kite would</p> <p>17 know the variability of his instrument and what was</p> <p>18 acceptable and what wasn't to classify it in that way,</p> <p>19 to say, "This is the same component that I am looking at</p> <p>20 that goes into the mass spectrometer".</p> <p>21 Q. Can one safely say that that difference is not</p> <p>22 significant but the difference between that range and</p> <p>23 6.9 is significant?</p> <p>24 A. Exactly that, it clearly is nowhere near the region of</p> <p>25 6.9 which says to me it has to be a different compound.</p> <p style="text-align: center;">Page 20</p> |

5 (Pages 17 to 20)

| | |
|---|---|
| <p>1 Q. The MS/MS?</p> <p>2 A. That is helpful in addition insofar as using 359 as what</p> <p>3 we call the precursor ion, that is the only signal from</p> <p>4 the first part of the mass spectrometer will let go into</p> <p>5 the second part of the mass spectrometer to break up the</p> <p>6 species that we are looking at is 359.</p> <p>7 It means that for example the 328 that we are</p> <p>8 observing here in the MS/MS has to have come from 359,</p> <p>9 with a slight plus/minus to it because of what is the</p> <p>10 plus minus around 359, is it one mass unit or two mass</p> <p>11 units away from that?</p> <p>12 We have the time, we have the mass of the whole</p> <p>13 molecule and we have the fragment.</p> <p>14 Q. Just to clarify, why the fragment is different from the</p> <p>15 stomach compound fragment, could you explain that for</p> <p>16 me?</p> <p>17 A. Yes, I have found in my notes the report by Dr Kite of</p> <p>18 27 October 2016, but I haven't managed to locate that in</p> <p>19 the bundle at the moment.</p> <p>20 Q. Let me see if I can find it for you.</p> <p>21 The start of 2, I am told, unless I have broken my</p> <p>22 bundle up. 27 October.</p> <p>23 A. 2016, yes. It is in answer to question 2 put to</p> <p>24 Dr Kite.</p> <p>25 Q. If it is the same one I am looking at ...</p> <p style="text-align: center;">Page 21</p> | <p>1 molecule that derives from that ion, is the same as any</p> <p>2 of the compounds found in the samples of gelsemium</p> <p>3 sempervirens and gelsemium elegans that Kew tested?</p> <p>4 A. I would say it is not reasonable to consider that the</p> <p>5 compound found in the stomach content is the same as</p> <p>6 that from the extracts of gelsemicine species, yes.</p> <p>7 Q. Whether or not isomer 4 is or is not probably</p> <p>8 gelsemicine is for the plant specialists to opine on?</p> <p>9 A. It is a refinement, yes, sir.</p> <p>10 Q. Can I come back to the issue of cluster ions, please.</p> <p>11 My understanding is that you, from your position as</p> <p>12 a sort of mass spectrometist, take the view it is</p> <p>13 certainly a possibility. That you defer to a degree to</p> <p>14 Dr Kite because he has a specialist in plant alkaloids</p> <p>15 and the mass spectrometry associated with that and he</p> <p>16 conducted the experiment or the experiments using the</p> <p>17 machinery at the time and viewed the data.</p> <p>18 Are you able to say ultimately that whether or not</p> <p>19 it is probable is for Dr Kite to take a view on, you</p> <p>20 having recognised it as possibility?</p> <p>21 A. Are you talking about the monomer or dimer theory.</p> <p>22 Q. Yes.</p> <p>23 A. I still cannot be persuaded exactly that it necessarily</p> <p>24 is one or the other, whilst I acknowledge Dr Kite's</p> <p>25 expertise on alkaloids, this small molecule does not</p> <p style="text-align: center;">Page 23</p> |
| <p>1 A. It is numbered 113 in my document.</p> <p>2 Q. Under tab 49.</p> <p>3 A. Thank you.</p> <p>4 Q. Do you have that?</p> <p>5 A. Thank you.</p> <p>6 Page 368.</p> <p>7 Q. Thank you.</p> <p>8 A. Here we see the MS/MS of 359, but in the data provided</p> <p>9 here we also have the accurate mass of the 180, which is</p> <p>10 helpful to give us the elemental composition of 180.</p> <p>11 Q. Yes.</p> <p>12 A. What I see is no -- I have lost my place. I see there</p> <p>13 is an absence of that ion at 328, so whilst 328 was the</p> <p>14 major ion seen from isomer 4, on page 276 --</p> <p>15 Q. Yes.</p> <p>16 A. -- it is absent from the spectrum given on page 368, but</p> <p>17 instead we see 180. It says to me they must be very</p> <p>18 different compounds.</p> <p>19 Q. And the retention data backed that up as well?</p> <p>20 A. Backed up by the retention data, exactly that.</p> <p>21 Q. Thank you.</p> <p>22 In conclusion from your perspective as a mass</p> <p>23 spectrometist, you can say that you can rule out the</p> <p>24 possibility that whatever was found in</p> <p>25 Mr Perepilichny's stomach, the unknown ion and unknown</p> <p style="text-align: center;">Page 22</p> | <p>1 appear to be an alkaloid.</p> <p>2 Q. You say that why?</p> <p>3 A. A much lower mass than you normally see for a majority</p> <p>4 of alkaloids, not all, some are small.</p> <p>5 Q. How does that relate to the question which is whether or</p> <p>6 not it is a cluster molecule or not?</p> <p>7 A. Sorry, there is some noise.</p> <p>8 Q. How does that relate to -- the fact that you take the</p> <p>9 view it may not be an alkaloid, how does that relate to</p> <p>10 the issue of whether or not it is a cluster?</p> <p>11 A. Sorry, I was just talking about Dr Kite's specialty, you</p> <p>12 said his instrument and his knowledge.</p> <p>13 Q. I understand. I may have interrupted you. You said you</p> <p>14 recognised it was a possibility but you are unable to</p> <p>15 say from your perspective whether or not he is right</p> <p>16 that it is probably a cluster ion.</p> <p>17 A. From the data provided to me, I was not persuaded beyond</p> <p>18 reasonable doubt that it was a monomer or a dimer.</p> <p>19 Q. What about on the balance of probabilities, which is</p> <p>20 what the court may be concerned with when it comes to</p> <p>21 this issue?</p> <p>22 A. I don't have a view.</p> <p>23 MR SKELTON: Thank you.</p> <p>24</p> <p>25</p> <p style="text-align: center;">Page 24</p> |

6 (Pages 21 to 24)

| | |
|---|--|
| <p>1 Questions from MR MOXON BROWNE 2 MR MOXON BROWNE: Professor, I represent Legal & General, 3 the life insurers. 4 May I take you to the conclusions of your report, 5 which is at paragraph 45, internal pagination 11. 6 I have a bundle reference Experts 2, 640.11. Do you 7 have that? 8 A. Do you mind just repeating that, which -- 9 Q. Yes, I want to take you to the conclusions of your 10 report. 11 A. My report, yes, I have that. 12 Q. You could look at paragraph 45 of your report -- 13 A. Thank you. 14 Q. -- you could look at internal pagination 11 of 12 of 15 your report -- 16 A. Yes. 17 Q. -- or you could look at 640.11 to assist my colleagues. 18 A. I see, yes. 19 Q. There we have the conclusion, starting at 45, with 20 agreement with Dr Kite that he is correct to ascribe the 21 formula C₂₀H₂₆ et cetera to 359.1965. That is 22 an important and significant conclusion, is it not, 23 because that weight of molecules could be represented by 24 some quite different chemical formula involving quite 25 different chemicals. It is a matter of mathematics and</p> <p style="text-align: center;">Page 25</p> | <p>1 A. No, I couldn't say except five. There may be some more 2 botanical materials giving that elemental composition. 3 Q. Yes, well I am sure that is right but according to the 4 Dictionary of Natural Products, there are in fact only 5 five. 6 A. I understand, yes. 7 Q. You accept that? 8 A. I accept that, yes. 9 Q. The vast majority of these chemicals that share that, 10 potentially share that formula, are man-made products, 11 synthetic products? 12 A. I beg your pardon, I see. Yes, I was just being 13 pedantic on the point. 14 If I have understood the question correctly, it is 15 considering gelsemium alkaloids, how many of those 16 alkaloids may give this accurate mass, this elemental 17 composition? 18 Q. No, my question was that of the vast array of chemicals 19 which answer to this formula, almost all of them are 20 synthetic. That was my question? 21 A. That I couldn't say, I am not sure that is correct. 22 Some of them could be biological, they could be from 23 animals, they could be from a whole variety of origins. 24 Q. But for one reason or other have not found their way 25 into the Dictionary of Natural Products?</p> <p style="text-align: center;">Page 27</p> |
| <p>1 technicality to say, "Using my skill, I think that is 2 the right formula"? 3 A. I tried to make just that point earlier on in my witness 4 statement. 5 Q. Yes. 6 A. Yes. 7 Q. You are in complete agreement about that and, as I say, 8 that excludes a whole raft of other chemicals being 9 involved here? 10 A. Considering that peak, you are correct, it excludes 11 other compounds. 12 Q. Yes. 13 You have told us that databases tell you that that 14 formula is the same formula for a very large number of 15 substances, measured in the thousands. 16 A. That elemental composition can be obtained from 17 a multiplicity of different compounds. 18 Q. Yes, and that of course is right. You mentioned that 19 that included, in answer to a question from Mr Skelton, 20 some synthetic substances? 21 A. Yes, indeed. 22 Q. I think that doesn't quite paint the picture does it 23 because, of those thousands, they are all synthetic 24 except five, which are found in the Dictionary of 25 Natural Products.</p> <p style="text-align: center;">Page 26</p> | <p>1 A. Ah, I understand. 2 Q. Correct? 3 A. That's correct, yes. 4 Q. Thank you. 5 In fact, if you want to examine the likelihood of 6 any chemical with this formula being something other 7 than gelsemium, the way to do it is very 8 straightforward, it doesn't involve tapping into your 9 computer C₂₀H₂₆N₂O₄, it involves tapping into your 10 computer the exact mass, 359, you have it to five places 11 of decimals, 19647. That will tell you straight away 12 what other substances in the world, be they natural or 13 be they synthetic, answer to that exact measurement. 14 A. You could use that approach certainly. 15 Q. I am suggesting to you it would much more productive 16 than simply pointing to 3,000 or 4,000 different 17 products because there are only three or four that match 18 this. 19 A. Correct. Yes, I agree with that. 20 Q. The lists go on and on but they are put in order of 21 closeness to the exact mass, so you can reach the stage 22 when you say it is very, after about 10, you say it is 23 really very improbable. At lunchtime you could tell us 24 whether this accurate mass, what it represents and you 25 could ask yourself whether there is any probability that</p> <p style="text-align: center;">Page 28</p> |

7 (Pages 25 to 28)

| | |
|---|--|
| <p>1 any of these substances other than gelsemium products 2 might have found their way into Alexander's stomach, an 3 easy thing to do?</p> <p>4 A. I don't follow the question.</p> <p>5 Q. Sorry?</p> <p>6 A. I haven't followed your question.</p> <p>7 Q. Yes, what I am suggesting to you is that if you tapped 8 into your computer the exact mass, 359.19647, you would 9 straight away be given the substances that have that 10 exact weight and there are very, very few of them.</p> <p>11 A. What has been published to date on that database for 12 gelsemium and other related alkaloids of natural 13 product.</p> <p>14 Q. No, not natural products, because we are now looking at 15 the possibility that it might be an analogue. I am 16 suggesting to you that that theory, that it is not 17 a natural product but is a synthetic product, could be 18 checked, not by tapping in the formula, which isn't 19 helpful, but to tap in the accurate mass.</p> <p>20 A. It would come to the same answer.</p> <p>21 Q. Well, there are a vast number of chemicals with varying 22 weights which have this formula. I am suggesting that 23 what we ought to be looking at are those chemicals that 24 have exactly the same weight and that there are not very 25 many. Is that right or not?</p> <p style="text-align: center;">Page 29</p> | <p>1 coelution is a precondition of the --</p> <p>2 A. I agree with that, yes.</p> <p>3 Q. -- conclusion?</p> <p>4 A. Yes.</p> <p>5 Q. It is right, isn't it, that you have seen no data in 6 relation to the work done in 2013, when this 7 unidentified ion was first found, that there was any 8 coelution?</p> <p>9 A. I don't think I heard the last bit of what you said, 10 that there was not coelution or --</p> <p>11 Q. That you have seen no data to support the proposition 12 that, when work was done in 2013 --</p> <p>13 A. Yes.</p> <p>14 Q. -- and the conclusion was then -- no mention of 15 dimerisation then --</p> <p>16 A. I understand.</p> <p>17 Q. -- no data indicating coelution that you have seen?</p> <p>18 A. Correct, yes.</p> <p>19 Q. Yes. That is one of the reasons why this is not 20 a conclusion that you are very confident about. No 21 data.</p> <p>22 A. No data, correct, yes.</p> <p>23 Q. The last of the three conclusions, whichever is the 24 exact molecular species, it is not one of the gelsemium 25 alkaloids analysed contemporaneously by Kew, that is</p> <p style="text-align: center;">Page 31</p> |
| <p>1 A. As I see it, I would come out with the same answer if 2 I put an elemental composition, because that would give 3 me that mass.</p> <p>4 Q. Do you agree with the proposition that by feeding into 5 a computer "359.19647" you will be told what substances 6 in the natural and man-made world answer that weight, 7 and there are not very many?</p> <p>8 A. I don't think I agree with that. I think against the 9 database you are describing I would accept it, but 10 against the range of natural compounds existing in the 11 world, that is more difficult to answer.</p> <p>12 Q. You are familiar with the ChemSpider database I expect?</p> <p>13 A. Yes.</p> <p>14 Q. All right, well we will leave that.</p> <p>15 The second conclusion relates to the possibility or 16 probability of dimerisation. You have expressed 17 yourself very clearly on that in answer to questions 18 from Mr Skelton.</p> <p>19 I think you would agree that the possibility of 20 dimerisation depends on the coelution of the ions which 21 are said to have joined together to form a cluster. You 22 have to have coelution as a precondition?</p> <p>23 A. If I see a lack of coelution, then I would conclude it 24 is a different compound.</p> <p>25 Q. Yes. I think I am right in saying that the detection of</p> <p style="text-align: center;">Page 30</p> | <p>1 carefully and if I may respectfully say so very 2 accurately expressed, it is the same conclusion that 3 Professor Simmonds reached, she is absolutely certain 4 that what was extracted from the stomach is not the same 5 as anything that was abstracted from any gelsemium plant 6 she looked at.</p> <p>7 A. Correct.</p> <p>8 Q. That is her conclusion and your conclusion, and it is, 9 if I may say so, obviously right.</p> <p>10 But you are not saying and nobody could say, 11 I suggest, on the basis of the work that has been done, 12 that the stomach contents ion didn't come from gelsemium 13 that, is a very different and much wider proposition?</p> <p>14 A. Are you saying am I excluding the possibility that what 15 was found in the stomach could not have come or did not 16 come from gelsemium.</p> <p>17 Q. I am suggesting to you that the conclusion that what was 18 found in the stomach has not been matched by anything 19 found coming from a gelsemium plant is not the same as 20 saying that what was found in the stomach didn't come 21 from a gelsemium plant. Two different propositions?</p> <p>22 A. Well it is a very remote possibility but it is 23 a possibility.</p> <p>24 Q. We will look in a moment if we may at whether it was 25 remote or not.</p> <p style="text-align: center;">Page 32</p> |

| | |
|---|--|
| <p>1 Thank you.</p> <p>2 Can we next look at what gelsemium looks like as</p> <p>3 a trace, so that we know what that beast is. I think if</p> <p>4 you look in the first of the experts' bundles, at</p> <p>5 page 261, we can see what work Kew did in late 2015 on</p> <p>6 a number of gelsemium plants.</p> <p>7 I think perhaps if we start at page 255, the</p> <p>8 beginning of that report which is dated November 2015,</p> <p>9 we will see straight away sample numbers 25492,</p> <p>10 gelsempervirens roots, is ascribed to each of a good</p> <p>11 number of samples. We have a number and then we can</p> <p>12 tell by referring back to this table where a particular</p> <p>13 sample has come from.</p> <p>14 If we just look at this, so we can --</p> <p>15 A. Thank you.</p> <p>16 Q. -- bear it in mind, the numbers 25492 through to 98 are</p> <p>17 various parts of gelsemium sempervirens plants. Whereas</p> <p>18 the higher numbers, 25459 going through to 25506, are</p> <p>19 from elegans?</p> <p>20 A. Yes.</p> <p>21 Q. Then if we go forward, if you would, to page 258, we see</p> <p>22 the thumbnails for each of those samples. In answer to</p> <p>23 questions posed by the coroner to the scientists at Kew,</p> <p>24 they identified, they were asked: which of these do you</p> <p>25 say is gelsemicine? They have identified particularly</p> <p style="text-align: center;">Page 33</p> | <p>1 A. That is my conclusion.</p> <p>2 Q. That is your conclusion and you express it very strongly</p> <p>3 and clearly.</p> <p>4 I think we see another elegans root bark in the next</p> <p>5 letter (e) on page 261, this time eluting at 12.77,</p> <p>6 359.1979?</p> <p>7 A. Sorry, I have lost the place.</p> <p>8 Q. It is letter (e) -- we are on page 261.</p> <p>9 A. Yes.</p> <p>10 Q. Letter (e) down the right-hand side shows us where --</p> <p>11 A. Thank you, yes.</p> <p>12 Q. -- in the table we are. This time it is elegans, last</p> <p>13 time it was sempervirens root bark this time it is</p> <p>14 elegans root bark, but we are still with the root bark</p> <p>15 and now we are eluting at 12.77 and it is 359.1979.</p> <p>16 I think it is suggested that is probably gelsemicine too</p> <p>17 although the different elution times might suggest,</p> <p>18 might it not, that what we are looking at are two</p> <p>19 closely associated compounds rather than exactly the</p> <p>20 same thing?</p> <p>21 A. I am going on the basis of what Dr Kite told us on this</p> <p>22 and as I explained earlier it depends on the pumping</p> <p>23 system used on the instrument.</p> <p>24 Q. Yes. These tests were all done on the same equipment at</p> <p>25 more or less the same time, as I understand it.</p> <p style="text-align: center;">Page 35</p> |
| <p>1 25491, that is going down the column as the second one,</p> <p>2 and 25492, and you will see that that shows a substance</p> <p>3 with an accurate mass of roughly 359.2 eluting in, one</p> <p>4 case at 11.89 and in the other at 11.51. Those are the</p> <p>5 candidates that they point at, both as it happens from</p> <p>6 the root bark of a gelsemium plant.</p> <p>7 We see the characteristics, just to pick up the true</p> <p>8 accurate mass rather than the rounded figure, if you go</p> <p>9 forward to page 261, you will see at the top on</p> <p>10 page 261, letter (a) down the side just to guide you, we</p> <p>11 have our familiar stomach contents eluting at 690 with</p> <p>12 359.1965 that, the familiar stomach contents and then we</p> <p>13 can disregard urine 1 and urine 2 and then we have our</p> <p>14 gelsempervirens root bark, which is 25491, eluting at</p> <p>15 11.89 and the accurate mass is 359.1977.</p> <p>16 Your point is that eluting at 11.89 is miles away</p> <p>17 from 6.90 so they cannot be the same, in other words,</p> <p>18 the stomach contents is not gelsemicine. That is right,</p> <p>19 isn't it?</p> <p>20 A. That's correct.</p> <p>21 Q. In particular you make the point that the difference in</p> <p>22 elution time, the much longer elution time observed when</p> <p>23 these roots were looked at in 2015, couldn't be</p> <p>24 accounted for by what I think you call drift, by</p> <p>25 vagaries in the use of the equipment?</p> <p style="text-align: center;">Page 34</p> | <p>1 A. Yes.</p> <p>2 Q. Do you think that the example from sempervirens at (d)</p> <p>3 and the example from elegans at (e) are the same</p> <p>4 compound or do you think they are biogenetic mutations</p> <p>5 which are very similar but not exactly the same?</p> <p>6 A. I can't really give a firm opinion on that, on the basis</p> <p>7 as I said I don't really know their equipment. With the</p> <p>8 equipment I use in my lab, I insist on a much tighter</p> <p>9 retention time when identifying a substance.</p> <p>10 Q. You attach importance to retention times?</p> <p>11 A. For my work in sport we have particular requirements</p> <p>12 that I think that Dr Kite does not have to follow. As</p> <p>13 I pointed out earlier, I was relying on Dr Kite's</p> <p>14 conclusions insofar as he was looking at the same</p> <p>15 compound.</p> <p>16 Q. Can we go back to the thumbnail just to get a general</p> <p>17 picture of what was discovered in 2015, page 258. It is</p> <p>18 not very conveniently laid out because they are not</p> <p>19 numbered and it is not said where they come from. But</p> <p>20 if you count down the first column, five, we see 11.88,</p> <p>21 we have another 359.2, so again in the 11-, 12-minute</p> <p>22 range we have a 359.2. My note says that is a gelsemium</p> <p>23 sempervirens root again. I am looking back a couple of</p> <p>24 pages to pick up where I get that information from, but</p> <p>25 you don't have to look at that.</p> <p style="text-align: center;">Page 36</p> |

| | |
|---|---|
| <p>1 Then the next one down, second from the bottom, 2 11.88, again 359.2. We have consistent elution of these 3 obviously either identical or very similar substances in 4 the 11- or 12-minute range.</p> <p>5 A. There is a difficulty with elution time, insofar as when 6 you have other material coming out, as you would with 7 a complex extract, it can cause slight shifts to 8 retention time. So comparing one sample with another, 9 one is very likely to see some shift in retention.</p> <p>10 Q. Yes, I am not drawing your attention to the difference, 11 I am drawing your attention to the similarity. Of you 12 get a bit of drift, I understand that, but you cannot 13 drift all the way from 6.9 minutes to 11/12, that is 14 impossible, as you have said?</p> <p>15 A. Correct.</p> <p>16 Q. Which is what enables us to say with some confidence 17 that what was found in the stomach contents is not the 18 same as what was found here?</p> <p>19 A. That was the basis of my conclusion, correct.</p> <p>20 Q. Yes, thank you.</p> <p>21 Let's see what was found back in -- this is 2015, 22 let's go back now if we may to 2013. For that purpose 23 we must go to this same bundle, experts' bundle 1, but 24 this time at page 236. You are in the same bundle but 25 at page 236.</p> <p style="text-align: center;">Page 37</p> | <p>1 Q. Four, okay.</p> <p>2 You will see that these peaks are ascribed accurate 3 masses of 359.1960 and 359.1958 eluting at between 4 8.68 minutes and 9.75, whatever else these are, they are 5 plainly not gelsemicine which we have just been looking 6 at?</p> <p>7 A. Sorry, you said these are plainly not gelsemicine?</p> <p>8 Q. Yes. We have just been looking at gelsemicine which has 9 a different accurate mass and a very different elution 10 time, up to the 11/12-minute mark?</p> <p>11 A. I don't follow why you make that assertion.</p> <p>12 First of all, the accurate mass has a plus/minus on 13 it, as I said earlier, and the equipment they were using 14 it was five parts per million.</p> <p>15 Q. Yes.</p> <p>16 A. Secondly, as I believe Dr Kite has explained elsewhere, 17 the difference in retention time across the years was 18 because of change amongst other things of his liquid 19 chromatograph column.</p> <p>20 Q. You have made the point, if I may say so, 21 Professor Cowan, that you cannot believe that what was 22 found in Mr Perepilichny's stomach contents at 6.90 can 23 be the same as what was found in 2015 from a gelsemium 24 plant because the elution time is so different?</p> <p>25 A. I may have misunderstood your point. On the data shown</p> <p style="text-align: center;">Page 39</p> |
| <p>1 In the middle of the table there, figure 6, you see 2 at the top this relates to a chromatogram of an analysis 3 of a gelsemium sempervirens root. We see in the middle 4 there, between the two arrows, two major peaks with 5 elution times ascribed to them and two minor bumps.</p> <p>6 It was the opinion of Dr Kite that that certainly 7 represented -- I think he said certainly or very 8 probably represented two compounds and that the bumps 9 might or might not be separate compounds. Does that 10 accord with your own opinion?</p> <p>11 A. You are saying the peak at 8.68 and the peak at 9.75 as 12 being separate compounds and the fairly broad peaks 13 sitting small to the left of each might be related, is 14 that what you just said?</p> <p>15 Q. I was saying that I understand Dr Kite to have said that 16 the two sharp peaks which have elution times ascribed to 17 them are compounds and are separate compounds, different 18 from one another, and he was less sure -- was not 19 asserting with any confidence -- that the two bumps also 20 represented separate compounds, he was not sure about 21 that.</p> <p>22 A. I see, yes, I would expect them to be separate compounds 23 as well.</p> <p>24 Q. Are we looking at two or four in your view?</p> <p>25 A. I think more likely than not we are looking at four.</p> <p style="text-align: center;">Page 38</p> | <p>1 in figure 6 on page 236, if the question is the peak at 2 6.90 being different from the peaks at 8.68 and 9.75, 3 I would say yes it is different.</p> <p>4 Q. No, I am not putting that.</p> <p>5 A. You are not saying that, okay.</p> <p>6 Q. I am employing parity of reasoning, I am saying if your 7 argument is that what was found in the stomach contents 8 at 6.9 units cannot be the same as what was found 11, 9 12 minutes from the root bark in 2015 because the 10 elution times are so different, it cannot be accounted 11 for by drift or anything like that, then exactly the 12 same reasoning must apply to the other thing that was 13 found in 2013, in other words this substance here.</p> <p>14 I will be corrected if I am wrong but I do not think 15 that Dr Kite suggested that the equipment used on the 16 two different occasions was so different that it could 17 possibly account for this. He, like you, was talking 18 about the possibility of drift but not these massive 19 differences.</p> <p>20 A. I am afraid I still haven't properly understood. 21 I think you are asking me the peaks at 8.68, 9.75 could 22 they be the same as 11.89?</p> <p>23 Q. Yes.</p> <p>24 A. Okay, thank you. I would say it is extremely unlikely 25 they are the same.</p> <p style="text-align: center;">Page 40</p> |

| | |
|--|---|
| <p>1 Q. I think we are getting there, Professor Cowan. 2 If Kew are right as they have said in answer to 3 questions from the coroner, until told 4 Professor Simmonds whose evidence we cannot know, but if 5 she is right that what eluted at between 11 and 6 12 minutes in 2015 was gelsemicine, it follows that what 7 we are looking at here is very likely not gelsemicine? 8 A. I understand. 9 Q. And that there are not one but in your view four 10 compounds with an accurate mass of 359.something, four 11 compounds eluting which are not, because of the elution 12 time, gelsemicine? 13 A. I think that is a reasonable conclusion, yes. 14 Q. Thank you. 15 I think you are aware that "the literature", this is 16 the phrase that Dr Kite used, simply wide range of 17 references, the literature indicates that of the 18 substances associated with gelsemium which answer to 19 an accurate mass, 359.1965, only gelsemicine is found in 20 both sempervirens and elegans, whereas the four isomers 21 are only found in elegans. Do you follow? 22 A. I follow the reasons, yes. 23 Q. Yes. 24 What we have here are, in your view, four substances 25 which appear to be isomers of gelsemicine but which are</p> <p style="text-align: center;">Page 41</p> | <p>1 A. I think it is a question of likelihood, I would say at 2 the moment more likely than not, that these are all 3 gelsemium alkaloids. 4 Q. Yes. I mean they look, because of the accurate mass, 5 and because we know they came from the root of 6 a gelsemium plant, they obviously are associated with 7 gelsemicine and that plant, but they are not in fact 8 gelsemicine or any of the named isomers, it is something 9 else? 10 A. Trying to be helpful, I would suggest that when these 11 databases are put together, one will analyse some plant 12 extracts, using a reasonable amount of material, one 13 would do additional analytical work and then one would 14 put the data that one has acquired on the database, 15 which is not the same as the experiments Kew have done 16 on this occasion, they have looked at some samples that 17 they have obtained and shown what it was they observed 18 in it. I think at their own acceptance they have simply 19 said "probably gelsemium", they have not said 20 definitively gelsemicine. 21 Q. There is no criticism of anybody here, I just want to 22 see what these things really mean when you look at them. 23 A. Yes. 24 Q. The net result of the work done in 2013 was that 25 an unidentified compound eluted at 6.9 minutes --</p> <p style="text-align: center;">Page 43</p> |
| <p>1 not gelsemicine, discovered it would seem by Kew simply 2 by carrying out this experiment in 2013. They are not 3 supposed to be there, are they, according to the 4 literature? It is only supposed to be one, gelsemicine, 5 we know it is not gelsemicine, we have just dealt with 6 that, and we have got four we have to account for. 7 A. May I just say this back in words to make sure I have 8 understood you correctly in my own words. 9 I think what you are suggesting to me is that the 10 Dictionary of Natural Products has only four or five 11 different compounds of a particular elemental 12 composition but perhaps here we have found something 13 additional to that? 14 Q. Well, four things. 15 A. Yes. 16 Q. That seems to be the case? 17 A. I think that is a reasonable suggestion. 18 Q. It is not in any way improbable, because there are 19 literally dozens of alkaloid compounds in the gelsemium 20 species and they are finding new ones all the time? 21 A. That would be what I would expect and I believe that has 22 been accepted by Dr Kite from what I have been reading. 23 Q. That does seem to be an accepted proposition, that it is 24 not helpful to assume that these substances can only be 25 X, Y or Z. No one really knows.</p> <p style="text-align: center;">Page 42</p> | <p>1 A. Yes. 2 Q. -- with an accurate mass which, if it was a natural 3 compound, matched gelsemicine and its isomers, if it was 4 a natural compound? 5 A. I am having difficulty with the term "natural compound". 6 Are you saying from a gelsemium when you say natural? 7 Q. No, that would be circular. I am saying if it was 8 a natural compound -- 9 A. Natural as appearing in nature? 10 Q. Yes, and therefore qualifying to appear in the database 11 for natural products, it is associated with gelsemium. 12 A. I think I follow you. 13 I think the problem with that natural database is 14 the botanical origin that are ha looked at. There are 15 far more compounds -- there are plants still being 16 discovered. 17 Q. Yes, as we have just seen, not plants but also 18 compounds. 19 Anyway, I think it is perhaps semantics, I think 20 I have perhaps made the point. You have something which 21 I am suggesting, if it is a natural compound, looks as 22 if it is associated with gelsemium. I am also saying if 23 it is not a natural compound, by tapping into a database 24 you could very quickly find what it is, if it is 25 something that is only found on the anti-fouling paint</p> <p style="text-align: center;">Page 44</p> |

| | |
|---|---|
| <p>1 on the bottom of oceangoing liners, then we could assume</p> <p>2 it was unlikely to be found in Alexander's stomach. You</p> <p>3 can apply some common sense?</p> <p>4 A. It is unlikely to, yes.</p> <p>5 Q. Let's look and see what that was matched against. What</p> <p>6 Professor Simmonds did was to take a plant of the</p> <p>7 gelsemium species, gelsemium sempervirens, that happened</p> <p>8 to be in her herbarium at Kew and to take one part of</p> <p>9 it, which was the root and extract something from it</p> <p>10 which, as I think we have just seen, it is impossible to</p> <p>11 say what it was apart from the fact that it is</p> <p>12 associated with gelsemium.</p> <p>13 She found, for the reasons that you understand and</p> <p>14 that the coroner clearly very well understands -- what</p> <p>15 she found in the root is not the same as what was found</p> <p>16 in the stomach?</p> <p>17 A. Correct.</p> <p>18 Q. Whether what was found in the stomach might exist in the</p> <p>19 leaves of sempervirens or in the seeds of sempervirens</p> <p>20 or indeed in the sempervirens plant grown at a different</p> <p>21 altitude or in different weather conditions than obtain</p> <p>22 at Kew, one knows not, to say nothing of what might be</p> <p>23 found in a different species such as elegans or indeed</p> <p>24 rakinii. All she could say was, "It is not the same as</p> <p>25 what I found in the root of this one"?</p> <p style="text-align: center;">Page 45</p> | <p>1 of the Inquest getting underway.</p> <p>2 At question 4:</p> <p>3 "Is it correct that Dr Rice's identification [that</p> <p>4 should of course be Dr Kite, he has got him mixed up</p> <p>5 with somebody else] identification of C20H27 was</p> <p>6 an accurate match for the following plant alkaloids in</p> <p>7 addition to 11 methoxy gelsedine [that's gelsemicine]</p> <p>8 ..."</p> <p>9 Then they are listed A to D, and she answers:</p> <p>10 "Yes, according to the Dictionary of Natural</p> <p>11 Products there are five alkaloids with that formula. We</p> <p>12 didn't have access to the standards of all five</p> <p>13 compounds so don't know whether they would have all</p> <p>14 eluted at 6.9 minutes."</p> <p>15 She is making the point that since she didn't have</p> <p>16 access to the standard reference material for the</p> <p>17 isomeric, she couldn't say whether or not they might</p> <p>18 naturally what was found in the stomach. You would</p> <p>19 agree with that?</p> <p>20 A. I would agree with that.</p> <p>21 Q. Yes.</p> <p>22 Then she says, last sentence of that:</p> <p>23 "Our analysis of gelsemium sempervirens showed that</p> <p>24 none of the compounds in that species eluted at 6.9</p> <p>25 minutes."</p> <p style="text-align: center;">Page 47</p> |
| <p>1 A. That's correct, yes.</p> <p>2 Q. To extrapolate more than that at that stage would have</p> <p>3 been wrong?</p> <p>4 A. I am not sure I would go as far as saying wrong.</p> <p>5 Q. Sorry?</p> <p>6 A. You said it would be wrong?</p> <p>7 Q. It would be wrong to try to build more into it than that</p> <p>8 rather limited finding?</p> <p>9 A. I would agree with you entirely if I wanted to say</p> <p>10 definitely what it was I identified. If I wanted to say</p> <p>11 more likely than not to exclude something, then I would</p> <p>12 use a lower standard.</p> <p>13 Q. Yes.</p> <p>14 I want next to look at some further information that</p> <p>15 Professor Simmonds gave about the results of the work</p> <p>16 that we have just looked at, in answer to questions</p> <p>17 posed by the senior coroner for Surrey and see to what</p> <p>18 extent you agree or disagree with what she then said.</p> <p>19 I expect you will then agree with most of it I am sure.</p> <p>20 That we see in the same bundle 1 at page 245. That</p> <p>21 starts, do you see these questions were posed on</p> <p>22 15 December 2014. For reasons which no doubt</p> <p>23 Professor Simmonds will explain they were not answered</p> <p>24 until May 2015, as far as I am aware, which was</p> <p>25 virtually on the eve, just for the coroner's chronology,</p> <p style="text-align: center;">Page 46</p> | <p>1 There has been a bit of misspeaking there, hasn't</p> <p>2 there, because I think we are agreed that all she could</p> <p>3 say was that she hadn't found it in the root and she</p> <p>4 couldn't say at that stage that none of the compounds in</p> <p>5 that species eluted because she simply didn't know. If</p> <p>6 she said, "None of the compounds we found in that</p> <p>7 species ..." That would be accurate you would agree</p> <p>8 with it?</p> <p>9 A. I believe she has used a short form here of as you said,</p> <p>10 on the sample that she analysed.</p> <p>11 Q. You would agree with that sentence if we insert the</p> <p>12 words "none of the compounds that we found", but you</p> <p>13 would not agree with it if you take out the words "that</p> <p>14 we found"?</p> <p>15 A. "Our analysis of gelsemium sempervirens showed that none</p> <p>16 of the compounds in that species eluted at 6.9 minutes</p> <p>17 ..."</p> <p>18 Was her statement.</p> <p>19 Q. There are many, many, many compounds in a gelsemium</p> <p>20 sempervirens plant, in the leaves, the seeds and so on.</p> <p>21 What Professor Simmonds found was that the substance</p> <p>22 that she located in the root didn't elute at 6.9</p> <p>23 minutes. I am suggesting to you that that is all she</p> <p>24 found and it doesn't follow that none of the compounds</p> <p>25 in the species, those that might be found in the leaves</p> <p style="text-align: center;">Page 48</p> |

| | |
|--|---|
| <p>1 and -- would similarly not have eluted at that time?</p> <p>2 A. Let me please paraphrase, if you are putting to me that</p> <p>3 perhaps a compound, perhaps an alkaloid coming from</p> <p>4 gelsemium species could have an alkaloid, of the</p> <p>5 structure C₂₀H₂₇N₂O₄, is that a possibility? I would</p> <p>6 agree it is a possibility, however remote, and I would</p> <p>7 consider it to be remote based on the literature and the</p> <p>8 alkaloids that Kew have looked at, not only in their</p> <p>9 early result but also in their later work.</p> <p>10 Q. Then the questions went on:</p> <p>11 "Can you confirm that the isobarics ..."</p> <p>12 Which is of course a synonym for "isomerics".</p> <p>13 A. In this context it is the same.</p> <p>14 Q. Yes:</p> <p>15 "The isobarics listed at A to D above [that is</p> <p>16 gelselegine and so on at the top of the page] have been</p> <p>17 found in elegans but not in sempervirens."</p> <p>18 That was the point that we were looking at a moment</p> <p>19 ago. She says, and I am sure this is right:</p> <p>20 "Today these compounds have been recorded in</p> <p>21 elegans."</p> <p>22 She is not saying that that is necessarily the end</p> <p>23 of the story?</p> <p>24 A. Correct.</p> <p>25 Q. You would agree with that?</p> <p style="text-align: center;">Page 49</p> | <p>1 question that the coroner asked Professor Simmonds.</p> <p>2 "Does the presence of the ion in the stomach at</p> <p>3 autopsy oblige the conclusion that at some time prior to</p> <p>4 his death the deceased had ingested something containing</p> <p>5 that compound"?</p> <p>6 A. Ah okay.</p> <p>7 Q. She says, "Yes, the data would suggest that".</p> <p>8 A. Yes, I think the problem is semantics, that is</p> <p>9 a question of compound or elemental composition. The</p> <p>10 compound is what you take of course, an elemental</p> <p>11 composition is carbon, hydrogen, oxygen, nitrogen of</p> <p>12 what you took.</p> <p>13 Q. We can cross out unidentified compound there and the</p> <p>14 question, to put in simple language: must this have been</p> <p>15 something he has eaten? She seemed to say yes, I was</p> <p>16 wondering if you agree with that?</p> <p>17 A. I think that is the likelihood, it was something that</p> <p>18 had been eaten, yes.</p> <p>19 Q. Yes.</p> <p>20 Then in question 8 you see what she is saying about</p> <p>21 the limitations of her work, material from sempervirens</p> <p>22 had been ingested, we didn't find any evidence of this.</p> <p>23 She is not excluding it, she is just saying we didn't</p> <p>24 find it?</p> <p>25 A. Correct, yes.</p> <p style="text-align: center;">Page 51</p> |
| <p>1 A. I agree with that, yes.</p> <p>2 Q. Then the coroner asks:</p> <p>3 "Can you identify whether the tests carried out by</p> <p>4 Dr Kite on extracts from the root have excluded the</p> <p>5 conclusion that the ion found by him might have been</p> <p>6 an isobaric of gelsemicine, for example gelselegine</p> <p>7 derived from the ingestion by the deceased of elegans or</p> <p>8 an extract from it?"</p> <p>9 In other words, you have made your points about</p> <p>10 sempervirens but how about the possibility it has come</p> <p>11 from elegans. She says:</p> <p>12 "The work undertaken by Dr Kite was not</p> <p>13 an exhaustive analysis of all potential toxins."</p> <p>14 Then over the page she says why she chose the roots.</p> <p>15 Then 7 I would like your view on. The coroner</p> <p>16 asked:</p> <p>17 "Does the precedence of the ion in the deceased's</p> <p>18 stomach at autopsy oblige the conclusion that at some</p> <p>19 time prior to his death the deceased had ingested some</p> <p>20 substance containing that compound?"</p> <p>21 She answered:</p> <p>22 "Yes, the data would suggest that."</p> <p>23 Do you agree with that conclusion?</p> <p>24 A. Do you mind repeating the question there?</p> <p>25 Q. Yes, well it is not really my question it is but the</p> <p style="text-align: center;">Page 50</p> | <p>1 Q. Then we asked for details about gelsemium having been</p> <p>2 suspected of being used in homicide, and she gives</p> <p>3 details about that. She also says that it is correct</p> <p>4 that the most recent reports of the use of gelsemium in</p> <p>5 Russian and Chinese homicide have referred to elegans</p> <p>6 rather than sempervirens.</p> <p>7 Then at 12:</p> <p>8 "Could the compounds be detected from the sample of</p> <p>9 Mr Perepilichnyy's stomach contents have come from</p> <p>10 species of gelsemium other than gelsemium sempervirens</p> <p>11 such as elegans?</p> <p>12 "Yes, this is an option that could be considered,</p> <p>13 especially saying that elegans is a known toxic plant."</p> <p>14 Just for the coroner's chronology and understanding</p> <p>15 the background to this case, this was all discussed on</p> <p>16 I think 17 May at a PIR at which the press attended and</p> <p>17 the contents of Dr Simmonds's report was discussed by</p> <p>18 the various counsel and was reported by the press. That</p> <p>19 helps you to understand how that reporting may have</p> <p>20 arisen. I am just mentioning that to help the coroner</p> <p>21 with the chronology.</p> <p>22 Broadly you agree with that, there was more work to</p> <p>23 do looking at elegans and sempervirens different parts</p> <p>24 of the plants. She said she thought there was more work</p> <p>25 to do and indeed more work was done?</p> <p style="text-align: center;">Page 52</p> |

| | |
|--|---|
| <p>1 A. Indeed, yes.</p> <p>2 Q. We then go forward from May 2015 when these answers were</p> <p>3 given, the Inquest was adjourned, not the time now to</p> <p>4 discuss why but it was adjourned and went off I think</p> <p>5 until, well, ultimately a series of adjournments until</p> <p>6 today.</p> <p>7 Then in the autumn, late autumn -- there having been</p> <p>8 apparent difficulties with the equipment to do with</p> <p>9 circuit boards -- those promised tests were done and we</p> <p>10 have seen what has happened with those numerous</p> <p>11 thumbnails involving both elegans and sempervirens and</p> <p>12 different parts of both those plants. If we could just</p> <p>13 very briefly go back and look at those and then we can</p> <p>14 move on, we need for that to go to 261 I think. Yes.</p> <p>15 A. Yes.</p> <p>16 Q. This is Dr Kite I think putting forward what he</p> <p>17 considered I think to be the most relevant of the</p> <p>18 results. He has as the marker at the top 6.90, 359.1965</p> <p>19 then one substance eluting at 11.89, 359.1977. It is</p> <p>20 not five points per million off, it is 12 points per</p> <p>21 million off what was found in the stomach and more than</p> <p>22 that, 15 or 20 points off what was attributed to</p> <p>23 gelsemium in 2013. It is not just the elution time, it</p> <p>24 is the accurate mass is way off?</p> <p>25 A. Correct, yes.</p> <p style="text-align: center;">Page 53</p> | <p>1 initial analysis are different from the compounds picked</p> <p>2 up in the later analysis?</p> <p>3 Q. Yes, if you look at the thumbnail on page 258, you can</p> <p>4 see -- the coroner can make up his own mind whether that</p> <p>5 is comprehensive or whether it is just a selection -- at</p> <p>6 all events there is nothing there that seems to have</p> <p>7 anything to do with what was found in the root bark in</p> <p>8 2013, that I can see.</p> <p>9 A. I would rather not comment at this time about that</p> <p>10 without considering it more carefully.</p> <p>11 Q. Okay, well we will move on from there.</p> <p>12 So far --</p> <p>13 THE CORONER: Can you just explain why --</p> <p>14 A. Because we have this chronology difficulty, and I need</p> <p>15 to understand how they actually match their peaks.</p> <p>16 I just don't want to take this point too far based on</p> <p>17 what I have seen.</p> <p>18 MR MOXON BROWNE: I want to just put to you in summary, if</p> <p>19 you can comment -- if you don't feel you can comment</p> <p>20 please say -- that by the time the tests had been</p> <p>21 completed in 2015, looking back at the results from</p> <p>22 2013, when we had an identified substance that had been</p> <p>23 extracted from Alexander's stomach, from the viewpoint</p> <p>24 of late 2015, instead of having just one unidentified</p> <p>25 substance with a 359.1965 weight, we have five.</p> <p style="text-align: center;">Page 55</p> |
| <p>1 Q. Yes. What may be a different substance also found in</p> <p>2 the root of elegans at 12.77, again 359.1979, way off</p> <p>3 what was assumed to be gelsemicine back in 2013.</p> <p>4 Then we have against letter (f) two substances</p> <p>5 eluting, one at 8.97 and one at 13.34, 359.1980 and</p> <p>6 359.1981, so from the accurate mass they look to be</p> <p>7 associated but they are eluting at very different times.</p> <p>8 We have got two more compounds there, have we not?</p> <p>9 Yes.</p> <p>10 I think if we can summarise the position as at late</p> <p>11 2015 --</p> <p>12 THE CORONER: Sorry, are you happy with all of that?</p> <p>13 A. Yes, I accept all of that, yes.</p> <p>14 MR MOXON BROWNE: I think the position at the end of 2015 is</p> <p>15 that having made a good trawl of what you can get out of</p> <p>16 both elegans and sempervirens, and from different parts</p> <p>17 of the plant, no match was found, even a remote match,</p> <p>18 with what was found in Alexander's stomach?</p> <p>19 A. Correct.</p> <p>20 Q. Nor was anything found that remotely matched what was</p> <p>21 found in the sempervirens root in 2013?</p> <p>22 A. I just need to check I have understood your second</p> <p>23 point.</p> <p>24 Q. Yes.</p> <p>25 A. Is your point that the compounds picked up in the</p> <p style="text-align: center;">Page 54</p> | <p>1 A. I agree with you on that point.</p> <p>2 Q. What they are and what they have or don't have to do</p> <p>3 with gelsemicine is not something that you or I think</p> <p>4 probably Professor Simmonds can be very confident about?</p> <p>5 A. Sorry, did you say what they have --</p> <p>6 Q. What they have to do is gelsemicine?</p> <p>7 A. We don't know which if any of them may be gelsemicine.</p> <p>8 Q. No.</p> <p>9 That is about what the possibilities are. I now</p> <p>10 want to just explore with you, and then we can stop,</p> <p>11 whether there is any evidence that it is actually</p> <p>12 probable that the unidentified substance is connected</p> <p>13 with gelsemium. I want you to help with that.</p> <p>14 A. Yes.</p> <p>15 Q. Because if the theory is this probability is wrong, we</p> <p>16 need to know. Do you understand?</p> <p>17 For that purpose I would like to look at the work</p> <p>18 that was done comparatively recently by Dr Kite when he</p> <p>19 retested the stomach contents. For that I would like to</p> <p>20 look, please, at the test in 2016. We need to look at</p> <p>21 that in the second of the expert's bundles and we have</p> <p>22 to move to another bundle. Expert's bundle 2 at</p> <p>23 page 368. I will get rid of that.</p> <p>24 A. I have bundle 2, which tab did you say?</p> <p>25 Q. I don't have tabs but I have a page number which is 68.</p> <p style="text-align: center;">Page 56</p> |

| | |
|--|--|
| <p>1 I am told it is tab 49. 2 How Lucas can tell that by looking at a computer 3 I don't know. 4 368, I hope is that right. 5 Would you excuse me a moment, sir, I am just trying 6 to find where I am. Yes, I am on the right page, that 7 is good. 8 What is done quite recently in 2016 is that very 9 kindly the Kew people went back and did a fresh test on 10 the stomach contents. The first thing is that they 11 found a substance in that second test which was, I am 12 going to suggest, pretty obviously the same thing that 13 they had found in 2013. We see that on page, I think, 14 369, it is above figure 4 and it is the second spectra 15 down, the second data down, which shows a peak emerging 16 at 6.39, 359.1960. 17 A. Yes. 18 Q. We are off a little bit on the elution time, we can 19 easily put that down to drift, that is not a problem in 20 saying it is the same given the passage of time and so 21 on. 22 We are a little bit off on the accurate mass but we 23 are well within five parts per million, and so the 24 conclusion of Dr Kite was that that is the same thing. 25 I think you would agree with that?</p> <p style="text-align: center;">Page 57</p> | <p>1 different. Coincidentally similar but a different 2 beast. 3 I just want to concentrate on the size of the 4 fragment. It produces a fragment at 180.1020, new 5 information which we hadn't had before. 6 Now we look and see what happened when the 7 substances were eluting. We see on the table above 8 figure 4 that you get the ion 359.1960, but at the same 9 time, eluting at the same moment, that is 6.39, you get 10 an ion 180.1016. It is that coelution that has 11 encouraged Dr Kite to say what we could be looking at 12 here is dimerisation, it is the coelution of 180.1016 13 and 359.1960 which says what we could be looking at here 14 is a cluster. Right? 15 A. Sorry, were you saying that is what led him to the 16 conclusion? 17 Q. Think it is not the only thing I think but it encouraged 18 him to conclude that we might be looking at a cluster, 19 that he has coelution of an ion which if doubled will 20 give you the right answer. 21 A. Sorry, I am not clear about the logic at the moment. I 22 have a chromatographic peak and I think the question 23 being asked is, is it 179 plus 1 or is it double that 24 amount plus 1. 25 Q. No. What I am drawing your attention to is the fact</p> <p style="text-align: center;">Page 59</p> |
| <p>1 A. That is reasonable, yes. 2 Q. Reasonable. That tells us that there is something 3 there, it is still sitting there, after all those years, 4 saying, "What am I? I haven't gone away". And he found 5 it again. 6 This time he was able, at the request of the 7 coroner, to look at matters in a little more detail. 8 The first thing he did was to give us data for the 9 I think accurate mass of -- sorry, he subjected it to 10 electronic collision energy and got a major fragment? 11 A. He conducted tandem MS/MS, he fragmented the molecule 12 and then obtained an accurate mass on the 180, that 13 previously he just put as 180. 14 Q. Yes, but this time he was able to weigh it -- 15 A. More accurately. 16 Q. We see on page 368 that he gets 180.1020. 17 368 at the top, 180.1020, which I understand to 18 be -- he says above that: 19 "The accurate mass of the fragment was measured at 20 M/Z 180.1020." 21 That is new information, he hadn't done that in 22 2013. 23 A. I hesitate because I was looking on the subsequent page, 24 when it is 180.1016. 25 Q. We will come to that. I think we will find that is</p> <p style="text-align: center;">Page 58</p> | <p>1 that when the stomach contents were tested again in 2 2016, our friend from 2013 popped out again and we see 3 that at 6.39 minutes? 4 A. Yes. 5 Q. It is 359.1960. 6 At the same time as that popped out, eluted, we got 7 an ion of 180.1016, we see that above. That is called 8 coelution, because it happens at the same moment? 9 A. It may be a question of terminology. We would normally 10 say coelution if two different compounds come out at 11 exactly the same time. The signal is actually 12 concurrent, which leads us to believe it is coming from 13 the same chemical compound. 14 Q. Yes, and then he has given us information as well on 15 this table that also at 6.39 something came out that 16 weighed 360.1996. 17 A. Thank you. 18 Q. There is quite a lot happening at 6.39 minutes. You 19 have three different things happening? 20 A. That is the power of mass spectrometry; you see a lot of 21 information. 22 Q. Yes, what I want to ask you is anybody looking at this 23 would, I suggest, be struck by the similarity between 24 the accurate mass of the fragment the major fragment 25 that was found from Alexander's stomach contents in</p> <p style="text-align: center;">Page 60</p> |

| | |
|---|---|
| <p>1 2013, let's say 180.1020 and the elution of an ion at 2 6.39 of 180.1016, they are within four parts per 3 million. There would seem to be a connection between 4 the two?</p> <p>5 A. Yes, indeed, yes.</p> <p>6 Q. Can you explain what that is or is it just 7 a coincidence?</p> <p>8 A. I would two possibilities.</p> <p>9 There is a remote possibility that two different 10 compounds come out at exactly the same time or more 11 likely than not it is just one compound that comes out 12 at that time and its mass spectrum contains both the 13 whole molecule and fragments.</p> <p>14 The other proposition being put here is that we are 15 seeing a dimeric peak point, with two molecules put 16 together, so 179 plus H is the 180 and then two by 179 17 plus H is the 359.</p> <p>18 Q. Can we just look at the first of those?</p> <p>19 A. Yes.</p> <p>20 Q. I think you were saying, if I followed, that what might 21 have been happening at 6.39 minutes is that you get the 22 ion 359.1960 and at the same time a fragment comes out?</p> <p>23 A. Yes, but what is going through the liquid chromatograph 24 is a compound, it is not the monomer or the dimer, it 25 has to be the dimer if it is a dimer or that bigger</p> <p style="text-align: center;">Page 61</p> | <p>1 A. They are very different process that are going on.</p> <p>2 Q. But they have the same result?</p> <p>3 A. Insofar as being able to see it or not see it, I guess 4 one could say it is the same or similar, but to take 5 a compound and -- if your thesis is, could the peak at 6 180 be a metabolite? I would say I don't see any 7 evidence for that.</p> <p>8 Q. No. No, I haven't got a thesis, I am just trying to 9 understand.</p> <p>10 A. Okay.</p> <p>11 Q. It could be but you don't have any evidence for that?</p> <p>12 A. We don't know what this peak is at 6.9 minutes.</p> <p>13 Q. If it isn't a metabolite, what is the other explanation 14 for it being so similar to the fragment?</p> <p>15 A. Well, the assumption, or one assumption, is it is 16 a dietary constituent that we don't know what it is, 17 something that he has eaten at some time, either 18 knowingly or unknowingly.</p> <p>19 Q. Just to complete the picture, I think we are left with 20 what looks like a coincidence between the size of the 21 fragment and the size of the ion that eluted, for which 22 might be explanations which are technical.</p> <p>23 A. Yes.</p> <p>24 Q. I just want to put a third step into it, which might be 25 presented to put another coincidence. I want to take</p> <p style="text-align: center;">Page 63</p> |
| <p>1 molecule if that is the case.</p> <p>2 Q. Can a compound such as 359.1965 fragment inside the 3 body, in other words can it metabolise so as to produce 4 a fragment?</p> <p>5 A. When a compound metabolises, then more often than not 6 you put an oxygen on the molecule, it gets a bit bigger, 7 sorry, I will speak up.</p> <p>8 When a compound is metabolised by the body, more 9 often than not you get components attached to it like 10 an oxygen in particular or sometimes a sugar. You can 11 get groups taken off from the compound, particularly -- 12 I am trying not to be too technical in my response. 13 Sometimes the molecule will break up into parts, that's 14 correct, it is a possibility that that will occur.</p> <p>15 Q. I am just going to pause you there and remind you of 16 some of the evidence from Dr Kite. We were talking 17 about why there didn't seem to be any evidence that 18 sorrel had been recovered from the various samples that 19 were analysed from the contents of Mr Perepilichny's 20 digestive tract. If I understood him correctly he was 21 saying that he thought they would fragment or metabolise 22 in the body so that they would be difficult to 23 recognise. That indicated to me that this process of 24 fragmentation, which can be induced by electrical 25 energy, can also happen naturally?</p> <p style="text-align: center;">Page 62</p> | <p>1 you to the Nardin paper which I think we looked at and 2 when we have done that we are nearly finished. We will 3 find that in the third I think of the experts' core 4 bundles at page 715.</p> <p>5 715 will enable us to ascertain that this is from 6 the Journal of Mass Spectrometry, which is a peer 7 reviewed and very well-regarded journal. I am told it 8 is in bundle 2, so I have misled you. Anyway, it is 9 page 715 in the top right-hand corner.</p> <p>10 THE CORONER: Do you have that? It is divider 87.</p> <p>11 MR MOXON BROWNE: I know you had to do an awful lot of work 12 in a very short space of time, did you have 13 an opportunity to glance at this article?</p> <p>14 A. I have looked at this paper.</p> <p>15 Q. Did you read it?</p> <p>16 A. I beg your pardon?</p> <p>17 Q. Did you read it? I know you were provided with it, 18 I wondered whether you had a chance to read it?</p> <p>19 A. I did review it a while ago now.</p> <p>20 Q. We will take the questions slowly.</p> <p>21 Looking at the title on page 715, we see they are 22 using high resolution mass spectrometry orbitrap. 23 I have certainly heard the word "orbitrap" used in 24 context with the work done at Kew, is this comparable?</p> <p>25 A. It is comparable. The orbitrap is a high resolution</p> <p style="text-align: center;">Page 64</p> |

| | |
|--|--|
| <p>1 mass spectrometer, one capable of getting these 2 elemental compositions. 3 Q. I think we were told by Dr Kite that the collision 4 energy used to produce fragments by Nardin and her 5 colleagues was different from that used at Kew. Can you 6 help with that? 7 A. I think it was not just the energy, it is the way the 8 molecule is caused to fragment. There are two main 9 approaches. 10 One is to collide the molecule into inert gas, 11 typically nitrogen. 12 The other method is to resonate the species, the 13 ion, in with a lighter gas. One is a more gentle but 14 slower process and that gives rise to very different 15 MS/MS data. 16 Q. I fully appreciate that and I don't want to take any 17 false points or in what is already quite a complicated 18 case to take any points that are not right. It is 19 a different method used and I think I am right in 20 suggesting, but please confirm, that the method of 21 collision energy used by the Italians is rougher, it 22 produces more fragments than the method used at Kew? 23 I think the difference between the two, I can give 24 you the labels, is -- 25 A. I do not recall which is the more energetic of the two.</p> <p style="text-align: center;">Page 65</p> | <p>1 identical to that for gelsemicine, it is instead of 2 being C₂₀H₂₆, it is C₂₂, so there are two extra carbon 3 atoms. I do not minimise the importance of that but it 4 is a very similar formula, they are clearly closely 5 associated? 6 A. Yes, that is very common for that to happen. 7 Q. Yes. It is, if we can just pause for a moment, I think 8 you call them the radicals, it is the N and the O which 9 is what wags the dog, there are a number of carbon 10 atoms. The number of carbon atoms and the number of 11 hydrogen atoms can vary but what really differentiates 12 these substances is the radicals, the oxygen and the 13 nitrogen? 14 A. I don't follow. 15 Q. A lot of these chemicals, these alkaloids, have very 16 similar formulae. I am suggesting to you that what 17 actually differentiates the substances importantly, is 18 not so much the number of carbon atoms, the number of 19 hydrogen atoms, which can vary, the really important 20 thing -- I called it the tail that wags the dog -- is 21 the number of oxygen and the number of nitrogen atoms, 22 they are the ones that really do the work? 23 A. Not necessarily just that. It is the structure of the 24 molecules that differentiate them. 25 Q. Yes, well, I am sure that is right.</p> <p style="text-align: center;">Page 67</p> |
| <p>1 Q. Anyway, there is a difference -- 2 A. There is a difference certainly, but I am not sure which 3 is which. 4 Q. The short point, just so if it is irrelevant we can get 5 it out of the way, we see on page 721. 6 A. Yes. 7 Q. Where we have thumbnail for various plants that Nardin 8 and her colleagues were looking at. One of those was 9 gelsemium. I don't know whether, when you glanced at 10 the article, you appreciated that gelsemium was one of 11 the plants they were looking at? 12 A. I had appreciated that, yes. 13 Q. You had appreciated that? 14 A. Yes. 15 Q. They extracted from the gelsemium -- it was an elegans 16 plant, what it was doing growing in Italy I don't know 17 but it was an elegans plant I think. They got 18 a substance from it called gelsempervine. We see from 19 page 721 there are two different types of gelsempervine, 20 one AC and one BD. Would you like to look at that? 21 A. I am just looking for a better copy than I have. 22 Q. Yes, I am struggling a bit. 23 Down the bottom there, first of all can 24 I respectfully tell you or remind you, you can check 25 this later, that the formula for gelsempervine is almost</p> <p style="text-align: center;">Page 66</p> | <p>1 Anyway it is a similar formula. The simple point 2 I wanted to draw your attention to is when subjected to 3 collision energy of the type that the Italians were 4 using, which differed as I understand it from the method 5 used at Kew, but when subjected to collision energy the 6 major fragment was produced at 180.10 -- so difficult to 7 read, 180.1011 in one case and 180.10 -- what is the 8 another one? Anyway -- 9 A. 1009 and 1011. 10 Q. What we have is a fragment pattern that seems to closely 11 match both the fragmentation pattern that was observed 12 when the ion recovered from Alexander's stomach was 13 subjected to collision energy and the ion which coeluted 14 with the C₂₀H₂₆ in 2016. 15 This seems to be a third coincidence, that we have 16 within a matter of parts per million, we have a fragment 17 which is virtually the same as that which was observed 18 at Kew. I was just wondering whether now we don't have 19 three coincidences and what the explanation for that 20 might be? 21 A. Let me check that I have understood your point. Are you 22 saying that because there is an ion at 180.something, 23 that could be the same as the peak at 6.9? 24 Q. No. 25 A. You are not saying that?</p> <p style="text-align: center;">Page 68</p> |

| | |
|--|---|
| <p>1 Q. No, I am not. I am saying that the peak at 6.9, when 2 fragmented, produced as you recall -- 3 A. 180 amongst other things. 4 Q. 180.1020, I am say that this closely related substance 5 found by the Italians in a gelsemium plant, when that 6 was subject to collision energy it produced a fragment 7 which was virtually the same? 8 A. Yes, that is what I was suggesting. 9 Q. Both of those are also within a few parts per million of 10 the substance that coeluted in 2016? 11 A. Yes, but we know that Kew did not find that when they 12 looked at the various gelsemium species. I think it is 13 generally common ground that there are many combinations 14 for that elemental composition or that accurate mass. 15 At this time it is my opinion that I do not know what 16 that peak at 6.9 -- what the compound is. 17 Q. The proposition I am putting to you is not very 18 complicated and it may well be wrong, we are looking for 19 your help as to if it is irrelevant we can get rid of 20 it. 21 A. Sure. 22 Q. It seems that substances closely from gelsemium, closely 23 allied to gelsemicine and its isomers, when subjected to 24 collision energy will produce fragments almost identical 25 to the fragment that was produced when Alexander's</p> <p style="text-align: center;">Page 69</p> | <p>1 a coincidence, but if I was doing the work myself 2 I would look at this and exclude it as a possibility to 3 the best of my ability. 4 Q. Yes, and that hasn't happened, plainly? 5 A. That has not happened. 6 THE CORONER: Why do you say more likely than not 7 coincidence? 8 A. Because you are going to get plenty of examples of where 9 you can get MS/MS data that look similar but not 10 identical. For me to get a reliable result, I would 11 wish to do some contemporaneous experiments. I run my 12 unknown sample, I run my standards in the same day or 13 experiment if possible. 14 If I have to rely on my own equipment with a big 15 difference in time, I would need to take some steps to 16 get coincidence on the data again. That is not the 17 accurate mass because, as Dr Kite has pointed out, you 18 can calibrate the mass very accurately across time and 19 between instruments. 20 If I cannot get the same material, I might use 21 a reference collection, which is exactly what Kew has 22 done, compare with standards. 23 It does not I should say exclude the possibility 24 that someone has manipulated a compound to increase the 25 amount of one compound or another and then administered</p> <p style="text-align: center;">Page 71</p> |
| <p>1 stomach contents were subjected. I am asking you 2 whether you think that is just a coincidence or whether 3 the simplest explanation is that all these three things 4 are linked and they are linked to gelsemium? 5 A. I think looking at the MS/MS data in isolation does not 6 tell us exactly what the compound is -- 7 Q. No. 8 A. -- you have to work the other way round. 9 Q. If I can put it in this way. The coroner will be 10 considering whether there is a possibility that the 11 substance found in Alexander's stomach was something to 12 do with gelsemium. 13 He may also in that, as part of that exercise, be 14 interested in whether there was any evidence that 15 points, there is obviously -- well, he may conclude 16 there is that possibility -- 17 A. Yes. 18 Q. -- but he may be interested in the question of whether 19 there is something that positively indicates that. What 20 I want to get your help on is whether this triple 21 coincidence is something that helps us to say not that 22 it is proved, shown or certain but that it is something 23 that looks odd and requires explanation, which I don't 24 think you are giving us? 25 A. I would say it is more likely than not to be</p> <p style="text-align: center;">Page 70</p> | <p>1 it. 2 MR MOXON BROWNE: I think finally this, if Dr Kite is 3 correct, that the ion C20H27N2O4 is in fact a cluster, 4 then we are looking at trying -- it may be relevant to 5 try to identify what the components of that cluster are. 6 We know what the formula would be, but as you pointed 7 out, there are numerous substances that answer that 8 formula. 9 Am I right that by feeding in the accurate mass 10 rather than the formula into a computer, you could 11 narrow down the range of options very quickly? 12 A. No, that is not correct. I think you may have 13 misunderstood that this elemental composition has 14 a theoretical mass. The instrument then will measure 15 an accurate mass and within a certain tolerance, 16 typically five parts per million, you can work out what 17 are the possible elemental compositions that would fit 18 that number. 19 If I put in elemental composition then that is 20 actually more precise than if I put in my measured 21 accurate mass. It is better to put in elemental 22 composition than to put the number into the computer. 23 Q. There are, are there not, database which list the 24 accurate masses in order of closeness to the figure that 25 you feed in, tell you, "This is the same, this is almost</p> <p style="text-align: center;">Page 72</p> |

| | |
|--|--|
| <p>1 the same"?</p> <p>2 A. That is a slight complication in terminology, the exact</p> <p>3 mass is going to be the mass of that elemental</p> <p>4 composition. Accurate mass databases could be measured</p> <p>5 masses, which will have a bit more error to it.</p> <p>6 Q. Yes.</p> <p>7 A. I think you were putting to me that a better way of</p> <p>8 doing it was to put the number in, I was not accepting</p> <p>9 that.</p> <p>10 Q. I was.</p> <p>11 A. Yes.</p> <p>12 Q. A question that was put to the toxicology experts, which</p> <p>13 they deferred to other experts, which is effectively</p> <p>14 I think for this purpose you, you might be able to help,</p> <p>15 is whether it is right that the compound, I think I am</p> <p>16 right to call it a compound, C10H13, half, could be</p> <p>17 a number of things which are commonly found in</p> <p>18 foodstuffs, one of them I think is maltoxazine,</p> <p>19 something like that, which is found in cereal, and</p> <p>20 another one called salsolinol, I think, which is found</p> <p>21 in chocolate. I think it is also the case that MDMA,</p> <p>22 ecstasy, matches although I want to say emphatically</p> <p>23 nobody is suggesting, least of all me, that Alexander</p> <p>24 was consuming ecstasy. I just mention that that is one</p> <p>25 of the possibilities.</p> <p style="text-align: center;">Page 73</p> | <p>1 Questions from MR STRAW</p> <p>2 MR STRAW: Professor, just two very short areas, please.</p> <p>3 I think you mentioned earlier, you commented on the</p> <p>4 comparatively small amount of the unidentified ion</p> <p>5 discovered in the stomach sample. Is that right?</p> <p>6 A. I don't recall saying that but I think it is a small</p> <p>7 amount, yes.</p> <p>8 Q. Were you aware that Dr Ratcliffe who performed the first</p> <p>9 post mortem on 14 November disposed of the stomach</p> <p>10 contents and it was only --</p> <p>11 A. Yes, I had read that.</p> <p>12 Q. You were aware of that?</p> <p>13 Flushed out the stomach and it was only when</p> <p>14 Dr Fegan-Earl came to do the forensic post mortem on</p> <p>15 30 November that the samples of the stomach were</p> <p>16 actually taken. Were you aware of that?</p> <p>17 A. Sorry, I missed the second bit of what you said.</p> <p>18 Q. It was only when Dr Fegan-Earl came to do the forensic</p> <p>19 post mortem on 30 November that the stomach sample that</p> <p>20 we are looking at was taken?</p> <p>21 A. No, I don't recall reading that. But ...</p> <p>22 Q. Have you seen as well Professor Ferner's opinion that</p> <p>23 the gelsemium alkaloids in the samples may have been</p> <p>24 destroyed or converted while they were stored over the</p> <p>25 months before they were tested at Kew?</p> <p style="text-align: center;">Page 75</p> |
| <p>1 I think it is right that the spectra for these</p> <p>2 common substances are easily obtainable, so if anybody</p> <p>3 thought well, it is probably maltoxazine, it could be,</p> <p>4 it would be the work of a minute to find out what the</p> <p>5 spectra look like. The Human Metabolome Database for</p> <p>6 example give it -- I think you were shown examples over</p> <p>7 night, I hope you were.</p> <p>8 A. I would say that databases are useful to guide but for</p> <p>9 certainty one really needs to use reference material.</p> <p>10 Q. "Reference material" was that?</p> <p>11 A. Yes, you need to get hold of the substance and run that</p> <p>12 concurrently with the unknown.</p> <p>13 Q. That has been one of the problems in this case. That,</p> <p>14 if I may say so, was pointed as long ago as 2014, that</p> <p>15 there is no certified reference for any of these</p> <p>16 isomers, you have to do it all empirically?</p> <p>17 A. It is possible to purchase gelsemicine.</p> <p>18 Q. Yes, but not the isomers?</p> <p>19 A. Not all of the compounds, correct.</p> <p>20 Q. That is the problem. All the time we can say I haven't</p> <p>21 found it, but nobody can say it is not there.</p> <p>22 A. Not, certainly, to be able to say it is not there.</p> <p>23 Q. No.</p> <p>24 A. It is a possibility.</p> <p>25 MR MOXON BROWNE: Thank you very much, Professor.</p> <p style="text-align: center;">Page 74</p> | <p>1 A. Unfortunately, no, I hadn't seen that.</p> <p>2 Q. Is that something that falls within your expertise or is</p> <p>3 that something that is better left for Professor Ferner?</p> <p>4 A. I couldn't comment about this alkaloid and its</p> <p>5 degradation.</p> <p>6 Q. All right.</p> <p>7 Finally, paragraph 43 of your report, you say:</p> <p>8 "Without knowledge of the structure of the compound</p> <p>9 [we are still talking unidentified compound found in the</p> <p>10 stomach contents] it would not be possible to find out</p> <p>11 whether it is toxic."</p> <p>12 Essentially, we cannot exclude this having been</p> <p>13 a toxic compound. Is that correct?</p> <p>14 A. Correct.</p> <p>15 Q. Okay.</p> <p>16 MR STRAW: Okay, thank you very much.</p> <p>17 Questions from MR COHEN</p> <p>18 MR COHEN: I have a small number of questions for you,</p> <p>19 almost all on the topic of cluster molecules.</p> <p>20 Just so I am clear on the terminology, you have</p> <p>21 remembered referred to "dimers", Dr Kite referred to</p> <p>22 "clusters". There is no difference though is there?</p> <p>23 A. No, "dimer" is slightly more specific than a cluster.</p> <p>24 It simply means two molecules put together, a cluster</p> <p>25 could be one, two, three.</p> <p style="text-align: center;">Page 76</p> |

| | |
|--|---|
| <p>1 Q. And a "monomer" is one?</p> <p>2 A. Is one.</p> <p>3 Q. When you have dimers forming in the process of mass</p> <p>4 spectrometry, it is right, isn't it that not all of the</p> <p>5 ions will dimerise necessarily?</p> <p>6 A. It is unlikely that they would all be dimers.</p> <p>7 Q. In any run of the machine, you might detect both the</p> <p>8 dimer and the monomer at the same time?</p> <p>9 A. Exactly that.</p> <p>10 Q. The monomer we discussed with Dr Kite gets, for these</p> <p>11 purposes, the shorthand M+H+?</p> <p>12 A. Just to add one point, that would be if the dimer is</p> <p>13 formed at the point of ionisation. For a monomer and</p> <p>14 a dimer to go through the liquid chromatograph at the</p> <p>15 same time is highly unlikely.</p> <p>16 Q. I see. But the monomer is M+H+ and the dimer 2M+H+?</p> <p>17 A. Yes.</p> <p>18 Q. You were asked questions by my learned friend</p> <p>19 Mr Moxon Browne in which he asked whether it was</p> <p>20 a coincidence that the peak at 180 found in 2016 was</p> <p>21 very close to the peak in 2013. Do you recall those</p> <p>22 questions?</p> <p>23 A. Yes. Yes.</p> <p>24 Q. It is right, isn't it, that one explanation for that</p> <p>25 could be that on each occasion they were finding the</p> <p style="text-align: center;">Page 77</p> | <p>1 "In the analysis performed in May 2013, low</p> <p>2 resolution scanning between M/Z 125 and 2000 was</p> <p>3 recorded in the same analysis as the high resolution</p> <p>4 scanning and explains ..."</p> <p>5 I am looking at the wrong question, I mean</p> <p>6 question 23.</p> <p>7 MR MOXON BROWNE: No. It isn't 23.</p> <p>8 MR COHEN: Sorry, yes, question 25:</p> <p>9 "The low resolution data showed that in the analysis</p> <p>10 performed on AWF 32 in May 2013, M/Z 180 exactly</p> <p>11 coeluted with M/Z 359 at 6.88 minutes max peak height."</p> <p>12 So the point is that although you may not have seen</p> <p>13 the data, Dr Kite and Professor Simmonds report that</p> <p>14 actually they did witness coelution in 2013?</p> <p>15 A. Yes.</p> <p>16 Q. You would agree with me that that would be another point</p> <p>17 that would lend credence to their view that this was</p> <p>18 a cluster?</p> <p>19 A. This would be dimerisation in the ion source, not at the</p> <p>20 point of injection.</p> <p>21 Q. Indeed.</p> <p>22 A. Would fit that hypothesis.</p> <p>23 Q. You agree it is another point in favour of their answers</p> <p>24 on the likelihood or otherwise of it being a cluster?</p> <p>25 A. I can see their reasoning --</p> <p style="text-align: center;">Page 79</p> |
| <p>1 monomer and that the other peak at 359 was the dimer?</p> <p>2 A. Let me just check I have understood. That you have both</p> <p>3 the monomer and dimer going into the mass spectrometer,</p> <p>4 being analysed in the mass spectrometer?</p> <p>5 Q. Yes.</p> <p>6 A. Provided it was formed in the ion source, yes.</p> <p>7 Q. Yes.</p> <p>8 The final question is that Mr Moxon Browne asked you</p> <p>9 about the reasons why Dr Kite had concluded that this</p> <p>10 was likely to be a cluster?</p> <p>11 A. Yes.</p> <p>12 Q. And told you, I am sure inadvertently, that there was no</p> <p>13 suggestion that they had coeluted in 2013. Do you</p> <p>14 remember that?</p> <p>15 A. I remember commenting about the word "coelution".</p> <p>16 Q. No data in 2013?</p> <p>17 A. Yes. Yes.</p> <p>18 Q. If we look in volume 3 of the expert bundle, page 831,</p> <p>19 which I think is probably at tab 95.</p> <p>20 A. Which tab?</p> <p>21 Q. I think it is 95, 831.</p> <p>22 A. Yes.</p> <p>23 Q. This is the answer to questions put to them by Dr Kite</p> <p>24 and Professor Simmonds.</p> <p>25 Question 25, if I read you a passage they note:</p> <p style="text-align: center;">Page 78</p> | <p>1 Q. Yes.</p> <p>2 A. -- it does not persuade me to say certainly that is the</p> <p>3 right conclusion.</p> <p>4 Q. I understand.</p> <p>5 A. Yes.</p> <p>6 Q. You agree that this would be another point in favour of</p> <p>7 that reasoning, that is the simple question?</p> <p>8 A. I agree with that.</p> <p>9 MR COHEN: Yes, thank you.</p> <p>10 MR SKELTON: Sir, unless you have any questions, that</p> <p>11 concludes Professor Cowan.</p> <p>12 THE CORONER: Thank you very much.</p> <p>13 A. May I be released, sir?</p> <p>14 THE CORONER: Yes, of course.</p> <p>15 A. Thank you.</p> <p>16 MR SKELTON: Sir, the next witness is Professor Simmonds.</p> <p>17 PROFESSOR MONIQUE SIMMONDS (sworn)</p> <p>18 Questions from MR SKELTON</p> <p>19 MR SKELTON: Professor Simmonds, thank you, will you state</p> <p>20 your full name, please?</p> <p>21 A. Monique Sheelagh Jacquard Simmonds.</p> <p>22 Q. Your position at Kew is what?</p> <p>23 A. I am the deputy director of science with responsibility</p> <p>24 for some of the aspects of the uses of plants, the</p> <p>25 chemistry and associated toxic features of plants.</p> <p style="text-align: center;">Page 80</p> |

| | |
|--|--|
| <p>1 Q. How long have you been at Kew?</p> <p>2 A. I have been at Kew since 1985.</p> <p>3 Q. What is your chair in?</p> <p>4 A. My chair is in biological interactions, which is to do</p> <p>5 with the interactions between plants and animals.</p> <p>6 Q. Can I ask you how often you have had occasion to address</p> <p>7 the kind of issues that you have been asked to address</p> <p>8 in this particular case?</p> <p>9 A. Quite often. By that I mean once every few years asked</p> <p>10 to provide some information about toxicity that might be</p> <p>11 involved in a trial or a police case.</p> <p>12 Q. On a few occasions you have cause --</p> <p>13 A. Yes.</p> <p>14 Q. There are a number of documents before the court.</p> <p>15 I will not read them all out but you are familiar with</p> <p>16 them, they are in the bundles and you will have seen</p> <p>17 them many times.</p> <p>18 Dr Kite performed the analyses for the most part in</p> <p>19 your laboratory?</p> <p>20 A. Yes, he did.</p> <p>21 Q. Why did he do those?</p> <p>22 A. When we started the work I was in charge of a group that</p> <p>23 would be looking at the chemistry of any form of inquiry</p> <p>24 that would come into Kew. I had a series of experts on</p> <p>25 different areas and Geoff Kite was an expert on mass</p> <p style="text-align: center;">Page 81</p> | <p>1 Q. Or DNA testing?</p> <p>2 A. DNA testing -- right, when we started the project in</p> <p>3 2013 we could have been undertaking some DNA, but really</p> <p>4 you do need to know what you are looking for. Within a,</p> <p>5 if you are talking about a gut context, it is often the</p> <p>6 chemistry that is the indicator, but yes, we could have</p> <p>7 done DNA.</p> <p>8 Q. You can not search blind for DNA?</p> <p>9 A. It is very complex to do that, yes.</p> <p>10 Q. Could you just clarify, while we are on the subject of</p> <p>11 that, what you are presently testing and if you are able</p> <p>12 to, although I don't want to put you on the spot, when</p> <p>13 you are likely to have a result for us?</p> <p>14 A. We have been asked now to look at some of the stomach</p> <p>15 contents and material from Reading University, bits of</p> <p>16 plant material that were isolated, to look at the DNA.</p> <p>17 We are now using the new forms of DNA next sequence</p> <p>18 generation, and we are hoping that we will get some</p> <p>19 results in possibly a fortnight. I am hoping by the end</p> <p>20 of next week we have an understanding on whether we have</p> <p>21 enough DNA to be able to undertake analysis or not.</p> <p>22 Q. What are you looking for in that sample. Do you have to</p> <p>23 target it -- sorrel has been a plant extract that has</p> <p>24 been of particular significance in the context of this</p> <p>25 Inquest, because it is alleged to be one of the items</p> <p style="text-align: center;">Page 83</p> |
| <p>1 spectrometry.</p> <p>2 Q. What are you an expert on that he is not an expert on?</p> <p>3 A. I am more an expert on the kind of historical uses of</p> <p>4 the plants, the general chemistry. I am not an expert</p> <p>5 on mass spectrometry; that is his expertise.</p> <p>6 Q. Just leaving aside the mass spectrometry for a moment,</p> <p>7 what specifically in terms of expertise do you bring to</p> <p>8 bear on the analysis of Mr Perepilichny's case which</p> <p>9 Dr Kite hasn't brought to bear?</p> <p>10 A. I think my general expertise in this area would be</p> <p>11 looking at which plants should we be looking at that</p> <p>12 potentially could contain toxins. Therefore what are</p> <p>13 the types of compounds that we would be looking for, if</p> <p>14 we were going to undertake an extract which is important</p> <p>15 in the fact that which method might we use, do we</p> <p>16 therefore use mass spectrometry or do we use another</p> <p>17 method.</p> <p>18 Q. Such as?</p> <p>19 A. It might be that we use gas chromatography, which could</p> <p>20 have been another person in the team, or it could have</p> <p>21 been NMR, nuclear magnetic resonance, which again would</p> <p>22 have been another person in the team that would have</p> <p>23 undertaken that.</p> <p>24 Q. Or DNA testing, presumably?</p> <p>25 A. Pardon?</p> <p style="text-align: center;">Page 82</p> | <p>1 that was put in the soup that Mr Perepilichny consumed.</p> <p>2 Will you be able to look for sorrel for starters or</p> <p>3 other things?</p> <p>4 A. I am afraid the simple question that we need to ask at</p> <p>5 the beginning is: do we identify plant DNA from all the</p> <p>6 human and the bacterial material DNA that will be in the</p> <p>7 contents?</p> <p>8 From that we will then go on to look at the</p> <p>9 potential for identifying the sorrel and then expand it</p> <p>10 from there.</p> <p>11 Q. Thank you.</p> <p>12 You mentioned other types of testing. In this</p> <p>13 particular case -- I don't want to jump too far ahead --</p> <p>14 why did you go down the mass spectrometry route and not</p> <p>15 the other two types of testing that you mentioned?</p> <p>16 A. Because of the types of compounds that we are looking</p> <p>17 at, the liquid chromatography mass spec would most</p> <p>18 likely be the appropriate route to go, it would be able</p> <p>19 to get an ion profile out of that that we would most</p> <p>20 likely be able to match to a compound. It is a method</p> <p>21 that we have used quite successfully in this type of</p> <p>22 analysis.</p> <p>23 Q. When you say type of compound, do you mean a toxic</p> <p>24 alkaloid?</p> <p>25 A. An alkaloid or it could have been a diterpenoid, a range</p> <p style="text-align: center;">Page 84</p> |

| | |
|--|--|
| <p>1 of other compounds derived from plants that could be 2 associated with toxicity. 3 Q. Thank you. You have been here all morning I think -- 4 A. Yes. 5 Q. -- so you have heard Professor Cowan's evidence and 6 I think you also will have read his report? 7 A. Yes. 8 Q. He identified the fact that as far as he was aware there 9 are a huge number of compounds that exist, not just in 10 theory but actually exist, that will have the same 11 molecular form, either as the single molecule that has 12 been described or identified by Dr Kite or the cluster 13 ion that he has identified? 14 A. Yes. 15 Q. Do you accept that as a proposition? 16 A. If you are using a general chemistry database you will 17 get much wider, yes, I do. 18 We deal mostly with the natural product database, 19 which would give us a smaller number. 20 Q. Can you clarify what -- so the wider chemist will 21 contain synthetics? 22 A. Synthetics, from not always -- yes, mainly synthetics, 23 yes. 24 Q. What are natural products or what are in the natural 25 products database?</p> <p style="text-align: center;">Page 85</p> | <p>1 really reflects, you know, the emphasis you could say on 2 organic chemistry. 3 Q. You were directing your research towards products which 4 have been identified as derived in the natural world 5 from plants or from a narrow number of animal species? 6 A. Yes, we were really concentrating on plants. 7 Q. Yes. You cannot rule out a huge swathe of compounds 8 that are synthetic within the outside world, because 9 they could be man made by chemists? 10 Thank you. Could you explain the spectral library 11 which I think is a term you used in your initial report. 12 What is that? 13 A. Because we have been studying using mass spectrometry 14 techniques for a number of years at Kew, we have built 15 up a library of what we call spectra, of the profile of 16 compounds in plants. Not all identified. Some are 17 identified, so when we are interested in a particular 18 compound, we will then go and isolate it, characterise 19 it, get a structure for it and its associated mass. 20 That would then be added to our library. 21 Because the fragmentation patterns vary quite a bit 22 from machine to machine, these are not commercially 23 available. The mass spectrometry library that we have 24 developed is really specific to the equipment that we 25 have at Kew.</p> <p style="text-align: center;">Page 87</p> |
| <p>1 A. Natural product database, you will find compounds from 2 plants, from fungi, also from algae, from frogs. 3 Q. Frogs did you say? 4 A. Yes, frogs. Or snakes. 5 Q. The type of poisons that one might see on a -- 6 A. Yes, it does contain poisons, as well as other 7 compounds. 8 Q. What about the kind of chemicals or compounds one might 9 find in the human body, the stomach, the gastric tract 10 et cetera? 11 A. You could say they would be natural and therefore they 12 would be in that database. I don't think they are all 13 in that database. I think there are other database that 14 would contain compounds associated with the human gut. 15 Q. And food -- 16 A. Food, chemicals from things like cabbage, et cetera. 17 Q. For "natural foods"? 18 A. Natural foods, you will often find them in those 19 databases, yes. 20 Q. If one compares the 4,000 to the much narrower number 21 that one might find in the database, why is there such 22 a huge difference between those two numbers? 23 A. I suppose because the -- there are a lot of organic 24 chemists who are interested in, you know, producing 25 compounds of a range of different masses. I presume it</p> <p style="text-align: center;">Page 86</p> | <p>1 Q. I see, so you would be comparing apples and pears if you 2 start to look at other people's databases? 3 A. There are comparisons you could make, but for us when we 4 are wanting quite quickly often to look at whether we 5 have a known or unknown compound in a plant, we have set 6 it up to match our equipment, we have set up the mass 7 spectrometry library to meet our equipment. 8 There are shared patterns and they are published, 9 that is why you publish your retention time, your 10 fragmentations and information about the equipment that 11 you have used and also the column type. 12 Q. Thank you. 13 Can I understand the thinking that went through your 14 mind when you first did the started to initiate the 15 testing. I think you identified five alkaloids 16 associated with gelsemium, can you explain how you came 17 to identify those? 18 A. Can I step back a stage? 19 Q. Please do. 20 A. We were asked to look if we could determine any 21 potential toxins from the plants, without any indication 22 what the plant would be, other than the fact that the 23 activity, the potential toxins, could have occurred over 24 a short period of time. We were looking therefore for 25 a compound, potential toxin that possibly would act in</p> <p style="text-align: center;">Page 88</p> |

| | |
|--|--|
| <p>1 a short period of time, a few hours, and not would 2 accumulate in body over, say, days, weeks. 3 Based on that information we put together a series, 4 like a minor database of potential plants that we were 5 aware of that contain toxins, which then contained 6 gelsemium. 7 Q. Pausing there, plants which you at Kew were aware of or 8 one is aware of in general? 9 A. That we are at Kew and therefore from the literature. 10 We went through the toxicity literature that we have at 11 Kew and then through some other databases, so we 12 gathered that information about which plants and 13 therefore which potential toxins were known, so we had 14 an open mind when we started the analysis. 15 MR SKELTON: Thank you. 16 I will pause there, if I may, for lunch. 17 THE CORONER: Yes. 18 2.05. 19 (1.01 pm) 20 (The Luncheon Adjournment) 21 (2.15 pm) 22 MR SKELTON: Professor Simmonds, I think you were explaining 23 before the lunch break how you started your 24 investigation in terms of your thinking about what you 25 were looking for and the references you looked at. Can</p> <p style="text-align: center;">Page 89</p> | <p>1 stomach contents but were you aware at that stage of 2 what you were testing, in terms of where the sample had 3 come from or how reliable the sample itself was? 4 A. All we had at that stage was the information given to us 5 that sample number and stomach or the various other 6 parts that we were given no history about other than 7 that it came from the deceased. So we were at that 8 stage unaware that it was not the major stomach 9 contents. 10 Q. Just for clarification, the evidence is that 11 Dr Ratcliffe, the first pathologist who performed a post 12 mortem, performed a non-forensic post mortem and flushed 13 away the stomach contents initially and. You were given 14 effectively what was left in the stomach after that? 15 A. We were unaware of that at the time. 16 Q. Can you explain what difference from your perspective it 17 makes to the reliability and comprehensiveness of the 18 results that you obtained? 19 A. Can I kind of refer back to other cases that we have 20 looked at when we are dealing with toxins. The toxins 21 are usually there present in quite high amounts. If we 22 have homogenate from the stomach. The first run that we 23 did, we realised that we were dealing with the chemistry 24 was at very, very low level, there was no obvious peak 25 associated with any of the compounds that we might</p> <p style="text-align: center;">Page 91</p> |
| <p>1 you take us back a step so we can get the context again, 2 please. 3 A. When we were requested to look for some potential plants 4 toxins, we did a review of those plants that might 5 contain toxins that could act over a shorter period of 6 time, based on our knowledge and the literature. As 7 a result of that we put together a list of about 120 8 different plant-derived compounds, or ... 9 Q. Thank you. Your next stage was to? 10 A. We then ran these samples that were -- the next stage 11 was to find out a little bit more about those, the 12 molecular weight et cetera of those compounds from those 13 plants and then if there was know mass spectral data to 14 put in a little file together that would assist us for 15 the analysis. That is partly the mass spectral library 16 that we put together. 17 We then undertook an analysis of the samples that 18 were sent to us for analysis. 19 Q. Yes, and that was your initial report? 20 A. That is the initial report. 21 Q. So Dr Kite did the LCMS analysis? 22 A. Yes, he did. 23 Q. And you produced a report which summarised the results? 24 A. Yes. 25 Q. Could you just explain. You tested what you had for the</p> <p style="text-align: center;">Page 90</p> | <p>1 suspect to be in the stomach. 2 Q. Can you explain what you mean by an "obvious peak"? 3 A. Sometimes when you are running -- so you get an extract, 4 you have no idea what the concentration is of that 5 particular extract. Sometimes when you run an extract 6 on the equipment you can overload it, so you get what 7 might be termed kind of a just a large peak, maybe and 8 flat top, because you cannot differentiate it. We 9 didn't get anything like that, initially we just got, 10 you could say, a lot of baseline, so we had to run more 11 sensitive to be able to do the analysis. 12 Q. Are you qualified to give a view on whether or not the 13 absence of the large peaks or consistent large peaks is 14 significant when it comes to deciding whether or not 15 Mr Perepilichny was poisoned? 16 A. I am just -- kind of assumptions here, because I am not 17 a qualified toxicologist. But again in cases where we 18 have looked at say toxins in horses or ponies, the level 19 of the toxin has been quite apparent because if it is 20 going to be absorbed from the guts, it would have to be 21 there in reasonably high concentrations depending on its 22 ability to be absorbed et cetera and the time taken for 23 it to be absorbed. 24 Q. Going back to the issue of the stomach contents being 25 thrown away, the fact that you were not testing the</p> <p style="text-align: center;">Page 92</p> |

| | |
|--|---|
| <p>1 major stomach contents may mean that that judgment 2 cannot be made in this case? 3 A. Yes, we did not know that at that time. 4 Q. Does it mean you cannot form that judgment in this case? 5 A. We can't, no, because we were dealing with what would 6 appear to be the remnants of what was in the stomach 7 contents. 8 Q. You ran the data and obtained your MS/MS, your results? 9 A. Yes. 10 Q. You then used that data to go back to your library? 11 A. Yes, we ran it against the library and discounted a lot 12 of peaks. We couldn't find any of the compounds that 13 matched some of the other plants so gelseminine(?) was 14 the only match that we so to speak potentially had, I 15 just want to really emphasise "potential". 16 Q. Just again to understand the limits of what your library 17 contains, the fact that you haven't found it in your 18 library, what does that mean in terms of positing 19 whether or not there may be a plant alkaloid out there 20 which does match but you just don't know about it? 21 A. That is an absolute possibility. I mean our library 22 search was quite extensive and of course we did make 23 reference to the national product library, once we had a 24 mass spec, to see if it met anything in the Natural 25 Product Library.</p> <p style="text-align: center;">Page 93</p> | <p>1 A. 245, yes. 2 Q. Having previously mentioned that there were these 3 alkaloids, then I think in answer to questions their 4 identity was made clear. Are these the ones you were 5 talking about as being associated with gelsemium? 6 A. Yes. 7 Q. Based on what did you take the view that gelsemicine is 8 the predominant alkaloid associated with human toxicity? 9 A. From information in the literature. 10 Q. Is it conceivable that that is not correct? 11 A. Yes. But it is based on what is currently known. 12 Q. Mr Moxon Browne put questions earlier on the premise 13 that there may well be alkaloids associated with 14 gelsemium which haven't yet been identified. I think 15 that is something which you have said yourself; is that 16 correct? 17 A. Yes. 18 Q. Can one hypothesise about the potential toxicity of 19 alkaloids that have not been identified? 20 A. No. 21 Q. So it may in fact be the case that it does contain some 22 form of toxic alkaloid, not gelsemicine, which as yet 23 the academic studies have not identified? 24 A. Or other alkaloids with no toxicity. 25 Q. Yes.</p> <p style="text-align: center;">Page 95</p> |
| <p>1 Q. Is the Natural Product Library a constantly evolving 2 entity? 3 A. Yes, it is. As soon as scientists have found other 4 natural product, chemists and they published then the 5 producers of the Natural Product Library will be going 6 through the literature and adding that data to the 7 database. 8 Q. Again, hypothetically might it be the case that the 9 compound you did find will be identified at some point 10 in the future as a natural product? 11 A. If it is plant derived. 12 Q. Potentially it could be identified as a synthetic 13 product some time in the future based on the further 14 research into those forms of compound? 15 A. Yes. 16 Q. You identified I think that there were five alkaloids 17 associated with gelsemium and you mentioned those, or 18 Dr Kite mentions them in his report at page 231 and then 19 specifies them later in answers to some questions 20 in December 2014. Is that correct? 21 A. Yes. 22 Q. Just looking at those alkaloids, can I take you to the 23 answers on under tab 43 at page 245, please. 24 A. Tab 43? 25 Q. Bundle 1.</p> <p style="text-align: center;">Page 94</p> | <p>1 When you get a toxic plant, do you tend to get 2 a multiplicity of toxic alkaloids or is there usually 3 one that predominates? 4 A. There is often one that is a predominant one, but you do 5 get an array of them that are part of the biosynthetic 6 pathway, possibly to the most toxic. 7 Q. Just looking at the other four that are mentioned on 8 page 246 after gelsemicine, is there literature on the 9 toxicity of those? Or is there sort of literature by 10 inference and -- 11 A. Literature by inference. I am unaware of a comparative 12 toxicology study. 13 Q. What we have is a positive literature associated with 14 gelsemium, but it isn't clear that the others aren't in 15 some way toxic? Is that a fair summary? 16 A. I think you need to have an expert on toxicology to 17 answer that. 18 Q. Thank you. 19 To summarise your work that you then conducted, you 20 then started to look at the gelsemium species? 21 A. Yes. 22 Q. You started off on the sempervirens and then tested the 23 elegans as well? 24 A. Yes. 25 Q. There is another one, rankinii, I think?</p> <p style="text-align: center;">Page 96</p> |

| | |
|--|--|
| <p>1 A. Yes.</p> <p>2 Q. First of all, is that possible to get hold of it?</p> <p>3 A. Right, once we had identified, you know, that this is</p> <p>4 somewhere we needed to look a little bit further, we did</p> <p>5 look at the Kew collection of verified plant material.</p> <p>6 This is the herbarium collection.</p> <p>7 The samples that we had of other species within the</p> <p>8 genus were poorly documented, so they were not fully</p> <p>9 verified. That is why we have really kept to two</p> <p>10 species of which we had multiple samples that we could</p> <p>11 use for the analysis.</p> <p>12 Q. And is there a particular differentiation between the</p> <p>13 two that you do have when it comes to the presumed</p> <p>14 gelsemicine?</p> <p>15 A. Until we started this work, I was not aware of</p> <p>16 a comparative study that would take the different parts</p> <p>17 of the plant and study its chemistry. When we started</p> <p>18 this comparative work, that was one of the first studies</p> <p>19 to be undertaken.</p> <p>20 Q. What was the result?</p> <p>21 A. The result is as presented in this report. We have not</p> <p>22 done an in depth study to characterise every compound,</p> <p>23 we are talking about working on dried herbarium samples,</p> <p>24 of which we have small amounts, so we take a few</p> <p>25 milligrams of plant material from the leaves, the bark</p> <p style="text-align: center;">Page 97</p> | <p>1 A. We have no knowledge of that because we were unable to</p> <p>2 compare living material with dried.</p> <p>3 Q. Based on your knowledge of other plants and how the</p> <p>4 fresh material compares to the dried material, is that</p> <p>5 a hypothesis which is possible?</p> <p>6 A. With our knowledge of alkaloids, they are pretty stable</p> <p>7 compounds if dried correctly in herbarium samples. That</p> <p>8 is why when we do this, we can undertake this type of</p> <p>9 study on dried herbarium samples, so they are usually</p> <p>10 very stable.</p> <p>11 Q. Are you therefore saying that actually you are quite</p> <p>12 confident that you have the principal alkaloids of</p> <p>13 gelsemium within the testing you did?</p> <p>14 A. Yes.</p> <p>15 Q. You tested the different parts of the plant for</p> <p>16 clarification as well, as we will come on to see in the</p> <p>17 table. That is presumably because different parts may</p> <p>18 have different alkaloids?</p> <p>19 A. That's right, and different layer concentrations, yes.</p> <p>20 Q. Were you looking at any particular part of the plant in</p> <p>21 gelsemium particular or --</p> <p>22 A. Traditionally it has been the bark of the plant that has</p> <p>23 been used, so we did concentrate on that.</p> <p>24 Q. That is what the literature says?</p> <p>25 A. That is what the literature says, yes.</p> <p style="text-align: center;">Page 99</p> |
| <p>1 or other parts and then grind that up and make it into</p> <p>2 a solution for analysis.</p> <p>3 If we want to do an exhaustive study, we would</p> <p>4 require a large amount of plant material, initially it</p> <p>5 would be fresh and then we would dry it under the</p> <p>6 appropriate conditions. We did try -- that is one of</p> <p>7 the delays in the work -- to get living material from,</p> <p>8 say, China or from India but after many attempts,</p> <p>9 unfortunately we were not successful.</p> <p>10 Q. How does the fact that you are using pre-dried material</p> <p>11 affect the reliability of the testing?</p> <p>12 A. We know that those compounds are stable from information</p> <p>13 in our literature but also from our knowledge of dealing</p> <p>14 with alkaloids. That these are quite stable over time</p> <p>15 in dried --</p> <p>16 Q. When you say "these are", how do you know --</p> <p>17 A. The main compounds that we suspect, based on their</p> <p>18 molecular weight, mass in the mass spectrometry data,</p> <p>19 that we are dealing with, the information on those</p> <p>20 compounds is that they are stable.</p> <p>21 Q. What about the -- I mean are there known unknowns?</p> <p>22 Could there be alkaloids in the gelsemium which would</p> <p>23 show up positively and quite strongly on mass</p> <p>24 spectrometry but which, because it has gone through</p> <p>25 degradation --</p> <p style="text-align: center;">Page 98</p> | <p>1 Q. You had some samples and you obtained other samples.</p> <p>2 You then ran I think 17 samples in total -- there was</p> <p>3 some confusion at one point about the number.</p> <p>4 A. Yes, because there were sub samples of some.</p> <p>5 Q. One doesn't need to dwell on that, I don't think.</p> <p>6 Then you found, as we have seen, the four isomers.</p> <p>7 A. Yes.</p> <p>8 Q. If I can take you to the table which has been the focus</p> <p>9 of quite a lot of attention during the course of this</p> <p>10 Inquest, it is on page 276 which is right at the back of</p> <p>11 246.</p> <p>12 Do you have that?</p> <p>13 A. Yes.</p> <p>14 Q. Can I just ask you first of all, there are four isomers</p> <p>15 here, isomer 4 says "Probably gelsemicine".</p> <p>16 A. That's right.</p> <p>17 Q. Could you explain how you have come to that view and how</p> <p>18 confident you are about it -- sorry, first of all</p> <p>19 I should ask, is that your view?</p> <p>20 A. Yes, I mean I went through this data with Dr Kite and</p> <p>21 I came to the same conclusions as he did.</p> <p>22 Q. Thank you.</p> <p>23 How confident are you that the isomer 4 that has</p> <p>24 been isolated there, and then we can see the data, the</p> <p>25 MS/MS data et cetera there, is probably gelsemicine?</p> <p style="text-align: center;">Page 100</p> |

| | |
|---|---|
| <p>1 A. I would support the report as written.</p> <p>2 Q. Why is it gelsemicine though?</p> <p>3 A. It is probably -- we haven't -- it is a tentative</p> <p>4 identification, we cannot be 100 per cent sure because</p> <p>5 we did not have a standard to run at the same time.</p> <p>6 Q. You cannot be 100 per --</p> <p>7 A. Therefore that is why we have used "probably".</p> <p>8 Q. I am trying to understand how you get to probably. Why</p> <p>9 of the various alkaloids that was isolated within the</p> <p>10 tests that you conducted on the 17 samples is that</p> <p>11 probably gelsemicine?</p> <p>12 A. Partly it is from the mass spec data, the ions which are</p> <p>13 slightly different and the peak area, that the fact that</p> <p>14 that one is supposed to be the dominant one that occurs</p> <p>15 in the plant. The others are usually there in smaller</p> <p>16 amounts and that partly is seen by the column there on</p> <p>17 the peak area.</p> <p>18 Q. Does the literature then demonstrate that gelsemicine is</p> <p>19 the predominant alkaloid, because I think you said it</p> <p>20 was the predominant toxic alkaloid but was it the</p> <p>21 dominant alkaloid? Or have you made a presumption there</p> <p>22 which may not necessarily be right?</p> <p>23 A. I am just trying to go back in time looking at the</p> <p>24 literature.</p> <p>25 It is the one that is reported most frequently and,</p> <p style="text-align: center;">Page 101</p> | <p>1 I understand.</p> <p>2 Without having that literature before us, is it</p> <p>3 possible for you to say beyond reasonable doubt that the</p> <p>4 compound found in Mr Perepilichny's stomach was not</p> <p>5 gelsemicine?</p> <p>6 A. Based on the retention time and the mass spectrum</p> <p>7 fragmentation pattern, no, it is a different compound.</p> <p>8 Q. If it is gelsemicine, then it is beyond reasonable doubt</p> <p>9 that what is found in the stomach is not gelsemicine?</p> <p>10 A. From my interpretation of the data, yes.</p> <p>11 Q. If it is not gelsemicine, whatever it is is not the same</p> <p>12 as what was found in the stomach?</p> <p>13 A. Yes. Yes. It is a different compound.</p> <p>14 Q. It is a different compound.</p> <p>15 Can I just go back to the issue of what the compound</p> <p>16 is. It hasn't been identified. How common will you</p> <p>17 find a molecule based on MS/MS testing of plant material</p> <p>18 which you cannot identify?</p> <p>19 A. A high proportion of the compounds, especially if you</p> <p>20 are dealing with an understudied plant, are not</p> <p>21 identified.</p> <p>22 Q. When you go back to your data or go back to the</p> <p>23 dictionary, or database, you don't find it listed, it is</p> <p>24 new?</p> <p>25 A. There might be something in the database that indicates</p> <p style="text-align: center;">Page 103</p> |
| <p>1 yes, it is associated with its toxicity.</p> <p>2 What I am not sure about is whether people have just</p> <p>3 homed in on that particular alkaloid. I think it is the</p> <p>4 most abundant in the plant.</p> <p>5 Q. Okay. It may be that really nailing that question is</p> <p>6 something that you have to do by looking again at the</p> <p>7 literature and I think that is probably beyond asking</p> <p>8 you to do live as it were in the witness box, but</p> <p>9 I think it may be an important point because as you</p> <p>10 appreciate Professor Cowan said well, looking at the</p> <p>11 tests we have done, I accept that the tests run by</p> <p>12 Dr Kite found isomers or compounds which are not the</p> <p>13 same as the one found in Mr Perepilichny's stomach.</p> <p>14 You looked at gelsemium in two forms, you found</p> <p>15 various isomers and none of them matched satisfactorily</p> <p>16 the unknown compound found in Mr Perepilichny's</p> <p>17 stomach. He is prepared to go that far. Where he</p> <p>18 couldn't go is further down the plant biology element</p> <p>19 and I am trying to understand what you have brought to</p> <p>20 the mass spectrometry and it sounds like it is</p> <p>21 literature which we don't have in front of us today?</p> <p>22 A. No, we don't have that in front of us, the comparative</p> <p>23 data from the literature that has been done in earlier</p> <p>24 studies.</p> <p>25 Q. Okay.</p> <p style="text-align: center;">Page 102</p> | <p>1 the same mass but it hasn't been confirmed that that is</p> <p>2 that compound in that particular plant because it hasn't</p> <p>3 been found in that plant before. What we would normally</p> <p>4 do is to hopefully isolate the compound and then confirm</p> <p>5 that it is, it matches for sure that particular compound</p> <p>6 in a plant.</p> <p>7 Q. Are there instances where you go through that exercise</p> <p>8 and it doesn't bear fruit in terms of identification?</p> <p>9 A. Yes. Many times we are only able to give tentative</p> <p>10 identifications. In many papers on natural product</p> <p>11 chemistry they are tentative.</p> <p>12 Q. In this particular case, as I understand it from what</p> <p>13 Professor Cowan was saying, it is no longer going to be</p> <p>14 possible to reliably go back and retest the compound to</p> <p>15 try and work out what it is.</p> <p>16 A. It doesn't match any of the compounds that we have</p> <p>17 available to us. When we gave the first report, we were</p> <p>18 wondering if somebody who is an expert on the chemistry</p> <p>19 of the stomach might be able to analyse it and identify</p> <p>20 it from our data.</p> <p>21 Q. It could be a form of digestive compound?</p> <p>22 A. It could be, yes. That is not our expertise.</p> <p>23 MR SKELTON: Thank you.</p> <p>24</p> <p>25</p> <p style="text-align: center;">Page 104</p> |

| | |
|--|---|
| <p>1 Questions from MR MOXON BROWNE</p> <p>2 MR MOXON BROWNE: Professor Simmonds, I represent Legal &</p> <p>3 General, the insurance company.</p> <p>4 Were you aware that in the spring of 2013 there is</p> <p>5 evidence before the coroner that it was the intention of</p> <p>6 Surrey Police to send to you some samples of vegetable</p> <p>7 material from Mr Perepilichny's stomach, so that you</p> <p>8 could identify them -- were you aware of that plan?</p> <p>9 A. We were aware that samples were going to be sent to us,</p> <p>10 yes.</p> <p>11 Q. With the general objective of trying to find out what it</p> <p>12 was that Mr Perepilichny might have eaten on the day of</p> <p>13 his death?</p> <p>14 A. Yes.</p> <p>15 Q. The starting point for an inquiry --</p> <p>16 A. Yes.</p> <p>17 Q. -- you were supposed to help with that?</p> <p>18 You are nodding, is that your understanding?</p> <p>19 A. We knew that we were going to be -- a request was made</p> <p>20 for us if we could analyse some plant material from the</p> <p>21 gut contents.</p> <p>22 Q. Yes. I think you were sent, with the original batch of</p> <p>23 material, a jar of a particular type of Russian or</p> <p>24 Ukrainian sorrel?</p> <p>25 A. That's correct.</p> <p style="text-align: center;">Page 105</p> | <p>1 A. I would be reluctant to say. Tannin is a very, very</p> <p>2 widely used term. I wouldn't link those two directly</p> <p>3 together.</p> <p>4 Q. Let's stick with quercetin, quercetin I think is</p> <p>5 commonly found in all kinds of foodstuffs but there is</p> <p>6 a particular type of quercetin which is something</p> <p>7 something glycoside which is, again, not exclusively</p> <p>8 connected with sorrel but is something approaching</p> <p>9 a marker?</p> <p>10 A. It is found in sorrel. I would be reluctant to say it</p> <p>11 is a marker because it occurs in other plant material.</p> <p>12 Q. That I appreciate.</p> <p>13 It was in fact the presence of that particular form</p> <p>14 of quercetin in the jar that persuaded you with</p> <p>15 a reasonable degree of confidence that that was indeed</p> <p>16 sorrel?</p> <p>17 A. Yes.</p> <p>18 Q. I think it is right that you didn't find, I am not going</p> <p>19 to call it a marker because you don't agree with that,</p> <p>20 but this indication, this indicative substance in the</p> <p>21 stomach contents?</p> <p>22 A. Yes.</p> <p>23 Q. Nor did you find it in any part of the digestive tract?</p> <p>24 A. Yes.</p> <p>25 Q. That's correct?</p> <p style="text-align: center;">Page 107</p> |
| <p>1 Q. Called ST/04 I think. You did have a look at that and</p> <p>2 I think you concluded, although short of certainty, that</p> <p>3 it did indeed contain sorrel as it said on the label?</p> <p>4 A. It contained compounds that would be associated with</p> <p>5 sorrel. Yes.</p> <p>6 Q. Did you understand why you had been asked to perform</p> <p>7 that function, why had you suddenly been sent this jar</p> <p>8 to look at?</p> <p>9 A. From the information that we had been given, it was</p> <p>10 an indication that not that particular jar but sorrel</p> <p>11 had been used in a meal that the deceased had taken.</p> <p>12 Q. Yes. As you understood it, the purpose of sending you</p> <p>13 this jar was to advance an inquiry as to what</p> <p>14 Mr Perepilichny might have had for lunch?</p> <p>15 A. Yes. To see if we could find that in the stomach. Yes.</p> <p>16 Q. Yes. You I think did analyse the jar of sorrel and you</p> <p>17 have told us that you found compounds in there that were</p> <p>18 not exclusively indicative of sorrel but certainly</p> <p>19 consistent with sorrel?</p> <p>20 A. Yes.</p> <p>21 Q. I think it is the case that sorrel has an acrid, peppery</p> <p>22 taste, it has been described, it is probably associated</p> <p>23 with quercetin, which is basically tannin, I think?</p> <p>24 A. With quercetin, yes.</p> <p>25 Q. Quercetin is basically tannin; is that correct?</p> <p style="text-align: center;">Page 106</p> | <p>1 A. From memory, yes.</p> <p>2 Q. Does that indicate that Mr Perepilichny had not eaten</p> <p>3 sorrel for lunch or does it indicate that what you were</p> <p>4 doing wasn't an appropriate way of finding that?</p> <p>5 A. We had no idea how much had been used. And that would</p> <p>6 often indicate the sensitivity of the equipment, it</p> <p>7 would very much depend on how much had been consumed and</p> <p>8 when.</p> <p>9 Q. Well the coroner has a certain amount of information</p> <p>10 which I would like to put to you.</p> <p>11 The first is that when Dr Ratcliffe opened the</p> <p>12 stomach there was in the stomach partly digested food,</p> <p>13 so some of the food that he had apparently recently</p> <p>14 eaten was still in his stomach. That is the first</p> <p>15 point.</p> <p>16 The second point is that people at Reading</p> <p>17 University had abstracted vegetable material from both</p> <p>18 the first part of the digestive tract and the second</p> <p>19 part. That would seem to indicate that what he had</p> <p>20 eaten, part of it was still in his stomach and part of</p> <p>21 it had begun to pass into his digestive tract. I think</p> <p>22 that the person who was involved with the lunch said</p> <p>23 that there was something like maybe 300 grams had gone</p> <p>24 in, quite a lot. I am just wondering whether you are</p> <p>25 saying that there is a possibility, or probability, that</p> <p style="text-align: center;">Page 108</p> |

| | |
|--|---|
| <p>1 within two, three, four hours of consumption of sorrel, 2 all trace of it would have disappeared from his stomach, 3 from his digestive tract and indeed from his blood? 4 A. I am afraid I don't know the retention time of 5 quercetin, how long it would remain in the gut. Of 6 course at that stage we did not know that we hadn't got 7 say the main contents of the gut to look at. 8 Q. Yes. Mine is a slightly different question, which is 9 whether if he had eaten quite a lot of sorrel for lunch, 10 all trace of it would have disappeared within two or 11 three hours? 12 A. No, you would have expected to have found some in the 13 gut. 14 Q. I think that quite recently the vegetable material that 15 was abstracted from the digestive tract that was 16 supposed to have been sent to you was discovered and now 17 has been sent to you and you are planning to use DNA 18 techniques to see if you can identify it. 19 Just wondering, you now have, as far as I understand 20 it, some small particles of solid vegetable material, 21 that's right, which you are going to do the DNA testing 22 on if you can. 23 A. Yes. 24 Q. Why can't you just use conventional gas chromatography 25 mass spectrometry, you have the solid stuff, surely that</p> <p style="text-align: center;">Page 109</p> | <p>1 equipment is able to detect this group of compounds. 2 Q. Yes. Well, obviously we must await and will await the 3 DNA testing but at the moment are you saying, without 4 the benefit of that are you saying you think it is 5 unlikely that sorrel formed part of his last meal? 6 A. I cannot make any comments than that, all I know is that 7 samples we looked at did not contain the quercetin 8 compounds that we would expect. 9 Q. I do understand, but I recollect that a few minutes ago 10 you said that if he had consumed sorrel you would have 11 expected to see it. 12 A. Yes. I can talk about the samples that we received, 13 that we did the initial analysis on, which we now know 14 were, you know, the stomach contents had already been 15 removed, you could say, from that. 16 Q. Yes. 17 THE CORONER: Is there a certain level that your tests won't 18 pick up? 19 A. Yes, there is a lower level of detection. I can't tell 20 you exactly what that would be but yes. 21 MR MOXON BROWNE: Could I next take you to page 276 of 22 bundle 1 of the experts, which is a table. I am having 23 a little difficulty in understanding what this is and 24 I would like you to help me. 25 I see down the left-hand side, my copy appears to</p> <p style="text-align: center;">Page 111</p> |
| <p>1 is enough? 2 A. I actually have not looked at the size of the sample, we 3 would need a small amount. I believe it is very small, 4 the amount that we have. We did discuss whether we did 5 chemistry on it or we did the DNA and the decision was 6 we would try the DNA. 7 Q. Yes. My understanding is that the GS/MS techniques are 8 capable of detecting minute quantities of compounds. 9 A. Yes. 10 Q. Whereas for DNA, as you have said, you need something 11 you can get a hold of. Why aren't you using that tried 12 and tested technique? 13 A. Because a decision was made that we would go the DNA 14 route and then, if there is any material left over, we 15 could look at it for LCMS. 16 Q. I understand. 17 Is it possible that in that initial series of tests 18 on the stomach contents on the upper and middle part of 19 the upper digestive tract and on the blood, that the 20 techniques you were using were simply not appropriate, 21 limits of detection were not appropriate, for detecting 22 even quite large quantities of vegetable material? 23 A. We have published frequently on the quercetin type of 24 compounds, so it is a compound we have a lot of 25 experience of working with. We would know that the</p> <p style="text-align: center;">Page 110</p> | <p>1 have been truncated but do we see tissue and then root 2 bark, leaf, fruit wall, et cetera? 3 A. Yes, you have the BI number, then the species, then the 4 tissue of the plant that was examined. 5 Q. You have the BI, the accession number which I haven't, 6 I just have root bark ... 7 Then going across, do we have four lots of data in 8 four columns, we don't read all the way across we go up 9 and down up and down. Is that right? 10 A. Yes, four columns, isomer 1 and isomer 2, 3 and 11 isomer -- 12 Q. I am having a little difficulty in hearing and it is my 13 fault. What did you say? 14 A. We have four columns. 15 Q. Right. 16 If we take the first one, root bark, what is the 17 accession number there, it is not written on my bit of 18 paper? 19 A. 25441. 20 Q. The second one, leaf? 21 A. 25499. 22 Q. And fruit wall? 23 A. 25499. 24 Q. And the root bark? 25 A. 25500.</p> <p style="text-align: center;">Page 112</p> |

| | |
|--|--|
| <p>1 Q. Yes, now where is the data for the root bark? Where am 2 I supposed to look to see what you found in relation to 3 that particular item? 4 A. If you go for root bark and go across there was nothing 5 present associated with isomer 1. 6 Q. Why do you call that isomer 1? 7 A. We had to give them some -- 8 Q. Is it marked anywhere on this chart that that is 9 isomer 1? 10 A. On this chart? 11 Q. This chart that I am looking at, there is a lot of talk 12 about isomer 4 and I couldn't find it. 13 THE CORONER: It says at the top. 14 MR SKELTON: Sir, a lot of the problems with this is 15 Mr Moxon Browne's problems rather than the witnesses and 16 I wonder if he ought to get another copy of the page. 17 We have passed it out before. 18 THE CORONER: I know, we are spending a lot of times 19 establishing the differences between Mr Moxon Browne's 20 copy and yours. 21 MR MOXON BROWNE: I am not sure it is entirely my fault. 22 THE CORONER: It would be less of your fault if you have 23 exactly the same copy as she has. 24 MR MOXON BROWNE: It would. It would. I think someone is 25 going to give me one.</p> <p style="text-align: center;">Page 113</p> | <p>1 Correct? 2 A. The one that we have identified is probably that 3 compound, yes. 4 Q. Yes, thank you. 5 I was looking for that information. Thank you very 6 much. 7 Can we go back then to 2013. When you found an ion 8 from Mr Perepilichny's stomach eluting at 6.90. You 9 make the assertion which seems, if I may say so, 10 obviously right that that cannot be the same as what you 11 found in 2015 eluting between 11 and 12 minutes, because 12 the elution time is so different. 13 A. Yes, it is very different, yes. On that particular run, 14 yes. 15 Q. At the same time, and having discovered that what you 16 had found in the stomach in point of accurate mass, that 17 is to say 359.1965, the Dictionary of Natural Products 18 told you seemed to be associated with gelsemium, you 19 took a sample of root bark from gelsemium 20 sempervirens -- 21 A. Yes. 22 Q. -- and subjected that to analysis. That gave you 23 I think four results, you heard Professor Cowan give 24 evidence about this I expect, four peaks? 25 A. Yes.</p> <p style="text-align: center;">Page 115</p> |
| <p>1 Has no one got one I can borrow? 2 A. Do you have a ruler or a pen. 3 THE CORONER: So you can read across? 4 A. Yes, thank you. 5 THE CORONER: There will be. 6 A. Thank you very much. 7 MR MOXON BROWNE: Yes. 8 Where do you say on this chart is what you have 9 presumed to be gelsemicine? 10 A. The one that we have put is probably is isomer 4, that 11 last column. 12 Q. Yes. Is that 359.1977, 11.89? Is that 359.1977 -- 13 THE CORONER: When you go further down I think it is, isn't 14 it? 15 A. I think it is, yes. 16 MR MOXON BROWNE: Is that the one you are talking about? 17 A. Can you just take me through that again? 18 Q. Yes, I am wondering whether what you have identified as 19 probably gelsemicine is from gelsemium sempervirens root 20 bark with an accession number ending 491 with an 21 accurate mass of 359.1977 and an elution time of 11.89, 22 is that right? 23 A. Retention time, yes. 24 Q. We are agreed that what you think is gelsemicine eluted 25 in your late 2015 tests between 11 and 12 minutes?</p> <p style="text-align: center;">Page 114</p> | <p>1 Q. What do you think they were? 2 A. We are not 100 per cent sure because we did not spike 3 them with any compounds, because we don't have any 4 standards so they could be alkaloids from the plant, 5 yes. 6 Q. They could be alkaloids from the root bark? 7 A. Yes. 8 Q. They have got exactly the same or pretty well the same 9 accurate mass as gelsemicine but they cannot be 10 gelsemicine, can they, because the elution time is 11 completely wrong? 12 A. It is different from the run that we did on the previous 13 data we were looking at, yes. 14 Q. I think we have all seen that. What I was putting to 15 you was that because of that they cannot be gelsemicine? 16 A. I can't say that they can't be. 17 Q. No, but it doesn't look like it, does it? 18 A. I think what you need to do is to run those samples at 19 the same time to be absolutely sure. 20 Q. Are you suggesting that your machine -- there could have 21 been drift in point of elution time because it was done 22 on a different occasion? 23 A. They were done on different occasions, yes. 24 Q. You cannot get drift, can you, of that kind for three, 25 four, five minutes?</p> <p style="text-align: center;">Page 116</p> |

| | |
|--|--|
| <p>1 A. You do not usually get drift unless something has 2 changed.</p> <p>3 Q. It looks much more likely doesn't it that in 2013 you 4 found some alkaloids in the root bark which had not 5 previously been identified. Nothing particularly 6 surprising in that?</p> <p>7 A. We have no evidence that they were unknowns, because of 8 the mass linking up with what was already in the 9 literature, we took them as not being an unknown.</p> <p>10 Q. The mass certainly answered --</p> <p>11 A. Yes.</p> <p>12 Q. -- but when you later came to have a detailed look, you 13 couldn't find anything that even remotely matched what 14 you had found in 2013, which is why I call them 15 unknowns.</p> <p>16 A. But I think if I could go back and somebody could give 17 me the number of the sample that we looked at in 2013, 18 we reran it in the later batch. I just don't have that 19 data in front of me.</p> <p>20 Q. Well I am afraid I didn't know that you had done that. 21 You got that old one from 2013 and ran it again?</p> <p>22 A. Yes, we ran it again.</p> <p>23 Q. That is an interesting piece of information which 24 I cannot help you with, but perhaps we can put that on 25 the back burner for the moment.</p> <p style="text-align: center;">Page 117</p> | <p>1 A. Yes.</p> <p>2 Q. I just want to see how that addendum came about. Did 3 you feel that you had adequately expressed the views you 4 had come to in your first report? Did you feel there 5 was any necessity to provide an addendum or did someone 6 suggest it to you?</p> <p>7 A. Somebody asked if we have any further information to add 8 to the report.</p> <p>9 Q. Yes. Can we just see how that evolved. Could 10 Professor Simmonds be provided with bundle 5, volume 4. 11 I call them the Hermitage documents but they are HOLMES 12 documents really.</p> <p>13 Thank you.</p> <p>14 Professor, if you would be good enough to look at 15 page, I think it was 1339.</p> <p>16 This is an email from someone called Ray Fysh to 17 you, dated 10 August 2013. If we just remind ourselves 18 that is after you had written your report but before you 19 produced the addendum.</p> <p>20 A. Yes.</p> <p>21 Q. Correct?</p> <p>22 A. Yes.</p> <p>23 Q. He is saying:</p> <p>24 "Dear Professor Simmonds, a couple of things if 25 I may. As you are aware we are just tidying up a few</p> <p style="text-align: center;">Page 119</p> |
| <p>1 A. That was a form of control.</p> <p>2 Q. Yes, I understand.</p> <p>3 What I am suggesting to you, the net result of what 4 you did in 2013 was you started out with one 5 unidentified ion which you have got from 6 Mr Perepilichny's stomach and you ended up with five 7 unidentified ions, including four that you got for some 8 root bark because you were never able subsequently to 9 retrieve anything like that from your gelsemium plants. 10 It was a one off?</p> <p>11 A. We did not replicate exactly the same traces as we did 12 on the initial analysis.</p> <p>13 Q. What I am putting to you is that the material that you 14 obtained in 2015 bears no relationship, there is not 15 even a suspect to match what you found in 2013. If 16 there is, please tell me.</p> <p>17 A. I would have to compare the two numbers, which I would 18 need somebody to give me that to be able to just do it 19 now but, yes, we often rerun a sample when we are 20 looking at further analysis to just see if there is any 21 drift, see if there are any differences.</p> <p>22 Q. Yes, I think you wrote your report in two halves, one 23 you wrote I think in June/July 2013, and then you wrote 24 an addendum or an extra bit dated 28 August 2013. Do 25 you remember that?</p> <p style="text-align: center;">Page 118</p> | <p>1 loose ends for the senior investigating officer and the 2 coroner and one of the aspects that DCI Pollard has 3 requested is to clarify the situation with the unknown 4 compound."</p> <p>5 I think you had been having a series of exchanges 6 with representatives of Surrey Police before this, do 7 you remember that?</p> <p>8 A. Yes.</p> <p>9 Q. The first thing he says is:</p> <p>10 "Would it be correct in reporting the following. 11 Although the analysis of the stomach content but none of 12 the other samples analysed gave a result that indicated 13 the possible presence of a compound related to the plant 14 alkaloid gelsemium. Further tests by analysing 15 a control sample of gelsemium sempervirens conclusively 16 showed that the compound was not related to gelsemium or 17 any other known plant poison."</p> <p>18 That is first proposition.</p> <p>19 Then the second proposition is:</p> <p>20 "Looking at the MS/MS with M/Z 180 [that is the 21 major fragment from what you found] to what may turn out 22 to be glycosidated material and it was therefore the 23 compound minus the glycoside would have a molecular 24 weight of 196, if it is a glycoside this I am afraid 25 would invalidate the molecular form of C20H27N2O4."</p> <p style="text-align: center;">Page 120</p> |

| | |
|--|--|
| <p>1 Do you see that?</p> <p>2 A. Yes.</p> <p>3 Q. Do you remember getting those suggestions from Mr Fysh?</p> <p>4 A. I can remember, yes, vaguely, getting them yes.</p> <p>5 Q. As far as the first proposition is concerned, of course</p> <p>6 what your tests have done and showed pretty certainly</p> <p>7 was that the sample from the contents of</p> <p>8 Mr Perepilichny's stomach was not the same as what you</p> <p>9 extracted from a particular part, the root bark of</p> <p>10 a particular plant, ie one growing at Kew of</p> <p>11 a particular species which was gelsemium sempervirens.</p> <p>12 That was all you have ever said?</p> <p>13 A. Yes.</p> <p>14 Q. As I understand it, you couldn't say that it</p> <p>15 conclusively showed that the compound was not related to</p> <p>16 gelsemium, you were nowhere near that, were you?</p> <p>17 A. We couldn't show that there was anything in that plant</p> <p>18 that was related to the stomach contents.</p> <p>19 Q. No, quite. That was your conclusion. That didn't</p> <p>20 demonstrate, did it, that the compound wasn't related to</p> <p>21 gelsemium, it could have been related to all kinds of</p> <p>22 compounds from gelsemium, including that from the leaf,</p> <p>23 maybe from elegans, all kinds of things?</p> <p>24 A. Our sample that we looked at at that time was the</p> <p>25 species identified here. We take it then, if one of the</p> <p style="text-align: center;">Page 121</p> | <p>1 A. No.</p> <p>2 Q. Do you think that is wrong or have you no view?</p> <p>3 A. I have no view.</p> <p>4 Q. Thank you.</p> <p>5 Can we then just briefly consider, we have nearly</p> <p>6 finished, the answer to the questions that were posed to</p> <p>7 you in December 2014 which you answered in May 2015. To</p> <p>8 look at those, we need to go in bundle 1. We can put</p> <p>9 away this 5.6 and go back into bundle 1 of the experts.</p> <p>10 It is at page 245.</p> <p>11 Do you remember that document?</p> <p>12 A. Yes.</p> <p>13 Q. These came to you I think, or were certainly issued by</p> <p>14 the coroner on 15 December. You didn't answer them it</p> <p>15 would seem until May 2015. Can you remember why that</p> <p>16 was?</p> <p>17 A. There was a delay in being able to do some of the</p> <p>18 analysis, et cetera. I think that was most likely why</p> <p>19 there was a delay there.</p> <p>20 Q. I didn't hear the last bit, sorry.</p> <p>21 A. We had equipment problems and I think that was why there</p> <p>22 was a delay.</p> <p>23 Q. Yes. I think if I can help you Professor Simmonds that</p> <p>24 may account for the delay between May 2015 and October</p> <p>25 of 2015, when we have heard from Dr Kite that you had</p> <p style="text-align: center;">Page 123</p> |
| <p>1 toxins that was reported to be in that plant, then we</p> <p>2 could show that we had not found it.</p> <p>3 Q. Yes, and you appreciate saying, "I haven't found it in</p> <p>4 the root bark of sempervirens" is not the same as</p> <p>5 saying, "The compound is not related to gelsemium", that</p> <p>6 a very different and much wider proposition?</p> <p>7 A. Yes, but the comment here is a control sample, it is not</p> <p>8 saying that it is not the whole of the species, it does</p> <p>9 say a control sample we looked at.</p> <p>10 Q. You did a control sample, you drew conclusions from that</p> <p>11 which I have put to you and I think which we all</p> <p>12 understand, which appeared in your report. I am simply</p> <p>13 saying that the proposition here that that showed that</p> <p>14 the compound was not related to gelsemium, to put it</p> <p>15 mildly, somewhat overstated the case?</p> <p>16 A. Yes, I mean -- yes, we cannot fully say it was not</p> <p>17 related.</p> <p>18 Q. No. Indeed you didn't put that in your report?</p> <p>19 A. No.</p> <p>20 Q. You didn't adopt the suggestion?</p> <p>21 A. No.</p> <p>22 Q. No. The second suggestion that the MS/MS points to what</p> <p>23 may turn out to be a glycosidated material and therefore</p> <p>24 minus the glycoside et cetera. You didn't adopt that</p> <p>25 either, did you?</p> <p style="text-align: center;">Page 122</p> | <p>1 equipment problems and everyone was waiting for the</p> <p>2 further tests, and indeed the whole Inquest was waiting</p> <p>3 and that took a long time. I am talking about the</p> <p>4 earlier period, between being given questions in 2014,</p> <p>5 December, and your answers in May. If you don't</p> <p>6 remember, it doesn't matter.</p> <p>7 A. I can't remember for sure why there would be a delay on</p> <p>8 that.</p> <p>9 Q. Were you told by for example the coroner's officer that</p> <p>10 the Inquest itself was due to start on 17 May I think?</p> <p>11 A. There was a delay in us having that information.</p> <p>12 I think we had emails to that effect, that emails were</p> <p>13 definitely sent to us, we got those, but there was</p> <p>14 a period when I was unaware of the dates.</p> <p>15 Q. You didn't know that the Inquest was due to start</p> <p>16 in May?</p> <p>17 A. I did not know at the early stages.</p> <p>18 Q. Very well.</p> <p>19 These have been looked at but basically the</p> <p>20 questions were all directed, as I am sure you realised,</p> <p>21 in the same direction which was basically that in 2013</p> <p>22 you had looked at the wrong species, you had looked at</p> <p>23 sempervirens whereas your best chance of finding isomers</p> <p>24 that might match what was found in the stomach was in</p> <p>25 elegans. I think you agreed with that.</p> <p style="text-align: center;">Page 124</p> |

| | |
|---|--|
| <p>1 A. We had two choices of plants to look at, we took the one</p> <p>2 that was most available to us at Kew.</p> <p>3 Q. Yes.</p> <p>4 A. And it was also reported to contain some of the</p> <p>5 compounds, as starting material.</p> <p>6 Q. Obviously the coroner was very reluctant to adjourn the</p> <p>7 Inquest but you were really recommending, weren't you,</p> <p>8 that further tests be done on elegans?</p> <p>9 A. We wanted to make sure that we had ruled out any</p> <p>10 potential toxins that might have been occurring, with</p> <p>11 the knowledge that these plants are not particularly</p> <p>12 well studied.</p> <p>13 Q. Yes.</p> <p>14 I think at question 12 on page 248:</p> <p>15 "Could the compounds detected in the sample of</p> <p>16 Mr Perepilichny's stomach contents have come from</p> <p>17 a species of gelsemium other than gelsemium sempervirens</p> <p>18 such as elegans?"</p> <p>19 You say:</p> <p>20 "Yes, this is an option that could be considered</p> <p>21 ..."</p> <p>22 Especially saying that elegans is a known toxin</p> <p>23 plant. You seem to be encouraging the idea of further</p> <p>24 tests?</p> <p>25 A. I wouldn't say I was encouraging. We would want to do</p> <p style="text-align: center;">Page 125</p> | <p>1 literature, gelsemicine is found in both sempervirens</p> <p>2 and elegans whereas the isomers, according to the</p> <p>3 literature, are only found in elegans?</p> <p>4 A. From those studies, yes.</p> <p>5 Q. The literature may not be accurate but that is what it</p> <p>6 suggests.</p> <p>7 If that is right, if one adopts that as gospel, what</p> <p>8 we have from 2013 is not one unidentified peak but four</p> <p>9 identified peaks, that is what we are?</p> <p>10 A. We have not given an accurate identification of the</p> <p>11 peaks, of the peak that we have identified, we give</p> <p>12 a tentative identification, is that what we term</p> <p>13 isomer 4.</p> <p>14 Q. That is in 2016. I am still I am afraid in 2013.</p> <p>15 A. We identified what could be one of the alkaloids in the</p> <p>16 earlier study. It is not -- this is, we never say that</p> <p>17 this is absolutely that compound.</p> <p>18 Q. No, I know you don't. You have said that what eluted</p> <p>19 between 11 and 12 minutes in 2006 is what you identify</p> <p>20 as gelsemicine, it is not the same as what you found in</p> <p>21 2013 and so we can perhaps put that, the possibility</p> <p>22 that any of those four is gelsemicine, perhaps we can</p> <p>23 put to one side. You still have four to account for,</p> <p>24 what are they?</p> <p>25 A. We don't know what exactly they are.</p> <p style="text-align: center;">Page 127</p> |
| <p>1 an exhaustive study to rule things out, yes.</p> <p>2 Q. Well you did do a thorough study in the late autumn of</p> <p>3 2015, you didn't look at rankinii but you looked at</p> <p>4 elegans as well as sempervirens and you looked at</p> <p>5 different parts of the plant, as we have seen.</p> <p>6 The net result of all of that was, as I have put to</p> <p>7 you, that you didn't find anything that matched what you</p> <p>8 had found in the root bark in 2013, and we have seen the</p> <p>9 thumbnails and you cannot find it.</p> <p>10 A. We didn't repeat exactly the same trace as that we found</p> <p>11 in that initial study, the trace is not the same in 2015</p> <p>12 as it was in 2013.</p> <p>13 Q. Do you say you didn't repeat the trace? You didn't find</p> <p>14 the same trace but you did the same type of test on the</p> <p>15 same type of material, you used root bark from</p> <p>16 sempervirens, you used root bark from elegans and you</p> <p>17 used material from leaves and seeds but none of it</p> <p>18 looked anything like what you had found in 2013?</p> <p>19 A. Material varies quite a bit in its chemical composition</p> <p>20 depending on which bit of the root you take. So it is</p> <p>21 highly unlikely you would get exactly the same profile</p> <p>22 from a trunk taking a sample there and taking a sample</p> <p>23 there. It will not be exactly the same.</p> <p>24 Q. You are now aware, aren't you, you may not have been in</p> <p>25 2013 but you are now aware that according to the</p> <p style="text-align: center;">Page 126</p> | <p>1 Q. What it means is, isn't it, that you find all sorts of</p> <p>2 things in the roots and other parts of gelsemium and</p> <p>3 that you don't know what they are?</p> <p>4 A. Yes, it is an understudied plant.</p> <p>5 Q. That's an understatement, did you say?</p> <p>6 A. It's an understudied plant.</p> <p>7 MR MOXON BROWNE: Understudied, yes.</p> <p>8 Yes, thank you very much.</p> <p>9 Questions from MS HILL</p> <p>10 MS HILL: Professor, I have a couple of questions on timing</p> <p>11 and then Mr Straw has a couple of other questions if</p> <p>12 that is all right.</p> <p>13 Could I ask for Professor Simmonds to be given what</p> <p>14 I think we are calling the Branch correspondence bundle,</p> <p>15 please. It is page 60 please, of that bundle,</p> <p>16 Professor.</p> <p>17 A. I do not have the bundle yet.</p> <p>18 Q. You are being helped.</p> <p>19 A. Page?</p> <p>20 Q. Page 60. Numbering on the top right-hand side, please.</p> <p>21 A. Yes.</p> <p>22 Q. Just is to assist you, Professor, this is a bundle of</p> <p>23 correspondence that was provided by Dr Branch but some</p> <p>24 emails from you are in this correspondence. I just have</p> <p>25 a couple of questions about some dates if I may. Do you</p> <p style="text-align: center;">Page 128</p> |

| | |
|---|--|
| <p>1 see at the foot of page 60 an email from you of 2 14 May 2013 to the Surrey Police team, copied to Mr Fysh 3 at Reading. Do you see that? 4 A. Yes. 5 Q. I think this is an email, isn't it, where you are 6 alerting the team to the possibility of your finding of 7 gelsemium. Is that right? 8 A. Yes, that is really at the initial stages when we have 9 something, before we do the detailed analysis. 10 Q. That is my question, if I may. Could I just check this, 11 that your email of 14 May indicated that you found 12 something that you wanted to investigate further. Is 13 that right? 14 A. Yes. 15 Q. Then if you scroll forward in the bundle, please, just 16 to assist your memory and I am sure it is a little bit 17 of time ago so it may be hard to remember otherwise, go 18 forward, please, to page 103. 19 Do you see that on 21 June, on that date, I think 20 Mr Craggs got in touch with you and asked you about your 21 report and when your report might be ready? 22 A. Yes. 23 Q. Then we see your report I think at page 104, do you see 24 that? 25 A. Yes.</p> <p style="text-align: center;">Page 129</p> | <p>1 Q. I see, so as far as the police were concerned, they 2 wouldn't have known until 13 July the detail of your 3 report. Is that right? 4 A. Yes. As far as I am aware, yes. 5 Q. Were you aware of any announcement being made by Surrey 6 Police at around that time about the conclusion of their 7 investigation or not? 8 A. No, I was unaware. 9 MS HILL: Thank you. 10 Questions from MR STRAW 11 MR STRAW: Professor Simmonds, in one of your reports you 12 note that the work undertaken by Dr Kite is not 13 an exhaustive analysis of all potential toxins. Does 14 that remain the case, and, if so, can you explain in 15 what respects it is not an exhaustive analysis? 16 A. As I indicated at the beginning of my evidence, that we 17 had put together a list about 120 potential toxins, 18 there are more toxins from plants around than we have 19 analysed in that report. 20 Q. Just to pick out three other reasons for that. 21 Dr Kite has told us that the method of analysis 22 wouldn't necessarily pick up all toxins from plants or 23 fungi; is that correct? 24 A. Absolutely correct, yes. 25 Q. Secondly, you have told us this morning that the library</p> <p style="text-align: center;">Page 131</p> |
| <p>1 Q. Although it is dated 13 June, it is no criticism of you, 2 Professor, but if you go back please in the bundle to 3 page 102, does it look rather like you provided that 4 report on 13 July. 5 As I say it is not a criticism, it is just 6 a statement of fact, if you look at the email on 102, 7 you say: 8 "Dear Nick, sorry taken rather longer than it should 9 ..." 10 Saturday, 13 July, it appears that you provide the 11 report on that day? 12 A. I presume it was sent on that day then, yes. 13 Q. Does it appear that the date of 13 June may not be 14 correct, it may be 13 July? 15 A. It was I think prepared on that date. 13 June would 16 have been the date that it was prepared. 17 Q. But it was sent to the police on 13 July? 18 A. It looks like that that was the date that it was 19 actually sent. 20 Q. As far as you are concerned, your investigations of the 21 possibility of gelsemium were certainly continuing 22 throughout the whole of June. Is that right? 23 A. No, it looks like the report would have been prepared 24 and for whatever reason, it was not sent until that 25 Saturday.</p> <p style="text-align: center;">Page 130</p> | <p>1 with which you compared the suspect ion in the stomach 2 doesn't necessarily contain all toxins? 3 A. That is right. 4 Q. Similarly, you were not analysing non-natural things, so 5 whether that is toxin anions, toxic gases? 6 A. We didn't look at any of those, we concentrated on the 7 plant toxins. 8 Q. Do you have the expert bundle, number 1, in front of you 9 and if not -- 10 A. I should have. 11 File number 1, yes? 12 Q. Tab 44, please. This is a series of questions asked by 13 the Chief Constable of Surrey. Can you see question 1 14 says: 15 "If a toxic alkaloid contained in one of the plants 16 of genus gelsemium were orally ingested by a person with 17 fatal results ..." 18 Then I am going to down to (iii) at the bottom: 19 "Would that alkaloid be subsequently detectable post 20 mortem in the urine of that person? If so, for how long 21 and by what means?" 22 I think your answer is: 23 "It could be that compounds from gelsemium could be 24 detected in the urine and that is why we asked for the 25 sample to test it. It arrived on 30 July 2015.</p> <p style="text-align: center;">Page 132</p> |

| | |
|---|--|
| <p>1 "As indicated ... there is very little information 2 about the levels of alkaloids in gelsemium, let alone 3 how they break down in different conditions." 4 A. Yes. 5 Q. Does that remain the case as well? 6 A. Yes. 7 Q. Is it right that it is possible that there had been 8 gelsemium in the stomach but that it had broken down by 9 the time it came to be tested? 10 A. That is a possibility. 11 Q. In another report, I can take you there if that would 12 help but just for speed, you say: 13 "It is highly unlikely that the urine samples would 14 contain the intact alkaloids because they would most 15 likely be broken down." 16 Can you explain that in any more detail? Does that 17 mean that it is most likely that they would be broken 18 down in the period between the death and when they came 19 to be tested? 20 A. No, it is as they go through your alimentary canal it is 21 highly likely that they would be broken down subject to 22 the conditions that are in your gut. 23 Q. Thank you. 24 The unidentified compound in the stomach, is it 25 likely that Mr Perepilichny ingested a substance that</p> <p style="text-align: center;">Page 133</p> | <p>1 A. 251, yes. 2 Q. Question number 4, the question is: 3 "The suspect compound [the unidentified compound in 4 the stomach that is] has a molecular weight of 358 and 5 a possible molecular formula ... is it possible that 6 this compound is derived from a constituent of the 7 following harmless things that the deceased may have 8 ingested prior to his death, sorrel leaves, mericarps, 9 caraway and potato." 10 Then is that your answer underneath that? 11 A. Yes: 12 "A search of the databases at Kew and of commercial 13 databases that provide information about the chemistry 14 of different plants showed no record of compounds in 15 these plants that have the above formula. Thus it is 16 not unlikely." 17 Q. Sorry, does it say "Thus it is not likely"? 18 A. "It is not likely." 19 Q. Okay. 20 That unidentified compound then, I think you have 21 said already but it could have been toxic, is that 22 correct? 23 A. I can make no comment on that. 24 Q. Is it right you cannot say anything about the toxicity, 25 you don't know whether or not it was toxic?</p> <p style="text-align: center;">Page 135</p> |
| <p>1 contained that compound? 2 A. That is not the only route of course, it could be 3 a breakdown product but if it is associated with diet, 4 you would assume that he would have eaten it, yes. 5 Q. I think if it helps, the way you put it in one of your 6 reports, this is 247 if you would like to go to it, you 7 were asked: 8 "Does the presence of the ion in the deceased's 9 stomach at autopsy oblige the conclusion that at some 10 point prior to his death the deceased ingested some 11 substance containing a compound?" 12 Your response I think was: 13 "Yes, the data would suggest that the deceased had 14 ingested a substance that contained a compound with that 15 molecular formula." 16 Is that correct? 17 A. Yes. Rethinking about it of course, you know, it could 18 be a breakdown as associated with the time of 19 decomposition, et cetera. 20 Q. Is it likely that the compound came from sorrel, 21 mericarps, caraway or potato? 22 A. I really cannot make any comment on that. 23 Q. Could you have a look, please, we were at page 249 24 I think in tab 44, could you have a look over at 25 page 251.</p> <p style="text-align: center;">Page 134</p> | <p>1 A. I don't know what it is. 2 Q. The unidentified compound I think was originally matched 3 in terms of its mass with five gelsemium alkaloids; is 4 that correct? 5 A. Could you say that again, please? 6 Q. You have told Mr Skelton a little earlier that the 7 unidentified compound in the stomach, its mass matched 8 that of five alkaloids from gelsemium? 9 A. It was a mass that linked to -- that was the only -- 10 when we did the analysis of the gut, that was the only 11 link with gelsemium. 12 Q. Since then, has it been matched to a further alkaloid, 13 scopolia? 14 A. Not in our ... 15 Q. It may help if I take you to your joint report. 16 A. Yes, sorry, we did look -- yes, at further analysis. 17 Could you just take me to the -- 18 Q. Yes, of course. Don't worry, there is so much 19 information, it is not a memory test, it is your joint 20 report -- 21 A. Yes. 22 Q. -- which is in a different bundle I am afraid. It is in 23 expert bundle 3, tab 95, please, page 832, question D28. 24 Do you say there: 25 "It is agreed that the molecular formula of the</p> <p style="text-align: center;">Page 136</p> |

| | |
|--|---|
| <p>1 compound found in the stomach is in accordance with 2 an alkaloid. The Dictionary of Natural Products lists 3 six compounds with that formula, five are alkaloids from 4 gelsemium, and one is an alkaloid from scopolia." 5 A. Yes, that is a later -- when we were writing this 6 report, we looked back at the natural product database, 7 yes. 8 Q. Dr Kite's analysis of the 17 or so gelsemium samples 9 that you obtained found four isomers within that. He 10 said to us, what that meant is since there were only 11 four isomers within the samples tested, some of the six 12 mass matching alkaloids were missing. Would you agree 13 with that? 14 A. Are missing? We were only able to match four, I am not 15 quite sure I would use the word "missing". There wasn't 16 a total overlap. 17 Q. Yes, so you had four isomers, but since there were six 18 alkaloids whose mass matched that in the stomach, we 19 know that two of those alkaloids at least -- 20 A. Sorry, in the stomach? 21 Q. Yes, there were six alkaloids which -- 22 A. In the stomach? 23 Q. Six alkaloids whose mass matched the compound found in 24 the stomach, so we have on the one hand the unidentified 25 ion in the stomach and then on the other hand the five</p> <p style="text-align: center;">Page 137</p> | <p>1 that. 2 Q. If it is not on that list -- 3 A. Then we didn't look at it. 4 Q. -- then you didn't test for it and then therefore it 5 cannot be excluded presumably that the stomach compound 6 was scopolia? 7 Are some alkaloids from scopolia poisonous? 8 A. Speltamine(?) I think is toxic, I couldn't tell you 9 comparatively how toxic they are. I mean it is known to 10 be a toxic plant and the main ingredients in it are 11 alkaloids. 12 Q. Did you say scopolamine there? 13 A. Yes. 14 Q. Is that the comparatively well known alkaloid that has 15 been said to have been used by Dr Crippen to murder his 16 wife? 17 A. From memory, yes. 18 Q. Is the scopolia plant sometimes called nightshade? 19 A. Yes. 20 MR STRAW: That is everything, thank you very much. 21 Questions from MS BARTON 22 MS BARTON: Professor Simmonds, a couple of issues on the 23 chronology if I may. I appear on behalf of the police. 24 Were the police very anxious to get the results of 25 the toxicological tests in order to advance their</p> <p style="text-align: center;">Page 139</p> |
| <p>1 alkaloids from gelsemium and then scopolia, so six all 2 together, whose masses matched. Do you follow? 3 A. Yes, I follow. 4 Q. We have those six, but because there are only four 5 isomers within the gelsemium plant samples, we know that 6 we cannot have all of the six. 7 A. Yes, because there are two that are not linked, yes. 8 Q. Yes. 9 Would it follow from that that it cannot be excluded 10 that the unidentified compound in the stomach was one of 11 the missing alkaloids that weren't within the plant 12 samples you tested? 13 A. Yes, that could be. We have not looked for these other 14 compounds. 15 Q. In particular the alkaloid from scopolia, so the new one 16 that has come up, would that appear in the gelsemium 17 samples? 18 A. From looking at the database I think it is a different 19 compound that is not present in the gelsemium. 20 Q. Did you test any samples from the plant scopolia? 21 A. I would have to go back and have a look at the database 22 we put together to actually confirm that. 23 Q. Okay, so from what you can tell us today -- 24 A. I know we provided the court with the list of all the 25 plants that we did look at. I don't think we looked at</p> <p style="text-align: center;">Page 138</p> | <p>1 inquiries? 2 A. Do you mean the chemistry? 3 Q. All of the expert tests, the chemistry, yes? 4 A. They were -- yes, they were keen to get our chemical 5 data, yes. 6 Q. The person who was liaising with your organisation was 7 Mr Craggs of the police, do you recall? 8 A. For some of the time, yes, and then it was a Ben? 9 Q. Yes. 10 A. Yes. 11 Q. They were making contact, were they, on a fairly regular 12 basis to see how your inquiries were progressing? 13 A. I would have thought it was every few months. 14 Q. Because what we see with the report that was sent on 15 13 July is the report itself was actually dated 13 June, 16 isn't it? 17 A. That's right. 18 Q. Within that report it makes reference to tests that had 19 been conducted by Dr Kite on 20 May? 20 A. Yes. 21 Q. We see that, if you need to check that, it is at 22 page 230 of volume 1. 23 Is it likely that the results of those tests were in 24 fact communicated to the police before the final report 25 was actually written up and sent because you knew how</p> <p style="text-align: center;">Page 140</p> |

| | |
|--|--|
| <p>1 important the results of the test were?</p> <p>2 A. It is highly unlikely that we would communicate</p> <p>3 something without having the report --</p> <p>4 Q. Without?</p> <p>5 A. Without sending the report.</p> <p>6 Q. The report that Mr Kite has done, is that a technical</p> <p>7 report that stands separately from the one that you</p> <p>8 later wrote, dated June?</p> <p>9 A. The technical that we normally put them together --</p> <p>10 Q. Yes.</p> <p>11 A. -- because I would write a summary of his report after</p> <p>12 going through it in detail.</p> <p>13 Q. You see, we have heard some evidence from the senior</p> <p>14 investigating officer in the case that by 7 June he was</p> <p>15 saying that the compound detected in the stomach</p> <p>16 contents, there was no evidence to support it being</p> <p>17 a toxic compound. We know that by 20 May your expert,</p> <p>18 Dr Kite had concluded there was no support for the</p> <p>19 compound detected in the stomach being gelsemicine.</p> <p>20 Where else would he have got that from if he didn't get</p> <p>21 it from Kew?</p> <p>22 A. He couldn't -- unless somebody else was involved in</p> <p>23 analysis, I don't think he could have got it anywhere</p> <p>24 else.</p> <p>25 Q. What we do know is that the result of the test that</p> <p style="text-align: center;">Page 141</p> | <p>1 please, is that the results of it?</p> <p>2 A. Yes.</p> <p>3 Q. You have two peaks, mass 359 and then MS/MS of 328?</p> <p>4 A. 328?</p> <p>5 Q. If the two peaks --</p> <p>6 A. The middle trace, yes.</p> <p>7 Q. The two peaks in the middle and then I think the MS/MS</p> <p>8 data is on either side; is that right?</p> <p>9 A. Yes.</p> <p>10 Q. You can see on one there is a 197 and a 328 and on the</p> <p>11 other a 328; is that correct?</p> <p>12 A. Yes.</p> <p>13 Q. Thank you.</p> <p>14 Could you now look under tab 46 at page 266, please.</p> <p>15 Actually just for clarification, this is a report from</p> <p>16 Kew dated 1 February 2016 from you and Dr Kite?</p> <p>17 A. Yes.</p> <p>18 Q. Which is an update on a previous report?</p> <p>19 A. Yes.</p> <p>20 Q. At page 266, there is a table set out --</p> <p>21 A. Yes.</p> <p>22 Q. -- which lists all your samples.</p> <p>23 A. Yes.</p> <p>24 Q. The third one down, which has a little star next to</p> <p>25 it --</p> <p style="text-align: center;">Page 143</p> |
| <p>1 Dr Kite did in fact were available to Kew by 20 May,</p> <p>2 don't we?</p> <p>3 A. Yes.</p> <p>4 Q. Yes. Thank you.</p> <p>5 A. The preliminary data, yes.</p> <p>6 MS BARTON: Yes.</p> <p>7 Further questions from MR SKELTON</p> <p>8 MR SKELTON: May I take you back, you were asked some</p> <p>9 questions by Mr Moxon Browne about the 2015 testing of</p> <p>10 material that may have been available in 2013 --</p> <p>11 A. Yes.</p> <p>12 Q. -- and the retesting issue.</p> <p>13 May I just take you back to that, please. If you go</p> <p>14 to page 230, under tab 41, please?</p> <p>15 MR MOXON BROWNE: 230?</p> <p>16 MR SKELTON: 230 under tab 41, yes.</p> <p>17 MR MOXON BROWNE: Thank you.</p> <p>18 MR SKELTON: Dr Kite's analysis dated 20 May 2013, do you</p> <p>19 have that?</p> <p>20 A. Yes.</p> <p>21 Q. At the bottom you see exhibit 22915, gelsemium</p> <p>22 sempervirens?</p> <p>23 A. Yes.</p> <p>24 Q. Thank you.</p> <p>25 If you scroll on through that analysis to page 236</p> <p style="text-align: center;">Page 142</p> | <p>1 A. Yes.</p> <p>2 Q. -- is 25492.</p> <p>3 A. Yes.</p> <p>4 Q. Now I didn't find the answer to what the star is but</p> <p>5 I am hoping you will be able to help me in a moment as</p> <p>6 to why it has a star.</p> <p>7 If you go forward to page 268.</p> <p>8 A. I am running out of fingers.</p> <p>9 Q. You don't have to keep your finger in the old one, you</p> <p>10 can go straight to 268.</p> <p>11 There is question 6, do you see that?</p> <p>12 A. Yes.</p> <p>13 Q. The last sentence, it says:</p> <p>14 "It should be noted that sample 25492 is from the</p> <p>15 same sample batch as 22915."</p> <p>16 A. Yes, that's right.</p> <p>17 Q. Has what has happened here, that while testing all the</p> <p>18 new material that you have got hold of in the interim</p> <p>19 period, you have got back to the 2013 sample and taken</p> <p>20 a further sample from it to test at the same time?</p> <p>21 A. Yes, and the key to be able to work that out, if you</p> <p>22 look at page 266, the number 25492, under collection</p> <p>23 number, it has an EBC number.</p> <p>24 Q. 90489?</p> <p>25 A. That is it, that is economic botany collection number,</p> <p style="text-align: center;">Page 144</p> |

| | |
|---|--|
| <p>1 90489. If you go back to the technical report on 2 May 2013, the BI number, 22915 is from that same 3 economic botany collection number, 90489. We have 4 a repeat sample as a form of control from our initial 5 analysis to the 2016 analysis. 6 Q. Thank you. 7 That is the answer to where you located the original 8 sample and retested it. 9 Can I now just show you what I think are the results 10 and just ask if you can interpret them for me. 11 What I didn't take you to was the elution time. 12 Perhaps it is just worth before we go to the second 13 result, looking at that, under, again, tab 41, please. 14 A. Tab 41, yes, page? 15 MR MOXON BROWNE: Page? 236. 16 MR SKELTON: Page 236. 17 A. Yes. 18 Q. Could you just explain the elution time there of the -- 19 A. If you take elution time in the middle. 20 Q. Yes. 21 A. There is 359 peak, 9.75. 22 Q. Yes. What about the other peak? 23 A. The 389 at 8.68. Is that the one you mean? 24 Q. 359 is it? 25 A. 359, 8.68.</p> <p style="text-align: center;">Page 145</p> | <p>1 Q. The elution times are different from the original 2 elution times, we had previously 8.68 and 9.75 and now 3 we have 11.51? 4 A. And -- yes, 10.2 and 11.51, yes. 5 Q. Yes. 6 I think Dr Kite explains why that may be the case, 7 in that you have -- you had had a change of equipment 8 for starters? 9 A. We would have different columns on the -- 10 Q. And a different form of preparation using different 11 solutions? 12 A. Yes. 13 Q. Is the MS/MS the same, and is that significant? 14 A. You have a 328, looks exactly the same, 328. 328 -- 15 lost it now. (Pause) 16 Q. On one we have -- 17 A. 297. 18 Q. 328 and 297 on isomer 3? 19 A. You have exactly the same as last time. 20 Q. Exactly the same MS/MS. 21 A. The same as last time. 22 Q. What does that say to you? 23 A. They chemical composition is very, very similar from one 24 to another. 25 Q. Notwithstanding the different elution times?</p> <p style="text-align: center;">Page 147</p> |
| <p>1 Q. There are two peaks at 8.68 and there is one at 9.75? 2 A. Why is. 3 Q. As we say, the MS/MS in both cases is 328? 4 A. Yes. 5 Q. And a smaller peak of 297? 6 A. Yes. 7 Q. Then if you go to the isomers that were tested in 2015, 8 could you look on page 276 which is the final page of 9 tab 46. Do you have that? 10 A. Yes. 11 Q. About two-thirds of the way down I think we find 25492; 12 is that correct? 13 A. Yes. 14 Q. Is that the original sample? 15 A. Yes. 16 Q. Or sorry, it is a resample of the original sample? 17 A. It is a resample, yes. 18 Q. Thank you. 19 Scrolling across, I think we don't find any results 20 in isomer 1 or isomer 2 columns -- 21 A. That's right. 22 Q. -- but we do find results in both isomer 3 and isomer 4? 23 A. That's right. 24 Q. The masses, 359.1987 in one and 359.1966 in the other? 25 A. That's right.</p> <p style="text-align: center;">Page 146</p> | <p>1 A. The different elution times. 2 MR SKELTON: Thank you. 3 Sir, may we have a short break, I have not had the 4 chance to speak to Dr Rice. 5 THE CORONER: It is all obviously complicated material. 6 I am just anxious, I am looking at the press 7 representatives -- I just hope everybody has understood 8 exactly what has been tested when, because it would be 9 possible to get a very misleading impression from some 10 of the things that are said if you were not clear what 11 was actually being looked at at a particular time, 12 whether it was stomach contents or a sample that Kew 13 already has, you see, it would be possible to get it 14 very wrong, wouldn't it, that is what just has been 15 going through my mind, but if you are all clear. 16 Had the same thought occurred to you. 17 A MEMBER OF THE PRESS: It had occurred to us, if it is 18 possible to refer to your counsel if we need 19 clarification or even if a report could be available for 20 us to refer to should we have any questions, that 21 perhaps would be a great advantage to us. 22 THE CORONER: I will have a think about it, but it is on my 23 mind. 24 Yes, we will certainly have a break. Yes. 25 (3.40 pm)</p> <p style="text-align: center;">Page 148</p> |

| | |
|--|--|
| <p>1 (A short adjournment)</p> <p>2 (4.25 pm)</p> <p>3 MR SKELTON: Sir, the next witness is Dr Rice, we are within</p> <p>4 striking distance of the usual court time that we</p> <p>5 conclude, sir. Dr Rice is able to stay a little late,</p> <p>6 so hopefully we will try and conclude him this</p> <p>7 afternoon.</p> <p>8 THE CORONER: Whatever suits everybody is what we will do.</p> <p>9 MR SKELTON: Thank you.</p> <p>10 DR PAUL RICE (sworn)</p> <p>11 Questions from MR SKELTON</p> <p>12 MR SKELTON: Dr Rice, would you give your full name, please.</p> <p>13 A. Dr Paul Rice.</p> <p>14 Q. And your position?</p> <p>15 A. I am currently chief medical officer at the DSTL</p> <p>16 laboratory at Porton Down.</p> <p>17 Q. DSTL stands for?</p> <p>18 A. Defence Science and Technology Laboratory.</p> <p>19 Q. How long have you held that position?</p> <p>20 A. I have held that position for the last four years.</p> <p>21 Q. Are you a pathologist by training?</p> <p>22 A. Yes.</p> <p>23 Q. You have become a specialist in certain types of</p> <p>24 toxicology?</p> <p>25 A. Yes, mainly to do with the medical and toxicological</p> <p style="text-align: center;">Page 149</p> | <p>1 through a large spreadsheet on which a number of</p> <p>2 potential poisons, toxins, had been listed by the police</p> <p>3 and whether or not we could actually eliminate some of</p> <p>4 them from their investigation. My understanding was</p> <p>5 that I was just called to that meeting to comment on the</p> <p>6 materials that were in that spreadsheet that were or can</p> <p>7 be defined as chemical weapons.</p> <p>8 Q. Chemical weapons, what categories is one looking at?</p> <p>9 Obviously we have heard something about organophosphates</p> <p>10 which can be pesticides or can be used as nerve agents.</p> <p>11 A. There are three main classical categories.</p> <p>12 The toxic gases that you breathe in, the examples</p> <p>13 being the gases we used during the First World War such</p> <p>14 as chlorine and phosgene.</p> <p>15 You then have the blister agents, so things like</p> <p>16 sulphur mustard, mustard gas, which predominantly affect</p> <p>17 the outside of the body causing burns to the skin.</p> <p>18 Then the next big category is the agents we call</p> <p>19 nerve agents, which can be absorbed through the body in</p> <p>20 many different ways but essentially affect the nervous</p> <p>21 system.</p> <p>22 Q. Are they all organophosphate compounds?</p> <p>23 A. The nerve agents are all organophosphates, yes.</p> <p>24 Q. Thank you.</p> <p>25 Obviously, Operation Daphne has to some extent been</p> <p style="text-align: center;">Page 151</p> |
| <p>1 effects of biological and chemical weapons.</p> <p>2 Q. It is axiomatic that much of your work is necessarily</p> <p>3 sensitive because you work in the defence sector?</p> <p>4 A. It is, yes.</p> <p>5 Q. As you are aware, this Inquest is a public enterprise</p> <p>6 and therefore evidence which is based on open source</p> <p>7 information can be elicited in open at this Inquest but</p> <p>8 evidence based on matters which you have received which</p> <p>9 are sensitive or confidential to the work you have</p> <p>10 conducted on behalf of your organisation cannot be aired</p> <p>11 today. You understand the distinction?</p> <p>12 A. I do.</p> <p>13 Q. Will you please signal or explain if we get to the point</p> <p>14 where you feel that you are unable to give an answer</p> <p>15 based on open source material?</p> <p>16 A. Yes, of course.</p> <p>17 Q. Thank you.</p> <p>18 You I think were involved, although not central, to</p> <p>19 the Operation Daphne conducted by Surrey Police into the</p> <p>20 death of Mr Perepilichny?</p> <p>21 A. Yes, I was called to a single meeting back in I think it</p> <p>22 must have been December -- I can't remember the exact</p> <p>23 date but early December 2012.</p> <p>24 Q. What was the reason that you were brought in?</p> <p>25 A. I was invited to attend that meeting purely to go</p> <p style="text-align: center;">Page 150</p> | <p>1 eclipsed by the further investigations that have been</p> <p>2 done during the course of this Inquest, so I am going to</p> <p>3 focus primarily on the elimination as far as you can</p> <p>4 give a view that has occurred during that process.</p> <p>5 Particularly by reference to your joint statements,</p> <p>6 which we will come on to, because you met</p> <p>7 Professor Ferner and Dr Perry recently?</p> <p>8 A. That's correct.</p> <p>9 Q. Can I just start by some background.</p> <p>10 You were aware that Dr Perry performed particular</p> <p>11 tests through LGC Forensics and HFL sports science and</p> <p>12 the primary purpose of those tests was to look for drugs</p> <p>13 of abuse, medications, cardiac glycosides and other</p> <p>14 substances which may be used to kill a human being?</p> <p>15 A. Yes.</p> <p>16 Q. You were aware obviously of Kew performing particular</p> <p>17 texts on plant toxicology and I think you have been here</p> <p>18 today during the evidence of Professor Simmonds?</p> <p>19 A. Yes, I have, yes.</p> <p>20 Q. And Dr Black at Reading University looked for heavy</p> <p>21 metals and anions as well?</p> <p>22 A. Yes.</p> <p>23 Q. Finally can I show you, because it hasn't featured in</p> <p>24 evidence at the moment in any great detail, some testing</p> <p>25 which was performed by the Atomic Weapons Establishment.</p> <p style="text-align: center;">Page 152</p> |

| | |
|---|---|
| <p>1 If you have bundle 2 of the expert bundle in front of 2 you, under tab 52, please, page 407 -- 3 A. Sorry, could you say the tab number again? 4 Q. Tab 52, page 407. 5 This is one of the conclusions of Dr Fysh's 6 involvement in 2013 where he summarises some of the 7 testing that is undertaken. You can see there, at 8 paragraph 6.3, there is reference to radionuclide 9 poisoning? 10 A. Yes, I see it. 11 Q. It says in effect that prior to the second post mortem 12 being carried out the body of Mr Perepilichny was 13 monitored for alpha and beta contamination with no 14 detectable amount found. Personal clothing was also 15 deemed free of contamination and that work was carried 16 out by the AWE? 17 A. Okay, yes. 18 Q. Then further testing was done of internal body tissue 19 which was sent to HPE. You can see that the results of 20 that are recorded underneath, which says that in 21 addition external alpha beta monitoring and gamma 22 spectrometry of post mortem specimens didn't demonstrate 23 the presence of any radioactive material at a level that 24 could be harmful to health and certainly not in lethal 25 doses?</p> <p style="text-align: center;">Page 153</p> | <p>1 have an immediate identity? 2 A. I think that is almost certainly true, yes. 3 Particularly if you are using these very sophisticated 4 techniques of mass spec/mass spec where you are looking 5 for, you know, basically molecular weights that have 6 a whole range of different structures. 7 Q. Do you give that answer from your general knowledge as 8 a physician specialist in pathology and toxicology or -- 9 A. Just from a position of general knowledge in terms of 10 those kind of techniques and what kind of molecular 11 weights and structures that they can throw up. Some of 12 those are going to be unknown in terms of particularly 13 their effects. 14 Q. The other aspect of course of the testing which I think 15 you are aware of and you discussed with your fellow 16 experts was the imperfection of the samples. For 17 example, the stomach contents were thrown away because 18 a forensic post mortem was not conducted and so what was 19 left was effectively washings from the stomach that were 20 tested. That, from your perspective as a toxicologist, 21 will inevitably affect the ability to test? 22 A. Yes, I think with any death which there isn't 23 an immediate cause for, one tries to retain as much of 24 the body as possible for further toxicological testing 25 and that is normally what the position would be at the</p> <p style="text-align: center;">Page 155</p> |
| <p>1 A. Yes, I see that. 2 Q. Broadly speaking, that covers the toxicological 3 investigations that took place, Dr Perry's work, the Kew 4 work, Dr Black's work at Reading and the AWE work 5 primarily. I am right in thinking that as far as you 6 were concerned, certainly when you were involved in the 7 Operation Daphne, there was no positive identification 8 of a poison? 9 A. That's correct. 10 Q. What was identified by Kew, and has been the subject of 11 a lot of discussion during the Inquest hearings, was 12 an unknown compound which had a similar atomic mass to 13 a gelsemium derivative but which ultimately Kew ruled 14 out as being gelsemicine or connected to gelsemium as 15 far as they could test the samples. I don't want to 16 rehearse any of that, you obviously heard quite a bit of 17 evidence about it already today. 18 A. Yes, I have. 19 Q. Can I ask you generally and if you cannot express a view 20 on this then please don't speculate, but as far as, if 21 one conducts toxicology of someone that you suspect has 22 died from poisoning or toxicology from someone who 23 hasn't and you are looking for compounds and trying to 24 identify what is in their stomach or in their intestine, 25 will one commonly find compounds for which you don't</p> <p style="text-align: center;">Page 154</p> | <p>1 first post mortem. If structurally you cannot see 2 an immediate cause of death, that you would then have to 3 start thinking about other causes and that would involve 4 toxicology and retaining the relevant samples to allow 5 you to do that toxicological testing. 6 Q. The other aspect was that the preservation itself of the 7 samples was not perfect. 8 A. I am not quite sure how those samples were stored. 9 I mean I have seen evidence but I couldn't comment on 10 whether or not those were appropriate storage 11 conditions. 12 Q. I think it has been agreed that there had been some 13 adulteration of some of the samples and so on and that 14 from your perspective is going to inevitably undermine 15 the efficacy of the test? 16 A. Yes for certain substances, as is the time delay, 17 I would suggest, between the time the person died, the 18 time at which the first post mortem was conducted, and 19 therefore the time at which the first samples were 20 taken, and then the subsequent samples that were taken 21 at the second autopsy, you know, that time period for me 22 is very important. 23 Q. Focusing on the timing, one of the points made by 24 Dr Perry, with whom I think Professor Ferner agreed, was 25 that a poisonous agent such as cyanide needs to be</p> <p style="text-align: center;">Page 156</p> |

| | |
|--|---|
| <p>1 tested within a relatively small window of time, about 2 a week or so, in order for you to draw a reliable 3 conclusion that it has or has not been used. 4 A. Yes, and I would concur with that view. 5 Q. The fact that cyanide was not tested during that period 6 of time means that it cannot be ruled out, for example? 7 A. It cannot be ruled out, no. 8 Q. Although one of course must look also to other potential 9 signs and symptoms? 10 A. Yes. 11 Q. We will come on to the totality of the elimination but 12 broadly speaking you have your toxicological testing, 13 you have pathology, you have clinical signs and 14 symptoms -- 15 A. Yes. 16 Q. -- you have method of administration and availability 17 insofar as you can ascertain those -- 18 A. Yes. 19 Q. -- and you have got things like perhaps testing on the 20 family for genetic testing. I think we heard from 21 Dr Sheppard that it is possible to test the family 22 members to see if you can identify genetic channelopathy 23 which you could then use to identify channelopathy with 24 the deceased, which may then help to you rule out 25 a toxicological cause?</p> <p style="text-align: center;">Page 157</p> | <p>1 A. Yes. 2 Q. On that basis, one excludes on the balance of 3 probabilities that as a form and in particular in 4 Mr Perepilichny's case, we know that he went for a run, 5 which I think is probably one of few things we can be 6 clear about. 7 A. Yes. 8 Q. He decided that he felt well enough to go for a run? 9 A. Well enough to run, yes. 10 I think the classic example here if I may is arsenic 11 poisoning where people have small amounts of arsenic put 12 in their food over long periods of time, you eventually 13 start looking unwell as well as feeling unwell and it 14 may then be several weeks before you actually die. That 15 is not the sort of picture that I get from the evidence 16 that I have read in this particular case. 17 Q. It is not a cumulative action poisoning, then the two 18 other possibilities are a fast-acting poison, which are 19 administered in the hours or minutes before he dies? 20 A. Yes. 21 Q. Or a delayed-action poison which has been administered 22 some time before that but hasn't come into effect until 23 he goes on his run? 24 A. Yes, some poison formulated in such a way that you could 25 give it to somebody, it wouldn't have an immediate</p> <p style="text-align: center;">Page 159</p> |
| <p>1 A. Yes. 2 Q. Thank you. 3 In Mr Perepilichny's case, I think that you and 4 Dr Ferner have ruled out the possibility of a cumulative 5 action poisoning, in other words a poison which had 6 accumulated or been administered secretly and 7 accumulated over a long period of time to the point of 8 toxicity. Could you explain your basis for coming to 9 that conclusion on the balance of probabilities? 10 A. We did consider that as a possible route but 11 administering small amounts cumulatively over a long 12 period of time, you ultimately reach a point where the 13 person starts becoming unwell and starts showing signs 14 of that illness. 15 Reading the evidence as I have, it appeared to me 16 that there was very little evidence of this slow 17 accumulation and him having periods where he felt unwell 18 prior to the day that he died. Therefore I think we 19 were fairly confident that based on the overall clinical 20 picture here, that the likelihood of a continual 21 administration of a low level of a poison that basically 22 accumulated in the body, was not strong. 23 Q. The expectation is that if a cumulative poison is given, 24 it is likely to be demonstrated by clinical signs and 25 symptoms before the critical event?</p> <p style="text-align: center;">Page 158</p> | <p>1 effect but as it reacts with things in the stomach or in 2 the intestines slowly releases a lethal amount of 3 poison, some time away from actually administering it. 4 Q. One can hypothesis one can that it could be a poison 5 that was administered in the day before in France or the 6 morning in the airport for example, it is possible? 7 A. That is -- that remains a possibility. 8 Q. If one tries to go further backwards, does it become 9 less and less probable? 10 A. I think it becomes less and less likely, yes, because of 11 how do you control for that much longer time delay? 12 Q. Are delayed-action poisons generally ingested through 13 food and drink and then become active or can you have 14 a delayed-action poison that is administered by another 15 means. 16 A. I think I am talking about in terms of delayed action is 17 you have a poison but the way in which you administer 18 it, the formulation in which it exists is different and 19 allows it to be slowly absorbed. An example would be to 20 put a sugar coat round it or a fatty coat round it and 21 then ingest it, such that the actual release of the 22 lethal amount of poison which is contained within that 23 coated pill is released some time after they have 24 actually ingested it. That is what I mean by slow 25 acting.</p> <p style="text-align: center;">Page 160</p> |

| | |
|---|--|
| <p>1 Q. Yes, but ingestion is the ordinary route for that kind 2 of poisoning? 3 A. Normally, yes. 4 Q. An example given by Dr Perry would be paracetamol, which 5 can be ingested in large quantities and not have 6 immediate effect until some time when you get 7 catastrophic liver failure? 8 A. Yes. 9 Q. Of course you will find that, it is -- 10 A. You would expect to see it in the stomach contents, the 11 slow absorption of that massive amount may have 12 structural effects on the stomach and its lining for 13 example. You would expect to see evidence on that. 14 Q. What kind of poison would you use that isn't an ingested 15 poison? 16 A. That acts more slowly? 17 Q. That has a delayed action, yes. 18 A. I don't know of any poisons but the pharmaceutical 19 industry are continually formulating drugs that can be 20 injected into the muscle which slowly release the drug 21 over a period of weeks or months. Such that the person 22 doesn't have to take a tablet every day, they have 23 a single injection which then lasts them for the next 24 month or so. 25 Q. My question really was focused on whether or not there</p> <p style="text-align: center;">Page 161</p> | <p>1 either he had taken previously and it had been delayed 2 action or it had been a fast-acting poison somehow 3 administered. We don't have any obvious signs on 4 pathology of forcible administration? 5 A. No. 6 Q. But Professor Ferner I think agreed it would be possible 7 for someone to be given a poison inadvertently through 8 food and drink or for example through a pinprick of some 9 kind or indeed just a splash of fluid while you are out 10 and about which can then activate and kill without you 11 realising, a trite statement it may be but is that true? 12 A. Those are all possibilities, yes. 13 Q. As far as elimination is concerned, the screening 14 Dr Perry did looked broadly for opioids and the like, 15 I have also mentioned things like heavy metals, I have 16 mentioned atomic radiation of some kind that was tested 17 for, drugs of abuse as well, all of which appears to 18 have been screened out by those tests as I understand 19 it. 20 I am just trying to work without what one has left 21 that one can consider, further poisons which you I think 22 consider to be eliminated. If you want to look on your 23 joint statement, I don't know if you have a copy of 24 that. Do you have your own copy of it or do you need to 25 rely on the bundle copy?</p> <p style="text-align: center;">Page 163</p> |
| <p>1 was other things, not like tablets or fluids that you 2 are actually taking in that way, but for example a gas 3 or an injection. Phosgene for example is something 4 which doesn't necessarily have an immediate fatal effect 5 but it may have an immediate clinical effect of some 6 kind and later become fatal. Is that right? 7 A. Yes, phosgene is a good example of a gas which you can 8 inhale, you may initially experience some irritation, 9 because it is quite an irritant gas, so a bit of 10 coughing and streaming of the eyes. But then, depending 11 on how much you have inhaled, it might be 6, 8, even 12 12 hours before the full effects of the gas that you 13 have actually inhaled become apparent in terms of its 14 toxic effect, truly toxic and potentially lethal effect, 15 actually. 16 Q. Before we come on to the elimination, just to go back to 17 what we know about Mr Perepilichny. We in effect don't 18 know because we don't have any account from him or his 19 doctors about how he felt in the preceding days or 20 indeed on the day, but we do know that he didn't report 21 anything untoward as far as we can tell certainly to his 22 family, that was the evidence that we received and he 23 did go out for a run. 24 A. Yes. 25 Q. That narrows it down to certain types of poison which</p> <p style="text-align: center;">Page 162</p> | <p>1 A. I need to rely on the bundle. 2 Q. It should be at tab 98 of bundle 3, and it is printed 3 horizontally. Page 877 and following, although I am not 4 using the bundle paginated version. 5 A. Yes, I have it. 6 Q. You have it, thank you. 7 If we refer to the internal pagination, I would just 8 like to take you back to the things that you have ruled 9 out, so page 15? 10 A. Yes, I am there. 11 Q. And overleaf, page 16 I think it continues on to. Just 12 taking phosgene gas, which is something you deal with 13 under "Specific poisons", that in effect is it ruled out 14 on the basis of absence of the sort of precursor 15 symptoms, partly? 16 A. Yes. 17 Q. Then what about the -- can one in fact, aside from that, 18 can one rule it out on the basis of the findings during 19 the final phase of Mr Perepilichny's life, when he did 20 demonstrate pulmonary oedema which can be consistent 21 with toxicity? 22 A. Yes, from my personal perspective, somebody dying of 23 pulmonary oedema is not a very pleasant sight. We 24 notice from the reports of the ambulancemen that he was 25 coughing up a little bit of fluid but not that much and</p> <p style="text-align: center;">Page 164</p> |

| | |
|---|---|
| <p>1 he had some phlegm in his mouth. Somebody who is 2 actually just about to die because of overwhelming 3 pulmonary oedema the fluid just pours out of them and 4 that is why I would rule out phosgene on clinical 5 grounds, because from my experience of seeing animals 6 die of phosgene poisoning, what is described in 7 Mr Perepilichny's case is not consistent with phosgene 8 poisoning. Plus the fact that when you look in detail 9 at the pathologists' reports from both the first and 10 second post mortem, there are other things that you 11 would see microscopically in the lung, so looking at 12 thin sections of the lung tissue under a microscope, 13 that were not seen that you would most certainly expect 14 to see in a fatal case of phosgene poisoning.</p> <p>15 Then you add to that, well, how are you going to 16 administer the phosgene to him? That is not easy, 17 particularly in an open space, so taking all of those 18 into consideration together, that is why I argued that 19 you could – I think, fairly comfortably eliminate it.</p> <p>20 I mean Professor Ferner is right in that, you know, 21 the symptoms, as far as we know them, you know, wouldn't 22 preclude it but I think they probably would.</p> <p>23 Q. Thank you. Dr Black has ruled out heavy metals? 24 A. Yes. 25 Q. You do not dissent from his view?</p> <p style="text-align: center;">Page 165</p> | <p>1 A. About a third of the general population have the gene 2 for smelling it, yes.</p> <p>3 Q. The definitive testing needs to be done within a few 4 days of death, which was not done?</p> <p>5 A. On most biological samples yes, that is true.</p> <p>6 Q. You cannot eliminate that on the balance of 7 probabilities?</p> <p>8 A. No, I mean they did check for it but at the time the 9 tests were done, the negative result, well, you can just 10 cannot interpret it.</p> <p>11 Q. It is unreliable?</p> <p>12 A. It is unreliable.</p> <p>13 Q. Azides, could you just explain what an azide is and how 14 one tests for azides?</p> <p>15 A. It is a very reactive ion, so it is basically 16 a trivalent nitrogen ion, so cyanide is CN-, azide is 17 N3- and then you have phosphide, which is the P3- ion. 18 They are all reactive ions basically.</p> <p>19 Q. You can test for azides if you do it deliberately, as it 20 were. It doesn't get picked up, you have to look for 21 it. Is that right?</p> <p>22 A. That's right.</p> <p>23 Q. Again, is it the case that there is a window of 24 opportunity for testing an azide? 25 A. Yes, much the same way as for cyanide.</p> <p style="text-align: center;">Page 167</p> |
| <p>1 A. No, I think the analysis for all of those was negative, 2 and clearly negative.</p> <p>3 Q. Dr Perry has ruled out opioids? 4 A. Yes.</p> <p>5 Q. Again, you do not dissent from her conclusions on that? 6 A. No.</p> <p>7 Q. You defer I think to the Kew plant experts when it comes 8 to gelsemium? 9 A. Yes.</p> <p>10 Q. And its -- 11 A. I do not have any experience at all or expertise in that 12 area.</p> <p>13 Q. Of plant alkaloids broadly? 14 A. Not of plant alkaloids, no.</p> <p>15 Q. Sildenafil was raised as a possibility but if that -- 16 A. Certainly not any experience in that area either, sir.</p> <p>17 Q. I think Dr Perry said that that was sub toxic in any 18 event, as far as she could see. 19 A. That is what I believe she said.</p> <p>20 Q. Just seeing what one has left, if you go back to 21 page 15, please, we have different forms of cyanide. Is 22 it the case that cyanide potentially can be administered 23 quickly without leaving any pathological trace beyond 24 potentially some smell, which I think only a minority of 25 people can actually notice?</p> <p style="text-align: center;">Page 166</p> | <p>1 Q. Just moving on ahead to phosphide, is that the same 2 position? 3 A. Yes.</p> <p>4 Q. You need to actively look for azides, phosphides and 5 cyanides? 6 A. I think you have to have in your mind those three 7 poisons because if you don't think about them, you will 8 never make the diagnosis because there can be delays in 9 actually testing for them which is crucial, as we have 10 seen.</p> <p>11 Q. At this stage it would not be possible to exclude those 12 conclusively? 13 A. That's correct.</p> <p>14 Q. Is there in fact a specific test for phosphides, that 15 you know of? 16 A. Not that I know of.</p> <p>17 Q. Do you hypothesise that there probably is? 18 A. I don't know, to be honest.</p> <p>19 Q. But you are content to give an answer that in any event 20 it would be too late to test for compounds such as 21 phosphide? 22 A. Yes.</p> <p>23 Q. As far as organophosphates are concerned, again it was 24 agreed I think by Professor Ferner, and I think as you 25 have said, there are two types, the pesticide type and</p> <p style="text-align: center;">Page 168</p> |

1 then the chemical weapon type. You can test for these
 2 as well?
 3 **A. Yes, you can.**
 4 Q. What is the window of reliable testing?
 5 **A. What you would normally do to confirm a case of**
 6 **organophosphorous poison is actually measure an enzyme**
 7 **in the blood and tissue called acetylcholinesterase.**
 8 **That is a specific target for all of those**
 9 **organophosphate materials, the pesticides and the nerve**
 10 **agents. It is a bit like the cyanide really, you have**
 11 **to think of that as a diagnosis so you can actually do**
 12 **the test because we know for a fact that the longer the**
 13 **time between death and actually doing the testing, you**
 14 **get a false level of that enzyme, it naturally starts**
 15 **degrading and disappearing from the body after death.**
 16 **It is a similar situation, that even if they had**
 17 **have measured the acetylcholinesterase level to see if**
 18 **that enzyme had been poisoned, the longer you go out**
 19 **from the time of death, the less reliable that test**
 20 **becomes.**
 21 Q. Presumably there is a limit to what can be established
 22 in the public sphere in terms of testing for
 23 organophosphate poisoning?
 24 **A. There are labs out there who can detect the**
 25 **organophosphorous pesticides and insecticides. There**

Page 169

1 **are tests for those that labs like LGC are able to**
 2 **conduct. Tests for actually identifying the presence of**
 3 **intact nerve agents is a very specialist area and**
 4 **I believe that the laboratory I work for is currently**
 5 **the only accredited lab in the UK that can test for the**
 6 **nerve agents.**
 7 Q. Again, sorry, just to clarify, I think you have made
 8 this point but to make it absolutely certain, those
 9 tests for organophosphates could not now be conducted in
 10 any of the samples that we have available and find
 11 a reliable result from those tests?
 12 **A. That I am not sure of. I think it is very unlikely**
 13 **after this period of time that you would be able to**
 14 **detect the nerve agents. I wouldn't like to comment on**
 15 **some of the pesticides because I know some of those are**
 16 **fairly long lived because they actually partition into**
 17 **the fat of the body. If there were tissue samples still**
 18 **available from the deceased then it is a possibility,**
 19 **but I don't know enough about the technical detail of**
 20 **how you would test them and how reliable your result**
 21 **would be, so long a period after the death.**
 22 Q. You mentioned the particular enzyme and how effectively
 23 all organophosphates effectively end up with the same
 24 toxicological pathway within the human body, resulting I
 25 think in a cholinergic reaction which is quite obviously

Page 170

1 symptomatic. Could you describe the symptoms that you
 2 would expect to see or probably would see in a patient
 3 who has been poisoned with an organophosphate?
 4 **A. Yes, so as I have said the organophosphates all attack**
 5 **this enzyme in our body called acetylcholinesterase. It**
 6 **is present in our blood and all our tissues and**
 7 **particularly in our nervous system.**
 8 **If you inhibit that enzyme you get a build up in the**
 9 **nervous system of a neurotransmitter called**
 10 **acetylcholine and people that have been poisoned with**
 11 **those materials classically show what we call**
 12 **a cholinergic crisis, which is an excessive amount of**
 13 **that essentially within your nervous system.**
 14 **The classic features that you see are basically**
 15 **an overstimulation of the nervous system initially, so**
 16 **your eyes would start running, your nose would start**
 17 **running, you would start coughing up secretions, you**
 18 **would lose the ability to control your bladder and your**
 19 **bowels and then eventually as the nervous system becomes**
 20 **more exhausted because of this hyperactivity initially,**
 21 **you then get a blockade of various nerve functions so**
 22 **you would see eventually a slowing of the heart,**
 23 **a reduction of the blood pressure, the overstimulation**
 24 **of the brain may cause the patient to actually seize, so**
 25 **have epileptic seizures but eventually all neural**

Page 171

1 **activity would be blocked and most importantly the brain**
 2 **stem which controls your respiration, so classically**
 3 **death from organophosphates and particularly the nerve**
 4 **agents occurs because you stop breathing.**
 5 Q. You mentioned I think the symptoms of seizure?
 6 **A. Yes.**
 7 Q. Do you have what looks like an epileptic fit then of
 8 some kind?
 9 **A. Yes.**
 10 Q. As part of the end result of the crisis?
 11 **A. Yes.**
 12 Q. Sorry, are you saying that it is likely that with
 13 a poisoning you go through that, those symptoms, you go
 14 through the crisis exhibiting those symptoms?
 15 **A. Yes.**
 16 Q. Can one therefore infer that the absence of evidence of
 17 that entire range of symptoms means that
 18 organophosphates on balance can be ruled out here?
 19 **A. I don't think you can be absolutely certain and rule**
 20 **them out but somebody dying acutely of nerve agent**
 21 **poisoning, and some of the organophosphate pesticides,**
 22 **those symptoms are so remarkable it would be difficult**
 23 **to overlook them.**
 24 Q. If it is the case that Mr Perepilichny didn't
 25 demonstrate the range of cholinergic crisis symptoms

Page 172

| | |
|---|---|
| <p>1 that you have described, including for example seizures, 2 incontinence et cetera, is it more likely than not that 3 it was not organophosphates? You don't have to be 4 certain, but is it more likely than not that it wasn't? 5 A. More likely than not, certainly. 6 Q. Thank you. 7 You were asked in your joint statement to consider 8 who might have access to nerve agents. If you want to 9 look at page 23 of your answers, at paragraph 65, 10 please. 11 A. Yes. 12 Q. As you are aware, in this case it is alleged that 13 Mr Perepilichny had become involved with a fraud in 14 Russia and that those who may have been directly 15 responsible for the fraud may have had an animus against 16 him which motivated them to kill him, that is 17 a possibility which has been raised in this Inquest, 18 that agents of the Russian state of some kind may have 19 been responsible for his death. 20 From your perspective, based on open source 21 material, is it the case that the Russian state or 22 agents of the Russian state could have access to 23 organophosphate nerve agents? 24 A. That is a possibility, yes. 25 Q. I think you go on to say in that answer, just for</p> <p style="text-align: center;">Page 173</p> | <p>1 going to be looking to make those poisons for reasons 2 which we are all familiar with? 3 A. Possibly, yes. 4 Q. Just to sum up then, there is no positive evidence that 5 Mr Perepilichny was poisoned in this case, 6 notwithstanding the battery of tests which were 7 conducted which I have taken you through? 8 A. Yes. 9 Q. Do you accept the hypothesis that either he died from 10 a cardiac arrhythmia or he died from poison? 11 A. I think those still remain possibilities, yes. Two 12 possibilities. 13 Q. Is it the case that if one becomes unlikely, the other 14 becomes likely, is that a proper assessment of the logic 15 of the death, if it's only to take those two potential 16 causes, that if one is unlikely, the other must 17 necessarily become likely? 18 A. Yes, I would agree with that. It works both ways round, 19 I think if you are absolutely certain and you can 20 absolutely eliminate poisoning, then your diagnosis 21 becomes one of sudden cardiac death but vice versa, if 22 the expert opinion is that sudden cardiac death is 23 unlikely, it then puts more emphasis on poisoning as the 24 only other cause of death that you have left to you. 25 Q. And --</p> <p style="text-align: center;">Page 175</p> |
| <p>1 completion, that they are potentially fatal in very 2 small doses indeed? 3 A. Yes. 4 Q. Is it the case that there are some nerve agents, 5 organophosphates, that can be really a spec of fluid 6 that can, if it gets into your system through the eyes 7 or indeed through the skin can result in a fatality? 8 A. Yes. The one that comes to mind is VX, which members of 9 the court may have heard about in relation to a recent 10 death in a Malaysian airport. The lethal dose of that 11 particular nerve agent would be a small droplet applied 12 to your skin that you would have difficulty in actually 13 seeing. It would be a droplet of around about 14 a millimetre in diameter. 15 Q. So relatively easy to administer and fatal in very small 16 doses? 17 A. Yes, over a period of time, because you have to absorb 18 it through the skin, and that is what takes time. 19 Q. Without again trespassing into areas beyond what is 20 known openly, is it the case that there are some poisons 21 which are going to be impossible to detect? 22 A. Yes. 23 Q. So known unknowns? 24 A. Yes. 25 Q. Presumably there are some states which are actively</p> <p style="text-align: center;">Page 174</p> | <p>1 A. I think is that the dilemma that we are in. 2 Q. Just taking the totality of the evidence as you have 3 seen it or the information available about the timing of 4 Mr Perepilichny's death and the supposition that it 5 could have been a delayed-action poison or a fast-acting 6 poison, the means of administration that are available 7 for certain types of poisons, whether a nerve agent or 8 a gas like cyanide, or cyanide in a different form, the 9 signs and symptoms he demonstrated pre-death which are 10 very few, obviously, pathological signs until the final 11 collapse. 12 A. Yes. 13 Q. The findings of the pathology and then the toxicology 14 testing, are you able to come to a view on the balance 15 of probabilities as to whether it is likely or unlikely 16 that poison is the cause of death? 17 A. I don't think you can, with 100 per cent certainty, 18 eliminate poisoning as a cause of death. However, given 19 all the things that you said in terms of summarising the 20 position, I would still put the balance of possibility 21 being on a sudden cardiac death. 22 Q. Can I just clarify in terms of your opinion, could you 23 just confirm -- I didn't take you to it -- that you 24 stand by the conclusions that you expressed in your 25 report originally to the court. I haven't taken you to</p> <p style="text-align: center;">Page 176</p> |

| | |
|--|--|
| <p>1 it because it has been eclipsed by the overall --</p> <p>2 A. Okay.</p> <p>3 Q. The report is dated 20 December 2016.</p> <p>4 A. Yes.</p> <p>5 Q. Do you also stand by the opinions expressed in your</p> <p>6 joint statement with your fellow experts?</p> <p>7 A. I do.</p> <p>8 Q. Is there anything that I have not asked you about or</p> <p>9 which doesn't appear in those documents that I have just</p> <p>10 referred to which you think is of significance for the</p> <p>11 learned coroner in his determination on how</p> <p>12 Mr Perepilichny died?</p> <p>13 A. I can't think of any other matters.</p> <p>14 MR SKELTON: Thank you.</p> <p>15 Questions from MR MOXON BROWNE</p> <p>16 MR MOXON BROWNE: Dr Rice, I think you have reminded us that</p> <p>17 your involvement in this investigation was pretty</p> <p>18 slender, you attended I think one meeting?</p> <p>19 A. Yes, I did, sir.</p> <p>20 Q. I think you were also asked for some advice?</p> <p>21 A. Yes, outside the meeting by correspondence with one of</p> <p>22 the police officers leading the investigation.</p> <p>23 Q. Yes I think you were able to help either at that stage</p> <p>24 or certainly in the course of the coronial investigation</p> <p>25 by saying that you know that no tests for weaponised</p> <p style="text-align: center;">Page 177</p> | <p>1 I wasn't involved in any of those meetings where that</p> <p>2 report was put together.</p> <p>3 Q. No.</p> <p>4 A. The criteria they were using looked very reasonable to</p> <p>5 me and it would be --</p> <p>6 Q. It is not so much the criteria they were using, it is</p> <p>7 the way they were applied, particularly to nerve agents.</p> <p>8 Let's not worry too much about what Mr Fysh may have</p> <p>9 said, let's just concentrate on your views today.</p> <p>10 It was suggested to you by Mr Skelton that the</p> <p>11 Russian state -- well, he was seeking your opinion as to</p> <p>12 whether or not they would have access to nerve agents.</p> <p>13 Your reply, I would suggest, was a very cautious one,</p> <p>14 was possibly, there is no doubt is there that the</p> <p>15 Russian state has easy access to these types of weapons?</p> <p>16 A. The reason I answered "possibly" was that we know the</p> <p>17 UK, the US and the former Soviet Union stock piled huge</p> <p>18 quantities of these particular chemical agents.</p> <p>19 Q. Yes.</p> <p>20 A. We have all undergone and are -- I believe in the</p> <p>21 Russian state case, still undergoing the destruction of</p> <p>22 those agents as part and parcel of being signatories to</p> <p>23 the Chemical Weapons Convention. I currently don't know</p> <p>24 the status of the destruction process in the former</p> <p>25 Soviet Union. That is why I said possibly, because they</p> <p style="text-align: center;">Page 179</p> |
| <p>1 biological warfare weapons were carried out at Porton</p> <p>2 Down?</p> <p>3 A. That's correct, we were not asked to test any samples.</p> <p>4 Q. No, and I think you are also aware that Dr Perry has</p> <p>5 said that no tests of that kind were carried out at her</p> <p>6 establishment?</p> <p>7 A. Yes, I believe I saw that in her earlier evidence, that</p> <p>8 they hadn't undertaken those tests for --</p> <p>9 Q. As far as you know, no such tests were carried out?</p> <p>10 A. Correct.</p> <p>11 Q. There seems to have been a perception by those who were</p> <p>12 writing reports on the whole picture that perhaps</p> <p>13 relevant tests had been done which would have revealed</p> <p>14 the presence of weaponised organophosphates. Do you</p> <p>15 know where that idea came from?</p> <p>16 A. No.</p> <p>17 Q. Not from you anyway?</p> <p>18 A. Certainly not from me, no.</p> <p>19 Q. I think you were involved, but I am not at all sure</p> <p>20 exactly how, in whether or not it would be appropriate</p> <p>21 to eliminate the possibility of the use of weaponised</p> <p>22 nerve agents in this particular case, by reference to</p> <p>23 various criteria.</p> <p>24 A. I have subsequently seen the criteria that were applied</p> <p>25 and what resulted in the production of Dr Fysh's report.</p> <p style="text-align: center;">Page 178</p> | <p>1 may not have got rid of all their stockpile.</p> <p>2 Q. They may not have got rid of all of them?</p> <p>3 A. All of their nerve agents, no.</p> <p>4 Q. That really wouldn't be a reason, would it, for</p> <p>5 eliminating this particular form of poison, that there</p> <p>6 would be some difficulty in getting hold of it, possibly</p> <p>7 they got rid of it all but that wouldn't be a reason for</p> <p>8 eliminating it if you are not sure about --</p> <p>9 A. No, but I think what I would say there, sir, with due</p> <p>10 respect, is that these are not generally widely</p> <p>11 available materials. I think I would use --</p> <p>12 Q. I am not suggesting that, I am suggesting that they</p> <p>13 would be available to the Russian state?</p> <p>14 A. Yes, possibly.</p> <p>15 Q. Possibly?</p> <p>16 A. Yes.</p> <p>17 Q. Yes.</p> <p>18 THE CORONER: Sorry, I am afraid was there anything else you</p> <p>19 wanted to say, you were saying not generally widely</p> <p>20 available but then you were interrupted. You went on to</p> <p>21 say but possibly to the Russian state or to the Russian</p> <p>22 state, had you said all you wanted to?</p> <p>23 A. Yes, I think I have, thank you.</p> <p>24 MR MOXON BROWNE: I think that you gave evidence at the</p> <p>25 inquest into the death of an aircraftman at Porton Down</p> <p style="text-align: center;">Page 180</p> |

| | |
|--|---|
| <p>1 who died as a result of sarin poisoning?</p> <p>2 A. Yes, sir, I did.</p> <p>3 Q. Certainly the reports of that inquest suggested that he</p> <p>4 died as a result of a dab on the arm with sarin.</p> <p>5 A. He had sarin applied to his forearm over pieces of</p> <p>6 clothing that he was wearing on his forearm, yes.</p> <p>7 Q. Yes. That would seem to indicate, would you agree, that</p> <p>8 difficulty of administration certainly wouldn't be</p> <p>9 a reason for eliminating that type of poison in this</p> <p>10 case, it sounds as if it is very easy to administer,</p> <p>11 albeit at some risk to the assailant?</p> <p>12 A. But in the death of the aircraftman at Porton Down, he</p> <p>13 "voluntarily" allowed them to apply the material to him.</p> <p>14 He had some understanding that he was partaking in</p> <p>15 an experiment and that was part of the experiment.</p> <p>16 Q. Yes.</p> <p>17 A. I don't think --</p> <p>18 THE CORONER: Do --</p> <p>19 A. -- there is a read across from that and the current</p> <p>20 situation. What I was erring towards in terms of</p> <p>21 administering something like a nerve agent, the person</p> <p>22 who is administering it has to handle it and there are</p> <p>23 certain dangers in doing that. But you also have to</p> <p>24 administer it in such a way that it would act rapidly.</p> <p>25 Q. Yes.</p> <p style="text-align: center;">Page 181</p> | <p>1 it, is that --</p> <p>2 A. Yes.</p> <p>3 Q. Do you know how long it took for him to exhibit</p> <p>4 symptoms?</p> <p>5 A. Not exactly. Only what was reported in the press, which</p> <p>6 was 15 to 20 minutes.</p> <p>7 Q. Yes, and do you know, in the same way, how long he lived</p> <p>8 for?</p> <p>9 A. I don't.</p> <p>10 Q. Do you know what symptoms he exhibited before he died?</p> <p>11 A. No, just symptoms of collapse. He collapsed.</p> <p>12 Q. You couldn't say for example whether he exhibited a --</p> <p>13 do you get a cholinergic crisis as a result of VX?</p> <p>14 A. Yes, you do.</p> <p>15 Q. Do you know whether he exhibited the suite of symptoms</p> <p>16 or not?</p> <p>17 A. I don't, I don't.</p> <p>18 Q. Thank you.</p> <p>19 Do you agree with the proposition that the</p> <p>20 difficulty of administration of a nerve agent would not</p> <p>21 be a reason for eliminating that particular poison in</p> <p>22 this case?</p> <p>23 A. No, but I think it makes it less likely.</p> <p>24 Q. Yes.</p> <p>25 Just for completeness, I think there is information</p> <p style="text-align: center;">Page 183</p> |
| <p>1 A. Depending on what the nerve agent is and what physical</p> <p>2 form it is in, you would pick certain routes of</p> <p>3 administration. If you wanted to kill somebody very</p> <p>4 quickly you would want to inject it. Not apply it to</p> <p>5 their skin.</p> <p>6 THE CORONER: Did you say you would want to inject it,</p> <p>7 I just didn't hear?</p> <p>8 A. You would want to inject it, sir, if you were wanting to</p> <p>9 have a very rapid lethal effect.</p> <p>10 MR MOXON BROWNE: Can you tell us a little bit more from</p> <p>11 your open source knowledge about the death of the Korean</p> <p>12 gentleman which you mentioned. Certainly according to</p> <p>13 reports that was not sarin but a nerve agent called VX.</p> <p>14 A. VX, yes.</p> <p>15 Q. Which I think is very, very poisonous?</p> <p>16 A. Yes, it is probably one of most potent nerve agents that</p> <p>17 we know of.</p> <p>18 Q. Yes. Can you tell us a bit more about how that was</p> <p>19 administered, as you understand it?</p> <p>20 A. All I can tell you is what I have read --</p> <p>21 Q. Yes.</p> <p>22 A. -- in the newspapers, that apparently somebody had some</p> <p>23 of the agent in their hand and they rubbed it in his</p> <p>24 face and particularly in and around his eyes.</p> <p>25 Q. They actually rubbed it in his face as opposed to threw</p> <p style="text-align: center;">Page 182</p> | <p>1 available about the terrorist attack using sarin in the</p> <p>2 Tokyo subway in the 1990s which you know about.</p> <p>3 A. Yes.</p> <p>4 Q. I think the technique there was to burst polythene</p> <p>5 plastic bags containing sarin, so that doesn't sound --</p> <p>6 A. The agent was in three polythene bags that were all left</p> <p>7 on underground trains. The bags were ruptured by poking</p> <p>8 them with an umbrella allowing the liquid to escape and</p> <p>9 sarin, unlike VX, is a very volatile liquid, it is very</p> <p>10 similar to petrol. If we were to spill some on the</p> <p>11 carpet down there it would very quickly evaporate and</p> <p>12 have an effect on us all very quickly.</p> <p>13 Q. As it came through the air?</p> <p>14 A. As it evaporated and formed a vapour which we all</p> <p>15 inhale. If I had have put VX on the carpet, if I put</p> <p>16 a similar amount of VX on the carpet, we would still be</p> <p>17 able to sit in this courtroom probably until at least</p> <p>18 tomorrow and suffer no ill effects because it is not</p> <p>19 volatile. It will just sit there.</p> <p>20 If you were to go up and touch the carpet or lick</p> <p>21 the carpet if you were stupid enough, then you would</p> <p>22 absorb the agent and it would have its effect. For the</p> <p>23 nerve agents it does depend on which one you are talking</p> <p>24 about as to which way you would administer it to have</p> <p>25 a rapid effect.</p> <p style="text-align: center;">Page 184</p> |

| | |
|--|--|
| <p>1 THE CORONER: Can I just ask you --</p> <p>2 A. Does that make sense?</p> <p>3 MR MOXON BROWNE: Perfectly.</p> <p>4 THE CORONER: The sarin you were giving as an example and</p> <p>5 saying if in this courtroom and on the underground, if</p> <p>6 you were outdoors and so on --</p> <p>7 A. You would have to put a lot more down --</p> <p>8 THE CORONER: That is what I was --</p> <p>9 A. -- the dilution in the air but in a fairly confined</p> <p>10 space, you know, a reasonable amount of it would</p> <p>11 evaporate very quickly and cause effects in all of us.</p> <p>12 MR MOXON BROWNE: I am taking, amongst other things, from</p> <p>13 what you are saying that VX is much more potent, much</p> <p>14 more poisonous than sarin but on the other hand much</p> <p>15 less volatile, or not volatile at all.</p> <p>16 A. It is far less volatile and therefore it is mainly</p> <p>17 deemed to be a contact hazard --</p> <p>18 Q. Yes.</p> <p>19 A. -- you have to touch it.</p> <p>20 Sarin is more volatile and therefore it is</p> <p>21 an inhalational hazard, you breathe in the vapour.</p> <p>22 Breathing something in often has effects very much more</p> <p>23 quickly than actually touching something and getting it</p> <p>24 on your skin because you then have to absorb it through</p> <p>25 the thickness of your skin which takes time. For VX,</p> <p style="text-align: center;">Page 185</p> | <p>1 I think you haven't mentioned it but I think</p> <p>2 hypothermia, that is cold to the touch, apparently</p> <p>3 a cold body is one of the features. You are obviously</p> <p>4 aware that two witnesses independently observed that</p> <p>5 Mr Perepilichny's body was cold.</p> <p>6 There is a feature of the release of mucous?</p> <p>7 THE CORONER: Forgive me interrupting. Did you say coldness</p> <p>8 is a consequence, did you say?</p> <p>9 A. Of nerve agent poisoning?</p> <p>10 THE CORONER: Is that what the suggestion was?</p> <p>11 MR MOXON BROWNE: Yes, it was.</p> <p>12 THE CORONER: You may have not understood, that is the</p> <p>13 suggestion.</p> <p>14 A. Sorry, I misinterpreted what you were trying to suggest.</p> <p>15 MR MOXON BROWNE: I was not trying to suggest anything.</p> <p>16 I thought it was common ground and I may be wrong,</p> <p>17 please correct me if I am, that hypothermia belonged in</p> <p>18 the suite of symptoms of a cholinogenic crisis, it is</p> <p>19 one of things that you list as --</p> <p>20 A. It can be, yes.</p> <p>21 Q. Can be?</p> <p>22 A. Yes.</p> <p>23 Q. Right. I had misunderstood that.</p> <p>24 Another feature is the free running of mucous and</p> <p>25 saliva. A piece of new information we received from the</p> <p style="text-align: center;">Page 187</p> |
| <p>1 the symptoms would take longer to come on, because it</p> <p>2 has to get through your skin.</p> <p>3 Q. Yes.</p> <p>4 A. That time can be several hours.</p> <p>5 If you were to inhale sarin, you would expect to see</p> <p>6 the effects within one or two minutes and you could be</p> <p>7 dead within three minutes. VX is slightly more toxic</p> <p>8 than sarin but not hugely so.</p> <p>9 Q. I want finally, on the question of elimination criteria,</p> <p>10 to ask you about the suite of symptoms of the</p> <p>11 cholinogenic crisis. Mr Skelton pressed you a little on</p> <p>12 the question of a seizure or epileptic fit and that the</p> <p>13 absence of evidence of such a fit might tell against</p> <p>14 that account, that explanation.</p> <p>15 It is by no means I think an inevitable feature of</p> <p>16 a cholinogenic crisis, it sometimes happens but --</p> <p>17 A. No, it is not inevitable but it is one of the signs that</p> <p>18 if you are exhibiting it, it does go along with all the</p> <p>19 others in helping you make the diagnosis.</p> <p>20 Q. Yes, so if it is there, it would tell in favour, but</p> <p>21 I am suggesting to you if it is not there, it doesn't</p> <p>22 really tell very strongly against?</p> <p>23 A. Agreed.</p> <p>24 Q. Thank you.</p> <p>25 Let's look at what some of the symptoms are.</p> <p style="text-align: center;">Page 186</p> | <p>1 paramedics who attended that in addition to finding</p> <p>2 a mixture of mucous and saliva in the mouth, which</p> <p>3 I think you knew about, there was also what was</p> <p>4 described as drooling, that is as I understand it saliva</p> <p>5 and/or mucous actually coming out of his mouth,</p> <p>6 "drooling" was the word that was used. That is I would</p> <p>7 suggest a classic symptom of a cholinogenic crisis.</p> <p>8 A. The evidence I have seen, it was some mucous in his</p> <p>9 mouth.</p> <p>10 Q. I am telling you that the coroner has heard evidence</p> <p>11 from the paramedic, and Mr St Clair-Ford, and I am</p> <p>12 saying you have not heard that and I am telling you.</p> <p>13 A. I haven't seen that evidence or heard that evidence.</p> <p>14 Q. Now I tell you that there is that evidence and the</p> <p>15 coroner will make of it what he will. I am suggesting</p> <p>16 to you that that is symptomatic of the cholinergic</p> <p>17 crisis, drooling?</p> <p>18 A. Yes.</p> <p>19 THE CORONER: To what extent? I mean I think I have</p> <p>20 a recollection of what the evidence was about it but to</p> <p>21 what extent -- I mean a very marked extent or --</p> <p>22 A. Very marked extent.</p> <p>23 THE CORONER: Then you had better just tell us.</p> <p>24 A. Once you have seen an animal poisoned with one of these</p> <p>25 nerve agents you don't forget it, because they bring up</p> <p style="text-align: center;">Page 188</p> |

| | |
|---|---|
| <p>1 and drool vast quantities of fluid. It is not just 2 a little bit of dribbling, it is constant production 3 over several minutes, hours of very excessive amounts of 4 fluid. 5 THE CORONER: The whole time? 6 A. Yes. 7 THE CORONER: Hold on. 8 MR MOXON BROWNE: I think all of us have seen on the 9 television the horrible effects of sarin poisoning in 10 Syria. The picture which we have seen on the 11 television, please comment, is of shivering and saliva 12 dripping from the mouth. That is what we are talking 13 about. 14 A. Yes. 15 Q. I am suggesting to you that the evidence the coroner may 16 recall is that I think in the short time that he was 17 observed was two tablespoons of drooling coming out of 18 his mouth. Is that relevant or not? 19 THE CORONER: It didn't sound like that is the sort of 20 amount you were talking about. 21 A. No, I would have said more than that. 22 THE CORONER: You are talking about a lot more than that. 23 MR MOXON BROWNE: Are we? 24 THE CORONER: That is what you have said, bring up vast 25 quantities, very large amounts of --</p> <p style="text-align: center;">Page 189</p> | <p>1 MR MOXON BROWNE: I would like to suggest to you that taken 2 in the round, that is to say hypothermia, drooling, and 3 the other symptoms that we have -- shivering, whatever 4 that means, I think another person used the word 5 "shuddering", are consistent with, although not 6 exclusively consistent with, a cholinergic crisis. 7 A. Yes, but if we are talking about a cholinergic crisis, 8 then I would have expected to see other symptoms which 9 have not been reported, was the point I was trying to 10 make. 11 Q. Perhaps we can examine those, there is the question of 12 a seizure? 13 A. Yes. 14 Q. Miosis is mentioned? 15 A. Yes. 16 Q. We heard evidence from Professor Ferner that the eyes 17 dilate in death. Is that within your professional 18 knowledge? 19 A. Yes. 20 Q. So that -- 21 A. But the classic sign of nerve agent poisoning is not 22 a dilatation of the pupils it is a constriction of the 23 pupils. 24 Q. Quite, that I understand, miosis. 25 A. That was not observed as far as the evidence --</p> <p style="text-align: center;">Page 191</p> |
| <p>1 MR MOXON BROWNE: Over what period? 2 THE CORONER: The whole time is what the witness just said. 3 That is why I said it sounded different from my 4 recollection of a tablespoon or two. 5 A. It depends on the dose, quite clearly. You may not see 6 any drooling at all if death occurs very rapidly, which 7 it can with an inhaled nerve agent. 8 With the ones that go through the skin, over 9 a longer period of time, those kind of symptoms can go 10 on for many, many minutes if not hours and in vast 11 quantities. 12 Q. Yes. 13 A. More than a teaspoon. 14 Q. I do appreciate that but, as I think you know, 15 Mr Perepilichny did not live very long under the 16 observation of the people who we are talking about, in 17 that time, however, it is a matter of minutes or 18 slightly longer, he was observed to be drooling, that is 19 really what I am putting to you. Not what may have 20 happened over hours. 21 A. Equally we don't have any good evidence of what he 22 appeared like before he collapsed either. 23 Q. We don't have any evidence at all. 24 A. And I recognise that. 25 THE CORONER: We have some, I think.</p> <p style="text-align: center;">Page 190</p> | <p>1 Q. No, what I am putting to you is the observation of 2 Professor Ferner, that if you die your pupils dilate and 3 since we don't know when the observation was made, it 4 doesn't seem to tell either way. 5 A. They do eventually. 6 Q. Dilate? 7 A. Yes. 8 Q. What do you mean by that? 9 A. Well it takes some time, they don't dilate immediately. 10 Depending on the cause of death. I would suggest that 11 if you are suggesting that the cause of death here is 12 nerve agent poisoning, I would expect the pupils to 13 remain constricted for some time after death. 14 Q. That is useful. 15 I am not suggesting anything, I am simply exploring 16 the possibilities with you. We are not I think at odds. 17 A. Thank you. 18 Q. All in all, and given the comparatively short time that 19 this gentleman was in the hands of the paramedics, 20 I would suggest that the suite of symptoms he exhibited, 21 although by no means exclusively consistent with nerve 22 agent poisoning was certainly not inconsistent with it? 23 A. I would agree. 24 Q. Thank you. 25 At the end of your evidence, and I think it is the</p> <p style="text-align: center;">Page 192</p> |

| | |
|--|--|
| <p>1 first time you have said this, it was elicited from you 2 an opinion about the likelihood that Mr Perepilichny 3 had died from a cardiac channelopathy. From what aspect 4 of your expertise does that opinion derive? 5 A. Well, just the circumstances around him actually 6 collapsing and dying quite quickly. 7 Q. Yes. You would presumably defer to the opinions of the 8 experts in that field? 9 A. Most certainly. Most certainly. 10 THE CORONER: Sorry, what is it you are relying on? What is 11 it you are drawing attention to? 12 A. Nothing in particular. I mean it was just in relation 13 to a question that Mr Skelton asked about, on the 14 balance of probability ... you know, between poisoning 15 and some sudden cardiac event, which we know has no 16 structural basis. What we are then talking about is 17 some kind of arrhythmia, channelopathy is just one cause 18 of, you know, those arrhythmias. From all the evidence 19 I have seen, all I am saying is personally I would 20 favour a cardiac death rather than a poisoning, but from 21 the evidence we have, you cannot 100 per cent rule out 22 either cause -- 23 MR MOXON BROWNE: No. 24 A. -- as far as I am concerned. 25 Q. Just so that we are not misunderstanding anything you</p> <p style="text-align: center;">Page 193</p> | <p>1 the eyes and the nose running, coughing, secretions, 2 unable to control bladder and bowels, just making sure 3 I've got it right, epileptic seizure, slowing of heart, 4 reduction of blood pressure and then you stop breathing. 5 Then I think what you said to Mr Moxon Browne was 6 that what there was here was not inconsistent with such 7 a crisis. Can you just explain why you say -- I mean 8 how many of these things do you have to have and if you 9 don't have them it becomes inconsistent with it? Do you 10 follow what I am asking? 11 A. Yes, I do, sir, I do. 12 How can I be helpful? (Pause) 13 I think in retrospect, knowing the time at which he 14 died, so the point at which these observations were made 15 were shortly before death. What I would expect based on 16 experience, both in animals and in man, that you should 17 have seen most of those symptoms, as that cholinergic 18 crisis complex. You should, but it comes down to the 19 reliability of the people that were observing him, you 20 know, he may have shown some of those symptoms 21 unobserved, we just don't know. 22 That is why I answered the way I did. 23 THE CORONER: No, well I have heard evidence about that and 24 I shall have to take a view about it. Suppose the 25 picture -- just assume for these purposes there is</p> <p style="text-align: center;">Page 195</p> |
| <p>1 are saying, it was suggested to you that this may be 2 a situation in which the coroner may come to the 3 conclusion that either Mr Perepilichny was poisoned or 4 that he died from a channelopathy. Your response to 5 that was that you thought that either explanation was 6 possible. That was your words. 7 A. Correct. 8 Q. I think that if we just adopt, as I think you were 9 doing, what I might call a binary analysis, because 10 although what you said was true, you could probably add, 11 if it be your opinion, that there isn't any other likely 12 cause that presents itself? 13 A. That is true. 14 Q. Although both are possible, the fact that it has to be 15 either one or the other really is a matter of high 16 probability? 17 A. Yes. 18 MR MOXON BROWNE: Thank you. 19 Thank you, sir. 20 THE CORONER: Can you just help me, death from a nerve 21 agent, I just want to understand what you are saying. 22 You told us about the pupils that you expect to be 23 narrow for some time, is that right? 24 A. Hmm. 25 THE CORONER: Just looking at the evidence you gave earlier</p> <p style="text-align: center;">Page 194</p> | <p>1 a reliable picture of what state he was in, if it is 2 reliable you would expect to see most of the symptoms? 3 A. I would suggest so, yes. At the point so close to his 4 death. 5 THE CORONER: Yes. 6 If you don't see most of those, without necessarily 7 ruling it out, does it make it less likely or does it -- 8 A. I think it makes it less likely. I wouldn't rule it 9 out, to be fair to Mr Moxon Browne. 10 THE CORONER: Yes. All right. 11 Who is next? 12 Questions from MS HILL 13 MS HILL: Dr Rice, just a couple of questions about the 14 evidence that Dr Perry gave. 15 I have her evidence in front of me and it appears 16 that although she discussed generally the opioid issue, 17 if I can call it that, she gave evidence that the 18 possibility remained of etorphine being a viable 19 possibility in this case. Does that accord with your 20 understanding or would you just defer to her expertise 21 on it? 22 A. No, I think I would defer to her expertise on etorphine, 23 it is not a compound that I am familiar with. 24 Q. You also are not a cardiologist, are you? 25 A. No.</p> <p style="text-align: center;">Page 196</p> |

1 Q. Although you have given some evidence of your
 2 understanding of how sudden adult death syndrome is
 3 diagnosed, that is not your primary area of expertise?
 4 **A. It is not, no.**
 5 Q. To the extent that you have assisted the coroner, your
 6 understanding is that the approach is one that looks at
 7 whether or not poisoning could be absolutely eliminated.
 8 That is the sort of phrasing you have used?
 9 **A. Yes.**
 10 Q. You stand by the contents of the joint report, as
 11 enlarged a little bit today, about which possibilities
 12 of poisoning remain in play. Is that fair?
 13 **A. I do.**
 14 Q. Generally, it is for the pathologist, is it not, to
 15 define the cause of death from the entire evidential
 16 matrix?
 17 **A. Absolutely.**
 18 MS HILL: Thank you.
 19 Further questions from MR SKELTON
 20 MR SKELTON: Sir, I had one very small point of
 21 clarification.
 22 Looking at the joint report, Dr Rice, where you
 23 describe in paragraph 58 on page 20 the signs of
 24 cholinergic crisis, you don't I think mention
 25 hyperthermia or hypothermia. Is it the case that

Page 197

1 cholinergic crisis includes one of those and which one
 2 is it?
 3 **A. Well, we have missed it off the list, I mean the list is**
 4 **not entirely comprehensive, one does see hypothermia.**
 5 Q. I think Mr Moxon Browne may have said "hyper" but meant
 6 "hypo" --
 7 MR MOXON BROWNE: I meant "hypo".
 8 **A. No, I think he did say hypo, and that is what I would**
 9 **agree with.**
 10 Q. Is that hypothermia based on core body temperature which
 11 you would test, not peripheral?
 12 **A. Yes.**
 13 Q. Thank you.
 14 THE CORONER: Can you give us a figure?
 15 **A. Not for humans, because I don't think it has ever been**
 16 **measured.**
 17 THE CORONER: All right.
 18 **A. But animals, it is quite typical to see a fall of two or**
 19 **three degrees from their normal body temperature.**
 20 MR SKELTON: Are you able to say whether or not cardiac
 21 failure is consistent with -- you become hypothermic
 22 from cardiac failure or is that beyond your expertise?
 23 MS HILL: Sir, I am loathe to interject but I am not sure
 24 that is a matter for this expert and his expertise,
 25 there has already been several questions already that

Page 198

1 the expert has answered that stray outside his area of
 2 expertise. I just put a marker down.
 3 MR SKELTON: That is why I said "are you able to say".
 4 MS HILL: The questions have already been asked of this
 5 witness in a similar vein.
 6 MR SKELTON: You are not able to say?
 7 **A. Sorry?**
 8 Q. You are not able to say?
 9 **A. I am not able to say, no.**
 10 MR SKELTON: Thank you.
 11 THE CORONER: No one else? No.
 12 There we are. Thank you very much indeed.
 13 **A. Thank you.**
 14 THE CORONER: Thank you.
 15 Is that all for now?
 16 MR SKELTON: It is, sir.
 17 THE CORONER: 10.00 tomorrow.
 18 MR SKELTON: Yes, please.
 19 (5.39 pm)
 20 (The Inquest adjourned until 10.00 am the following day)
 21
 22
 23
 24
 25

Page 199

1
 2
 3 I N D E X
 4
 5 PROFESSOR DAVID COWAN (affirmed)1
 6 Questions from MR SKELTON1
 7 Questions from MR MOXON BROWNE25
 8 Questions from MR STRAW75
 9 Questions from MR COHEN76
 10 PROFESSOR MONIQUE SIMMONDS (sworn)80
 11 Questions from MR SKELTON80
 12 Questions from MR MOXON BROWNE105
 13 Questions from MS HILL128
 14 Questions from MR STRAW131
 15 Questions from MS BARTON139
 16 Further questions from MR SKELTON142
 17 DR PAUL RICE (sworn)149
 18 Questions from MR SKELTON149
 19 Questions from MR MOXON BROWNE177
 20 Questions from MS HILL196
 21 Further questions from MR SKELTON197
 22
 23
 24
 25

Page 200

| A | | | | |
|--|---|---|--|---|
| ability 6:14 71:3 92:22 155:21 171:18 | accepted 12:3 42:22,23 | 181:24 | 163:4 176:6 181:8 | 57:25 79:16,23 |
| able 5:15 7:12 8:6 16:17 17:2 23:18 58:6,14 63:3 73:14 74:22 83:11 83:21 84:2,18,20 92:11 104:9,19 111:1 118:8,18 123:17 137:14 144:5,21 149:5 170:1,13 176:14 177:23 184:17 198:20 199:3,6,8 199:9 | accepting 73:8 | acting 160:25 | 182:3 183:20 | 80:6,8 107:19 |
| absence 22:13 92:13 164:14 172:16 186:13 | access 47:12,16 173:8,22 179:12 179:15 | action 158:5 159:17 160:16 161:17 163:2 | adopt 122:20,24 194:8 | 137:12 175:18 |
| absent 22:16 | accession 112:5,17 114:20 | activate 163:10 | adopts 127:7 | 181:7 183:19 |
| absolute 93:21 | accord 38:10 196:19 | active 160:13 | adult 197:2 | 192:23 198:9 |
| absolutely 32:3 116:19 127:17 131:24 170:8 172:19 175:19,20 197:7,17 | account 40:17 42:6 123:24 127:23 162:18 186:14 | actively 168:4 174:25 | adulteration 156:13 | agreed 48:2 114:24 124:25 136:25 156:12,24 163:6 168:24 186:23 |
| absorb 174:17 184:22 185:24 | accounted 34:24 40:10 | activity 14:5 88:23 172:1 | advance 106:13 139:25 | agreement 25:20 26:7 |
| absorbed 92:20,22 92:23 151:19 160:19 | accredited 170:5 | acts 161:16 | advantage 148:21 | Ah 28:1 51:6 |
| absorption 161:11 | accumulate 89:2 | actual 8:2 13:20,21 13:22 160:21 | advice 177:20 | ahead 84:13 168:1 |
| abstracted 32:5 108:17 109:15 | accumulated 158:6 158:7,22 | acutely 172:20 | affect 98:11 151:16 151:20 155:21 | air 184:13 185:9 |
| abundant 102:4 | accumulation 158:17 | add 77:12 119:7 165:15 194:10 | affirmed 1:6 200:5 | aircraftman 180:25 181:12 |
| abuse 152:13 163:17 | accuracy 4:21 10:1 20:2 | added 87:20 | afraid 40:20 84:4 109:4 117:20 120:24 127:14 136:22 180:18 | aired 150:10 |
| AC 66:20 | accurate 6:14,16,18 9:2,2 17:23 20:15 22:9 27:16 28:24 29:19 34:3,8,15 39:2,9,12 41:10 41:19 43:4 44:2 47:6 48:7 53:24 54:6 57:22 58:9 58:12,19 60:24 69:14 71:17 72:9 72:15,21,24 73:4 114:21 115:16 116:9 127:5,10 | addendum 118:24 119:2,5,19 | afternoon 149:7 | airport 160:6 174:10 |
| academic 95:23 | acetylcholine 171:10 | adding 94:6 | agent 156:25 172:20 174:11 176:7 181:21 182:1,13,23 183:20 184:6,22 187:9 190:7 191:21 192:12,22 194:21 | albeit 181:11 |
| accept 10:15 27:7,8 30:9 54:13 85:15 102:11 175:9 | acetylcholinester... 169:7,17 171:5 | addition 21:2 47:7 153:21 188:1 | agents 151:10,15 151:18,19,23 169:10 170:3,6,14 172:4 173:8,18,22 173:23 174:4 178:22 179:7,12 179:18,22 180:3 182:16 184:23 188:25 | alerting 129:6 |
| acceptable 20:18 | accurately 4:18 32:2 58:15 71:18 | additional 7:12 42:13 43:13 | ago 49:19 64:19 74:14 111:9 129:17 | Alexander 73:23 |
| acceptance 43:18 | act 88:25 90:5 | address 16:17 81:6 81:7 | agree 18:15 28:19 30:4,8,19 31:2 46:9,18,19 47:19 47:20 48:7,11,13 49:6,25 50:1,23 51:16 52:22 56:1 | Alexander's 29:2 45:2 54:18 55:23 60:25 68:12 69:25 70:11 |
| | | adequately 119:3 | | algae 86:2 |
| | | adjourn 125:6 | | alimentary 133:20 |
| | | adjourned 53:3,4 199:20 | | alkaloid 15:12 17:12 24:1,9 42:19 49:3,4 76:4 84:24,25 93:19 95:8,22 101:19,20 101:21 102:3 120:14 132:15,19 136:12 137:2,4 138:15 139:14 |
| | | adjournment 19:12 89:20 149:1 | | alkaloids 11:15 12:9 13:15 15:10 15:17,21 16:19 23:14,25 24:4 27:15,16 29:12 31:25 43:3 47:6 47:11 49:8 67:15 75:23 88:15 94:16 94:22 95:3,13,19 |
| | | adjournments 53:5 | | |
| | | administer 160:17 165:16 174:15 181:10,24 184:24 | | |
| | | administered 71:25 158:6 159:19,21 160:5,14 163:3 166:22 182:19 | | |
| | | administering 158:11 160:3 181:21,22 | | |
| | | administration 157:16 158:21 | | |

| | | | | |
|---|---|--|--|--|
| 95:24 96:2 98:14 98:22 99:6,12,18 101:9 116:4,6 117:4 127:15 133:2,14 136:3,8 137:3,12,18,19,21 137:23 138:1,11 139:7,11 166:13 166:14 alleged 83:25 173:12 allied 69:23 allow 156:4 allowed 181:13 allowing 184:8 allows 6:18 160:19 alpha 153:13,21 altitude 45:21 ambulancemen 164:24 amount 7:5 43:12 59:24 71:25 75:4 75:7 98:4 108:9 110:3,4 153:14 160:2,22 161:11 171:12 184:16 185:10 189:20 amounts 91:21 97:24 101:16 158:11 159:11 189:3,25 analogue 29:15 analyse 43:11 104:19 105:20 106:16 analysed 16:5 31:25 48:10 62:19 78:4 120:12 131:19 analyses 1:20 81:18 analysing 2:2 120:14 132:4 analysis 7:12 12:18 14:19 18:9 19:17 38:2 47:23 48:15 50:13 55:1,2 79:1 | 79:3,9 82:8 83:21 84:22 89:14 90:15 90:17,18,21 92:11 97:11 98:2 111:13 115:22 118:12,20 120:11 123:18 129:9 131:13,15 131:21 136:10,16 137:8 141:23 142:18,25 145:5,5 166:1 194:9 analytical 1:16 43:13 and/or 188:5 angles 7:2 animal 87:5 188:24 animals 27:23 81:5 165:5 195:16 198:18 animus 173:15 anions 132:5 152:21 announcement 131:5 answer 14:13 18:24 19:2 21:23 26:19 27:19 28:13 29:20 30:1,6,11,17 33:22 41:2,18 46:16 59:20 72:7 78:23 95:3 96:17 123:6,14 132:22 135:10 144:4 145:7 150:14 155:7 168:19 173:25 answered 15:18 46:23 50:21 117:10 123:7 179:16 195:22 199:1 answers 47:9 53:2 79:23 94:19,23 124:5 173:9 Anthony 1:10 anti-fouling 44:25 | anxious 139:24 148:6 anybody 43:21 60:22 74:2 anyway 44:19 64:8 66:1 68:1,8 178:17 apart 45:11 apparent 53:8 92:19 162:13 apparently 108:13 182:22 187:2 appear 24:1 41:25 44:10 93:6 130:13 138:16 139:23 177:9 appeared 122:12 158:15 190:22 appearing 44:9 appears 1:17 16:20 111:25 130:10 163:17 196:15 appendices 17:7 apples 88:1 applied 174:11 178:24 179:7 181:5 apply 14:13 40:12 45:3 181:13 182:4 appreciate 65:16 102:10 107:12 122:3 190:14 appreciated 66:10 66:12,13 approach 28:14 197:6 approaches 7:2 65:9 approaching 107:8 appropriate 84:18 98:6 108:4 110:20 110:21 156:10 178:20 area 82:10 101:13 101:17 166:12,16 170:3 197:3 199:1 | areas 75:2 81:25 174:19 argued 165:18 argument 40:7 arisen 52:20 arm 181:4 arms 5:11 array 13:16 27:18 96:5 arrhythmia 175:10 193:17 arrhythmias 193:18 arrived 132:25 arrows 38:4 arsenic 159:10,11 art 6:16 article 64:13 66:10 ascertain 64:5 157:17 ascribe 25:20 ascribed 33:10 38:5 38:16 39:2 aside 82:6 164:17 asked 2:2 13:10 18:24 33:24 50:16 51:1 52:1 59:23 77:18,19 78:8 81:7,9 83:14 88:20 106:6 119:7 129:20 132:12,24 134:7 142:8 173:7 177:8,20 178:3 193:13 199:4 asking 40:21 70:1 102:7 195:10 asks 50:2 aspect 155:14 156:6 193:3 aspects 80:24 120:2 assailant 181:11 asserting 38:19 assertion 39:11 115:9 assessment 175:14 assist 25:17 90:14 | 128:22 129:16 assisted 197:5 associated 23:15 35:19 41:18 43:6 44:11,22 45:12 54:7 67:5 80:25 85:2 86:14 87:19 88:16 91:25 94:17 95:5,8,13 96:13 102:1 106:4,22 113:5 115:18 134:3,18 assume 42:24 45:1 134:4 195:25 assumed 54:3 assumption 63:15 63:15 assumptions 12:6 92:16 assure 6:24 atom 8:22 9:3 atomic 152:25 154:12 163:16 atoms 15:2 67:3,10 67:10,11,18,19,21 attach 36:10 attached 3:21 5:25 62:9 attachment 16:8 attack 171:4 184:1 attempts 98:8 attend 150:25 attended 52:16 177:18 188:1 attention 37:10,11 59:25 68:2 100:9 193:11 attributed 53:22 August 118:24 119:17 autopsy 50:18 51:3 134:9 156:21 autumn 53:7,7 126:2 availability 157:16 available 14:22 |
|---|---|--|--|--|

| | | | | |
|--|--|--|---|---|
| 87:23 104:17 125:2 142:1,10 148:19 170:10,18 176:3,6 180:11,13 180:20 184:1 await 111:2,2 aware 2:20,21 8:10 41:15 46:24 75:8 75:12,16 85:8 89:5,7,8 91:1 97:15 105:4,8,9 119:25 126:24,25 131:4,5 150:5 152:10,16 155:15 173:12 178:4 187:4 AWE 153:16 154:4 AWF 79:10 awful 64:11 axiomatic 150:2 azide 167:13,16,24 azides 167:13,14,19 168:4 | balance 9:10 24:19 158:9 159:2 167:6 172:18 176:14,20 193:14 bark 17:20 34:6,14 35:4,13,14,14 40:9 55:7 97:25 99:22 112:2,6,16 112:24 113:1,4 114:20 115:19 116:6 117:4 118:8 121:9 122:4 126:8 126:15,16 BARTON 139:21 139:22 142:6 200:15 based 49:7 55:16 89:3 90:6 94:13 95:7,11 98:17 99:3 103:6,17 150:6,8,15 158:19 173:20 195:15 198:10 baseline 92:10 basic 14:8 basically 2:25 106:23,25 124:19 124:21 155:5 158:21 167:15,18 171:14 basis 17:11,15 32:11 35:21 36:6 37:19 140:12 158:8 159:2 164:14,18 193:16 batch 105:22 117:18 144:15 battery 175:6 BD 66:20 bear 33:16 82:8,9 104:8 bears 118:14 beast 33:3 59:2 becoming 158:13 beg 17:10 27:12 64:16 | beginning 2:25 33:8 84:5 131:16 begun 108:21 behalf 139:23 150:10 behave 12:10 beings 1:22 believe 2:21 39:16 39:21 42:21 48:9 60:12 110:3 166:19 170:4 178:7 179:20 belonged 187:17 Ben 140:8 benefit 15:12 111:4 best 71:3 124:23 beta 153:13,21 better 66:21 72:21 73:7 76:3 188:23 beyond 12:1 24:17 102:7 103:3,8 166:23 174:19 198:22 BI 112:3,5 145:2 big 71:14 151:18 bigger 10:8 61:25 62:6 biggest 20:12 binary 194:9 biogenetic 36:4 biological 1:24 7:25 14:4 27:22 81:4 150:1 167:5 178:1 biology 102:18 biosynthetic 96:5 bit 31:9 37:12 48:1 57:18,22 62:6 66:22 73:5 75:17 87:21 90:11 97:4 112:17 118:24 123:20 126:19,20 129:16 154:16 162:9 164:25 169:10 182:10,18 189:2 197:11 bits 5:12 6:12,13 | 83:15 Black 152:20 165:23 Black's 154:4 bladder 171:18 195:2 blind 83:8 blister 151:15 blockade 171:21 blocked 172:1 blood 109:3 110:19 169:7 171:6,23 195:4 boards 53:9 body 62:3,8,22 86:9 89:2 151:17,19 153:12,18 155:24 158:22 169:15 170:17,24 171:5 187:3,5 198:10,19 borrow 114:1 botanical 27:2 44:14 botany 144:25 145:3 bottom 17:19 37:1 45:1 66:23 132:18 142:21 bowels 171:19 195:2 box 102:8 brain 171:24 172:1 Branch 128:14,23 break 5:13 6:12 11:3 13:25 19:7 19:10 21:5 62:13 89:23 133:3 148:3 148:24 breakdown 134:3 134:18 breaking 5:12 6:13 breathe 151:12 185:21 breathing 172:4 185:22 195:4 briefly 53:13 123:5 | bring 82:7 188:25 189:24 broad 38:12 broadly 52:22 154:2 157:12 163:14 166:13 broke 9:15 broken 9:18 21:21 133:8,15,17,21 brought 82:9 102:19 150:24 Browne 16:7 18:18 25:1,2 54:14 55:18 64:11 72:2 74:25 77:19 78:8 79:7 95:12 105:1 105:2 111:21 113:21,24 114:7 114:16 128:7 142:9,15,17 145:15 177:15,16 180:24 182:10 185:3,12 187:11 187:15 189:8,23 190:1 191:1 193:23 194:18 195:5 196:9 198:5 198:7 200:7,12,19 Browne's 113:15 113:19 build 5:22 46:7 171:8 built 87:14 bumps 38:5,8,19 bundle 2:13 16:5 21:19,22 25:6 37:23,23,24 46:20 56:22,22,24 64:8 78:18 94:25 111:22 119:10 123:8,9 128:14,15 128:17,22 129:15 130:2 132:8 136:22,23 153:1,1 163:25 164:1,2,4 bundles 33:4 56:21 |
| <hr/> B <hr/> | | | | |
| back 9:8 15:4 23:10 33:12 36:16,23 37:21,22 42:7 53:13 54:3 55:21 57:9 88:18 90:1 91:19 92:24 93:10 100:10 101:23 103:15,22,22 104:14 115:7 117:16,25 123:9 130:2 137:6 138:21 142:8,13 144:19 145:1 150:21 162:16 164:8 166:20 backed 22:19,20 background 52:15 152:9 backwards 160:8 bacterial 84:6 bags 184:5,6,7 | | | | |

| | | | | |
|-----------------------------|----------------------------|---------------------------|----------------------------|-----------------------------|
| 64:4 81:16 | 55:10 | certain 15:17 32:3 | check 54:22 66:24 | 3:12,13,15 4:24 |
| burner 117:25 | carpet 184:11,15 | 70:22 72:15 108:9 | 68:21 78:2 129:10 | 11:4 20:10,16 |
| burns 151:17 | 184:16,20,21 | 111:17 149:23 | 140:21 167:8 | 39:19 61:23 77:14 |
| burst 184:4 | carried 50:3 153:12 | 156:16 162:25 | checked 18:12 | chromatographic |
| | 153:15 178:1,5,9 | 170:8 172:19 | 29:18 | 59:22 |
| C | carrying 42:2 | 173:4 175:19 | checking 12:23 | chromatography |
| C10H13 73:16 | case 3:18 11:6 13:9 | 176:7 181:23 | chemical 4:2 7:23 | 3:3,6 82:19 84:17 |
| C20H26 25:21 67:2 | 20:14 34:4 42:16 | 182:2 | 8:2,4 13:14 14:4 | 109:24 |
| 68:14 | 52:15 62:1 65:18 | certainly 9:23 | 25:24 28:6 60:13 | chronology 46:25 |
| C20H26N2O4 28:9 | 68:7 73:21 74:13 | 23:13 28:14 38:6 | 126:19 140:4 | 52:14,21 55:14 |
| C20H27 20:6 47:5 | 81:8,11 82:8 | 38:7 64:23 66:2 | 147:23 150:1 | 139:23 |
| C20H27N2O4 8:14 | 84:13 93:2,4 94:8 | 74:22 80:2 106:18 | 151:7,8 169:1 | circuit 53:9 |
| 49:5 72:3 120:25 | 95:21 104:12 | 117:10 121:6 | 179:18,23 | circular 44:7 |
| C22 67:2 | 106:21 122:15 | 123:13 130:21 | chemicals 16:14 | circumstances |
| cabbage 86:16 | 131:14 133:5 | 148:24 153:24 | 25:25 26:8 27:9 | 193:5 |
| calculations 6:3 | 141:14 147:6 | 154:6 155:2 | 27:18 29:21,23 | Clair-Ford 188:11 |
| calibrate 71:18 | 158:3 159:4,16 | 162:21 165:13 | 67:15 86:8,16 | clarification 91:10 |
| call 11:1 21:3 34:24 | 165:7,14 166:22 | 166:16 173:5 | chemist 85:20 | 99:16 143:15 |
| 67:8 73:16 87:15 | 167:23 169:5 | 177:24 178:18 | chemistry 13:5 | 148:19 197:21 |
| 107:19 113:6 | 172:24 173:12,21 | 181:3,8 182:12 | 80:25 81:23 82:4 | clarify 21:14 83:10 |
| 117:14 119:11 | 174:4,20 175:5,13 | 192:22 193:9,9 | 83:6 85:16 87:2 | 85:20 120:3 170:7 |
| 151:18 171:11 | 178:22 179:21 | certainty 74:9 | 91:23 97:17 | 176:22 |
| 194:9 196:17 | 181:10 183:22 | 106:2 176:17 | 104:11,18 110:5 | classic 159:10 |
| called 4:1 5:6 60:7 | 196:19 197:25 | certified 74:15 | 135:13 140:2,3 | 171:14 188:7 |
| 66:18 67:20 73:20 | cases 91:19 92:17 | cetera 25:21 86:10 | chemists 86:24 | 191:21 |
| 106:1 119:16 | 146:3 | 86:16 90:12 92:22 | 87:9 94:4 | classical 151:11 |
| 139:18 150:21 | catastrophic 161:7 | 100:25 112:2 | ChemSpider 30:12 | classically 171:11 |
| 151:5 169:7 171:5 | categories 151:8,11 | 122:24 123:18 | chief 132:13 149:15 | 172:2 |
| 171:9 182:13 | category 151:18 | 134:19 173:2 | China 98:8 | classify 20:18 |
| calling 128:14 | cause 37:7 81:12 | chair 81:3,4 | Chinese 52:5 | clear 7:20,21 59:21 |
| canal 133:20 | 155:23 156:2 | chance 64:18 | chlorine 151:14 | 76:20 95:4 96:14 |
| candidates 34:5 | 157:25 171:24 | 124:23 148:4 | chocolate 73:21 | 148:10,15 159:6 |
| capable 65:1 110:8 | 175:24 176:16,18 | change 39:18 147:7 | choices 125:1 | clearly 20:24 30:17 |
| caraway 134:21 | 185:11 192:10,11 | changed 117:2 | cholinergic 170:25 | 35:3 45:14 67:4 |
| 135:9 | 193:17,22 194:12 | channelopathy | 171:12 172:25 | 166:2 190:5 |
| carbon 4:17,19 | 197:15 | 157:22,23 193:3 | 188:16 191:7 | clinical 1:23 157:13 |
| 5:23 13:17 15:4 | caused 65:8 | 193:17 194:4 | 195:17 197:24 | 158:19,24 162:5 |
| 51:11 67:2,9,10 | causes 156:3 | characterise 87:18 | 198:1 | 165:4 |
| 67:18 | 175:16 | 97:22 | cholinogenic | close 77:21 196:3 |
| cardiac 152:13 | causing 151:17 | characteristic | 183:13 186:11,16 | closely 35:19 67:4 |
| 175:10,21,22 | cautious 179:13 | 20:11 | 187:18 188:7 | 68:10 69:4,22,22 |
| 176:21 193:3,15 | cent 101:4 116:2 | characteristics | 191:6 | closeness 28:21 |
| 193:20 198:20,22 | 176:17 193:21 | 34:7 | chose 50:14 | 72:24 |
| cardiologist 196:24 | central 150:18 | charge 5:4,5 81:22 | chromatogram | clothing 153:14 |
| career 1:15 | Centre 1:19 | chart 113:8,10,11 | 38:2 | 181:6 |
| carefully 32:1 | cereal 73:19 | 114:8 | chromatograph | cluster 8:11 9:11 |

| | | | | |
|--|--|---|---|--|
| 9:18 12:18 14:14 23:10 24:6,10,16 30:21 59:14,18 72:3,5 76:19,23 76:24 78:10 79:18 79:24 85:12 clusters 76:22 CN- 167:16 CO2 4:19 coat 160:20,20 coated 3:17 160:23 coelute 9:13 coeluted 68:13 69:10 78:13 79:11 coelution 9:13 30:20,22,23 31:1 31:8,10,17 59:10 59:12,19 60:8,10 78:15 79:14 COHEN 76:17,18 79:8 80:9 200:9 coincidence 61:7 63:20,25 68:15 70:2,21 71:1,7,16 77:20 coincidences 68:19 Coincidentally 59:1 cold 187:2,3,5 coldness 187:7 collapse 176:11 183:11 collapsed 183:11 190:22 collapsing 193:6 collate 13:6 colleagues 25:17 65:5 66:8 collected 1:20 2:3 collection 71:21 97:5,6 144:22,25 145:3 collide 6:11 65:10 collision 58:10 65:3 65:21 68:3,5,13 69:6,24 | column 3:16,20,22 19:23 34:1 36:20 39:19 88:11 101:16 114:11 columns 112:8,10 112:14 146:20 147:9 combinations 69:13 combined 8:3 come 4:4,6,23 21:8 23:10 29:20 30:1 32:12,15,16,20 33:13 36:19 50:10 52:9 58:25 60:10 61:10 81:24 91:3 99:16 100:17 119:4 125:16 138:16 152:6 157:11 159:22 162:16 176:14 186:1 194:2 comes 2:4,8 3:12,24 15:11 16:13 24:20 61:11,22 92:14 97:13 166:7 174:8 195:18 comfortably 165:19 coming 32:19 37:6 49:3 60:12 158:8 188:5 189:17 comment 55:9,19 55:19 76:4 122:7 134:22 135:23 151:5 156:9 170:14 189:11 commented 75:3 commenting 78:15 comments 111:6 commercial 135:12 commercially 87:22 common 5:11,21 45:3 67:6 69:13 74:2 103:16 | 187:16 commonly 73:17 107:5 154:25 communicate 141:2 communicated 140:24 company 105:3 comparable 64:24 64:25 comparative 96:11 97:16,18 102:22 comparatively 56:18 75:4 139:9 139:14 192:18 compare 71:22 99:2 118:17 compared 132:1 compares 86:20 99:4 comparing 37:8 88:1 comparisons 88:3 competitors 1:20 complete 26:7 63:19 completed 55:21 completely 116:11 completeness 183:25 completion 174:1 complex 11:2 37:7 83:9 195:18 complicated 65:17 69:18 148:5 complication 73:2 component 3:12 20:19 components 3:11 15:25 62:9 72:5 composition 4:2,22 5:23 6:23,24 8:2 8:21 12:24 13:10 13:13,17 17:13,16 20:5 22:10 26:16 27:2,17 30:2 | 42:12 51:9,11 69:14 72:13,19,22 73:4 126:19 147:23 compositions 14:21 15:5 65:2 72:17 compound 4:8,14 4:15,22,23 6:25 7:1,13,14 16:16 18:10 20:25 21:15 23:5 30:24 36:4 36:15 43:25 44:3 44:4,5,8,21,23 49:3 50:20 51:5,9 51:10,13 60:13 61:11,24 62:2,5,8 62:11 63:5 69:16 70:6 71:24,25 73:15,16 76:8,9 76:13 84:20,23 87:18 88:5,25 94:9,14 97:22 102:16 103:4,7,13 103:14,15 104:2,4 104:5,14,21 110:24 115:3 120:4,13,16,23 121:15,20 122:5 122:14 127:17 133:24 134:1,11 134:14,20 135:3,3 135:6,20 136:2,7 137:1,23 138:10 138:19 139:5 141:15,17,19 154:12 196:23 compounds 1:25 12:24 13:4,6,11 13:12,20,21,22,23 14:9,17 15:13,14 17:1 22:18 23:2 26:11,17 30:10 35:19 38:8,9,12 38:17,17,20,22 41:10,11 42:11,19 44:15,18 47:13,24 | 48:4,6,12,16,19 48:24 49:20 52:8 54:8,25 55:1 60:10 61:10 74:19 82:13 84:16 85:1 85:9 86:1,7,8,14 86:25 87:7,16 90:8,12 91:25 93:12 98:12,17,20 99:7 102:12 103:19 104:16 106:4,17 110:8,24 111:1,8 116:3 121:22 125:5,15 132:23 135:14 137:3 138:14 151:22 154:23,25 168:20 comprehensive 55:5 198:4 comprehensiven... 91:17 computer 28:9,10 29:8 30:5 57:2 72:10,22 conceivable 95:10 conceived 5:20 concentrate 59:3 99:23 179:9 concentrated 132:6 concentrating 87:6 concentration 92:4 concentrations 92:21 99:19 concerned 24:20 121:5 130:20 131:1 154:6 163:13 168:23 193:24 conclude 30:23 59:18 70:15 149:5 149:6 concluded 78:9 106:2 141:18 concludes 80:11 conclusion 7:4 8:5 |
|--|--|---|---|--|

| | | | | |
|---|---|--|---|---|
| 10:14 22:22 25:19 25:22 30:15 31:3 31:14,20 32:2,8,8 32:17 35:1,2 37:19 41:13 50:5 50:18,23 51:3 57:24 59:16 80:3 121:19 131:6 134:9 157:3 158:9 194:3 | connected 3:7 56:12 107:8 154:14 connection 61:3 consequence 187:8 consider 2:2,9 4:15 23:4 49:7 123:5 158:10 163:21,22 173:7 consideration 165:18 considered 9:7 16:20 52:12 53:17 125:20 considering 7:24 26:10 27:15 55:10 70:10 consistent 20:2 37:2 92:13 106:19 164:20 165:7 191:5,6 192:21 198:21 consists 3:15 Constable 132:13 constant 189:2 constantly 94:1 constituent 63:16 135:6 constricted 192:13 constriction 191:22 consumed 84:1 108:7 111:10 consuming 73:24 consumption 109:1 contact 140:11 185:17 contain 82:12 85:21 86:6,14 89:5 90:5 95:21 106:3 111:7 125:4 132:2 133:14 contained 89:5 106:4 132:15 134:1,14 160:22 containing 50:20 51:4 134:11 184:5 | contains 61:12 93:17 contamination 153:13,15 contemporaneous 71:11 contemporaneou... 11:20 31:25 content 18:6 23:5 120:11 168:19 contents 18:1 32:12 34:11,12,18 37:17 39:22 40:7 52:9 52:17 56:19 57:10 60:1,25 62:19 70:1 75:10 76:10 83:15 84:7 91:1,9 91:13 92:24 93:1 93:7 105:21 107:21 109:7 110:18 111:14 121:7,18 125:16 141:16 148:12 155:17 161:10 197:10 context 12:20 19:3 49:13 64:24 83:5 83:24 90:1 continual 158:20 continually 161:19 continues 164:11 continuing 6:20 130:21 control 1:19 118:1 120:15 122:7,9,10 145:4 160:11 171:18 195:2 controls 172:2 conveniently 36:18 Convention 179:23 conventional 109:24 converted 75:24 copied 129:2 copy 2:11 66:21 111:25 113:16,20 | 113:23 163:23,24 163:25 core 64:3 198:10 corner 64:9 coroner 1:5 19:6,14 33:23 41:3 45:14 46:17 50:2,15 51:1 52:20 54:12 55:4,13 58:7 64:10 70:9 71:6 80:12,14 89:17 105:5 108:9 111:17 113:13,18 113:22 114:3,5,13 120:2 123:14 125:6 148:5,22 149:8 177:11 180:18 181:18 182:6 185:1,4,8 187:7,10,12 188:10,15,19,23 189:5,7,15,19,22 189:24 190:2,25 193:10 194:2,20 194:25 195:23 196:5,10 197:5 198:14,17 199:11 199:14,17 coroner's 46:25 52:14 124:9 coronial 177:24 correct 1:13,18 8:23 16:21 25:20 26:10 27:21 28:2 28:3,19 31:18,22 32:7 34:20 37:15 37:19 45:17 46:1 47:3 49:24 51:25 52:3 53:25 54:19 62:14 72:3,12 74:19 76:13,14 94:20 95:10,16 105:25 106:25 107:25 115:1 119:21 120:10 130:14 131:23,24 | 134:16 135:22 136:4 143:11 146:12 152:8 154:9 168:13 178:3,10 187:17 194:7 corrected 40:14 correctly 27:14 42:8 62:20 99:7 correspondence 128:14,23,24 177:21 coughing 162:10 164:25 171:17 195:1 counsel 52:18 148:18 count 36:20 couple 36:23 119:24 128:10,11 128:25 139:22 196:13 coupled 3:6 course 7:16 8:10 12:17 26:18 47:4 49:12 51:10 80:14 93:22 100:9 109:6 121:5 134:2,17 136:18 150:16 152:2 155:14 157:8 161:9 177:24 court 1:9 2:10 9:4 24:20 81:14 138:24 149:4 174:9 176:25 courtroom 184:17 185:5 courts 12:4 covers 154:2 Cowan 1:4,6,8,10 18:22 19:16 39:21 41:1 80:11 102:10 104:13 115:23 200:5 Cowan's 85:5 |
|---|---|--|---|---|

| | | | | |
|---|--|---|--|--|
| Craggs 129:20 140:7 | 22:20 23:17 24:17 31:5,11,17,21,22 39:25 43:14 50:22 | DCI 120:2 | deemed 153:15 185:17 | 30:20 35:22 190:5 |
| credence 79:17 | 51:7 57:15 58:8 | dead 186:7 | defence 149:18 150:3 | depth 97:22 |
| Crippen 139:15 | 65:15 70:5 71:9 | deal 19:18 85:18 164:12 | defer 2:8 11:14 23:13 166:7 193:7 196:20,22 | deputy 80:23 |
| crisis 171:12 | 71:16 78:16 79:9 | dealing 1:25 9:17 15:2 91:20,23 93:5 98:13,19 103:20 | deferred 73:13 | derivative 154:13 |
| 172:10,14,25 | 79:13 90:13 93:8 | dealt 42:5 | deferring 11:12 | derive 8:21 193:4 |
| 183:13 186:11,16 | 93:10 94:6 98:18 | Dear 119:24 130:8 | define 5:16 197:15 | derived 50:7 85:1 87:4 94:11 135:6 |
| 187:18 188:7,17 | 100:20,24,25 | death 50:19 51:4 105:13 133:18 134:10 135:8 150:20 155:22 156:2 167:4 169:13,15,19 170:21 172:3 173:19 174:10 175:15,21,22,24 176:4,16,18,21 180:25 181:12 182:11 190:6 191:17 192:10,11 192:13 193:20 194:20 195:15 196:4 197:2,15 | defined 151:7 | derives 23:1 |
| 191:6,7 195:7,18 | 101:12 102:23 | debate 12:17 | definitely 13:24 46:10 124:13 | describe 1:11 4:12 6:9,21 13:3 171:1 197:23 |
| 197:24 198:1 | 103:10,22 104:20 | deceased 2:3 16:25 18:2 50:7,19 51:4 91:7 106:11 134:10,13 135:7 157:24 170:18 | definitive 167:3 | described 85:12 106:22 165:6 173:1 188:4 |
| criteria 178:23,24 | 112:7 113:1 | deceased's 50:17 134:8 | definitively 18:17 43:20 | describing 30:9 |
| 179:4,6 186:9 | 116:13 117:19 | December 46:22 94:20 123:7,14 124:5 150:22,23 177:3 | degradation 76:5 98:25 | description 5:11 |
| critical 158:25 | 134:13 140:5 | deduction 5:18 | degrading 169:15 | destroyed 75:24 |
| criticism 43:21 | 142:5 143:8 | deductions 12:6 | degree 4:21 23:13 107:15 | destruction 179:21 179:24 |
| cross 51:13 | database 12:23 13:6,7,10,11 14:4 14:12,22,25 29:11 30:9,12 43:14 44:10,13,23 72:23 74:5 85:16,18,25 86:1,12,13,13,21 89:4 94:7 103:23 103:25 137:6 138:18,21 | | degrees 198:19 | detail 4:9 10:3 58:7 131:2 133:16 141:12 152:24 165:8 170:19 |
| crucial 168:9 | databases 26:13 43:11 73:4 74:8 86:19 88:2 89:11 135:12,13 | | delay 123:17,19,22 123:24 124:7,11 156:16 160:11 | detailed 117:12 129:9 |
| cumulative 158:4 | date 29:11 129:19 130:13,15,16,18 150:23 | | delayed 160:16 161:17 163:1 | details 52:1,3 |
| 158:23 159:17 | dated 33:8 118:24 119:17 130:1 140:15 141:8 142:18 143:16 177:3 | | delayed-action 159:21 160:12,14 176:5 | detect 77:7 111:1 169:24 170:14 174:21 |
| cumulatively | dates 124:14 128:25 | | delays 98:7 168:8 | detectable 132:19 153:14 |
| 158:11 | David 1:6,10 200:5 | | deliberately 167:19 101:18 121:20 153:22 164:20 172:25 | detected 11:12 52:8 125:15 132:24 141:15,19 |
| cup 5:14,14 | day 71:12 105:12 130:11,12 158:18 160:5 161:22 162:20 199:20 | | demonstrate 101:18 121:20 153:22 164:20 172:25 | detecting 110:8,21 |
| current 181:19 | days 16:3 89:2 162:19 167:4 | | demonstrated 158:24 176:9 | detection 30:25 110:21 111:19 |
| currently 95:11 | | | depend 108:7 184:23 | determination 177:11 |
| 149:15 170:4 | | | dependent 4:2 | determine 7:13 88:20 |
| 179:23 | | | depending 92:21 126:20 162:10 182:1 192:10 | developed 87:24 |
| cyanide 156:25 | | | depends 20:14 | diagnosed 197:3 |
| 157:5 166:21,22 | | | | diagnosis 168:8 169:11 175:20 186:19 |
| 167:16,25 169:10 | | | | |
| 176:8,8 | | | | |
| cyanides 168:5 | | | | |
| <hr/> | | | | |
| D | | | | |
| d 36:2 47:9 49:15 200:3 | | | | |
| D28 136:23 | | | | |
| dab 181:4 | | | | |
| dangers 181:23 | | | | |
| Daphne 150:19 151:25 154:7 | | | | |
| data 5:1 6:6,6,7,8 6:21 9:7 10:16 12:1,7 13:3 14:16 16:2,21 17:2,8,14 17:17,22 18:4,11 18:13,15 22:8,19 | | | | |

| | | | | |
|----------------------------|-----------------------------|----------------------------|---------------------------|----------------------------|
| diameter 174:14 | 135:14 136:22 | 124:20 | 73:8 108:4 169:13 | draw 6:8 68:2 |
| dictionary 26:24 | 138:18 147:1,9,10 | directing 87:3 | 181:23 194:9 | 157:2 |
| 27:4,25 42:10 | 147:10,25 148:1 | direction 124:21 | dominant 101:14 | drawing 37:10,11 |
| 47:10 103:23 | 151:20 155:6 | directly 107:2 | 101:21 | 59:25 193:11 |
| 115:17 137:2 | 160:18 166:21 | 173:14 | dose 174:10 190:5 | drawn 12:17 |
| die 159:14 165:2,6 | 176:8 190:3 | director 1:19 80:23 | doses 153:25 174:2 | drew 122:10 |
| 192:2 | differentiate 67:24 | disagree 46:18 | 174:16 | dribbling 189:2 |
| died 154:22 156:17 | 92:8 | disappeared 109:2 | double 59:23 | dried 97:23 98:15 |
| 158:18 175:9,10 | differentiates | 109:10 | doubled 59:19 | 99:2,4,7,9 |
| 177:12 181:1,4 | 67:11,17 | disappearing | doubt 12:2 15:20 | drift 34:24 37:12 |
| 183:10 193:3 | differentiation | 169:15 | 24:18 46:22 103:3 | 37:13 40:11,18 |
| 194:4 195:14 | 12:21 97:12 | discounted 93:11 | 103:8 179:14 | 57:19 116:21,24 |
| dies 159:19 | difficult 7:25 30:11 | discovered 36:17 | dozens 42:19 | 117:1 118:21 |
| diet 134:3 | 62:22 68:6 172:22 | 42:1 44:16 75:5 | Dr 2:20 7:14 8:9 | drink 160:13 163:8 |
| dietary 63:16 | difficulties 53:8 | 109:16 115:15 | 9:6 12:7,18 16:4 | dripping 189:12 |
| differed 68:4 | difficulty 9:22 37:5 | discuss 53:4 110:4 | 17:12 18:7 20:6 | drool 189:1 |
| difference 9:3 | 44:5 55:14 111:23 | discussed 52:15,17 | 20:16 21:17,24 | drooling 188:4,6,17 |
| 20:21,22 34:21 | 112:12 174:12 | 77:10 155:15 | 23:14,19,24 24:11 | 189:17 190:6,18 |
| 37:10 39:17 65:23 | 180:6 181:8 | 196:16 | 25:20 35:21 36:12 | 191:2 |
| 66:1,2 71:15 | 183:20 | discussion 7:16 | 36:13 38:6,15 | droplet 174:11,13 |
| 76:22 86:22 91:16 | digested 108:12 | 154:11 | 39:16 40:15 41:16 | drug 1:19 161:20 |
| differences 40:19 | digestive 62:20 | disposed 75:9 | 42:22 47:3,4 50:4 | drugs 1:17 152:12 |
| 113:19 118:21 | 104:21 107:23 | disregard 34:13 | 50:12 52:17 53:16 | 161:19 163:17 |
| different 5:25 7:12 | 108:18,21 109:3 | dissent 165:25 | 56:18 57:24 59:11 | dry 98:5 |
| 8:3 9:19 12:11 | 109:15 110:19 | 166:5 | 62:16 65:3 71:17 | DSTL 149:15,17 |
| 13:12,18 14:13,17 | dilatation 191:22 | dissolve 3:19 | 72:2 75:8,14,18 | due 124:10,15 |
| 14:21 15:5,25 | dilate 191:17 192:2 | dissolved 4:5 | 76:21 77:10 78:9 | 180:9 |
| 16:24 17:1 18:4 | 192:6,9 | distance 149:4 | 78:23 79:13 81:18 | dwelt 100:5 |
| 20:25 21:14 22:18 | dilemma 176:1 | distinction 150:11 | 82:9 85:12 90:21 | dying 164:22 |
| 25:24,25 26:17 | dilution 185:9 | diterpenoid 84:25 | 91:11 94:18 | 172:20 193:6 |
| 28:16 30:24 32:13 | dimer 11:1,7 12:14 | divider 64:10 | 100:20 102:12 | |
| 32:21 35:17 38:17 | 23:21 24:18 61:24 | DNA 82:24 83:1,2 | 108:11 123:25 | E |
| 39:9,9,24 40:2,3 | 61:25,25 76:23 | 83:3,7,8,16,17,21 | 128:23 131:12,21 | e 35:5,8,10 36:3 |
| 40:10,16,16 42:11 | 77:8,12,14,16 | 84:5,6 109:17,21 | 137:8 139:15 | 200:3 |
| 45:20,21,23 52:23 | 78:1,3 | 110:5,6,10,13 | 140:19 141:18 | earlier 16:25 26:3 |
| 53:12 54:1,7,16 | dimeric 61:15 | 111:3 | 142:1,18 143:16 | 35:22 36:13 39:13 |
| 55:1 59:1,1 60:10 | dimerisation 30:16 | doctors 162:19 | 147:6 148:4 149:3 | 75:3 95:12 102:23 |
| 60:19 61:9 63:1 | 30:20 31:15 59:12 | document 22:1 | 149:5,10,12,13 | 124:4 127:16 |
| 65:5,14,19 66:19 | 79:19 | 123:11 | 152:7,10,20 153:5 | 136:6 178:7 |
| 81:25 86:25 90:8 | dimerise 12:15,15 | documentation | 154:3,4 156:24 | 194:25 |
| 97:16 99:15,17,18 | 77:5 | 7:18 | 157:21 158:4 | early 49:9 124:17 |
| 99:19 101:13 | dimers 76:21 77:3 | documented 97:8 | 161:4 163:14 | 150:23 |
| 103:7,13,14 109:8 | 77:6 | documents 81:14 | 165:23 166:3,17 | easily 57:19 74:2 |
| 115:12,13 116:12 | dioxide 4:17,19 | 119:11,12 177:9 | 177:16 178:4,25 | easy 29:3 165:16 |
| 116:22,23 122:6 | 15:4 | dog 67:9,20 | 196:13,14 197:22 | 174:15 179:15 |
| 126:5 133:3 | directed 1:17 | doing 66:16 71:1 | 200:17 | 181:10 |

| | | | | |
|--|--|---|--|--|
| <p>eaten 51:15,18 63:17 105:12 108:2,14,20 109:9 134:4 EBC 144:23 eclipsed 152:1 177:1 economic 144:25 145:3 ecstasy 73:22,24 effect 4:1 14:11 124:12 153:11 159:22 160:1 161:6 162:4,5,14 162:14,17 164:13 182:9 184:12,22 184:25 effectively 73:13 91:14 155:19 170:22,23 effects 1:23,24 150:1 155:13 161:12 162:12 184:18 185:11,22 186:6 189:9 efficacy 156:15 either 4:3,16 5:4 7:23 11:18 37:3 63:17 85:11 122:25 143:8 163:1 166:16 175:9 177:23 190:22 192:4 193:22 194:3,5,15 electrical 62:24 electronic 58:10 elegans 16:14 23:3 33:19 35:4,12,14 36:3 41:20,21 45:23 49:17,21 50:7,11 52:5,11 52:13,23 53:11 54:2,16 66:15,17 96:23 121:23 124:25 125:8,18 125:22 126:4,16</p> | <p>127:2,3 element 10:5 102:18 elemental 4:22 5:23 6:22,23 8:2 13:9 13:17 17:13,16 20:5 22:10 26:16 27:2,16 30:2 42:11 51:9,10 65:2 69:14 72:13 72:17,19,21 73:3 elements 8:3 13:12 14:21 elicited 150:7 193:1 eliminate 151:3 165:19 167:6 175:20 176:18 178:21 eliminated 163:22 197:7 eliminating 180:5,8 181:9 183:21 elimination 152:3 157:11 162:16 163:13 186:9 elute 48:22 eluted 4:24 41:5 43:25 47:14,24 48:5,16 49:1 60:6 63:21 114:24 127:18 eluting 8:19 16:25 34:3,11,14,16 35:5,15 39:3 41:11 53:19 54:5 54:7 59:7,9 115:8 115:11 elution 34:22,22 35:17 37:2,5 38:5 38:16 39:9,24 40:10 41:11 53:23 57:18 61:1 114:21 115:12 116:10,21 145:11,18,19 147:1,2,25 148:1 email 119:16 129:1</p> | <p>129:5,11 130:6 emails 124:12,12 128:24 emerging 57:15 emphasis 87:1 175:23 emphasise 93:15 emphatically 73:22 empirical 6:18 empirically 6:17 74:16 employing 40:6 enable 4:7,16 64:5 enables 37:16 encouraged 59:11 59:17 encouraging 125:23,25 ended 118:6 ends 120:1 energetic 65:25 energy 6:11 58:10 62:25 65:4,7,21 68:3,5,13 69:6,24 enlarged 197:11 enterprise 150:5 entire 172:17 197:15 entirely 2:19 46:9 113:21 198:4 entity 94:2 enzymatic 7:23 enzyme 169:6,14 169:18 170:22 171:5,8 epileptic 171:25 172:7 186:12 195:3 Equally 190:21 equipment 20:14 34:25 35:24 36:7 36:8 39:13 40:15 53:8 71:14 87:24 88:6,7,10 92:6 108:6 111:1 123:21 124:1</p> | <p>147:7 equivalence 11:21 11:21,22,22 equivalent 11:24 erring 181:20 error 73:5 escape 184:8 especially 12:7 52:13 103:19 125:22 essentially 76:12 151:20 171:13 establish 7:9 established 169:21 establishing 113:19 establishment 152:25 178:6 et 25:21 86:10,16 90:12 92:22 100:25 112:2 122:24 123:18 134:19 173:2 ether 12:16 etorphine 196:18 196:22 evaporate 184:11 185:11 evaporated 184:14 eve 46:25 event 158:25 166:18 168:19 193:15 events 55:6 eventually 159:12 171:19,22,25 192:5 everybody 148:7 149:8 evidence 2:19,20 2:21 9:6 15:9,20 18:7 41:4 51:22 56:11 62:16,17 63:7,11 70:14 85:5 91:10 105:5 115:24 117:7 131:16 141:13,16</p> | <p>150:6,8 152:18,24 154:17 156:9 158:15,16 159:15 161:13 162:22 172:16 175:4 176:2 178:7 180:24 186:13 188:8,10,13,13,14 188:20 189:15 190:21,23 191:16 191:25 192:25 193:18,21 194:25 195:23 196:14,15 196:17 197:1 evidential 197:15 evolved 119:9 evolving 94:1 exact 4:22 9:1,5 17:11 28:10,13,21 29:8,10 31:24 73:2 150:22 exactly 7:21 8:8 14:19,20 20:24 22:20 23:23 29:24 35:19 36:5 40:11 60:11 61:10 70:6 71:21 77:9 79:10 111:20 113:23 116:8 118:11 126:10,21,23 127:25 147:14,19 147:20 148:8 178:20 183:5 examine 28:5 191:11 examined 112:4 example 4:17 5:19 12:14 15:4 17:4 21:7 36:2,3 50:6 74:6 124:9 155:17 157:6 159:10 160:6,19 161:4,13 162:2,3,7 163:8 173:1 183:12 185:4 examples 71:8 74:6</p> |
|--|--|---|--|--|

| | | | | |
|----------------------------|-----------------------------|----------------------------|----------------------------|----------------------------|
| 151:12 | 110:25 162:8 | 68:19 70:3,23 | 142:1 157:5 | featured 152:23 |
| excessive 171:12 | 165:5 166:11,16 | 77:24 186:14 | 164:17 165:8 | features 4:7 80:25 |
| 189:3 | 195:16 | 194:5 | 168:14 169:12 | 171:14 187:3 |
| exchanges 120:5 | experienced 10:15 | explanations 63:22 | 194:14 | February 143:16 |
| exclude 46:11 71:2 | 10:21 | explore 56:10 | failure 161:7 | feed 72:25 |
| 71:23 76:12 | experiment 23:16 | exploring 192:15 | 198:21,22 | feeding 30:4 72:9 |
| 168:11 | 42:2 71:13 181:15 | exponentially 15:7 | fair 96:15 196:9 | feel 55:19 119:3,4 |
| excluded 50:4 | 181:15 | express 11:16 35:2 | 197:12 | 150:14 |
| 138:9 139:5 | experiments 9:25 | 154:19 | fairly 38:12 140:11 | feeling 159:13 |
| excludes 26:8,10 | 23:16 43:15 71:11 | expressed 30:16 | 158:19 165:19 | Fegan-Earl 75:14 |
| 159:2 | expert 78:18 81:25 | 32:2 119:3 176:24 | 170:16 185:9 | 75:18 |
| excluding 32:14 | 82:2,2,3,4 96:16 | 177:5 | fall 198:18 | fellow 155:15 177:6 |
| 51:23 | 104:18 132:8 | extensive 93:22 | falls 76:2 | felt 158:17 159:8 |
| exclusively 106:18 | 136:23 140:3 | extent 1:21 2:23 | false 65:17 169:14 | 162:19 |
| 107:7 191:6 | 141:17 153:1 | 6:2 10:18 18:8 | familiar 30:12 | Ferner 76:3 152:7 |
| 192:21 | 175:22 198:24 | 46:18 151:25 | 34:11,12 81:15 | 156:24 158:4 |
| excuse 57:5 | 199:1 | 188:19,21,21,22 | 175:2 196:23 | 163:6 165:20 |
| exercise 70:13 | expert's 56:21,22 | 197:5 | family 157:20,21 | 168:24 191:16 |
| 104:7 | expertise 1:11 2:4,6 | external 153:21 | 162:22 | 192:2 |
| exhausted 171:20 | 11:15 23:25 76:2 | extra 67:2 118:24 | far 4:18 44:15 46:4 | Ferner's 75:22 |
| exhaustive 50:13 | 82:5,7,10 104:22 | extract 37:7 45:9 | 46:24 55:12,16 | fewer 15:1,2 |
| 98:3 126:1 131:13 | 166:11 193:4 | 50:8 82:14 83:23 | 84:13 85:8 102:17 | field 193:8 |
| 131:15 | 196:20,22 197:3 | 92:3,5,5 | 109:19 121:5 | figure 5:8 14:13 |
| exhibit 142:21 | 198:22,24 199:2 | extracted 32:4 | 130:20 131:1,4 | 34:8 38:1 40:1 |
| 183:3 | experts 2:8,9 25:6 | 55:23 66:15 121:9 | 152:3 154:5,15,20 | 57:14 59:8 72:24 |
| exhibited 183:10 | 73:12,13 81:24 | extracts 23:6 43:12 | 162:21 163:13 | 198:14 |
| 183:12,15 192:20 | 111:22 123:9 | 50:4 | 165:21 166:18 | file 2:14 90:14 |
| exhibiting 172:14 | 155:16 166:7 | extrapolate 46:2 | 168:23 178:9 | 132:11 |
| 186:18 | 177:6 193:8 | extremely 16:20 | 185:16 191:25 | filled 3:16 |
| exist 45:18 85:9,10 | experts' 33:4 37:23 | 40:24 | 193:24 | final 78:8 140:24 |
| existing 30:10 | 64:3 | eyes 162:10 171:16 | fast-acting 159:18 | 146:8 164:19 |
| exists 160:18 | explain 2:24 3:3 | 174:6 182:24 | 163:2 176:5 | 176:10 |
| expand 84:9 | 5:2 13:4 17:2 | 191:16 195:1 | fat 3:19,25 4:3,5 | finally 72:2 76:7 |
| expect 11:7 15:17 | 21:15 46:23 55:13 | | 170:17 | 152:23 186:9 |
| 20:4 30:12 38:22 | 61:6 87:10 88:16 | F | fatal 132:17 162:4 | find 8:9 9:16 10:22 |
| 42:21 46:19 111:8 | 90:25 91:16 92:2 | f 54:4 | 162:6 165:14 | 13:11 15:17 16:5 |
| 115:24 161:10,13 | 100:17 131:14 | face 182:24,25 | 174:1,15 | 17:14 21:20 44:24 |
| 165:13 171:2 | 133:16 145:18 | faced 16:1 | fatality 174:7 | 51:22,24 57:6 |
| 186:5 192:12 | 150:13 158:8 | fact 2:16 7:8 12:20 | fatty 3:21,23 | 58:25 64:3 69:11 |
| 194:22 195:15 | 167:13 195:7 | 24:8 27:4 28:5 | 160:20 | 74:4 76:10 86:1,9 |
| 196:2 | explained 2:23 | 43:7 45:11 59:25 | fault 112:13 113:21 | 86:18,21 90:11 |
| expectation 158:23 | 35:22 39:16 | 72:3 82:15 85:8 | 113:22 | 93:12 94:9 103:17 |
| expected 109:12 | explaining 19:19 | 88:22 92:25 93:17 | favour 79:23 80:6 | 103:23 105:11 |
| 111:11 191:8 | 89:22 | 95:21 98:10 | 186:20 193:20 | 106:15 107:18,23 |
| expects 11:3 | explains 79:4 147:6 | 101:13 107:13 | feature 186:15 | 113:12 117:13 |
| experience 12:9 | explanation 63:13 | 130:6 140:24 | 187:6,24 | 126:7,9,13 128:1 |

| | | | | |
|--|---|---|--|---|
| 144:4 146:11,19 146:22 154:25 161:9 170:10 finding 16:13 42:20 46:8 77:25 108:4 124:23 129:6 188:1 findings 164:18 176:13 finger 144:9 fingers 144:8 finished 64:2 123:6 firm 11:11 36:6 first 1:3 8:10 12:22 17:10 21:4 31:7 33:4 36:20 39:12 57:10 58:8 61:18 66:23 75:8 88:14 91:11,22 97:2,18 100:14,18 104:17 108:11,14,18 112:16 119:4 120:9,18 121:5 151:13 156:1,18 156:19 165:9 193:1 Firstly 3:3 fit 72:17 79:22 172:7 186:12,13 five 26:24 27:1,5 28:10 36:20 39:14 42:10 47:11,12 53:20 55:25 57:23 72:16 88:15 94:16 116:25 118:6 136:3,8 137:3,25 flat 92:8 fluid 163:9 164:25 165:3 174:5 189:1 189:4 fluids 162:1 flushed 75:13 91:12 focus 100:8 152:3 focused 161:25 focusing 16:3 | 156:23 follow 18:23 29:4 36:12 39:11 41:21 41:22 44:12 48:24 67:14 138:2,3,9 195:10 followed 29:6 61:20 following 47:6 120:10 135:7 164:3 199:20 follows 41:6 food 86:15,16 108:12,13 159:12 160:13 163:8 foods 86:17,18 foodstuffs 73:18 107:5 foot 129:1 forcible 163:4 forearm 181:5,6 forensic 11:17 75:14,18 155:18 Forensics 152:11 forget 188:25 Forgive 187:7 form 9:19 10:14 11:10,13 30:21 48:9 81:23 85:11 93:4 95:22 104:21 107:13 118:1 120:25 145:4 147:10 159:3 176:8 180:5 182:2 formed 6:10 77:13 78:6 111:5 184:14 former 179:17,24 forming 77:3 forms 83:17 94:14 102:14 166:21 formula 6:19 9:12 25:21,24 26:2,14 26:14 27:10,19 28:6 29:18,22 47:11 66:25 67:4 68:1 72:6,8,10 | 134:15 135:5,15 136:25 137:3 formulae 67:16 formulated 159:24 formulating 161:19 formulation 160:18 fortnight 83:19 forward 20:5 33:21 34:9 53:2,16 129:15,18 144:7 found 2:13 6:17 7:14 8:12,14 9:14 10:20,23,24 14:2 16:14,16,18 17:16 21:17 22:24 23:2 23:5 26:24 27:24 29:2 31:7 32:15 32:18,19,20 37:17 37:18,21 39:22,23 40:7,8,13 41:19 41:21 42:12 44:25 45:2,13,15,15,18 45:23,25 47:18 48:3,6,12,14,21 48:24,25 49:17 50:5 53:21 54:1 54:17,18,20,21 55:7 57:11,13 58:4 60:25 69:5 70:11 73:17,19,20 74:21 76:9 77:20 93:17 94:3 100:6 102:12,13,14,16 103:4,9,12 104:3 106:17 107:5,10 109:12 113:2 115:7,11,16 117:4 117:14 118:15 120:21 122:2,3 124:24 126:8,10 126:18 127:1,3,20 129:11 137:1,9,23 153:14 four 15:5 16:4 28:17 38:24,25 39:1 41:9,10,20 | 41:24 42:6,10,14 61:2 96:7 100:6 100:14 109:1 112:7,8,10,14 115:23,24 116:25 118:7 127:8,22,23 137:9,11,14,17 138:4 149:20 fragment 21:13,14 21:15 58:10,19 59:4,4 60:24,24 61:22 62:2,4,21 63:14,21 65:8 68:6,10,16 69:6 69:25 120:21 fragmentation 10:8 11:25 62:24 68:11 87:21 103:7 fragmentations 88:10 fragmented 58:11 69:2 fragments 5:10,10 5:18 6:3,7,15,24 61:13 65:4,22 69:24 France 160:5 fraud 173:13,15 free 153:15 187:24 frequently 101:25 110:23 fresh 57:9 98:5 99:4 friend 60:2 77:18 frogs 86:2,3,4 front 2:11 102:21 102:22 117:19 132:8 153:1 196:15 fruit 17:20 104:8 112:2,22 full 1:8 11:25 80:20 149:12 162:12 fully 65:16 97:8 122:16 function 106:7 | functional 5:25 functions 171:21 fungi 86:2 131:23 further 7:11 46:14 94:13 97:4 102:18 114:13 118:20 119:7 120:14 124:2 125:8,23 129:12 136:12,16 142:7 144:20 152:1 153:18 155:24 160:8 163:21 197:19 200:16,21 Furthermore 20:9 future 94:10,13 Fysh 119:16 121:3 129:2 179:8 Fysh's 153:5 178:25 |
| G | | | | |
| gains 3:2 gamma 153:21 gas 6:11 65:10,13 82:19 109:24 151:16 162:2,7,9 162:12 164:12 176:8 gases 132:5 151:12 151:13 gastric 86:9 gathered 89:12 gelsedine 47:7 gelselegine 49:16 50:6 gelsemicine 16:19 18:16,17,20 19:4 23:6,8 33:25 34:18 35:16 39:5 39:7,8 41:6,7,12 41:19,25 42:1,4,5 43:7,8,20 44:3 47:7 50:6 54:3 56:3,6,7 67:1 69:23 74:17 95:7 | | | | |

| | | | | |
|---|---|--|---|--|
| 95:22 96:8 97:14 100:15,25 101:2 101:11,18 103:5,8 103:9,11 114:9,19 114:24 116:9,10 116:15 127:1,20 127:22 141:19 154:14 gelseminine 93:13 gelsemium 15:11 15:16 16:14,15 17:20 18:18 23:2 23:3 27:15 28:7 29:1,12 31:24 32:5,12,16,19,21 33:2,6,17 34:6 36:22 38:3 39:23 41:18 42:19 43:3 43:6,19 44:6,11 44:22 45:7,7,12 47:23 48:15,19 49:4 52:1,4,10,10 53:23 56:13 66:9 66:10,15 69:5,12 69:22 70:4,12 75:23 88:16 89:6 94:17 95:5,14 96:14,20 98:22 99:13,21 102:14 114:19 115:18,19 118:9 120:14,15 120:16 121:11,16 121:21,22 122:5 122:14 125:17,17 128:2 129:7 130:21 132:16,23 133:2,8 136:3,8 136:11 137:4,8 138:1,5,16,19 142:21 154:13,14 166:8 gelsempervine 66:18,19,25 gelsempervirens 33:10 34:14 gene 167:1 | general 17:15 25:2 36:16 82:4,10 85:16 89:8 105:3 105:11 155:7,9 167:1 generalisation 14:8 generality 4:9 generally 2:1 5:8 12:10 15:15 69:13 154:19 160:12 180:10,19 196:16 197:14 generation 83:18 generically 15:13 genetic 157:20,22 gentle 65:13 gentleman 182:12 192:19 genus 97:8 132:16 Geoff 81:25 getting 41:1 47:1 65:1 121:3,4 180:6 185:23 give 4:13,16,18 5:7 6:18 7:2 9:4,17,20 12:1 14:16 15:9 22:10 27:16 30:2 36:6 58:8 59:20 65:23 74:6 85:19 92:12 104:9 113:7 113:25 115:23 117:16 118:18 127:11 149:12 150:14 152:4 155:7 159:25 168:19 198:14 given 7:18 22:16 29:9 53:3 57:20 60:14 91:4,6,13 106:9 124:4 127:10 128:13 158:23 161:4 163:7 176:18 192:18 197:1 gives 5:1,9 7:6 52:2 65:14 | giving 27:2 70:24 185:4 glance 64:13 glanced 66:9 glorified 4:12 glycosidated 120:22 122:23 glycoside 107:7 120:23,24 122:24 glycosides 152:13 go 4:20 15:6 21:4 28:20 33:21 34:8 36:16 37:22,23 46:4 53:2,13,14 77:14 84:8,14,18 87:18 93:10 101:23 102:17,18 103:15,22,22 104:7,14 110:13 112:8 113:4,4 114:13 115:7 117:16 123:8,9 129:17 130:2 133:20 134:6 138:21 142:13 144:7,10 145:1,12 146:7 150:25 159:8 160:8 162:16,23 166:20 169:18 172:13,13 173:25 184:20 186:18 190:8,9 goes 11:4 20:20 159:23 going 2:14 10:18 15:4 19:7 33:18 34:1 35:21 57:12 61:23 62:15 63:1 71:8 73:3 78:3 82:14 92:20,24 94:5 104:13 105:9 105:19 107:18 109:21 112:7 113:25 132:18 141:12 148:15 152:2 155:12 | 156:14 165:15 174:21 175:1 good 10:1 17:22 33:10 54:15 57:7 119:14 162:7 190:21 gospel 127:7 grams 108:23 great 148:21 152:24 grind 98:1 ground 69:13 187:16 grounds 165:5 group 5:20 14:3 81:22 111:1 groups 5:25 62:11 growing 66:16 121:10 grown 45:20 GS/MS 110:7 guess 63:3 guide 34:10 74:8 gut 83:5 86:14 105:21 109:5,7,13 133:22 136:10 guts 92:20 | happy 8:24,25 54:12 hard 129:17 harmful 14:10 153:24 harmless 135:7 hazard 185:17,21 health 153:24 hear 2:24 123:20 182:7 heard 31:9 64:23 85:5 115:23 123:25 141:13 151:9 154:16 157:20 174:9 188:10,12,13 191:16 195:23 hearing 112:12 hearings 154:11 heart 171:22 195:3 heavy 152:20 163:15 165:23 height 79:11 held 149:19,20 help 5:16 52:20 56:13 65:6 69:19 70:20 73:14 105:17 111:24 117:24 123:23 133:12 136:15 144:5 157:24 177:23 194:20 helped 128:18 helpful 2:24 6:22 12:8 16:18 21:2 22:10 29:19 42:24 43:10 195:12 helpfully 13:5 helping 186:19 helps 6:24 52:19 70:21 134:5 herbarium 45:8 97:6,23 99:7,9 Hermitage 119:11 hesitate 58:23 HFL 152:11 |
| H | | | | |
| H 61:16,17 H28 20:6,6 ha 44:14 half 10:13 73:16 halves 118:22 hand 137:24,25 182:23 185:14 handle 5:14 181:22 hands 192:19 happen 62:25 67:6 happened 45:7 53:10 59:6 71:4,5 144:17 190:20 happening 60:18 60:19 61:21 happens 11:3 34:5 60:8 186:16 | | | | |

| | | | | |
|---------------------------|----------------------------|----------------------------|----------------------------|-----------------------------|
| hierarchy 18:7,8 | 51:11 67:11,19 | 109:18 127:19 | indicate 108:2,3,6 | ingredients 139:10 |
| high 64:22,25 79:3 | hydrogens 5:23 | 154:24 157:22,23 | 108:19 181:7 | inhalational 185:21 |
| 91:21 92:21 | 13:17 | identifying 18:10 | indicated 62:23 | inhale 162:8 184:15 |
| 103:19 194:15 | hyper 198:5 | 36:9 84:9 170:2 | 120:12 129:11 | 186:5 |
| higher 33:18 | hyperactivity | identity 7:1,13 8:1 | 131:16 133:1 | inhaled 162:11,13 |
| highly 7:11 8:5 | 171:20 | 95:4 155:1 | indicates 41:17 | 190:7 |
| 77:15 126:21 | hyperthermia | iii 132:18 | 70:19 103:25 | inherent 4:14 |
| 133:13,21 141:2 | 197:25 | ill 184:18 | indicating 31:17 | inhibit 171:8 |
| HILL 128:9,10 | hypo 198:6,7,8 | illness 158:14 | indication 88:21 | initial 55:1 87:11 |
| 131:9 196:12,13 | hypothermia 187:2 | immediate 155:1 | 106:10 107:20 | 90:19,20 110:17 |
| 197:18 198:23 | 187:17 191:2 | 155:23 156:2 | indicative 106:18 | 111:13 118:12 |
| 199:4 200:13,20 | 197:25 198:4,10 | 159:25 161:6 | 107:20 | 126:11 129:8 |
| historical 82:3 | hypothermic | 162:4,5 | indicator 83:6 | 145:4 |
| history 91:6 | 198:21 | immediately 192:9 | individuals 2:3 | initially 91:13 92:9 |
| Hmm 194:24 | hypothesis 79:22 | imperfection | induced 62:24 | 98:4 162:8 171:15 |
| hold 19:6 74:11 | 99:5 160:4 175:9 | 155:16 | industry 161:19 | 171:20 |
| 97:2 110:11 | hypothesise 12:25 | importance 36:10 | inert 65:10 | initiate 88:14 |
| 144:18 180:6 | 95:18 168:17 | 67:3 | inevitable 186:15 | inject 182:4,6,8 |
| 189:7 | hypothetically 94:8 | important 3:7,14 | 186:17 | injected 161:20 |
| HOLMES 119:11 | | 10:5 12:20 25:22 | inevitably 155:21 | injection 79:20 |
| homed 102:3 | I | 67:19 82:14 102:9 | 156:14 | 161:23 162:3 |
| homicide 52:2,5 | idea 9:17 92:4 | 141:1 156:22 | inexorably 19:16 | innocuous 14:9 |
| homogenate 91:22 | 108:5 125:23 | importantly 67:17 | infer 172:16 | inquest 7:16 12:21 |
| honest 168:18 | 178:15 | 172:1 | inference 96:10,11 | 47:1 53:3 83:25 |
| hope 15:18 57:4 | identical 37:3 67:1 | impossible 37:14 | inform 11:9 | 100:10 124:2,10 |
| 74:7 148:7 | 69:24 71:10 | 45:10 174:21 | information 3:14 | 124:15 125:7 |
| hopefully 104:4 | identification 7:2 | impression 148:9 | 7:6 13:8 36:24 | 150:5,7 152:2 |
| 149:6 | 11:17 47:3,5 | improbable 28:23 | 46:14 58:21 59:5 | 154:11 173:17 |
| hoping 83:18,19 | 101:4 104:8 | 42:18 | 60:14,21 81:10 | 180:25 181:3 |
| 144:5 | 127:10,12 154:7 | improve 1:22 | 88:10 89:3,12 | 199:20 |
| horizontally 164:3 | identifications | inadvertently | 91:4 95:9 98:12 | inquiries 140:1,12 |
| horrible 189:9 | 104:10 | 78:12 163:7 | 98:19 106:9 108:9 | inquiry 81:23 |
| horses 92:18 | identified 33:24,25 | include 13:23 | 115:5 117:23 | 105:15 106:13 |
| hours 89:1 109:1 | 46:10 55:22 85:8 | included 26:19 | 119:7 124:11 | insecticides 169:25 |
| 109:11 159:19 | 85:12,13 87:4,16 | includes 198:1 | 133:1 135:13 | insert 48:11 |
| 162:12 186:4 | 87:17 88:15 94:9 | including 2:17 | 136:19 150:7 | inside 62:2 |
| 189:3 190:10,20 | 94:12,16 95:14,19 | 118:7 121:22 | 176:3 183:25 | insist 36:8 |
| HPE 153:19 | 95:23 97:3 103:16 | 173:1 | 187:25 | insofar 4:13 16:18 |
| huge 85:9 86:22 | 103:21 114:18 | inconsistent 192:22 | ingest 160:21 | 18:5 20:6 21:2 |
| 87:7 179:17 | 115:2 117:5 | 195:6,9 | ingested 50:19 51:4 | 36:14 37:5 63:3 |
| hugely 186:8 | 121:25 127:9,11 | incontinence 173:2 | 51:22 132:16 | 157:17 |
| human 1:21 74:5 | 127:15 154:10 | increase 71:24 | 133:25 134:10,14 | instances 104:7 |
| 84:6 86:9,14 95:8 | identify 8:6 15:25 | increases 15:7,7,7 | 135:8 160:12,24 | instrument 10:16 |
| 152:14 170:24 | 50:3 72:5 84:5 | independently | 161:5,14 | 20:17 24:12 35:23 |
| humans 198:15 | 88:17 103:18 | 187:4 | ingestion 50:7 | 72:14 |
| hydrogen 8:22 9:2 | 104:19 105:8 | India 98:8 | 161:1 | instruments 71:19 |

| | | | | |
|----------------------------|----------------------------|----------------------------|---------------------------|---------------------------|
| insurance 105:3 | involves 28:9 | 100:6,14 102:12 | 43:15 45:8,22 | Kite's 12:18 17:12 |
| insurers 25:3 | involving 25:24 | 102:15 124:23 | 49:8 57:9 64:24 | 23:24 24:11 36:13 |
| intact 5:9 133:14 | 53:11 | 127:2 137:9,11,17 | 65:5,22 68:5,18 | 137:8 142:18 |
| 170:3 | ion 8:14 17:5,11 | 138:5 146:7 | 69:11 71:21 75:25 | knew 105:19 |
| integer 4:17 | 21:3 22:13,14,25 | issue 8:10 9:21 | 80:22 81:1,2,24 | 140:25 188:3 |
| intention 105:5 | 23:1 24:16 31:7 | 23:10 24:10,21 | 87:14,25 89:7,9 | knock 5:15 |
| interactions 81:4,5 | 32:12 50:5,17 | 92:24 103:15 | 89:11 97:5 121:10 | know 7:15 12:10 |
| interest 1:14 | 51:2 59:8,10,19 | 142:12 196:16 | 125:2 135:12 | 15:13,21,23 17:13 |
| interested 70:14,18 | 60:7 61:1,22 | issued 123:13 | 141:21 142:1 | 20:17 33:3 36:7 |
| 86:24 87:17 | 63:21 65:13 68:12 | issues 81:7 139:22 | 143:16 148:12 | 41:4 42:5 43:5 |
| interesting 117:23 | 68:13,22 72:3 | Italians 65:21 68:3 | 152:16 154:3,10 | 47:13 48:5 56:7 |
| interim 144:18 | 75:4 78:6 79:19 | 69:5 | 154:13 166:7 | 56:16 57:3 63:12 |
| interject 198:23 | 84:19 85:13 115:7 | Italy 66:16 | key 16:17 144:21 | 63:16 64:11,17 |
| intermediate 9:15 | 118:5 132:1 134:8 | item 113:3 | kill 1:21 152:14 | 66:9,16 69:11,15 |
| internal 2:14 25:5 | 137:25 167:15,16 | items 83:25 | 163:10 173:16 | 72:6 83:4 86:24 |
| 25:14 153:18 | 167:17 | | 182:3 | 87:1 90:13 93:3 |
| 164:7 | ionisation 5:7 | J | kind 3:1 13:4 81:7 | 93:20 97:3 98:12 |
| interpret 145:10 | 77:13 | Jacquard 80:21 | 82:3 86:8 91:19 | 98:16 109:4,6 |
| 167:10 | ionise 5:3 | jar 105:23 106:7,10 | 92:7,16 116:24 | 110:25 111:6,13 |
| interpretation | ions 9:13,15 23:10 | 106:13,16 107:14 | 155:10,10 161:1 | 111:14 113:18 |
| 103:10 | 30:20 77:5 101:12 | joined 10:12 11:2 | 161:14 162:6 | 117:20 124:15,17 |
| interrupted 6:20 | 118:7 167:18 | 30:21 | 163:9,16 172:8 | 127:18,25 128:3 |
| 24:13 180:20 | irrelevant 66:4 | joining 13:17 | 173:18 178:5 | 134:17 135:25 |
| interrupting 187:7 | 69:19 | joint 136:15,19 | 190:9 193:17 | 136:1 137:19 |
| intestine 154:24 | irritant 162:9 | 152:5 163:23 | kindly 57:9 | 138:5,24 141:17 |
| intestines 160:2 | irritation 162:8 | 173:7 177:6 | kinds 107:5 121:21 | 141:25 155:5 |
| intuition 10:18 | isobaric 50:6 | 197:10,22 | 121:23 | 156:21 159:4 |
| invalidate 120:25 | isobarics 49:11,15 | journal 64:6,7 | Kite 2:20 7:14 8:9 | 161:18 162:17,18 |
| investigate 129:12 | isolate 87:18 104:4 | judgment 18:21 | 9:6 12:7 16:4 | 162:20 163:23 |
| investigating 120:1 | isolated 10:24 | 93:1,4 | 18:7 20:6,16 | 165:20,21,21 |
| 141:14 | 83:16 100:24 | July 130:4,10,14,17 | 21:17,24 23:14,19 | 168:15,16,18 |
| investigation 89:24 | 101:9 | 131:2 132:25 | 25:20 35:21 36:12 | 169:12 170:15,19 |
| 131:7 151:4 | isolation 70:5 | 140:15 | 38:6,15 39:16 | 177:25 178:9,15 |
| 177:17,22,24 | isomer 17:4,19 | jump 84:13 | 40:15 41:16 42:22 | 179:16,23 182:17 |
| investigations | 18:19,19 19:17,23 | June 1:1 129:19 | 47:4 50:4,12 | 183:3,7,10,15 |
| 130:20 152:1 | 22:14 23:7 100:15 | 130:1,13,15,22 | 53:16 56:18 57:24 | 184:2 185:10 |
| 154:3 | 100:23 112:10,10 | 140:15 141:8,14 | 59:11 62:16 65:3 | 190:14 192:3 |
| invited 150:25 | 112:11 113:5,6,9 | June/July 118:23 | 71:17 72:2 76:21 | 193:14,15,18 |
| involve 28:8 156:3 | 113:12 114:10 | | 77:10 78:9,23 | 195:20,21 |
| involved 26:9 81:11 | 127:13 146:20,20 | K | 79:13 81:18,25 | knowing 195:13 |
| 108:22 141:22 | 146:22,22 147:18 | keen 140:4 | 82:9 85:12 90:21 | knowingly 63:18 |
| 150:18 154:6 | isomeric 47:17 | keep 144:9 | 94:18 100:20 | knowledge 12:9,23 |
| 173:13 178:19 | isomerics 49:12 | kept 97:9 | 102:12 123:25 | 24:12 76:8 90:6 |
| 179:1 | isomers 16:4 41:20 | Kew 2:8,9 16:1,21 | 131:12,21 140:19 | 98:13 99:1,3,6 |
| involvement 153:6 | 41:25 43:8 44:3 | 23:3 31:25 33:5 | 141:6,18 142:1 | 125:11 155:7,9 |
| 177:17 | 69:23 74:16,18 | 33:23 41:2 42:1 | 143:16 147:6 | 182:11 191:18 |

| | | | | |
|---|--|---|---|--|
| known 15:15 52:13 88:5 89:13 95:11 98:21 120:17 125:22 131:2 139:9,14 174:20 174:23 | 76:3 91:14 110:14 155:19 163:20 166:20 175:24 184:6 | lipid 12:16 | 190:15 | 15:12,16 17:4,12 19:1,23 20:19 21:6,25 29:14,23 35:18 36:14,23 38:24,25 39:5,8 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| knowns 7:19 | left-hand 111:25 | liquid 3:3,11,13,15 3:20,24 4:3,4,24 11:4 20:10,16,16 39:18 61:23 77:14 84:17 184:8,9 | longer 4:3,3 34:22 104:13 130:8 160:11 169:12,18 186:1 190:9,18 | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| knows 42:25 45:22 | Legal 25:2 105:2 | list 72:23 90:7 131:17 138:24 139:2 187:19 198:3,3 | look 1:23,24 7:25 9:8 11:20 14:12 15:14 17:18 25:12 25:14,17 32:24 33:2,4,14 36:25 43:4,22 45:5 46:14 53:13 54:6 55:3 56:17,20,20 58:7 59:6 61:18 66:20 71:2,9 74:5 78:18 83:14,16 84:2,8 88:2,4,20 90:3 96:20 97:4,5 106:1,8 109:7 110:15 113:2 116:17 117:12 119:14 123:8 125:1 126:3 130:3 130:6 132:6 134:23,24 136:16 138:21,25 139:3 143:14 144:22 146:8 152:12 157:8 163:22 165:8 167:20 168:4 173:9 186:25 | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| Korean 182:11 | legs 5:12 | listed 14:24 47:9 49:15 103:23 151:2 | looks 33:2 44:21 63:20 70:23 117:3 130:18,23 147:14 172:7 197:6 | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| L | lend 79:17 | lists 28:20 137:2 143:22 | loose 11:2 120:1 | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| lab 36:8 170:5 | let's 37:21,22 45:5 61:1 107:4 179:8 179:9 186:25 | literally 42:19 | lose 5:19 171:18 | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| label 106:3 | lethal 153:24 160:2 160:22 162:14 174:10 182:9 | literature 41:15,17 42:4 49:7 89:9,10 90:6 94:6 95:9 96:8,9,11,13 98:13 99:24,25 101:18,24 102:7 102:21,23 103:2 117:9 127:1,3,5 | losses 5:21 | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| labels 65:24 | letter 34:10 35:5,8 35:10 54:4 | little 10:8 57:18,22 58:7 90:11,14 97:4 111:23 112:12 129:16 133:1 136:6 143:24 149:5 158:16 164:25 182:10 186:11 189:2 197:11 | loss 5:21 | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| laboratory 81:19 149:16,18 170:4 | level 14:8 91:24 92:18 111:17,19 153:23 158:21 169:14,17 | live 102:8 190:15 | lost 22:12 35:7 147:15 | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| labs 169:24 170:1 | LGC 152:11 170:1 | lived 170:16 183:7 | lot 20:13 60:18,20 64:11 67:15 86:23 92:10 93:11 100:9 108:24 109:9 110:24 113:11,14 113:18 154:11 185:7 189:22 | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| lack 11:21,22 30:23 | liaising 140:6 | liver 161:7 | lots 112:7 | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| laid 36:18 | library 87:10,15,20 87:23 88:7 90:15 93:10,11,16,18,21 93:23,25 94:1,5 131:25 | living 98:7 99:2 | low 79:1,9 91:24 158:21 | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| language 51:14 | lick 184:20 | loathe 198:23 | lower 10:2 24:3 46:12 111:19 | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| large 12:25 14:10 18:5 26:14 92:7 92:13,13 98:4 110:22 151:1 161:5 189:25 | life 25:3 164:19 | locate 21:18 | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| lasts 161:23 | lighter 65:13 | located 48:22 145:7 | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| late 33:5 53:7 54:10 55:24 114:25 126:2 149:5 168:20 | liked 10:19 | logic 59:21 175:14 | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| layer 3:22,23 99:19 | likelihood 11:13,15 28:5 43:1 51:17 79:24 158:20 193:2 | long 74:14 81:1 109:5 124:3 132:20 149:19 158:7,11 159:12 170:16,21 183:3,7 | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| LCMS 3:9 90:21 110:15 | limit 169:21 | | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| leading 177:22 | limitations 51:21 | | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| leads 60:12 | limited 46:8 | | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| leaf 112:2,20 121:22 | limits 93:16 110:21 | | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| learned 77:18 177:11 | liners 45:1 | | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| leave 30:14 | lining 161:12 | | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| leaves 45:19 48:20 48:25 97:25 126:17 135:8 | link 107:2 136:11 | | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| leaving 82:6 166:23 | linked 70:4,4 136:9 138:7 | | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| led 59:15 | linking 117:8 | | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |
| left 38:13 63:19 | | | | 41:7 49:18 52:23 55:21 57:2 58:23 59:11,13,18 60:22 64:21 66:8,11,21 69:18 70:5 72:4 75:20 79:5 81:23 82:11,11,13 83:4 83:22 84:16 88:24 89:25 94:22 96:7 99:20 101:23 102:6,10 113:11 115:5 116:13 118:20 120:20 138:18 145:13 148:6 151:8 154:23 155:4 159:13 165:11 175:1 194:25 197:22 |

| | | | | |
|----------------------------|--------------------------|---------------------------|---------------------------|----------------------------|
| Lucas 57:2 | 10:21 11:8,22 | 137:23 138:2 | 192:8 193:12 | metabolite 63:6,13 |
| lunch 89:16,23 | 15:6 16:21 17:5 | matches 73:22 | 195:7 198:3 | Metabolome 74:5 |
| 106:14 108:3,22 | 17:11,23 19:19 | 104:5 | means 21:7 76:24 | metals 152:21 |
| 109:9 | 20:3,11,20 21:4,5 | matching 137:12 | 128:1 132:21 | 163:15 165:23 |
| Luncheon 89:20 | 21:10,10,12 22:9 | material 3:18,24 | 157:6 160:15 | method 65:12,19 |
| lunchtime 28:23 | 22:22 23:12,15 | 4:2 11:19 12:5 | 172:17 176:6 | 65:20,22 68:4 |
| lung 165:11,12 | 24:3 27:16 28:10 | 37:6 43:12 47:16 | 186:15 191:4 | 82:15,17 84:20 |
| | 28:21,24 29:8,19 | 51:21 71:20 74:9 | 192:21 | 131:21 157:16 |
| | 30:3 34:3,8,15 | 74:10 83:15,16 | meant 18:22 | methoxy 47:7 |
| M | 39:9,12 41:10,19 | 84:6 97:5,25 98:4 | 137:10 198:5,7 | methyl 5:20 |
| M/Z 17:8 58:20 | 43:4 44:2 53:24 | 98:7,10 99:2,4,4 | measure 6:14 72:14 | microscope 165:12 |
| 79:2,10,11 120:20 | 54:6 57:22 58:9 | 103:17 105:7,20 | 169:6 | microscopically |
| M+H 17:10 77:11 | 58:12,19 60:20,24 | 105:23 107:11 | measured 26:15 | 165:11 |
| 77:16 | 61:12 64:6,22 | 108:17 109:14,20 | 58:19 72:20 73:4 | middle 38:1,3 |
| machine 4:12 6:2 | 65:1 69:14 71:17 | 110:14,22 118:13 | 169:17 198:16 | 110:18 143:6,7 |
| 77:7 87:22,22 | 71:18 72:9,14,15 | 120:22 122:23 | measurement | 145:19 |
| 116:20 | 72:21 73:3,3,4 | 125:5 126:15,17 | 28:13 | mildly 122:15 |
| machinery 23:17 | 77:3 78:3,4 81:25 | 126:19 142:10 | medical 149:15,25 | miles 34:16 |
| magnetic 82:21 | 82:5,6,16 84:14 | 144:18 148:5 | medications 152:13 | milligrams 97:25 |
| main 65:8 98:17 | 84:17 87:13,19,23 | 150:15 153:23 | meet 88:7 | millimetre 174:14 |
| 109:7 139:10 | 88:6 90:13,15 | 173:21 181:13 | meeting 150:21,25 | million 39:14 53:20 |
| 151:11 | 93:24 98:18,18,23 | materials 3:19,21 | 151:5 177:18,21 | 53:21 57:23 61:3 |
| major 22:14 38:4 | 101:12 102:20 | 10:21 27:2 151:6 | meetings 179:1 | 68:16 69:9 72:16 |
| 58:10 60:24 68:6 | 103:6 104:1 | 169:9 171:11 | MEMBER 148:17 | mind 25:8 33:16 |
| 91:8 93:1 120:21 | 109:25 114:21 | 180:11 | members 157:22 | 50:24 55:4 88:14 |
| majority 24:3 27:9 | 115:16 116:9 | mathematical 9:12 | 174:8 | 89:14 148:15,23 |
| making 47:15 | 117:8,10 136:3,7 | 10:19 | memory 108:1 | 168:6 174:8 |
| 140:11 195:2 | 136:9 137:12,18 | mathematics 25:25 | 129:16 136:19 | Mine 109:8 |
| Malaysian 174:10 | 137:23 143:3 | matrix 197:16 | 139:17 | minimise 67:3 |
| maltoxazine 73:18 | 154:12 155:4 | matter 25:25 68:16 | mention 31:14 | minor 38:5 89:4 |
| 74:3 | masses 39:3 72:24 | 124:6 190:17 | 73:24 197:24 | minority 166:24 |
| man 87:9 195:16 | 73:5 86:25 138:2 | 194:15 198:24 | mentioned 26:18 | minus 21:10 120:23 |
| man-made 27:10 | 146:24 | matters 58:7 150:8 | 75:3 84:12,15 | 122:24 |
| 30:6 | massive 40:18 | 177:13 | 94:17 95:2 96:7 | minute 74:4 110:8 |
| managed 21:18 | 161:11 | max 79:11 | 163:15,16 170:22 | minute's 19:8 |
| manipulated 71:24 | match 18:14 28:17 | MDMA 73:21 | 172:5 182:12 | minutes 8:19 37:13 |
| mark 39:10 | 47:6 54:17,17 | meal 106:11 111:5 | 187:1 191:14 | 39:4 40:9 41:6 |
| marked 113:8 | 55:15 68:11 84:20 | mean 18:19 43:4,22 | mentioning 52:20 | 43:25 47:14,25 |
| 188:21,22 | 88:6 93:14,20 | 79:5 81:9 84:23 | mentions 94:18 | 48:16,23 60:3,18 |
| marker 53:18 | 104:16 118:15 | 92:2 93:1,4,18,21 | merely 10:16 | 61:21 63:12 79:11 |
| 107:9,11,19 199:2 | 124:24 137:14 | 98:21 100:20 | mericarps 134:21 | 111:9 114:25 |
| mass 1:14,15 3:6,13 | matched 32:18 | 122:16 133:17 | 135:8 | 115:11 116:25 |
| 4:10,11,13,16,18 | 44:3 45:5 54:20 | 139:9 140:2 | met 93:24 152:6 | 127:19 159:19 |
| 4:20,20,25 5:3,8 | 93:13 102:15 | 145:23 156:9 | metabolise 62:3,21 | 183:6 186:6,7 |
| 5:19 6:6,14,14,16 | 117:13 126:7 | 160:24 165:20 | metabolised 62:8 | 189:3 190:10,17 |
| 6:17,18 7:5 9:2,4 | 136:2,7,12 137:18 | 167:8 188:19,21 | metabolises 62:5 | miosis 191:14,24 |
| 9:19,25,25 10:1,2 | | | | |

| | | | | |
|---------------------------------|--------------------------|---------------------------|----------------------------|---------------------------|
| misinterpreted 187:14 | monitoring 153:21 | mucous 187:6,24 | 150:2 162:4 | nightshade 139:18 |
| misleading 148:9 | monomer 12:14 | 188:2,5,8 | 175:17 196:6 | nitrogen 51:11 |
| misled 64:8 | 23:21 24:18 61:24 | multiple 97:10 | necessity 119:5 | 65:11 67:13,21 |
| missed 75:17 198:3 | 77:1,8,10,13,16 | multiplicity 26:17 | need 6:7 18:13 19:1 | 167:16 |
| missing 137:12,14 | 78:1,3 | 96:2 | 53:14 54:22 55:14 | nitrogens 5:24 |
| 137:15 138:11 | month 161:24 | murder 139:15 | 56:16,20 71:15 | 13:18 |
| misspeaking 48:1 | months 75:25 | muscle 161:20 | 74:11 83:4 84:4 | NMR 82:21 |
| misunderstanding | 140:13 161:21 | mustard 151:16,16 | 96:16 100:5 110:3 | nodding 105:18 |
| 193:25 | morning 85:3 | mutations 36:4 | 110:10 116:18 | noise 24:7 |
| misunderstood | 131:25 160:6 | | 118:18 123:8 | non-forensic 91:12 |
| 39:25 72:13 | mortem 75:9,14,19 | N | 140:21 148:18 | non-natural 132:4 |
| 187:23 | 91:12,12 132:20 | N 67:8 200:3 | 163:24 164:1 | normal 198:19 |
| mixed 47:4 | 153:11,22 155:18 | N2O4 20:6 | 168:4 | normally 5:20 12:3 |
| mixing 3:19 | 156:1,18 165:10 | N3- 167:17 | needed 97:4 | 24:3 60:9 104:3 |
| mixture 3:11 188:2 | motivated 173:16 | nailing 102:5 | needs 74:9 156:25 | 141:9 155:25 |
| modification 7:23 | mouth 165:1 188:2 | name 1:8,10 80:20 | 167:3 | 161:3 169:5 |
| molecular 8:21 | 188:5,9 189:12,18 | 149:12 | negative 5:5 166:1 | nose 171:16 195:1 |
| 31:24 85:11 90:12 | move 12:19 18:13 | named 43:8 | 166:2 167:9 | note 36:22 78:25 |
| 98:18 120:23,25 | 53:14 55:11 56:22 | Nardin 64:1 65:4 | nerve 151:10,19,23 | 131:12 |
| 134:15 135:4,5 | moving 168:1 | 66:7 | 169:9 170:3,6,14 | noted 17:17 144:14 |
| 136:25 155:5,10 | Moxon 16:7 18:18 | narrow 72:11 87:5 | 171:21 172:3,20 | notes 21:17 |
| molecule 4:13 5:4,8 | 25:1,2 54:14 | 194:23 | 173:8,23 174:4,11 | notice 164:24 |
| 5:9,12,13,15,17 | 55:18 64:11 72:2 | narrower 86:20 | 176:7 178:22 | 166:25 |
| 5:24 6:1,10,11,15 | 74:25 77:19 78:8 | narrows 162:25 | 179:7,12 180:3 | notwithstanding |
| 6:23 7:24 8:11 | 79:7 95:12 105:1 | national 93:23 | 181:21 182:1,13 | 147:25 175:6 |
| 9:11 10:12,13 | 105:2 111:21 | natural 26:25 27:4 | 182:16 183:20 | November 33:8 |
| 11:8,25 12:18,25 | 113:15,19,21,24 | 27:25 28:12 29:12 | 184:23 187:9 | 75:9,15,19 |
| 14:14 19:25 21:13 | 114:7,16 128:7 | 29:14,17 30:6,10 | 188:25 190:7 | nuclear 82:21 |
| 23:1,25 24:6 | 142:9,15,17 | 42:10 44:2,4,5,6,8 | 191:21 192:12,21 | number 5:23 7:19 |
| 58:11 61:13 62:1 | 145:15 177:15,16 | 44:9,11,13,21,23 | 194:20 | 14:22 15:6 26:14 |
| 62:6,13 65:8,10 | 180:24 182:10 | 47:10 85:18,24,24 | nervous 151:20 | 29:21 33:6,11,11 |
| 85:11 103:17 | 185:3,12 187:11 | 86:1,11,17,18 | 171:7,9,13,15,19 | 56:25 67:9,10,10 |
| molecules 11:1,4,7 | 187:15 189:8,23 | 87:4 93:24 94:1,4 | net 43:24 118:3 | 67:18,18,21,21 |
| 12:10 25:23 61:15 | 190:1 191:1 | 94:5,10 104:10 | 126:6 | 72:18,22 73:8,17 |
| 67:24 76:19,24 | 193:23 194:18 | 115:17 137:2,6 | neural 171:25 | 76:18 81:14 85:9 |
| moment 21:19 | 195:5 196:9 198:5 | naturally 14:1 | neurotransmitter | 85:19 86:20 87:5 |
| 32:24 43:2 49:18 | 198:7 200:7,12,19 | 47:18 62:25 | 171:9 | 87:14 91:5 100:3 |
| 57:5 59:9,21 60:8 | MS/MS 5:1 6:9 | 169:14 | never 118:8 127:16 | 112:3,5,17 114:20 |
| 67:7 82:6 111:3 | 9:14 12:1 17:18 | nature 44:9 | 168:8 | 117:17 132:8,11 |
| 117:25 144:5 | 18:4,11,12,15,25 | near 20:24 121:16 | new 42:20 58:21 | 135:2 144:22,23 |
| 152:24 | 19:1 21:1,8 22:8 | nearest 4:16 | 59:4 83:17 103:24 | 144:23,25 145:2,3 |
| Monday 1:1 | 58:11 65:15 70:5 | nearly 64:2 123:5 | 138:15 144:18 | 151:1 153:3 |
| Monique 80:17,21 | 71:9 93:8 100:25 | necessarily 15:21 | 187:25 | numbered 22:1 |
| 200:10 | 103:17 120:20 | 17:6 23:23 49:22 | newspapers 182:22 | 36:19 |
| monitored 153:13 | 122:22 143:3,7 | 67:23 77:5 101:22 | Nick 130:8 | Numbering 128:20 |
| | 146:3 147:13,20 | 131:22 132:2 | night 74:7 | numbers 20:1 33:9 |

| | | | | |
|---|---|--|--|--|
| 33:16,18 86:22 118:17 numerous 53:10 72:7 | 125:10 occurs 101:14 107:11 172:4 190:6 oceangoing 45:1 October 21:18,22 123:24 odd 70:23 odds 192:16 oedema 164:20,23 165:3 officer 120:1 124:9 141:14 149:15 officers 177:22 okay 39:1 40:5,24 51:6 55:11 63:10 76:15,16 102:5,25 135:19 138:23 153:17 177:2 old 7:21 117:21 144:9 once 81:9 93:23 97:3 188:24 ones 14:1,2,24 42:20 67:22 95:4 190:8 open 89:14 150:6,7 150:15 165:17 173:20 182:11 opened 108:11 openly 174:20 Operation 150:19 151:25 154:7 opine 23:8 opinion 36:6 38:6 38:10 69:15 75:22 175:22 176:22 179:11 193:2,4 194:11 opinions 177:5 193:7 opioid 196:16 opioids 163:14 166:3 opportunity 10:3 64:13 167:24 | opposed 1:22 9:18 13:20 182:25 option 52:12 125:20 options 72:11 orally 132:16 orbitrap 64:22,23 64:25 order 10:1 20:12 28:20 72:24 139:25 157:2 ordinary 161:1 organic 3:18 12:15 86:23 87:2 organisation 140:6 150:10 organophosphate 151:22 169:9,23 171:3 172:21 173:23 organophosphates 151:9,23 168:23 170:9,23 171:4 172:3,18 173:3 174:5 178:14 organophosphor... 169:6,25 origin 44:14 original 6:6,9 7:24 8:14 15:4 105:22 145:7 146:14,16 147:1 originally 136:2 176:25 origins 27:23 ought 29:23 113:16 outdoors 185:6 outside 87:8 151:17 177:21 199:1 overall 6:25 158:19 177:1 overlap 137:16 overleaf 164:11 overload 92:6 overlook 172:23 overread 17:7 | overstated 122:15 overstimulation 171:15,23 overwhelming 165:2 oxygen 51:11 62:6 62:10 67:12,21 oxygens 5:24 13:18 | paragraph 7:8,10 13:1 25:5,12 76:7 153:8 173:9 197:23 paramedic 188:11 paramedics 188:1 192:19 paraphrase 49:2 parcel 179:22 pardon 17:10 27:12 64:16 82:25 parity 40:6 part 3:6 4:10,14,15 21:4,5 45:8 70:13 81:18 96:5 99:20 107:23 108:18,19 108:20,20 110:18 111:5 121:9 172:10 179:22 181:15 partaking 181:14 particles 3:16,17 109:20 particular 1:14 2:4 2:5 9:24 10:23 15:13,16,22 17:3 19:18 33:12 34:21 36:11 42:11 62:10 81:8 83:24 84:13 87:17 92:5 97:12 99:20,21 102:3 104:2,5,12 105:23 106:10 107:6,13 113:3 115:13 121:9,10,11 138:15 148:11 152:10,16 159:3 159:16 170:22 174:11 178:22 179:18 180:5 183:21 193:12 particularly 1:18 10:23 15:10 16:3 16:24 33:25 62:11 117:5 125:11 152:5 155:3,12 |
| O | | | P | |
| O 67:8 objective 105:11 oblige 50:18 51:3 134:9 observation 190:16 192:1,3 observations 195:14 observe 10:3 observed 18:1 34:22 43:17 68:11 68:17 187:4 189:17 190:18 191:25 observing 21:8 195:19 obtain 11:18,18 45:21 obtainable 74:2 obtained 18:6 26:16 43:17 58:12 91:18 93:8 100:1 118:14 137:9 obvious 91:24 92:2 163:3 obviously 32:9 37:3 43:6 57:12 70:15 111:2 115:10 125:6 148:5 151:9 151:25 152:16 154:16 170:25 176:10 187:3 occasion 43:16 77:25 81:6 116:22 occasions 40:16 81:12 116:23 occur 62:14 occurred 88:23 148:16,17 152:4 occurring 14:1 | | | P3- 167:17 page 8:16,17 13:1 16:7,8,10 19:20 19:24 22:6,14,16 33:5,7,21 34:9,10 35:5,8 36:17 37:24,25 40:1 46:20 49:16 50:14 55:3 56:23,25 57:6,13 58:16,23 64:4,9,21 66:5,19 78:18 94:18,23 96:8 100:10 111:21 113:16 119:15 123:10 125:14 128:15,19 128:20 129:1,18 129:23 130:3 134:23,25 136:23 140:22 142:14,25 143:14,20 144:7 144:22 145:14,15 145:16 146:8,8 153:2,4 164:3,9 164:11 166:21 173:9 197:23 pages 2:16,17 36:24 paginated 164:4 pagination 2:15 25:5,14 164:7 paint 26:22 44:25 paper 64:1,14 112:18 papers 104:10 paracetamol 161:4 | |

| | | | | |
|----------------------------|---------------------------|--------------------------|----------------------------|----------------------------|
| 165:17 171:7 | 69:1,16 77:20,21 | 79:1,10 81:18 | phlegm 165:1 | 88:5,22 93:19 |
| 172:3 179:7 | 78:1 79:11 91:24 | 91:11,12 152:10 | phosgene 151:14 | 94:11 96:1 97:5 |
| 182:24 | 92:2,7 101:13,17 | 152:25 | 162:3,7 164:12 | 97:17,25 98:4 |
| partition 170:16 | 127:8,11 145:21 | performing 152:16 | 165:4,6,7,14,16 | 99:15,20,22 |
| partitioning 4:1 | 145:22 146:5 | period 88:24 89:1 | phosphide 167:17 | 101:15 102:4,18 |
| partly 90:15 101:12 | peaks 38:4,12,16 | 90:5 124:4,14 | 168:1,21 | 103:17,20 104:2,3 |
| 101:16 108:12 | 39:2 40:2,21 | 133:18 144:19 | phosphides 168:4 | 104:6 105:20 |
| 164:15 | 55:15 92:13,13 | 156:21 157:5 | 168:14 | 107:11 112:4 |
| parts 5:15 33:17 | 93:12 115:24 | 158:7,12 161:21 | phrase 41:16 | 116:4 120:13,17 |
| 39:14 52:23 53:12 | 127:9,11 143:3,5 | 170:13,21 174:17 | phrasing 197:8 | 121:10,17 122:1 |
| 54:16 57:23 61:2 | 143:7 146:1 | 190:1,9 | physical 182:1 | 125:23 126:5 |
| 62:13 68:16 69:9 | pears 88:1 | periods 158:17 | physician 155:8 | 128:4,6 132:7 |
| 72:16 91:6 97:16 | pedantic 27:13 | 159:12 | pick 34:7 36:24 | 138:5,11,20 |
| 98:1 99:15,17 | peer 64:6 | peripheral 198:11 | 111:18 131:20,22 | 139:10,18 152:17 |
| 126:5 128:2 | pen 114:2 | permutations | 182:2 | 166:7,13,14 |
| pass 108:21 | people 19:7 57:9 | 13:16 14:23 | picked 54:25 55:1 | plant-derived 90:8 |
| passage 57:20 | 102:2 108:16 | Perry 152:7,10 | 167:20 | plants 33:6,17 |
| 78:25 | 159:11 166:25 | 156:24 161:4 | picture 26:22 36:17 | 44:15,17 52:24 |
| passed 113:17 | 171:10 190:16 | 163:14 166:3,17 | 63:19 158:20 | 53:12 66:7,11 |
| passes 3:20 | 195:19 | 178:4 196:14 | 159:15 178:12 | 80:24,25 81:5 |
| pathological | people's 88:2 | Perry's 154:3 | 189:10 195:25 | 82:4,11 85:1 86:2 |
| 166:23 176:10 | peppery 106:21 | person 82:20,22 | 196:1 | 87:5,6,16 88:21 |
| pathologist 91:11 | perception 178:11 | 108:22 132:16,20 | piece 3:14 117:23 | 89:4,7,12 90:3,4 |
| 149:21 197:14 | Perepilichnyy 84:1 | 140:6 156:17 | 187:25 | 90:13 93:13 99:3 |
| pathologists' 165:9 | 92:15 105:12 | 158:13 161:21 | pieces 5:12 6:12,13 | 118:9 125:1,11 |
| pathology 155:8 | 106:14 108:2 | 181:21 191:4 | 181:5 | 131:18,22 132:15 |
| 157:13 163:4 | 133:25 150:20 | personal 153:14 | piled 179:17 | 135:14,15 138:25 |
| 176:13 | 153:12 162:17 | 164:22 | pill 160:23 | plastic 184:5 |
| pathway 96:6 | 172:24 173:13 | personally 193:19 | pinprick 163:8 | play 197:12 |
| 170:24 | 175:5 177:12 | perspective 8:7 | PIR 52:16 | pleasant 164:23 |
| patient 171:2,24 | 190:15 193:2 | 22:22 24:15 91:16 | place 22:12 35:7 | please 1:9 5:2 9:21 |
| pattern 68:10,11 | 194:3 | 155:20 156:14 | 154:3 | 16:6 23:10 49:2 |
| 103:7 | Perepilichnyy's | 164:22 173:20 | places 28:10 | 55:20 56:20 65:20 |
| patterns 87:21 88:8 | 16:16 22:25 39:22 | persuade 80:2 | plainly 39:5,7 71:4 | 75:2 80:20 88:19 |
| Paul 149:10,13 | 52:9 62:19 82:8 | persuaded 10:5,11 | plan 105:8 | 90:2 94:23 118:16 |
| 200:17 | 102:13,16 103:4 | 16:18 23:23 24:17 | planning 109:17 | 128:15,15,20 |
| pause 62:15 67:7 | 105:7 115:8 118:6 | 107:14 | plant 2:5,5 10:21 | 129:15,18 130:2 |
| 89:16 147:15 | 121:8 125:16 | persuasion 10:25 | 11:15 12:9 13:15 | 132:12 134:23 |
| 195:12 | 158:3 159:4 | pesticide 168:25 | 15:9,10,12,14,16 | 136:5,23 142:13 |
| Pausing 89:7 | 164:19 165:7 | pesticides 151:10 | 15:22 23:8,14 | 142:14 143:1,14 |
| peak 10:23,23,24 | 176:4 187:5 | 169:9,25 170:15 | 32:5,19,21 34:6 | 145:13 149:12 |
| 11:6 16:25 17:15 | perfect 156:7 | 172:21 | 39:24 43:6,7,11 | 150:13 153:2 |
| 18:1 20:10 26:10 | Perfectly 185:3 | petrol 184:10 | 45:6,20 47:6 | 154:20 166:21 |
| 38:11,11 40:1 | perform 106:6 | pharmaceutical | 48:20 52:13 54:17 | 173:10 187:17 |
| 57:15 59:22 61:15 | performance 1:22 | 1:12 161:18 | 66:16,17 69:5 | 189:11 199:18 |
| 63:5,12 68:23 | performed 75:8 | phase 3:23 164:19 | 83:16,23 84:5 | plenty 71:8 |

| | | | | |
|--|--|---|---|---|
| 165:22 168:17 171:2 182:16 184:17 194:10 problem 15:23 44:13 51:8 57:19 74:20 problems 74:13 113:14,15 123:21 124:1 process 6:21 62:23 63:1 65:14 77:3 152:4 179:24 produce 62:3 65:4 69:24 produced 2:10 3:2 9:7 16:21 68:6 69:2,6,25 90:23 119:19 producers 94:5 produces 15:14 59:4 65:22 producing 86:24 product 29:13,17 29:17 85:18 86:1 93:23,25 94:1,4,5 94:10,13 104:10 134:3 137:6 production 178:25 189:2 productive 28:15 products 26:25 27:4,10,11,25 28:17 29:1,14 42:10 44:11 47:11 85:24,25 87:3 115:17 137:2 professional 191:17 Professor 1:4,6,8 15:19 18:22 19:16 25:2 32:3 39:21 41:1,4 45:6 46:15 46:23 48:21 51:1 56:4 74:25 75:2 75:22 76:3 78:24 79:13 80:11,16,17 | 80:19 85:5 89:22 102:10 104:13 105:2 115:23 119:10,14,24 123:23 128:10,13 128:16,22 130:2 131:11 139:22 152:7,18 156:24 163:6 165:20 168:24 191:16 192:2 200:5,10 profile 84:19 87:15 126:21 progressing 140:12 prohibited 1:25 project 83:2 promised 53:9 proper 175:14 properly 40:20 proportion 103:19 proposition 30:4 31:11 32:13 42:23 61:14 69:17 85:15 120:18,19 121:5 122:6,13 183:19 propositions 32:21 proton 9:1,3 protonated 17:11 19:24 20:7 proved 70:22 provide 81:10 119:5 130:10 135:13 provided 10:17 16:1 22:8 24:17 64:17 78:6 119:10 128:23 130:3 138:24 public 150:5 169:22 publish 88:9 published 29:11 88:8 94:4 110:23 pulmonary 164:20 164:23 165:3 pumping 20:15,15 | 35:22 pupils 191:22,23 192:2,12 194:22 purchase 74:17 purely 150:25 purpose 37:22 56:17 73:14 106:12 152:12 purposes 12:21 77:11 195:25 push 3:22 pushing 3:24 put 4:11 5:4 6:6,11 12:20 13:9 14:20 18:7,10 20:5 21:23 28:20 30:2 43:11,14 51:14 55:18 57:19 58:13 61:14,15 62:6 63:24,25 70:9 72:19,20,21,22 73:8,12 76:24 78:23 83:12 84:1 89:3 90:7,14,16 95:12 108:10 114:10 117:24 122:11,14,18 123:8 126:6 127:21,23 131:17 134:5 138:22 141:9 159:11 160:20 176:20 179:2 184:15,15 185:7 199:2 puts 175:23 putting 10:21 13:7 40:4 49:2 53:16 69:17 73:7 116:14 118:13 190:19 192:1 | 179:18 189:1,25 190:11 quercetin 106:23 106:24,25 107:4,4 107:6,14 109:5 110:23 111:7 question 6:5,10 15:18 16:17 21:23 24:5 26:19 27:14 27:18,20 29:4,6 40:1 43:1 47:2 50:24,25 51:1,9 51:14,20 59:22 60:9 70:18 73:12 78:8,25 79:5,6,8 80:7 84:4 102:5 109:8 125:14 129:10 132:13 135:2,2 136:23 144:11 161:25 186:9,12 191:11 193:13 questions 1:7 25:1 30:17 33:23 41:3 46:16,21 49:10 64:20 75:1 76:17 76:18 77:18,22 78:23 80:10,18 94:19 95:3,12 105:1 123:6 124:4 124:20 128:9,10 128:11,25 131:10 132:12 139:21 142:7,9 148:20 149:11 177:15 196:12,13 197:19 198:25 199:4 200:6,7,8,9,11,12 200:13,14,15,16 200:18,19,20,21 quickly 44:24 72:11 88:4 166:23 182:4 184:11,12 185:11,23 193:6 quite 7:15 10:19 18:8 20:13 25:24 | 25:24 26:22 57:8 60:18 65:17 81:9 84:21 87:21 88:4 91:21 92:19 93:22 98:14,23 99:11 100:9 108:24 109:9,14 110:22 121:19 126:19 137:15 154:16 156:8 162:9 170:25 190:5 191:24 193:6 198:18 |
| R | | | | |
| radiation 163:16 radicals 67:8,12 radioactive 153:23 radionuclide 153:8 raft 26:8 raised 166:15 173:17 rakinii 45:24 ran 90:10 93:8,11 100:2 117:21,22 range 20:22 30:10 36:22 37:4 41:16 72:11 84:25 86:25 155:6 172:17,25 rankinii 96:25 126:3 rapid 182:9 184:25 rapidly 4:5 15:8 181:24 190:6 Ratcliffe 75:8 91:11 108:11 ratio 17:5 Ray 119:16 reach 28:21 158:12 reached 32:3 reaction 170:25 reactive 167:15,18 reacts 160:1 read 9:23 64:15,17 64:18 68:7 75:11 78:25 81:15 85:6 | | | | |

| | | | | |
|---|--|--|---|--|
| 112:8 114:3 159:16 181:19 182:20 readily 13:6 14:5 reading 7:18 42:22 75:21 83:15 108:16 129:3 152:20 154:4 158:15 ready 129:21 realised 91:23 124:20 realising 163:11 really 16:2,12 28:23 36:6,7 42:25 43:22 50:25 67:11,19,22 74:9 83:3 87:1,6,24 93:15 97:9 102:5 119:12 125:7 129:8 134:22 161:25 169:10 174:5 180:4 186:22 190:19 194:15 reason 3:10 5:20,21 9:1 15:1 27:24 130:24 150:24 179:16 180:4,7 181:9 183:21 reasonable 12:1 23:4 24:18 41:13 42:17 43:12 58:1 58:2 103:3,8 107:15 179:4 185:10 reasonably 92:21 reasoning 40:6,12 79:25 80:7 reasons 9:12 11:10 31:19 41:22 45:13 46:22 78:9 131:20 175:1 recall 65:25 69:2 75:6,21 77:21 140:7 189:16 | received 111:12 150:8 162:22 187:25 recognise 5:14 62:23 190:24 recognised 23:20 24:14 recollect 111:9 recollection 188:20 190:4 recommending 125:7 record 135:14 recorded 49:20 79:3 153:20 recovered 62:18 68:12 reduced 10:2 reduction 171:23 195:4 refer 8:15 91:19 148:18,20 164:7 reference 2:13 11:19 12:5 17:2 25:6 47:16 71:21 74:9,10,15 93:23 140:18 152:5 153:8 178:22 references 41:17 89:25 referred 52:5 76:21 76:21 177:10 referring 13:4 33:12 refinement 23:9 reflects 87:1 region 20:24 regular 140:11 rehearse 154:16 relate 24:5,8,9 related 15:14 29:12 38:13 69:4 120:13 120:16 121:15,18 121:20,21 122:5 122:14,17 relates 30:15 38:2 | relation 31:6 113:2 174:9 193:12 relationship 118:14 relatively 11:2 20:2 157:1 174:15 release 160:21 161:20 187:6 released 80:13 160:23 releases 160:2 relevant 2:19 53:17 72:4 156:4 178:13 189:18 reliability 91:17 98:11 195:19 reliable 71:10 91:3 157:2 169:4,19 170:11,20 196:1,2 reliably 8:7 104:14 reluctant 107:1,10 125:6 rely 71:14 163:25 164:1 relying 36:13 193:10 remain 109:5 131:14 133:5 175:11 192:13 197:12 remained 196:18 remains 160:7 remarkable 172:22 remember 78:14,15 118:25 120:7 121:3,4 123:11,15 124:6,7 129:17 150:22 remembered 76:21 remind 62:15 66:24 119:17 reminded 177:16 remnants 93:6 remote 32:22,25 49:6,7 54:17 61:9 remotely 54:20 117:13 | remove 3:21 9:1 removed 111:15 repeat 126:10,13 145:4 repeating 25:8 50:24 replicate 118:11 reply 179:13 report 1:11 2:10,12 2:16,25 7:7 8:15 12:22 13:1 17:8 21:17 25:4,10,11 25:12,15 33:8 52:17 76:7 79:13 85:6 87:11 90:19 90:20,23 94:18 97:21 101:1 104:17 118:22 119:4,8,18 122:12 122:18 129:21,21 129:23 130:4,11 130:23 131:3,19 133:11 136:15,20 137:6 140:14,15 140:18,24 141:3,5 141:6,7,11 143:15 143:18 145:1 148:19 162:20 176:25 177:3 178:25 179:2 197:10,22 reported 52:18 101:25 122:1 125:4 183:5 191:9 reporting 52:19 120:10 reports 52:4 131:11 134:6 164:24 165:9 178:12 181:3 182:13 represent 25:2 105:2 representatives 120:6 148:7 represented 25:23 38:7,8,20 | represents 28:24 request 58:6 105:19 requested 90:3 120:3 require 98:4 requirements 36:11 requires 70:23 reran 117:18 rerun 118:19 resample 146:16,17 research 87:3 94:14 resolution 64:22,25 79:2,3,9 resonance 82:21 resonate 65:12 respect 15:15 16:4 180:10 respectfully 32:1 66:24 respects 131:15 respiration 172:2 response 62:12 134:12 194:4 responsibility 80:23 responsible 173:15 173:19 result 6:4 43:24 49:9 63:2 71:10 83:13 90:7 97:20 97:21 118:3 120:12 126:6 141:25 145:13 167:9 170:11,20 172:10 174:7 181:1,4 183:13 resulted 178:25 resulting 170:24 results 3:1,2 46:15 53:18 55:21 83:19 90:23 91:18 93:8 115:23 132:17 139:24 140:23 |
|---|--|--|---|--|

| | | | | |
|--|--|---|--|--|
| 141:1 143:1 145:9 146:19,22 153:19 retain 155:23 retaining 156:4 retention 11:21,24 17:8,14,25 18:11 18:13 19:2 20:9 22:19,20 36:9,10 37:8,9 39:17 88:9 103:6 109:4 114:23 retest 104:14 retested 56:19 145:8 retesting 142:12 Rethinking 134:17 retrieve 118:9 retrospect 195:13 revealed 178:13 review 64:19 90:4 reviewed 64:7 Rice 148:4 149:3,5 149:10,12,13 177:16 196:13 197:22 200:17 Rice's 47:3 rid 56:23 69:19 180:1,2,7 right 7:9 18:9 19:10 24:15 26:2 26:18 27:3 29:25 30:14,25 31:5 32:9 34:18 41:2,5 49:19 57:4,6 59:14,20 65:18,19 67:25 72:9 73:15 73:16 74:1 75:5 76:6 77:4,24 80:3 83:2 97:3 99:19 100:10,16 101:22 107:18 109:21 112:9,15 114:22 115:10 127:7 128:12 129:7,13 130:22 131:3 132:3 133:7 | 135:24 140:17 143:8 144:16 146:21,23,25 154:5 162:6 165:20 167:21,22 187:23 194:23 195:3 196:10 198:17 right-hand 17:19 19:23 35:10 64:9 128:20 rise 65:14 risk 181:11 root 17:20 34:6,14 35:4,13,14,14 36:23 38:3 40:9 43:5 45:9,15,25 48:3,22 50:4 54:2 54:21 55:7 112:1 112:6,16,24 113:1 113:4 114:19 115:19 116:6 117:4 118:8 121:9 122:4 126:8,15,16 126:20 roots 33:10 34:23 50:14 128:2 rougher 65:21 roughly 34:3 round 70:8 160:20 160:20 175:18 191:2 rounded 34:8 route 84:14,18 110:14 134:2 158:10 161:1 routes 182:2 Royal 13:5 rubbed 182:23,25 rule 18:25 22:23 87:7 126:1 157:24 164:18 165:4 172:19 193:21 196:8 ruled 125:9 154:13 157:6,7 158:4 | 164:8,13 165:23 166:3 172:18 ruler 114:2 ruling 16:13 196:7 run 11:19 71:11,12 74:11 77:7 91:22 92:5,10 101:5 102:11 115:13 116:12,18 159:4,8 159:9,23 162:23 running 92:3 144:8 171:16,17 187:24 195:1 runs 2:16 ruptured 184:7 Russia 173:14 Russian 52:5 105:23 173:18,21 173:22 179:11,15 179:21 180:13,21 180:21 <hr/> S <hr/> safely 20:21 saliva 187:25 188:2 188:4 189:11 salsolinol 73:20 sample 7:20,22,25 11:20 33:9,13 37:8 48:10 52:8 71:12 75:5,19 83:22 91:2,3,5 110:2 115:19 117:17 118:19 120:15 121:7,24 122:7,9,10 125:15 126:22,22 132:25 144:14,15,19,20 145:4,8 146:14,16 148:12 samples 1:20 2:2 15:25 23:2 33:11 33:22 43:16 62:18 75:15,23 90:10,17 97:7,10,23 99:7,9 100:1,1,2,4 | 101:10 105:6,9 111:7,12 116:18 120:12 133:13 137:8,11 138:5,12 138:17,20 143:22 154:15 155:16 156:4,7,8,13,19 156:20 167:5 170:10,17 178:3 sarin 181:1,4,5 182:13 184:1,5,9 185:4,14,20 186:5 186:8 189:9 satisfactorily 102:15 Saturday 130:10 130:25 saw 9:24 178:7 saying 3:5 30:25 32:10,14,20 38:11 38:15 40:5,6 44:6 44:7,22 46:4 49:22 51:20,23 52:13 57:20 58:4 59:15 61:20 62:21 68:22,25 69:1 75:6 99:11 104:13 108:25 111:3,4 119:23 122:3,5,8 122:13 125:22 141:15 172:12 177:25 180:19 185:5,13 188:12 193:19 194:1,21 says 18:16,20 20:25 22:17 36:22 47:22 49:19 50:11,14 51:7 52:3 58:18 59:13 99:24,25 100:15 113:13 120:9 132:14 144:13 153:11,20 scale 4:20 scanning 79:2,4 science 80:23 149:18 152:11 | scientific 8:7 scientists 12:3 33:23 94:3 scopolamine 139:12 scopolia 136:13 137:4 138:1,15,20 139:6,7,18 screened 163:18 screening 163:13 scroll 129:15 142:25 Scrolling 146:19 search 13:7 14:3,6 14:12,20 17:12,15 83:8 93:22 135:12 searching 17:13 second 3:6 21:5 30:15 34:1 37:1 54:22 56:21 57:11 57:14,15 75:17 108:16,18 112:20 120:19 122:22 145:12 153:11 156:21 165:10 Secondly 39:16 131:25 secretions 171:17 195:1 secretly 158:6 sections 165:12 sector 150:3 see 5:10,25 10:25 11:5,7,21 12:12 15:23 17:4,5,22 18:15,20 19:24 20:4 21:20 22:8 22:12,12,17 24:3 25:18 27:12 30:1 30:23 33:5,9,21 34:2,7,9 35:4 36:20 37:9,21 38:1,3,22 39:2 43:22 45:5 46:17 46:20,21 51:20 55:4,8 57:13 |
|--|--|---|--|--|

| | | | | |
|---|---|--|--|--|
| 58:16 59:6,7 60:2 60:7,20 63:3,3,6 64:21 66:5,18 77:16 79:25 86:5 88:1 93:24 99:16 100:24 106:15 109:18 111:11,25 112:1 113:2 118:20,21 119:2,9 121:1 129:1,3,19 129:23,23 131:1 132:13 140:12,14 140:21 141:13 142:21 143:10 144:11 148:13 153:7,10,19 154:1 156:1 157:22 161:10,13 165:11 165:14 166:18 169:17 171:2,2,14 171:22 186:5 190:5 191:8 196:2 196:6 198:4,18 seed 17:20 seeds 45:19 48:20 126:17 seeing 61:15 165:5 166:20 174:13 seeking 179:11 seen 17:3 22:14 31:5,11,17 44:17 45:10 53:10 55:17 75:22 76:1 79:12 81:16 100:6 101:16 116:14 126:5,8 156:9 165:13 168:10 176:3 178:24 188:8,13,24 189:8 189:10 193:19 195:17 seize 171:24 seizure 172:5 186:12 191:12 195:3 seizures 171:25 | 173:1 selection 55:5 semantics 44:19 51:8 sempervirens 16:15 17:20 23:3 33:17 35:13 36:2 36:23 38:3 41:20 45:7,19,19,20 47:23 48:15,20 49:17 50:10 51:21 52:6,10,23 53:11 54:16,21 96:22 114:19 115:20 120:15 121:11 122:4 124:23 125:17 126:4,16 127:1 142:22 send 105:6 sending 106:12 141:5 senior 46:17 120:1 141:13 sense 19:3 45:3 185:2 sensitive 92:11 150:3,9 sensitivity 108:6 sent 90:18 105:9,22 106:7 109:16,17 124:13 130:12,17 130:19,24 140:14 140:25 153:19 sentence 47:22 48:11 144:13 separate 3:11 12:14 38:9,12,17,20,22 separately 141:7 sequence 83:17 series 53:5 81:24 89:3 110:17 120:5 132:12 set 88:5,6 143:20 share 27:9,10 shared 88:8 sharp 11:5 38:16 | Sheelagh 80:21 Sheppard 157:21 shift 37:9 shifts 37:7 shivering 189:11 191:3 short 3:4,9 19:12 48:9 64:12 66:4 75:2 88:24 89:1 106:2 148:3 149:1 189:16 192:18 shorter 90:5 shorthand 77:11 shortly 195:15 show 9:15 11:6 98:23 121:17 122:2 145:9 152:23 171:11 showed 47:23 48:15 79:9 120:16 121:6,15 122:13 135:14 showing 18:5 158:13 shown 19:25 39:25 43:17 70:22 74:6 195:20 shows 34:2 35:10 57:15 shuddering 191:5 side 34:10 35:10 111:25 127:23 128:20 143:8 sight 164:23 sign 191:21 signal 21:3 60:11 150:13 signatories 179:22 significance 10:24 16:13 18:12 83:24 177:10 significant 10:22 20:22,23 25:22 92:14 147:13 significantly 18:4 signs 157:9,13 | 158:13,24 163:3 176:9,10 186:17 197:23 Sildenafil 166:15 silence 19:9 similar 17:25 36:5 37:3 59:1 63:4,14 67:4,16 68:1 71:9 147:23 154:12 169:16 184:10,16 199:5 similarity 17:22 37:11 60:23 similarly 49:1 132:4 Simmonds 15:19 32:3 41:4 45:6 46:15,23 48:21 51:1 56:4 78:24 79:13 80:16,17,19 80:21 89:22 105:2 119:10,24 123:23 128:13 131:11 139:22 152:18 200:10 Simmonds's 52:17 simple 51:14 68:1 80:7 84:4 simplest 70:3 simplicity 10:19 simply 4:16 9:15,18 28:16 41:16 42:1 43:18 48:5 76:24 110:20 122:12 192:15 single 8:11 9:11 11:3,6,8 85:11 150:21 161:23 sir 1:3 19:15 23:9 57:5 80:10,13,16 113:14 148:3 149:3,5 166:16 177:19 180:9 181:2 182:8 194:19 195:11 197:20 198:23 | 199:16 sit 184:17,19 sitting 38:13 58:3 situation 15:24 120:3 169:16 181:20 194:2 six 137:3,11,17,21 137:23 138:1,4,6 size 19:24 59:3 63:20,21 110:2 Skelton 1:3,7,8 16:8 18:19 19:14 19:15 24:23 26:19 30:18 80:10,16,18 80:19 89:15,22 104:23 113:14 136:6 142:7,8,16 142:18 145:16 148:2 149:3,9,11 149:12 177:14 179:10 186:11 193:13 197:19,20 198:20 199:3,6,10 199:16,18 200:6 200:11,16,18,21 skill 26:1 skin 151:17 174:7 174:12,18 182:5 185:24,25 186:2 190:8 slender 177:18 slight 9:3 19:25 21:9 37:7 73:2 slightly 76:23 101:13 109:8 186:7 190:18 slow 158:16 160:24 161:11 slower 65:14 slowing 171:22 195:3 slowly 4:6 19:16 64:20 160:2,19 161:16,20 small 20:2 23:25 24:4 38:13 75:4,6 |
|---|---|--|--|--|

| | | | | |
|--|---|--|--|---|
| 76:18 97:24 109:20 110:3,3 157:1 158:11 159:11 174:2,11 174:15 197:20 smaller 85:19 101:15 146:5 smallest 4:14 smell 166:24 smelling 167:2 snakes 86:4 so-called 14:14 Society 13:5 soft 5:6 solid 109:20,25 solution 98:2 solutions 147:11 solvent 12:12,16 somebody 47:5 104:18 117:16 118:18 119:7 141:22 159:25 164:22 165:1 172:20 182:3,22 somewhat 122:15 soon 94:3 sophisticated 155:3 sorrel 62:18 83:23 84:2,9 105:24 106:3,5,10,16,18 106:19,21 107:8 107:10,16 108:3 109:1,9 111:5,10 134:20 135:8 sorry 6:20 18:23 19:5,14 24:7,11 29:5 35:7 39:7 46:5 54:12 56:5 58:9 59:15,21 62:7 75:17 79:8 100:18 123:20 130:8 135:17 136:16 137:20 146:16 153:3 170:7 172:12 180:18 187:14 | 193:10 199:7 sort 12:19 18:7,24 20:3 23:12 96:9 159:15 164:14 189:19 197:8 sorts 128:1 sound 184:5 189:19 sounded 190:3 sounds 102:20 181:10 soup 84:1 source 78:6 79:19 150:6,15 173:20 182:11 sources 13:14 Soviet 179:17,25 space 64:12 165:17 185:10 speak 62:7 93:14 148:4 speaking 154:2 157:12 spec 84:17 93:24 101:12 155:4 174:5 spec/mass 155:4 specialist 23:14 149:23 155:8 170:3 specialists 15:10 23:8 specialty 24:11 species 10:8 21:6 23:6 31:24 42:20 45:7,23 47:24 48:5,7,16,25 49:4 52:10 65:12 69:12 87:5 96:20 97:7 97:10 112:3 121:11,25 122:8 124:22 125:17 specific 13:15 76:23 87:24 164:13 168:14 169:8 specifically 82:7 | specifies 94:19 specimens 153:22 spectra 57:14 74:1 74:5 87:15 spectral 87:10 90:13,15 spectrometer 3:7 3:13 4:11 5:3 20:3,11,20 21:4,5 65:1 78:3,4 spectrometist 22:23 23:12 spectrometry 1:14 1:16 4:10 5:1 7:5 10:22 23:15 60:20 64:6,22 77:4 82:1 82:5,6,16 84:14 87:13,23 88:7 98:18,24 102:20 109:25 153:22 spectrum 9:14,25 11:8,23 16:21 22:16 61:12 103:6 speculate 154:20 speed 133:12 Speltamine 139:8 spending 113:18 spends 4:4 sphere 169:22 spike 116:2 spill 184:10 splash 163:9 sport 1:18 36:11 sports 1:20 152:11 spot 83:12 spreadsheet 151:1 151:6 spring 105:4 St 188:11 ST/04 106:1 stable 98:12,14,20 99:6,10 stage 8:6 28:21 46:2 48:4 88:18 90:9,10 91:1,4,8 109:6 168:11 | 177:23 stages 18:9 124:17 129:8 stand 176:24 177:5 197:10 standard 11:20 46:12 47:16 101:5 standards 47:12 71:12,22 116:4 stands 141:7 149:17 star 143:24 144:4,6 start 5:22 6:2 7:9 8:15 12:6 19:1 21:21 33:7 88:2 124:10,15 152:9 156:3 159:13 171:16,16,17 started 9:25 19:18 81:22 83:2 88:14 89:14,23 96:20,22 97:15,17 118:4 starters 84:2 147:8 starting 25:19 105:15 125:5 starts 18:25 46:21 158:13,13 169:14 state 1:8 80:19 173:18,21,22 179:11,15,21 180:13,21,22 196:1 statement 26:4 48:18 130:6 163:11,23 173:7 177:6 statements 152:5 states 174:25 stationary 3:23 status 179:24 stay 4:3 149:5 stem 172:2 step 63:24 88:18 90:1 steps 71:15 stick 107:4 | stock 179:17 stockpile 180:1 stomach 16:16 18:1 18:6 21:15 22:25 23:5 29:2 32:4,12 32:15,18,20 34:11 34:12,18 37:17 39:22 40:7 45:2 45:16,18 47:18 50:18 51:2 52:9 53:21 54:18 55:23 56:19 57:10 60:1 60:25 68:12 70:1 70:11 75:5,9,13 75:15,19 76:10 83:14 86:9 91:1,5 91:8,13,14,22 92:1,24 93:1,6 102:13,17 103:4,9 103:12 104:19 105:7 106:15 107:21 108:12,12 108:14,20 109:2 110:18 111:14 115:8,16 118:6 120:11 121:8,18 124:24 125:16 132:1 133:8,24 134:9 135:4 136:7 137:1,18,20,22,24 137:25 138:10 139:5 141:15,19 148:12 154:24 155:17,19 160:1 161:10,12 stop 56:10 172:4 195:4 storage 156:10 stored 7:22 75:24 156:8 story 49:23 straight 28:11 29:9 33:9 144:10 straightforward 28:8 Straw 75:1,2 76:16 |
|--|---|--|--|---|

| | | | | |
|--|--|---|--|--|
| 128:11 131:10,11 139:20 200:8,14 stray 199:1 streaming 162:10 striking 149:4 strong 10:14,14 158:22 strongly 35:2 98:23 186:22 struck 60:23 structural 161:12 193:16 structurally 156:1 structure 4:8 5:16 8:4 15:2 49:5 67:23 76:8 87:19 structures 155:6,11 struggling 66:22 studied 125:12 studies 95:23 97:18 102:24 127:4 study 96:12 97:16 97:17,22 98:3 99:9 126:1,2,11 127:16 studying 87:13 stuff 109:25 stupid 184:21 sub 14:6 100:4 166:17 subject 7:15 69:6 83:10 133:21 154:10 subjected 58:9 68:2 68:5,13 69:23 70:1 115:22 subsequent 20:1 58:23 156:20 subsequently 118:8 132:19 178:24 substance 12:2 34:2 36:9 40:13 48:21 50:20 53:19 54:1 55:22,25 56:12 57:11 66:18 69:4,10 70:11 | 74:11 107:20 133:25 134:11,14 substances 26:15 26:20 28:12 29:1 29:9 30:5 37:3 41:18,24 42:24 54:4 59:7 67:12 67:17 69:22 72:7 74:2 152:14 156:16 subway 184:2 successful 98:9 successfully 84:21 sudden 175:21,22 176:21 193:15 197:2 suddenly 106:7 suffer 184:18 sufficient 4:21 sugar 62:10 160:20 suggest 32:11 35:17 43:10 50:22 51:7 57:12 60:23 119:6 134:13 156:17 179:13 187:14,15 188:7 191:1 192:10,20 196:3 suggested 35:16 40:15 179:10 181:3 194:1 suggesting 28:15 29:7,16,22 32:17 42:9 44:21 48:23 65:20 67:16 69:8 73:23 116:20 118:3 180:12,12 186:21 188:15 189:15 192:11,15 suggestion 42:17 78:13 122:20,22 187:10,13 suggestions 121:3 suggests 127:6 suitable 11:19 suite 183:15 186:10 187:18 192:20 | suits 149:8 sulphur 151:16 sum 175:4 summarise 54:10 96:19 summarised 90:23 summarises 153:6 summarising 176:19 summary 55:18 96:15 141:11 support 2:1 31:11 101:1 141:16,18 suppose 8:25 86:23 195:24 supposed 42:3,4 101:14 105:17 109:16 113:2 supposition 176:4 sure 6:5 14:5 27:3 27:21 38:18,20 42:7 46:4,19 49:19 66:2 67:25 69:21 78:12 101:4 102:2 104:5 113:21 116:2,19 124:7,20 125:9 129:16 137:15 156:8 170:12 178:19 180:8 195:2 198:23 surely 109:25 surface 3:17 surprising 117:6 Surrey 46:17 105:6 120:6 129:2 131:5 132:13 150:19 suspect 92:1 98:17 118:15 132:1 135:3 154:21 suspected 52:2 swathe 87:7 sworn 80:17 149:10 200:10,17 symmetrical 10:12 symptom 188:7 | symptomatic 171:1 188:16 symptoms 157:9,14 158:25 164:15 165:21 171:1 172:5,13,14,17,22 172:25 176:9 183:4,10,11,15 186:1,10,25 187:18 190:9 191:3,8 192:20 195:17,20 196:2 syndrome 197:2 synonym 49:12 synthetic 13:23 26:20,23 27:11,20 28:13 29:17 87:8 94:12 synthetics 85:21,22 85:22 Syria 189:10 system 20:15 35:23 151:21 171:7,9,13 171:15,19 174:6 | 16:2 23:12,19 24:8 25:4,9 45:6,8 48:13 51:10 55:16 63:4,25 64:20 65:16,18 71:15 90:1 94:22 95:7 97:16,24 100:8 111:21 112:16 114:17 121:25 126:20 133:11 136:15,17 142:8 142:13 145:11,19 161:22 164:8 175:15 176:23 186:1 195:24 taken 15:24 62:11 75:16,20 92:22 106:11 130:8 144:19 156:20,20 163:1 175:7 176:25 191:1 takes 174:18 185:25 192:9 talk 8:16 111:12 113:11 talking 7:14 23:21 24:11 40:17 62:16 76:9 83:5 95:5 97:23 114:16 124:3 160:16 184:23 189:12,20 189:22 190:16 191:7 193:16 tandem 4:25 58:11 tannin 106:23,25 107:1 tap 29:19 tapped 29:7 tapping 28:8,9 29:18 44:23 target 83:23 169:8 task 16:1 taste 106:22 team 82:20,22 129:2,6 teaspoon 190:13 |
| T | | | | |
| tab 2:14 16:5,9,10 19:22 22:2 56:24 57:1 78:19,20 94:23,24 132:12 134:24 136:23 142:14,16 143:14 145:13,14 146:9 153:2,3,4 164:2 table 16:22 17:19 18:20 19:23 33:12 35:12 38:1 59:7 60:15 99:17 100:8 111:22 143:20 tablespoon 190:4 tablespoons 189:17 tablet 161:22 tablets 162:1 tabs 56:25 tail 67:20 take 7:17 14:10 | | | | |

| | | | | |
|---|--|---|---|---|
| technical 62:12 63:22 141:6,9 145:1 170:19 | test 56:20 57:9,11 126:14 132:25 136:19 138:20 139:4 141:1,25 144:20 154:15 155:21 156:15 157:21 167:19 168:14,20 169:1 169:12,19 170:5 170:20 178:3 198:11 | 22:3,5,7,21 24:23 25:13 28:4 33:1 33:15 35:11 37:20 40:24 41:14 60:17 74:25 76:16 80:9 80:12,15,19 84:11 85:3 87:10 88:12 89:15 90:9 96:18 100:22 104:23 114:4,6 115:4,5 119:13 123:4 128:8 131:9 133:23 139:20 142:4,17,24 143:13 145:6 146:18 148:2 149:9 150:17 151:24 158:2 164:6 165:23 173:6 177:14 180:23 183:18 186:24 192:17,24 194:18,19 197:18 198:13 199:10,12 199:13,14 | 163:15 164:8 165:10 176:19 185:12 187:19 195:8 think 6:9 10:5,7,19 12:8,11,22 14:16 15:19 16:1,17 18:10,19 19:18 26:1,22 30:8,8,19 30:25 31:9 33:3,7 34:24 35:4,16 36:2,4,12 38:7,25 40:14,21 41:1,13 41:15 42:9,17 43:1,18 44:12,13 44:19,19 45:10 48:2 51:8,17 52:16 53:4,14,16 53:17 54:10,14 56:3 57:13,25 58:9,25 59:17,17 59:22 61:20 63:19 64:1,3 65:3,7,19 65:23 66:17 67:7 69:12 70:2,5,24 72:2,12 73:7,14 73:15,18,20,21 74:1,6 75:3,6 78:19,21 82:10 85:3,6 86:12,13 87:11 88:15 89:22 94:16 95:3,14 96:16,25 100:2,5 101:19 102:3,7,9 105:22 106:1,2,16 106:21,23 107:4 107:18 108:21 109:14 111:4 113:24 114:13,15 114:24 115:23 116:1,14,18 117:16 118:22,23 119:15 120:5 122:11 123:2,13 123:18,21,23 124:10,12,25 | 125:14 128:14 129:5,19,23 130:15 132:22 134:5,12,24 135:20 136:2 138:18,25 139:8 141:23 143:7 145:9 146:11,19 147:6 148:22 150:18,21 152:17 155:2,14,22 156:12,24 157:20 158:3,18 159:5,10 160:10,16 163:6 163:21 164:11 165:19,22 166:1,7 166:17,24 168:6,7 168:24,24 169:11 170:7,12,25 172:5 172:19 173:25 175:11,19 176:1 176:17 177:10,13 177:16,18,20,23 178:4,19 180:9,11 180:23,24 181:17 182:15 183:23,25 184:4 186:15 187:1,1 188:3,19 189:8,16 190:14 190:25 191:4 192:16,25 194:8,8 195:5,13 196:8,22 197:24 198:5,8,15 thinking 88:13 89:24 154:5 156:3 thinks 9:10 third 63:24 64:3 68:15 143:24 167:1 thorough 126:2 thought 19:6 52:24 62:21 74:3 140:13 148:16 187:16 194:5 thousands 26:15,23 three 28:17 31:23 |
| technicality 26:1 Technically 11:1 technique 1:16 3:1 5:6 9:5 110:12 184:4 techniques 2:23 87:14 109:18 110:7,20 155:4,10 Technology 149:18 television 189:9,11 tell 4:7,18 6:3 13:10 19:6 26:13 28:11 28:23 33:12 57:2 66:24 70:6 72:25 111:19 118:16 138:23 139:8 162:21 182:10,18 182:20 186:13,20 186:22 188:14,23 192:4 telling 188:10,12 tells 58:2 temperature 198:10,19 tend 11:6 96:1 tends 3:18 5:7 tentative 101:3 104:9,11 127:12 tentatively 11:12 term 6:16 17:6 44:5 87:11 107:2 127:12 termed 92:7 terminology 60:9 73:2 76:20 terms 2:4 3:4 14:1 18:10 82:7 89:24 91:2 93:18 104:8 136:3 155:9,12 160:16 162:13 169:22 176:19,22 181:20 terrorist 184:1 | tested 23:3 60:1 75:25 90:25 96:22 99:15 110:12 133:9,19 137:11 138:12 146:7 148:8 155:20 157:1,5 163:16 testing 1:18 82:24 83:1,2,11 84:12 84:15 88:15 91:2 92:25 98:11 99:13 103:17 109:21 111:3 142:9 144:17 152:24 153:7,18 155:14 155:24 156:5 157:12,19,20 167:3,24 168:9 169:4,13,22 176:14 tests 35:24 50:3 53:9 55:20 101:10 102:11,11 110:17 111:17 114:25 120:14 121:6 124:2 125:8,24 139:25 140:3,18 140:23 152:11,12 163:18 167:9,14 170:1,2,9,11 175:6 177:25 178:5,8,9,13 texts 152:17 thank 2:10 7:7 8:20 13:2 19:15,21 | 22:3,5,7,21 24:23 25:13 28:4 33:1 33:15 35:11 37:20 40:24 41:14 60:17 74:25 76:16 80:9 80:12,15,19 84:11 85:3 87:10 88:12 89:15 90:9 96:18 100:22 104:23 114:4,6 115:4,5 119:13 123:4 128:8 131:9 133:23 139:20 142:4,17,24 143:13 145:6 146:18 148:2 149:9 150:17 151:24 158:2 164:6 165:23 173:6 177:14 180:23 183:18 186:24 192:17,24 194:18,19 197:18 198:13 199:10,12 199:13,14 thankfully 2:18 theoretical 13:20 13:21 72:14 theory 23:21 29:16 56:15 85:10 thesis 63:5,8 thickness 185:25 thin 165:12 thing 29:3 35:20 40:12 57:10,12,24 58:8 59:17 67:20 120:9 things 3:19 39:18 42:14 43:22 60:19 69:3 70:3 73:17 84:3 86:16 119:24 121:23 126:1 128:2 132:4 135:7 148:10 151:15 157:19 159:5 160:1 162:1 | | |

| | | | | |
|--|--|--|--|--|
| 60:19 68:19 70:3 76:25 109:1,11 116:24 131:20 151:11 168:6 184:6 186:7 198:19 threw 182:25 throw 155:11 thrown 92:25 155:17 thumbnail 36:16 55:3 66:7 thumbnails 33:22 53:11 126:9 tidying 119:25 tighter 36:8 time 1:25 2:2,2 3:12 4:4 9:13,14 11:21,25 17:9,25 18:11,13 19:2 20:9,9,11 21:12 23:17 34:22,22 35:5,12,13,13,25 36:9 37:5,8,24 39:10,17,24 41:12 42:20 49:1 50:19 51:3 53:3,23 55:9 55:20 57:18,20 58:6,14 59:9 60:6 60:11 61:10,12,22 63:17 64:12 69:15 71:15,18 74:20 77:8,15 88:9,24 89:1 90:6 91:15 92:22 93:3 94:13 98:14 101:5,23 103:6 109:4 114:21,23 115:12 115:15 116:10,19 116:21 121:24 124:3 129:17 131:6 133:9 134:18 140:8 144:20 145:11,18 145:19 147:19,21 148:11 149:4 | 156:16,17,18,19 156:21 157:1,6 158:7,12 159:12 159:22 160:3,11 160:23 161:6 167:8 169:13,19 170:13 174:17,18 185:25 186:4 189:5,16 190:2,9 190:17 192:9,13 192:18 193:1 194:23 195:13 times 35:17 36:10 38:5,16 40:10 54:7 81:17 104:9 113:18 147:1,2,25 148:1 timing 128:10 156:23 176:3 tissue 112:1,4 153:18 165:12 169:7 170:17 tissues 171:6 title 64:21 today 1:3 2:19 14:22 49:20 53:6 102:21 138:23 150:11 152:18 154:17 179:9 197:11 Tokyo 184:2 told 21:21 26:13 30:5 35:21 41:3 57:1 64:7 65:3 78:12 106:17 115:18 124:9 131:21,25 136:6 194:22 tolerance 72:15 tomorrow 184:18 199:17 top 34:9 38:2 49:16 53:18 58:17 64:9 92:8 113:13 128:20 topic 76:19 | total 100:2 137:16 totality 157:11 176:2 totally 14:9 touch 129:20 184:20 185:19 187:2 touching 185:23 toxic 14:11 16:20 52:13 76:11,13 80:25 84:23 95:22 96:1,2,6,15 101:20 132:5,15 135:21,25 139:8,9 139:10 141:17 151:12 162:14,14 166:17 186:7 toxicity 14:7 81:10 85:2 89:10 95:8 95:18,24 96:9 102:1 135:24 158:8 164:21 toxicological 139:25 149:25 154:2 155:24 156:5 157:12,25 170:24 toxicologist 92:17 155:20 toxicology 1:12 73:12 96:12,16 149:24 152:17 154:21,22 155:8 156:4 176:13 toxin 88:25 92:19 125:22 132:5 toxins 2:5 50:13 82:12 88:21,23 89:5,13 90:4,5 91:20,20 92:18 122:1 125:10 131:13,17,18,22 132:2,7 151:2 trace 33:3 109:2,10 126:10,11,13,14 143:6 166:23 | traces 118:11 tract 62:20 86:9 107:23 108:18,21 109:3,15 110:19 Traditionally 99:22 training 149:21 trains 184:7 transcript 9:24 trawl 54:15 trespassing 174:19 trial 81:11 tried 26:3 110:11 tries 155:23 160:8 triple 70:20 trite 15:1 163:11 trivalent 167:16 true 34:7 155:2 163:11 167:5 194:10,13 truly 162:14 truncated 112:1 trunk 126:22 try 3:20 11:18 12:19 46:7 72:5 98:6 104:15 110:6 149:6 trying 43:10 57:5 62:12 63:8 72:4 101:8,23 102:19 105:11 154:23 163:20 187:14,15 191:9 tube 3:16,23,25 turn 8:9 120:21 122:23 two 3:7 7:2 11:1,6 14:21 21:10 32:21 35:18 38:4,4,5,8 38:16,19,24 40:16 54:4,8 60:10 61:4 61:8,9,15,16 65:8 65:23,25 66:19 67:2 75:2 76:24 76:25 84:15 86:22 97:9,13 102:14 | 107:2 109:1,10 118:17,22 125:1 137:19 138:7 143:3,5,7 146:1 159:17 168:25 175:11,15 186:6 187:4 189:17 190:4 198:18 two-thirds 146:11 type 3:1 12:16 15:13 20:3 68:3 84:21,23 86:5 88:11 99:8 105:23 107:6 110:23 126:14,15 168:25 169:1 181:9 types 66:19 82:13 84:12,15,16 149:23 162:25 168:25 176:7 179:15 typical 198:18 typically 15:5 65:11 72:16 |
| U | | | | |
| UK 170:5 179:17 Ukrainian 105:24 ultimately 18:11 23:18 53:5 154:13 158:12 umbrella 184:8 unable 24:14 99:1 150:14 195:2 unaware 91:8,15 96:11 124:14 131:8 undergoing 179:21 undergone 179:20 underground 184:7 185:5 undermine 156:14 underneath 135:10 153:20 understand 24:13 27:6 28:1 31:16 | | | | |

| | | | | |
|---|--|--|---|---|
| 35:25 37:12 38:15 41:8 45:13 52:19 55:15 56:16 58:17 63:9 68:4 80:4 88:13 93:16 101:8 102:19 103:1 104:12 106:6 109:19 110:16 111:9 118:2 121:14 122:12 150:11 163:18 182:19 188:4 191:24 194:21 | 138:10 Union 179:17,25 unit 5:8 21:10 units 5:19 21:11 40:8 University 83:15 108:17 152:20 unknowingly 63:18 unknown 15:24 22:25,25 71:12 74:12 88:5 102:16 117:9 120:3 154:12 155:12 unknowns 7:20 98:21 117:7,15 174:23 unobserved 195:21 unreliable 167:11 167:12 untoward 162:21 unwell 158:13,17 159:13,13 update 143:18 upper 110:18,19 urine 34:13,13 132:20,24 133:13 use 2:14 12:11 28:14 34:25 36:8 46:12 52:4 71:20 74:9 82:15,16,16 82:19 97:11 109:17,24 137:15 157:23 161:14 178:21 180:11 useful 2:18 74:8 192:14 uses 80:24 82:3 usual 149:4 usually 5:6 91:21 96:2 99:9 101:15 117:1 | values 17:3 vapour 184:14 185:21 variability 20:12 20:17 variation 19:19 20:1,4,13,14 varies 126:19 variety 13:7,13,18 27:23 various 33:17 52:18 62:18 66:7 69:12 91:5 101:9 102:15 171:21 178:23 vary 67:11,19 87:21 varying 29:21 vast 7:5 27:9,18 29:21 189:1,24 190:10 vegetable 105:6 108:17 109:14,20 110:22 vein 199:5 verified 97:5,9 versa 175:21 version 164:4 viable 196:18 vice 175:21 view 7:17 8:5 9:10 9:21 10:20 11:11 11:14,16 23:12,19 24:9,22 38:24 41:9,24 50:15 79:17 92:12 95:7 100:17,19 123:2,3 152:4 154:19 157:4 165:25 176:14 195:24 viewed 23:17 viewpoint 55:23 views 16:12 119:3 179:9 virtually 46:25 68:17 69:7 | volatile 184:9,19 185:15,15,16,20 volume 78:18 119:10 140:22 voluntarily 181:13 VX 174:8 182:13 182:14 183:13 184:9,15,16 185:13,25 186:7 | 167:25 179:7 181:24 183:7 184:24 192:4 195:22 ways 13:19 151:20 175:18 weapon 169:1 weaponised 177:25 178:14,21 weapons 150:1 151:7,8 152:25 178:1 179:15,23 wearing 181:6 weather 45:21 week 2:21 9:6 83:20 157:2 weeks 89:2 159:14 161:21 weigh 58:14 weighed 60:16 weighing 4:12 weight 25:23 29:10 29:24 30:6 55:25 90:12 98:18 120:24 135:4 weights 29:22 155:5,11 well-regarded 64:7 went 17:18 18:9 49:10 53:4 57:9 88:13 89:10 100:20 159:4 180:20 weren't 125:7 138:11 whichever 31:23 whilst 22:13 23:24 wide 41:16 widely 107:2 180:10,19 wider 32:13 85:17 85:20 122:6 wife 139:16 window 157:1 167:23 169:4 wish 19:8 71:11 |
| 23:11 52:14 83:20 105:18 110:7 111:23 151:4 181:14 196:20 197:2,6 understanding understands 45:14 understatement 128:5 understood 6:5 17:5 27:14 40:20 42:8 54:22 62:20 68:21 78:2 106:12 148:7 187:12 understudied 103:20 128:4,6,7 undertake 82:14 83:21 99:8 undertaken 50:12 82:23 97:19 131:12 153:7 178:8 undertaking 83:3 undertook 90:17 underway 47:1 unfortunately 76:1 98:9 unidentified 31:7 43:25 51:13 55:24 56:12 75:4 76:9 118:5,7 127:8 133:24 135:3,20 136:2,7 137:24 | <hr/> V <hr/> vagaries 34:25 vaguely 121:4 value 18:15 | <hr/> W <hr/> wags 67:9,20 waiting 124:1,2 wall 17:20 112:2,22 want 5:10 7:9 8:15 25:9 28:5 43:21 46:14 55:16,18 56:10,13 59:3 60:22 63:24,25 65:16 70:20 73:22 83:12 84:13 93:15 98:3 119:2 125:25 154:15 163:22 173:8 182:4,6,8 186:9 194:21 wanted 12:13 46:9 46:10 68:2 125:9 129:12 180:19,22 182:3 wanting 88:4 182:8 War 151:13 warfare 178:1 washings 155:19 wasn't 20:18 108:4 121:20 137:15 173:4 179:1 water 5:21 12:15 way 3:5 5:13 11:17 12:13 14:3 20:18 27:24 28:7 29:2 37:13 42:18 53:24 54:2 65:7 66:5 70:8,9 73:7 96:15 108:4 112:8 134:5 146:11 159:24 160:17 162:2 | | |

| | | | | |
|---|---|--|--|---|
| witness 1:3 26:3 79:14 80:16 102:8 149:3 190:2 199:5 | 180:4,7 181:8 196:8 | 176:17 193:21 | 123:14 164:9 | 2013 31:6,12 37:22 40:13 42:2 43:24 53:23 54:3,21 55:8,22 57:13 58:22 60:2 61:1 77:21 78:13,16 79:1,10,14 83:3 105:4 115:7 117:3 117:14,17,21 118:4,15,23,24 119:17 124:21 126:8,12,18,25 127:8,14,21 129:2 142:10,18 144:19 145:2 153:6 |
| witnesses 113:15 187:4 | write 141:11 | 1009 68:9 | 166:21 183:6 | 2014 46:22 74:14 94:20 123:7 124:4 |
| wonder 113:16 | writing 137:5 178:12 | 1011 68:9 | 16 164:11 | 2015 33:5,8 34:23 36:17 37:21 39:23 40:9 41:6 46:24 53:2 54:11,14 55:21,24 114:25 115:11 118:14 123:7,15,24,25 126:3,11 132:25 142:9 146:7 |
| wondered 64:18 | written 15:20 101:1 112:17 119:18 140:25 | 102 130:3,6 | 17 52:16 100:2 101:10 124:10 137:8 | 2016 21:18,23 56:20 57:8 60:2 68:14 69:10 77:20 127:14 143:16 145:5 177:3 |
| wondering 51:16 68:18 104:18 108:24 109:19 114:18 | wrong 40:14 46:3,4 46:6,7 56:15 69:18 79:5 116:11 123:2 124:22 148:14 187:16 | 103 129:18 | 177 200:19 | 2017 1:1 |
| word 18:9 64:23 78:15 137:15 188:6 191:4 | wrote 118:22,23,23 141:8 | 104 129:23 | 179 59:23 61:16,16 | 21 129:19 |
| words 34:17 40:13 42:7,8 48:12,13 50:9 62:3 158:5 194:6 | <hr/> X <hr/> | 105 200:12 | 18 5:21 | 22915 142:21 144:15 145:2 |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> X <hr/> | 11 25:5,14 40:8 41:5 47:7 114:25 115:11 127:19 | 180 9:16 10:3,9 18:5 22:9,10,17 58:12,13 61:16 63:6 69:3 77:20 79:10 120:20 | 23 79:6,7 173:9 |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 11-36 21 37:4 | 180.10 68:6,7 | 230 140:22 142:14 142:15,16 |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 11.00 19:9 | 180.1011 68:7 | 231 94:18 |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 11.10 19:13 | 180.1016 58:24 59:10,12 60:7 61:2 | 236 37:24,25 40:1 142:25 145:16 |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 11.51 20:13 34:4 147:3,4 | 180.something 68:22 | 245 46:20 94:23 95:1 123:10 |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 11.88 36:20 37:2 | 19 1:1 | 246 96:8 100:11 |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 11.89 34:4,15,16 40:22 53:19 114:12,21 | 196 120:24 200:20 | 247 134:6 |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 11/12 37:13 | 19647 28:11 | 248 125:14 |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 11/12-minute 39:10 | 197 143:10 200:21 | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 113 22:1 | 1985 81:2 | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 12 2:16 25:14 40:9 41:6 52:7 53:20 114:25 115:11 125:14 127:19 162:12 | 1990s 184:2 | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 12-12 36:21 37:4 | <hr/> 2 <hr/> | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 12.77 35:5,15 54:2 | 2 2:13,14 16:8 21:21,23 25:6 34:13 56:22,24 64:8 112:10 146:20 153:1 | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 120 90:7 131:17 | 2.05 89:18 | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 125 79:2 | 2.15 89:21 | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 128 200:13 | 20 53:22 140:19 141:17 142:1,18 177:3 183:6 197:23 | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 13 130:1,4,10,13,14 130:15,17 131:2 140:15,15 | 2000 79:2 | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 13.03 20:13 | 2006 127:19 | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 13.34 54:5 | 2012 150:23 | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 131 200:14 | | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 1339 119:15 | | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 139 200:15 | | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 14 13:1 75:9 129:2 129:11 | | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 142 200:16 | | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 149 200:17,18 | | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | 15 5:19 46:22 53:22 | | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | | | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | | | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | | | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | | | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | | | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 64:11,24 67:22 70:8 71:1 72:16 74:4 81:22 96:19 97:15,18 98:7 104:15 131:12 144:21 150:2,3,9 153:15 154:3,4,4 154:4 163:20 170:4 | <hr/> Y <hr/> | | | |
| work 1:17,21 12:19 31:6,12 32:11 33:5 36:11 43:13 43:24 46:15 49:9 50:12 51:21 52:22 52:24,25 56:17 | | | | |

| | | | |
|----------------------------|----------------------------|----------------------------|---------------------------|
| 249 134:23 | 22:8 28:10 61:17 | 407 153:2,4 | 75 200:8 |
| 25 78:25 79:8 200:7 | 78:1 79:11 143:3 | 41 142:14,16 | 76 2:14 200:9 |
| 250 10:1 | 145:21,24,25 | 145:13,14 | <hr/> |
| 251 134:25 135:1 | 359.19 17:23 | 43 76:7 94:23,24 | 8 |
| 25441 112:19 | 359.1958 39:3 | 44 4:17 15:5 132:12 | 8 51:20 162:11 |
| 25459 33:18 | 359.1960 39:3 | 134:24 | 8.68 38:11 39:4 |
| 25491 34:1,14 | 57:16 59:8,13 | 45 25:5,12,19 | 40:2,21 145:23,25 |
| 25492 33:9,16 34:2 | 60:5 61:22 | 46 16:5,10 19:22 | 146:1 147:2 |
| 144:2,14,22 | 359.19647 29:8 | 143:14 146:9 | 8.97 54:5 |
| 146:11 | 30:5 | 49 7:10 22:2 57:1 | 80 200:10,11 |
| 25499 112:21,23 | 359.1965 25:21 | 491 114:20 | 831 78:18,21 |
| 255 33:7 | 34:12 41:19 53:18 | <hr/> | 832 136:23 |
| 25500 112:25 | 55:25 62:2 115:17 | 5 | 87 64:10 |
| 25506 33:18 | 359.1966 19:25 | 5 119:10 | 877 164:3 |
| 258 33:21 36:17 | 146:24 | 5,000 14:1 | <hr/> |
| 55:3 | 359.1977 19:25 | 5.39 199:19 | 9 |
| 261 33:5 34:9,10 | 34:15 53:19 | 5.6 123:9 | 9.75 38:11 39:4 |
| 35:5,8 53:14 | 114:12,12,21 | 500 2:17 | 40:2,21 145:21 |
| 266 143:14,20 | 359.1979 35:6,15 | 52 153:2,4 | 146:1 147:2 |
| 144:22 | 54:2 | 58 197:23 | 90489 144:24 145:1 |
| 268 144:7,10 | 359.1980 54:5 | <hr/> | 145:3 |
| 27 21:18,22 | 359.1981 54:6 | 6 | 95 78:19,21 136:23 |
| 276 16:8 19:20,24 | 359.1987 146:24 | 6 38:1 40:1 144:11 | 98 33:16 164:2 |
| 22:14 100:10 | 359.2 34:3 36:21,22 | 162:11 | |
| 111:21 146:8 | 37:2 | 6.3 153:8 | |
| 28 118:24 | 359.something | 6.39 57:16 59:9 | |
| 297 146:5 147:17 | 41:10 | 60:3,15,18 61:2 | |
| 147:18 | 360.1996 60:16 | 61:21 | |
| 2M+H 77:16 | 368 22:6,16 56:23 | 6.88 79:11 | |
| <hr/> | 57:4 58:16,17 | 6.9 8:19 20:23,25 | |
| 3 | 369 57:14 | 37:13 40:8 43:25 | |
| 3 13:1 78:18 112:10 | 389 145:23 | 47:14,24 48:16,22 | |
| 136:23 146:22 | <hr/> | 63:12 68:23 69:1 | |
| 147:18 164:2 | 4 | 69:16 | |
| 3,000 28:16 | 4 8:16,17 17:4,19 | 6.90 34:17 39:22 | |
| 3,346 14:16 | 18:19,19 19:17,23 | 40:2 53:18 115:8 | |
| 3.40 148:25 | 22:14 23:7 47:2 | 60 128:15,20 129:1 | |
| 30 75:15,19 132:25 | 57:14 59:8 100:15 | 640.11 25:6,17 | |
| 300 108:23 | 100:23 113:12 | 65 173:9 | |
| 32 79:10 | 114:10 119:10 | 68 56:25 | |
| 328 18:5 21:7 22:13 | 127:13 135:2 | 690 34:11 | |
| 22:13 143:3,4,10 | 146:22 | <hr/> | |
| 143:11 146:3 | 4,000 13:25 28:16 | 7 | |
| 147:14,14,14,18 | 86:20 | 7 50:15 141:14 | |
| 358 135:4 | 4,979 12:24 | 715 64:4,5,9,21 | |
| 359 21:2,6,8,10 | 4.25 149:2 | 721 66:5,19 | |