Monday, 19 June 2017
(10.30 am)
MR SKELTON: Sir, our first witness today is Professor Cowan.
THE CORONER: Yes.
PROFESSOR DAVID COWAN (affirmed)
Questions from MR SKELTON
MR SKELTON: Professor Cowan, could you state your full name to the court, please.
A. My name is David Anthony Cowan.
Q. In your report, you describe your expertise as pharmaceutical toxicology?
A. That is correct.
Q. In particular you have an interest in mass spectrometry?
A. Yes, for much of my career I have worked using mass spectrometry as an analytical technique.
Q. Much of your work it appears is directed towards drugs testing, particularly in sport, is that correct?
A. Yes, I am the director of the Drug Control Centre, which analyses samples collected from sports competitors.
Q. To what extent do you work on poisons that kill human beings as opposed to improve performance?
A. I do not look at the clinical effects of poisons but I do look at the biological effects of poisons, most of the time I am dealing with compounds that are prohibited

in support rather than looking more generally but from time to time I am asked to consider analysing samples collected from deceased individuals.
Q. In terms of your expertise where it comes to particular plant toxins, plant poisons, do you have any particular expertise in that?
A. No, I do not.
Q. You defer to the experts from Kew when it comes to --
A. I would consider Kew to be the experts.
Q. Thank you. You have produced a report to the court. Do you have a copy of that in front of you?
A. My report?
Q. Yes. For reference it will be found in bundle 2, file 2, under tab 76. I am going to use the internal pagination.
The report runs to 12 pages, although in fact behind it there are many many pages including 500 plus definitions which were very useful but thankfully not entirely relevant to this evidence today.
Dr Kite, as you are probably aware, gave evidence last week and I believe you are aware of his evidence?
A. Yes.
Q. He explained the techniques to some extent but it might be helpful to hear from you because you also explain them at the beginning of your report. Basically the

type of technique that is used and the kind of results that are produced and what one gains from those results. Firstly liquid chromatography, can you explain what that is in short terms?
A. Maybe by way of preamble it is worth saying that the chromatography is coupled to this second part, the mass spectrometer, it is very important the two are connected to each other.
Q. The LCMS, as we have been using for short.
A. The reason I say that is because we will actually separate the components of a mixture in a liquid chromatograph. The time that the component comes out of the liquid chromatograph into the mass spectrometer is a very important piece of information.
The liquid chromatograph itself consists of a column, it is a tube which is filled with particles, the surface of the particles are coated. Sometimes, as in this case, with an organic material that tends to dissolve materials like mixing things into a fat. The liquid that passes through the column will then try to remove those materials which are attached into the fatty layer and push it down the column.
The stationary phase are the fatty layer in the tube and the liquid is pushing the material that comes out of the fat along the tube.

The effect of that is called partitioning where, dependent on the chemical composition, the material will either stay longer in the fat or longer in the liquid. If it spends more time in the liquid, it will come out more rapidly. If it is more dissolved in the fat it will come out more slowly.
These are the features that enable us to tell something about the structure of a compound, not in detail but in generality.
Q. Then the mass spectrometry part?
A. But then we put into the mass spectrometer, which sometimes I describe as a glorified weighing machine insofar as it can give us the mass of a whole molecule, that is one inherent part of a compound, the smallest part of the compound that we can consider and it can enable us either to simply give a mass to the nearest integer, for example carbon dioxide might be 44, or it can give us that mass far more accurately and tell us that it is CO2 for carbon dioxide.
As we go up in the mass scale, if we have the mass to a sufficient degree of accuracy, we can get out the exact elemental composition of the compound that we are looking at. That is the compound that has come out or eluted from the liquid chromatograph.
Q. What we are looking at here though is tandem mass

spectrometry, which gives us MS/MS data, could you explain what that is, please?

A. In the mass spectrometer we have to actually ionise the molecule, we have to put either positive charge on it or a negative charge.

We do that usually by a technique called soft ionisation, because what it tends to do is to give us the whole molecule, generally with one mass unit figure, but it gives us the whole intact molecule rather than fragments. Sometimes we also want to see the fragments, again using a common description I may say the arms and legs of the molecule, breaking off bits and pieces of the molecule. In the same way as one may break off the handle of a cup and recognise that it came from a cup. We might be able to knock off parts of the molecule that will help us to define the whole structure of the molecule.

Q. How is that deduction made from the fragments?

A. For example, if you lose 15 mass units, the only normally conceived reason for that is a methyl group. If it loses 18, the most common reason is loss of water.

From that one can start to build up, not just that elemental composition, the number of carbon, hydrogens, oxygens, nitrogens in the molecule but also possible to see where the different functional groups are attached

to the molecule.

Q. To what extent does the machine itself start to do the calculations with the fragments to tell you what the result is?

A. I am not sure if I understood your question.

Q. You put the data, you have data about the original mass and you have data about the fragments and you then need to draw conclusions from that data.

A. If I describe MS/MS, which I think was your original question, then we having formed the whole molecule, we then collide the molecule into a gas and put energy into it to make it break off the bits and pieces. By breaking off those bits and pieces we now have the ability to measure the mass or indeed the accurate mass of the whole molecule and also the fragments.

Q. The "accurate mass" is a term of art in your world for the mass as empirically found by --

A. Using accurate mass allows us to give that empirical formula.

Q. Sorry, I interrupted you. You were continuing to describe how you process the data?

A. It is very helpful if I can get the elemental composition of the whole molecule and also the elemental composition of the fragments because it helps to assure me of the overall compound that I am looking at, the

identity of the compound.

Q. It approaches the identification from two angles to give confirmatory -- to make you more confident about the conclusion?

A. The power of mass spectrometry is the vast amount of information that it gives us.

Q. Thank you. You make the point within your report and it is towards the end and in fact the very last paragraph. I just want to establish this right from the start, it is paragraph 49, you say:

"It is now highly unlikely, even with further additional or different analysis, to be able to determine the identity of this compound."

I am talking about the compound found by Dr Kite, which as you know has been the subject of quite some discussion during the course of this Inquest. Why do you take that view?

A. Yes, so reading through the documentation that was given to me, there seemed to be some knowns but a number of unknowns as well. It was very clear that the sample now is many years old. I am not clear exactly how the sample had been stored, so whether there had been any either enzymatic or chemical modification of the original molecule, and also considering just how difficult it is to look at a biological sample and to

actually get out the identity, that is not just the elemental composition but what is the actual chemical, how are those different elements combined into one chemical structure.

Q. Your view in conclusion is that it is highly unlikely at this stage that one could be able to identify it reliably from a scientific perspective?

A. Exactly that.

Q. May we turn then to what Dr Kite did find.

The first issue of course, which you are aware of, is whether or not this is a single molecule or a cluster that has been found.

A. Yes.

Q. He found an original ion, C20H27N2O4.

If you want to refer to your report you start to talk about this on page 4.

A. Page 4?

Q. Yes.

Eluting at 6.9 minutes.

A. Thank you.

Q. From that one can derive a molecular composition by taking away a hydrogen atom?

A. That's correct, yes.

Q. You are happy with?

A. Yes, that I am happy with that. I suppose I should be

exact and say you actually remove a proton. The reason I say that is accurate mass is so accurate the hydrogen atom and the proton have a very slight difference in mass, but I say that just to give to the court just how exact this technique can be.

Q. Yes. Dr Kite said last week in evidence that having considered all of the data that he produced, and gone back to look at it --

A. Yes.

Q. -- he took the view that on balance he thinks it was a cluster rather than a single molecule.

The reasons he gave were: the mathematical formula; the coelution time of the ions, they coelute at the same time; and the MS/MS spectrum which he found which he said didn't show intermediate ions, it simply broke down to 180 so you didn't find anything in between which might give you an idea that you are dealing with a cluster which is just simply broken as opposed to a different form of mass.

Those were his conclusions. Could you give me your view on that issue, please?

A. Yes. The difficulty I have with that -- it is a possibility, certainly -- and from what I read from the transcript, I saw in particular that in some of his experiments he started from a mass in the mass spectrum

from 250 in order to get very good mass accuracy but when he reduced that lower mass that gave him the opportunity to observe the 180 in more detail.

Q. Yes.

A. I think that was one important element that persuaded him.

I think the other one, as you say, because there was little fragmentation between this bigger species and 180 --

Q. Yes.

A. -- he was persuaded that rather than having a symmetrical molecule joined together it was only one half of that whole molecule.

I could not form a strong as strong a conclusion as he did, but I do accept that he is experienced with using his instrument, I am merely looking at the data provided to me in.

Q. To some extent he was going on intuition as well and I think he quite liked the mathematical simplicity of what he had found, which from his view as someone who is experienced as putting plant materials through mass spectrometry for years was significant, to find that, particularly the peak, the particular peak he found, isolated peak, he found of significance?

A. Yes. I could also see the persuasion of that.

Technically you call it a "dimer" when two molecules are joined together in a relatively loose complex, and when that happens one expects that it might break into single molecules as it goes through the liquid chromatograph. If it does that it is unlikely you will see a very sharp single peak. It will tend to show two but in that case I would expect to see the dimer, both molecules, and the single molecule in the mass spectrum and he doesn't inform us about that.

That was one of the reasons why I didn't form a very firm view as he had.

Q. I detected that you were tentatively deferring to him when it came to the likelihood or not. You can form a view about the possibility. Do you defer to his expertise with plant alkaloids on the likelihood or can you not express a view on that?

A. The way we would do a forensic identification is to obtain either if we have it or to try to obtain, suitable reference material and then run contemporaneously the sample and a standard and look to see equivalence or lack of equivalence of retention time and equivalence or lack of equivalence of the mass spectrum.

If they are equivalent then that is both retention time, the full molecule and the fragmentation under

MS/MS, data like that would give us beyond reasonable doubt that that was the substance. That is what -- it would normally be accepted by scientists and by the courts.

Where we don't have that reference material then we can start to make some assumptions and deductions, especially by looking at the data as Dr Kite had.

I think it is very helpful that because of his knowledge and experience of looking at plant alkaloids he would know generally how those molecules behave.

Q. Yes, he also I think said you could use a different solvent to see if --

A. That would be my preferred way if I wanted to actually separate a dimer from a monomer, for example it might dimerise in water but less dimerise in a more organic more lipid type of solvent like ether.

Q. Yes. We have of course been drawn into the debate about the molecule or the cluster by Dr Kite's analysis.

Can I now sort of move on to try and work out and put in context whether in fact that is an important differentiation for the purposes of this Inquest.

First of all, I think you say in your report that from your own knowledge or checking on the database that there are 4,979 compounds with the composition of what we hypothesise is the large molecule, that is

paragraph 14 of your report, page 3.
A. Thank you.
Q. Could you describe where you get that data from and explain what kind of compounds you are referring to?
A. Yes. The Royal Society of Chemistry very helpfully collate a database of compounds and one can readily search that database, putting in a variety of information.
In this case, what I put in was the elemental composition and I asked the database to tell me how many compounds it could find, it had on its database, that were different compounds with that same elements composition. These will be from a whole variety of chemical sources.
It is not specific to plant alkaloids it is just on the array of permutations that one could get from that elemental composition, of joining the carbon, hydrogens, nitrogens and oxygens together in a variety of different ways.
Q. These are actual compounds as opposed to theoretical?
A. These are actual compounds, not theoretical they are actual compounds.
Q. Do they include synthetic compounds?
A. They will do definitely, yes.
Q. Can one say anything about the break down of the 4,000

plus, almost 5,000, in terms of naturally occurring ones or ones found --
A. No, I didn't search to actually group it in that way. It is more a chemical database than one about biological activity that. I am not sure how readily one could do that sub search.
Q. What about toxicity, can one say anything about that, even at the most basic level of generalisation?
A. Yes, some of the compounds can be totally innocuous, one could take large quantities without having any harmful effect or it could be that some of them will be toxic but I did not search the database to look for that.
Q. Does the same answer with a different figure apply to the so-called cluster molecule --
A. Yes.
Q. -- which I think you give data on as well as being 3,346 different compounds.
A. Yes.
Q. Exactly the same analysis?
A. It's exactly the same search that I did, I put in the two different elements compositions and that was the number that were available on the database today.
There probably are more permutations than are down there but these are the ones that are listed on the database.

Q. The reason there are fewer is it a trite point, that you are actually dealing with fewer atoms in the structure so --
A. Yes, going back to my original example of carbon dioxide 44, typically there are four different compositions you can have at that mass and as you go up the number increases exponentially, it just increases and increases more and more rapidly.
Q. Can you give any evidence or is it for the plant specialists about the plant alkaloids, particularly when it comes to gelsemium?
A. The benefit of looking at a plant alkaloid is you would know generically the type of compounds the particular plant produces, so one will look for related compounds generally. That is what would be known with respect to a particular plant, so if one is looking at gelsemium, one would expect to find certain alkaloids.
I hope I answered your question.
Q. Yes, although I think a point which Professor Simmonds no doubt does make in her written evidence is one does not know all the alkaloids necessarily from this particular plant?
A. As I see, that is the problem. I don't know what had been taken so I have an unknown situation, how to identify the different components I have in the samples

provided to me. I think that was the task faced by Kew.
Q. Yes. Can I take you to some data that really we have been focusing on over the last few days, particularly with Dr Kite, in respect of the four isomers that he analysed. You will find this in bundle 1 at tab 46, please.
MR MOXON BROWNE: Page?
MR SKELTON: Page 276, it is attachment 2.
A. Which tab?
Q. Tab 46, it should be the last page in there.
A. Yes.
Q. I would like to get your views really on the significance of this finding when it comes to ruling out whether or not the chemicals found in gelsemium elegans and gelsemium sempervirens, any of them are the same as the compound found in Mr Perepilichnyy's stomach, that is the key question I think you are able to address.
A. Yes, I found that helpful insofar as it persuaded me that the alkaloids like gelsemicine, which are considered to be extremely toxic, actually appears in the mass spectrum of the data produced by Kew is correct in what he has in his table --
Q. Yes.
A. -- and particularly that it is different from this earlier eluting peak that came from the deceased. That

is that they are different compounds.
Q. Would you be able to explain by reference to the data that we have seen here, so in particular the values that you can see -- we are looking for example at isomer 4, you see the mass to ion ratio although as I understood it that was a term that one should not necessarily be using but perhaps I have overread the appendices to your report but just M/Z data. Then there is the retention time and then there is the MS ...
A. Yes, I beg your pardon, first we have this M+H, the protonated ion, with this exact mass, this was the basis of Dr Kite's search. I am looking for this alkaloid, I know what its elemental composition is, just searching through all of the retention data, how often do I find that peak? That was the general basis of his search, whenever he found that elemental composition then he noted that data.
When he went on to do MS/MS, so if we look at the right-hand isomer 4 at the bottom of the table, so for gelsemium sempervirens root bark, seed, fruit wall and so on.
Then we see good similarity in the data, the accurate mass, that is the 359.19 something, something.
Q. Yes.
A. The retention time also being similar, much later than

the peak observed from the stomach contents of the deceased.
Q. Yes.
A. Also the MS/MS data being significantly different, insofar as it is showing a large 328 rather than a 180 that he obtained from the stomach content.
Q. Yes. In his evidence, Dr Kite sort of put a hierarchy to some extent -- perhaps "hierarchy" is not quite the right word but the analysis went through several stages in terms of identifying a compound. I think he put the MS/MS data actually ultimately above retention time as being of significance. If you have checked the MS/MS data you don't need to move on to the retention time if there is not a match?
A. Yes, I agree with the value of the MS/MS data but I see that he says "Probably gelsemicine", he doesn't say definitively it is gelsemicine.
MR MOXON BROWNE: Which one is probably gelsemium?
MR SKELTON: Isomer 4, I think you mean isomer 4 where you see on the table he says "Probably gelsemicine", which is a judgment he has made.
Is what you meant, Professor Cowan?
A. Sorry, I didn't follow.
Q. In your last answer I asked you about the sort of whether MS/MS starts as one of the -- if you can rule

out something on MS/MS whether you need to start looking at the retention time. You gave an answer, well, that does make sense in the context of it probably being gelsemicine.
A. Sorry, yes.
THE CORONER: Can you hold that thought. I will tell you why. Because I am going to break off so people can do it as they wish or don't, but there is a minute's silence at 11.00.
All right, so we will just break now.
(10.55 am)
(A short adjournment)
(11.10 am)
THE CORONER: Sorry, Mr Skelton.
MR SKELTON: Thank you, sir.
Professor Cowan, you were slowly but inexorably taking us through your analysis of isomer 4 in particular. I think you had started to deal with the mass, which you were explaining had some variation page 276.
A. Thank you.
Q. Under tab 46.
A. Looking at isomer 4, the right-hand column in the table on page 276, I see that the size of the protonated whole molecule is shown as 359.1977, 359.1966, a slight

variation in that in the subsequent numbers but relatively small, which is consistent with the accuracy of a mass spectrometer of that type. The sort of variation that one would expect to see were it still to have the elemental composition as put forward by Dr Kite, that is the C20H27, or H28, N2O4, H28 insofar as it is protonated.
Q. Yes.
A. Furthermore, the retention time, that is the time that this peak came out of the liquid chromatograph into the mass spectrometer, that characteristic time has some variability to it, the biggest being of the order of 11.51 through to 13.03. Quite a lot of variation in this case but variation depends on the equipment used, the pumping system, how accurate it is in pumping the liquid through the liquid chromatograph. Dr Kite would know the variability of his instrument and what was acceptable and what wasn't to classify it in that way, to say, "This is the same component that I am looking at that goes into the mass spectrometer".
Q. Can one safely say that that difference is not significant but the difference between that range and 6.9 is significant?
A. Exactly that, it clearly is nowhere near the region of 6.9 which says to me it has to be a different compound.

Q. The MS/MS?
A. That is helpful in addition insofar as using 359 as what we call the precursor ion, that is the only signal from the first part of the mass spectrometer will let go into the second part of the mass spectrometer to break up the species that we are looking at is 359.
It means that for example the 328 that we are observing here in the MS/MS has to have come from 359, with a slight plus/minus to it because of what is the plus minus around 359, is it one mass unit or two mass units away from that?
We have the time, we have the mass of the whole molecule and we have the fragment.
Q. Just to clarify, why the fragment is different from the stomach compound fragment, could you explain that for me?
A. Yes, I have found in my notes the report by Dr Kite of 27 October 2016, but I haven't managed to locate that in the bundle at the moment.
Q. Let me see if I can find it for you.
The start of 2, I am told, unless I have broken my bundle up. 27 October.
A. 2016, yes. It is in answer to question 2 put to Dr Kite.
Q. If it is the same one I am looking at ...

A. It is numbered 113 in my document.
Q. Under tab 49.
A. Thank you.
Q. Do you have that?
A. Thank you.
Page 368.
Q. Thank you.
A. Here we see the MS/MS of 359, but in the data provided here we also have the accurate mass of the 180, which is helpful to give us the elemental composition of 180.
Q. Yes.
A. What I see is no -- I have lost my place. I see there is an absence of that ion at 328, so whilst 328 was the major ion seen from isomer 4, on page 276 --
Q. Yes.
A. -- it is absent from the spectrum given on page 368, but instead we see 180. It says to me they must be very different compounds.
Q. And the retention data backed that up as well?
A. Backed up by the retention data, exactly that.
Q. Thank you.
In conclusion from your perspective as a mass spectrometist, you can say that you can rule out the possibility that whatever was found in Mr Perepilichnyy's stomach, the unknown ion and unknown

molecule that derives from that ion, is the same as any of the compounds found in the samples of gelsemium sempervirens and gelsemium elegans that Kew tested?
A. I would say it is not reasonable to consider that the compound found in the stomach content is the same as that from the extracts of gelsemicine species, yes.
Q. Whether or not isomer 4 is or is not probably gelsemicine is for the plant specialists to opine on?
A. It is a refinement, yes, sir.
Q. Can I come back to the issue of cluster ions, please.
My understanding is that you, from your position as a sort of mass spectrometist, take the view it is certainly a possibility. That you defer to a degree to Dr Kite because he has a specialist in plant alkaloids and the mass spectrometry associated with that and he conducted the experiment or the experiments using the machinery at the time and viewed the data.
Are you able to say ultimately that whether or not it is probable is for Dr Kite to take a view on, you having recognised it as possibility?
A. Are you talking about the monomer or dimer theory.
Q. Yes.
A. I still cannot be persuaded exactly that it necessarily is one or the other, whilst I acknowledge Dr Kite's expertise on alkaloids, this small molecule does not

appear to be an alkaloid.
Q. You say that why?
A. A much lower mass than you normally see for a majority of alkaloids, not all, some are small.
Q. How does that relate to the question which is whether or not it is a cluster molecule or not?
A. Sorry, there is some noise.
Q. How does that relate to -- the fact that you take the view it may not be an alkaloid, how does that relate to the issue of whether or not it is a cluster?
A. Sorry, I was just talking about Dr Kite's specialty, you said his instrument and his knowledge.
Q. I understand. I may have interrupted you. You said you recognised it was a possibility but you are unable to say from your perspective whether or not he is right that it is probably a cluster ion.
A. From the data provided to me, I was not persuaded beyond reasonable doubt that it was a monomer or a dimer.
Q. What about on the balance of probabilities, which is what the court may be concerned with when it comes to this issue?
A. I don't have a view.
MR SKELTON: Thank you.

Questions from MR MOXON BROWNE

MR MOXON BROWNE: Professor, I represent Legal & General, the life insurers.

May I take you to the conclusions of your report, which is at paragraph 45, internal pagination 11. I have a bundle reference Experts 2, 640.11. Do you have that?

A. Do you mind just repeating that, which --

Q. Yes, I want to take you to the conclusions of your report.

A. My report, yes, I have that.

Q. You could look at paragraph 45 of your report --

A. Thank you.

Q. -- you could look at internal pagination 11 of 12 of your report --

A. Yes.

Q. -- or you could look at 640.11 to assist my colleagues.

A. I see, yes.

Q. There we have the conclusion, starting at 45, with agreement with Dr Kite that he is correct to ascribe the formula C20H26 et cetera to 359.1965. That is an important and significant conclusion, is it not, because that weight of molecules could be represented by some quite different chemical formula involving quite different chemicals. It is a matter of mathematics and

technicality to say, "Using my skill, I think that is the right formula"?

A. I tried to make just that point earlier on in my witness statement.

Q. Yes.

A. Yes.

Q. You are in complete agreement about that and, as I say, that excludes a whole raft of other chemicals being involved here?

A. Considering that peak, you are correct, it excludes other compounds.

Q. Yes.

You have told us that databases tell you that that formula is the same formula for a very large number of substances, measured in the thousands.

A. That elemental composition can be obtained from a multiplicity of different compounds.

Q. Yes, and that of course is right. You mentioned that that included, in answer to a question from Mr Skelton, some synthetic substances?

A. Yes, indeed.

Q. I think that doesn't quite paint the picture does it because, of those thousands, they are all synthetic except five, which are found in the Dictionary of Natural Products.

A. No, I couldn't say except five. There may be some more botanical materials giving that elemental composition.

Q. Yes, well I am sure that is right but according to the Dictionary of Natural Products, there are in fact only five.

A. I understand, yes.

Q. You accept that?

A. I accept that, yes.

Q. The vast majority of these chemicals that share that, potentially share that formula, are man-made products, synthetic products?

A. I beg your pardon, I see. Yes, I was just being pedantic on the point.

If I have understood the question correctly, it is considering gelsemium alkaloids, how many of those alkaloids may give this accurate mass, this elemental composition?

Q. No, my question was that of the vast array of chemicals which answer to this formula, almost all of them are synthetic. That was my question?

A. That I couldn't say, I am not sure that is correct. Some of them could be biological, they could be from animals, they could be from a whole variety of origins.

Q. But for one reason or other have not found their way into the Dictionary of Natural Products?

A. Ah, I understand.

Q. Correct?

A. That's correct, yes.

Q. Thank you.

In fact, if you want to examine the likelihood of any chemical with this formula being something other than gelsemium, the way to do it is very straightforward, it doesn't involve tapping into your computer C20H26N2O4, it involves tapping into your computer the exact mass, 359, you have it to five places of decimals, 19647. That will tell you straight away what other substances in the world, be they natural or be they synthetic, answer to that exact measurement.

A. You could use that approach certainly.

Q. I am suggesting to you it would much more productive than simply pointing to 3,000 or 4,000 different products because there are only three or four that match this.

A. Correct. Yes, I agree with that.

Q. The lists go on and on but they are put in order of closeness to the exact mass, so you can reach the stage when you say it is very, after about 10, you say it is really very improbable. At lunchtime you could tell us whether this accurate mass, what it represents and you could ask yourself whether there is any probability that

any of these substances other than gelsemium products might have found their way into Alexander's stomach, an easy thing to do?
A. I don't follow the question.
Q. Sorry?
A. I haven't followed your question.
Q. Yes, what I am suggesting to you is that if you tapped into your computer the exact mass, 359.19647, you would straight away be given the substances that have that exact weight and there are very, very few of them.
A. What has been published to date on that database for gelsemium and other related alkaloids of natural product.
Q. No, not natural products, because we are now looking at the possibility that it might be an analogue. I am suggesting to you that that theory, that it is not a natural product but is a synthetic product, could be checked, not by tapping in the formula, which isn't helpful, but to tap in the accurate mass.
A. It would come to the same answer.
Q. Well, there are a vast number of chemicals with varying weights which have this formula. I am suggesting that what we ought to be looking at are those chemicals that have exactly the same weight and that there are not very many. Is that right or not?

A. As I see it, I would come out with the same answer if I put an elemental composition, because that would give me that mass.
Q. Do you agree with the proposition that by feeding into a computer "359.19647" you will be told what substances in the natural and man-made world answer that weight, and there are not very many?
A. I don't think I agree with that. I think against the database you are describing I would accept it, but against the range of natural compounds existing in the world, that is more difficult to answer.
Q. You are familiar with the ChemSpider database I expect?
A. Yes.
Q. All right, well we will leave that.
The second conclusion relates to the possibility or probability of dimerisation. You have expressed yourself very clearly on that in answer to questions from Mr Skelton.
I think you would agree that the possibility of dimerisation depends on the coelution of the ions which are said to have joined together to form a cluster. You have to have coelution as a precondition?
A. If I see a lack of coelution, then I would conclude it is a different compound.
Q. Yes. I think I am right in saying that the detection of

coelution is a precondition of the --
A. I agree with that, yes.
Q. -- conclusion?
A. Yes.
Q. It is right, isn't it, that you have seen no data in relation to the work done in 2013, when this unidentified ion was first found, that there was any coelution?
A. I don't think I heard the last bit of what you said, that there was not coelution or --
Q. That you have seen no data to support the proposition that, when work was done in 2013 --
A. Yes.
Q. -- and the conclusion was then -- no mention of dimerisation then --
A. I understand.
Q. -- no data indicating coelution that you have seen?
A. Correct, yes.
Q. Yes. That is one of the reasons why this is not a conclusion that you are very confident about. No data.
A. No data, correct, yes.
Q. The last of the three conclusions, whichever is the exact molecular species, it is not one of the gelsemium alkaloids analysed contemporaneously by Kew, that is

carefully and if I may respectfully say so very accurately expressed, it is the same conclusion that Professor Simmonds reached, she is absolutely certain that what was extracted from the stomach is not the same as anything that was abstracted from any gelsemium plant she looked at.
A. Correct.
Q. That is her conclusion and your conclusion, and it is, if I may say so, obviously right.
But you are not saying and nobody could say, I suggest, on the basis of the work that has been done, that the stomach contents ion didn't come from gelsemium that, is a very different and much wider proposition?
A. Are you saying am I excluding the possibility that what was found in the stomach could not have come or did not come from gelsemium.
Q. I am suggesting to you that the conclusion that what was found in the stomach has not been matched by anything found coming from a gelsemium plant is not the same as saying that what was found in the stomach didn't come from a gelsemium plant. Two different propositions?
A. Well it is a very remote possibility but it is a possibility.
Q. We will look in a moment if we may at whether it was remote or not.

Thank you.
Can we next look at what gelsemium looks like as a trace, so that we know what that beast is. I think if you look in the first of the experts' bundles, at page 261, we can see what work Kew did in late 2015 on a number of gelsemium plants.
I think perhaps if we start at page 255, the beginning of that report which is dated November 2015, we will see straight away sample numbers 25492, gelsempervirens roots, is ascribed to each of a good number of samples. We have a number and then we can tell by referring back to this table where a particular sample has come from.
If we just look at this, so we can --
A. Thank you.
Q. -- bear it in mind, the numbers 25492 through to 98 are various parts of gelsemium sempervirens plants. Whereas the higher numbers, 25459 going through to 25506, are from elegans?
A. Yes.
Q. Then if we go forward, if you would, to page 258, we see the thumbnails for each of those samples. In answer to questions posed by the coroner to the scientists at Kew, they identified, they were asked: which of these do you say is gelsemicine? They have identified particularly

25491, that is going down the column as the second one, and 25492, and you will see that that shows a substance with an accurate mass of roughly 359.2 eluting in, one case at 11.89 and in the other at 11.51. Those are the candidates that they point at, both as it happens from the root bark of a gelsemium plant.
We see the characteristics, just to pick up the true accurate mass rather than the rounded figure, if you go forward to page 261, you will see at the top on page 261, letter (a) down the side just to guide you, we have our familiar stomach contents eluting at 690 with 359.1965 that, the familiar stomach contents and then we can disregard urine 1 and urine 2 and then we have our gelsempervirens root bark, which is 25491, eluting at 11.89 and the accurate mass is 359.1977.
Your point is that eluting at 11.89 is miles away from 6.90 so they cannot be the same, in other words, the stomach contents is not gelsemicine. That is right, isn't it?
A. That's correct.
Q. In particular you make the point that the difference in elution time, the much longer elution time observed when these roots were looked at in 2015, couldn't be accounted for by what I think you call drift, by vagaries in the use of the equipment?

A. That is my conclusion.
Q. That is your conclusion and you express it very strongly and clearly.
I think we see another elegans root bark in the next letter (e) on page 261, this time eluting at 12.77, 359.1979?
A. Sorry, I have lost the place.
Q. It is letter (e) -- we are on page 261.
A. Yes.
Q. Letter (e) down the right-hand side shows us where --
A. Thank you, yes.
Q. -- in the table we are. This time it is elegans, last time it was sempervirens root bark this time it is elegans root bark, but we are still with the root bark and now we are eluting at 12.77 and it is 359.1979. I think it is suggested that is probably gelsemicine too although the different elution times might suggest, might it not, that what we are looking at are two closely associated compounds rather than exactly the same thing?
A. I am going on the basis of what Dr Kite told us on this and as I explained earlier it depends on the pumping system used on the instrument.
Q. Yes. These tests were all done on the same equipment at more or less the same time, as I understand it.

A. Yes.
Q. Do you think that the example from sempervirens at (d) and the example from elegans at (e) are the same compound or do you think they are biogenetic mutations which are very similar but not exactly the same?
A. I can't really give a firm opinion on that, on the basis as I said I don't really know their equipment. With the equipment I use in my lab, I insist on a much tighter retention time when identifying a substance.
Q. You attach importance to retention times?
A. For my work in sport we have particular requirements that I think that Dr Kite does not have to follow. As I pointed out earlier, I was relying on Dr Kite's conclusions insofar as he was looking at the same compound.
Q. Can we go back to the thumbnail just to get a general picture of what was discovered in 2015, page 258. It is not very conveniently laid out because they are not numbered and it is not said where they come from. But if you count down the first column, five, we see 11.88, we have another 359.2, so again in the 11-, 12-minute range we have a 359.2. My note says that is a gelsemium sempervirens root again. I am looking back a couple of pages to pick up where I get that information from, but you don't have to look at that.

Then the next one down, second from the bottom, 11.88, again 359.2. We have consistent elution of these obviously either identical or very similar substances in the 11- or 12-minute range.

A. There is a difficulty with elution time, insofar as when you have other material coming out, as you would with a complex extract, it can cause slight shifts to retention time. So comparing one sample with another, one is very likely to see some shift in retention.

Q. Yes, I am not drawing your attention to the difference, I am drawing your attention to the similarity. Of you get a bit of drift, I understand that, but you cannot drift all the way from 6.9 minutes to 11/12, that is impossible, as you have said?

A. Correct.

Q. Which is what enables us to say with some confidence that what was found in the stomach contents is not the same as what was found here?

A. That was the basis of my conclusion, correct.

Q. Yes, thank you.

Let's see what was found back in -- this is 2015, let's go back now if we may to 2013. For that purpose we must go to this same bundle, experts' bundle 1, but this time at page 236. You are in the same bundle but at page 236.

In the middle of the table there, figure 6, you see at the top this relates to a chromatogram of an analysis of a gelsemium sempervirens root. We see in the middle there, between the two arrows, two major peaks with elution times ascribed to them and two minor bumps.

It was the opinion of Dr Kite that that certainly represented -- I think he said certainly or very probably represented two compounds and that the bumps might or might not be separate compounds. Does that accord with your own opinion?

A. You are saying the peak at 8.68 and the peak at 9.75 as being separate compounds and the fairly broad peaks sitting small to the left of each might be related, is that what you just said?

Q. I was saying that I understand Dr Kite to have said that the two sharp peaks which have elution times ascribed to them are compounds and are separate compounds, different from one another, and he was less sure -- was not asserting with any confidence -- that the two bumps also represented separate compounds, he was not sure about that.

A. I see, yes, I would expect them to be separate compounds as well.

Q. Are we looking at two or four in your view?

A. I think more likely than not we are looking at four.

Q. Four, okay.

You will see that these peaks are ascribed accurate masses of 359.1960 and 359.1958 eluting at between 8.68 minutes and 9.75, whatever else these are, they are plainly not gelsemicine which we have just been looking at?

A. Sorry, you said these are plainly not gelsemicine?

Q. Yes. We have just been looking at gelsemicine which has a different accurate mass and a very different elution time, up to the 11/12-minute mark?

A. I don't follow why you make that assertion.

First of all, the accurate mass has a plus/minus on it, as I said earlier, and the equipment they were using it was five parts per million.

Q. Yes.

A. Secondly, as I believe Dr Kite has explained elsewhere, the difference in retention time across the years was because of change amongst other things of his liquid chromatograph column.

Q. You have made the point, if I may say so, Professor Cowan, that you cannot believe that what was found in Mr Perepilichnyy's stomach contents at 6.90 can be the same as what was found in 2015 from a gelsemium plant because the elution time is so different?

A. I may have misunderstood your point. On the data shown

in figure 6 on page 236, if the question is the peak at 6.90 being different from the peaks at 8.68 and 9.75, I would say yes it is different.

Q. No, I am not putting that.

A. You are not saying that, okay.

Q. I am employing parity of reasoning, I am saying if your argument is that what was found in the stomach contents at 6.9 units cannot be the same as what was found 11, 12 minutes from the root bark in 2015 because the elution times are so different, it cannot be accounted for by drift or anything like that, then exactly the same reasoning must apply to the other thing that was found in 2013, in other words this substance here.

I will be corrected if I am wrong but I do not think that Dr Kite suggested that the equipment used on the two different occasions was so different that it could possibly account for this. He, like you, was talking about the possibility of drift but not these massive differences.

A. I am afraid I still haven't properly understood. I think you are asking me the peaks at 8.68, 9.75 could they be the same as 11.89?

Q. Yes.

A. Okay, thank you. I would say it is extremely unlikely they are the same.

Q. I think we are getting there, Professor Cowan.
If Kew are right as they have said in answer to questions from the coroner, until told Professor Simmonds whose evidence we cannot know, but if she is right that what eluted at between 11 and 12 minutes in 2015 was gelsemicine, it follows that what we are looking at here is very likely not gelsemicine?
A. I understand.
Q. And that there are not one but in your view four compounds with an accurate mass of 359.something, four compounds eluting which are not, because of the elution time, gelsemicine?
A. I think that is a reasonable conclusion, yes.
Q. Thank you.
I think you are aware that "the literature", this is the phrase that Dr Kite used, simply wide range of references, the literature indicates that of the substances associated with gelsemium which answer to an accurate mass, 359.1965, only gelsemicine is found in both sempervirens and elegans, whereas the four isomers are only found in elegans. Do you follow?
A. I follow the reasons, yes.
Q. Yes.
What we have here are, in your view, four substances which appear to be isomers of gelsemicine but which are

not gelsemicine, discovered it would seem by Kew simply by carrying out this experiment in 2013. They are not supposed to be there, are they, according to the literature? It is only supposed to be one, gelsemicine, we know it is not gelsemicine, we have just dealt with that, and we have got four we have to account for.
A. May I just say this back in words to make sure I have understood you correctly in my own words.
I think what you are suggesting to me is that the Dictionary of Natural Products has only four or five different compounds of a particular elemental composition but perhaps here we have found something additional to that?
Q. Well, four things.
A. Yes.
Q. That seems to be the case?
A. I think that is a reasonable suggestion.
Q. It is not in any way improbable, because there are literally dozens of alkaloid compounds in the gelsemium species and they are finding new ones all the time?
A. That would be what I would expect and I believe that has been accepted by Dr Kite from what I have been reading.
Q. That does seem to be an accepted proposition, that it is not helpful to assume that these substances can only be X, Y or Z. No one really knows.

A. I think it is a question of likelihood, I would say at the moment more likely than not, that these are all gelsemium alkaloids.
Q. Yes. I mean they look, because of the accurate mass, and because we know they came from the root of a gelsemium plant, they obviously are associated with gelsemicine and that plant, but they are not in fact gelsemicine or any of the named isomers, it is something else?
A. Trying to be helpful, I would suggest that when these databases are put together, one will analyse some plant extracts, using a reasonable amount of material, one would do additional analytical work and then one would put the data that one has acquired on the database, which is not the same as the experiments Kew have done on this occasion, they have looked at some samples that they have obtained and shown what it was they observed in it. I think at their own acceptance they have simply said "probably gelsemium", they have not said definitively gelsemicine.
Q. There is no criticism of anybody here, I just want to see what these things really mean when you look at them.
A. Yes.
Q. The net result of the work done in 2013 was that an unidentified compound eluted at 6.9 minutes --

A. Yes.
Q. -- with an accurate mass which, if it was a natural compound, matched gelsemicine and its isomers, if it was a natural compound?
A. I am having difficulty with the term "natural compound". Are you saying from a gelsemium when you say natural?
Q. No, that would be circular. I am saying if it was a natural compound --
A. Natural as appearing in nature?
Q. Yes, and therefore qualifying to appear in the database for natural products, it is associated with gelsemium.
A. I think I follow you.
I think the problem with that natural database is the botanical origin that are ha looked at. There are far more compounds -- there are plants still being discovered.
Q. Yes, as we have just seen, not plants but also compounds.
Anyway, I think it is perhaps semantics, I think I have perhaps made the point. You have something which I am suggesting, if it is a natural compound, looks as if it is associated with gelsemium. I am also saying if it is not a natural compound, by tapping into a database you could very quickly find what it is, if it is something that is only found on the anti-fouling paint

on the bottom of oceangoing liners, then we could assume it was unlikely to be found in Alexander's stomach. You can apply some common sense?

A. It is unlikely to, yes.

Q. Let's look and see what that was matched against. What Professor Simmonds did was to take a plant of the gelsemium species, gelsemium sempervirens, that happened to be in her herbarium at Kew and to take one part of it, which was the root and extract something from it which, as I think we have just seen, it is impossible to say what it was apart from the fact that it is associated with gelsemium.

She found, for the reasons that you understand and that the coroner clearly very well understands -- what she found in the root is not the same as what was found in the stomach?

A. Correct.

Q. Whether what was found in the stomach might exist in the leaves of sempervirens or in the seeds of sempervirens or indeed in the sempervirens plant grown at a different altitude or in different weather conditions than obtain at Kew, one knows not, to say nothing of what might be found in a different species such as elegans or indeed rakinii. All she could say was, "It is not the same as what I found in the root of this one"?

A. That's correct, yes.

Q. To extrapolate more than that at that stage would have been wrong?

A. I am not sure I would go as far as saying wrong.

Q. Sorry?

A. You said it would be wrong?

Q. It would be wrong to try to build more into it than that rather limited finding?

A. I would agree with you entirely if I wanted to say definitely what it was I identified. If I wanted to say more likely than not to exclude something, then I would use a lower standard.

Q. Yes.

I want next to look at some further information that Professor Simmonds gave about the results of the work that we have just looked at, in answer to questions posed by the senior coroner for Surrey and see to what extent you agree or disagree with what she then said. I expect you will then agree with most of it I am sure.

That we see in the same bundle 1 at page 245. That starts, do you see these questions were posed on 15 December 2014. For reasons which no doubt Professor Simmonds will explain they were not answered until May 2015, as far as I am aware, which was virtually on the eve, just for the coroner's chronology,

of the Inquest getting underway.

At question 4:

"Is it correct that Dr Rice's identification [that should of course be Dr Kite, he has got him mixed up with somebody else] identification of C20H27 was an accurate match for the following plant alkaloids in addition to 11 methoxy gelsedine [that's gelsemicine] ..."

Then they are listed A to D, and she answers:

"Yes, according to the Dictionary of Natural Products there are five alkaloids with that formula. We didn't have access to the standards of all five compounds so don't know whether they would have all eluted at 6.9 minutes."

She is making the point that since she didn't have access to the standard reference material for the isomeric, she couldn't say whether or not they might naturally what was found in the stomach. You would agree with that?

A. I would agree with that.

Q. Yes.

Then she says, last sentence of that:

"Our analysis of gelsemium sempervirens showed that none of the compounds in that species eluted at 6.9 minutes."

There has been a bit of misspeaking there, hasn't there, because I think we are agreed that all she could say was that she hadn't found it in the root and she couldn't say at that stage that none of the compounds in that species eluted because she simply didn't know. If she said, "None of the compounds we found in that species ..." That would be accurate you would agree with it?

A. I believe she has used a short form here of as you said, on the sample that she analysed.

Q. You would agree with that sentence if we insert the words "none of the compounds that we found", but you would not agree with it if you take out the words "that we found"?

A. "Our analysis of gelsemium sempervirens showed that none of the compounds in that species eluted at 6.9 minutes ..."

Was her statement.

Q. There are many, many, many compounds in a gelsemium sempervirens plant, in the leaves, the seeds and so on.

What Professor Simmonds found was that the substance that she located in the root didn't elute at 6.9 minutes. I am suggesting to you that that is all she found and it doesn't follow that none of the compounds in the species, those that might be found in the leaves

and -- would similarly not have eluted at that time?
A. Let me please paraphrase, if you are putting to me that perhaps a compound, perhaps an alkaloid coming from gelsemium species could have an alkaloid, of the structure C20H27N2O4, is that a possibility? I would agree it is a possibility, however remote, and I would consider it to be remote based on the literature and the alkaloids that Kew have looked at, not only in their early result but also in their later work.
Q. Then the questions went on:
"Can you confirm that the isobarics ..."
Which is of course a synonym for "isomerics".
A. In this context it is the same.
Q. Yes:
"The isobarics listed at A to D above [that is gelselegine and so on at the top of the page] have been found in elegans but not in sempervirens."
That was the point that we were looking at a moment ago. She says, and I am sure this is right:
"Today these compounds have been recorded in elegans."
She is not saying that that is necessarily the end of the story?
A. Correct.
Q. You would agree with that?

A. I agree with that, yes.
Q. Then the coroner asks:
"Can you identify whether the tests carried out by Dr Kite on extracts from the root have excluded the conclusion that the ion found by him might have been an isobaric of gelsemicine, for example gelselegine derived from the ingestion by the deceased of elegans or an extract from it?"
In other words, you have made your points about sempervirens but how about the possibility it has come from elegans. She says:
"The work undertaken by Dr Kite was not an exhaustive analysis of all potential toxins."
Then over the page she says why she chose the roots.
Then 7 I would like your view on. The coroner asked:
"Does the precedence of the ion in the deceased's stomach at autopsy oblige the conclusion that at some time prior to his death the deceased had ingested some substance containing that compound?"
She answered:
"Yes, the data would suggest that."
Do you agree with that conclusion?
A. Do you mind repeating the question there?
Q. Yes, well it is not really my question it is but the

question that the coroner asked Professor Simmonds.
"Does the presence of the ion in the stomach at autopsy oblige the conclusion that at some time prior to his death the deceased had ingested something containing that compound"?
A. Ah okay.
Q. She says, "Yes, the data would suggest that".
A. Yes, I think the problem is semantics, that is a question of compound or elemental composition. The compound is what you take of course, an elemental composition is carbon, hydrogen, oxygen, nitrogen of what you took.
Q. We can cross out unidentified compound there and the question, to put in simple language: must this have been something he has eaten? She seemed to say yes, I was wondering if you agree with that?
A. I think that is the likelihood, it was something that had been eaten, yes.
Q. Yes.
Then in question 8 you see what she is saying about the limitations of her work, material from sempervirens had been ingested, we didn't find any evidence of this. She is not excluding it, she is just saying we didn't find it?
A. Correct, yes.

Q. Then we asked for details about gelsemium having been suspected of being used in homicide, and she gives details about that. She also says that it is correct that the most recent reports of the use of gelsemium in Russian and Chinese homicide have referred to elegans rather than sempervirens.
Then at 12:
"Could the compounds be detected from the sample of Mr Perepilichnyy's stomach contents have come from species of gelsemium other than gelsemium sempervirens such as elegans?
"Yes, this is an option that could be considered, especially saying that elegans is a known toxic plant."
Just for the coroner's chronology and understanding the background to this case, this was all discussed on I think 17 May at a PIR at which the press attended and the contents of Dr Simmonds's report was discussed by the various counsel and was reported by the press. That helps you to understand how that reporting may have arisen. I am just mentioning that to help the coroner with the chronology.
Broadly you agree with that, there was more work to do looking at elegans and sempervirens different parts of the plants. She said she thought there was more work to do and indeed more work was done?

A. Indeed, yes.
Q. We then go forward from May 2015 when these answers were given, the Inquest was adjourned, not the time now to discuss why but it was adjourned and went off I think until, well, ultimately a series of adjournments until today.
Then in the autumn, late autumn -- there having been apparent difficulties with the equipment to do with circuit boards -- those promised tests were done and we have seen what has happened with those numerous thumbnails involving both elegans and sempervirens and different parts of both those plants. If we could just very briefly go back and look at those and then we can move on, we need for that to go to 261 I think. Yes.
A. Yes.
Q. This is Dr Kite I think putting forward what he considered I think to be the most relevant of the results. He has as the marker at the top 6.90, 359.1965 then one substance eluting at 11.89, 359.1977. It is not five points per million off, it is 12 points per million off what was found in the stomach and more than that, 15 or 20 points off what was attributed to gelsemium in 2013. It is not just the elution time, it is the accurate mass is way off?
A. Correct, yes.

Q. Yes. What may be a different substance also found in the root of elegans at 12.77, again 359.1979, way off what was assumed to be gelsemicine back in 2013.
Then we have against letter (f) two substances eluting, one at 8.97 and one at 13.34, 359.1980 and 359.1981, so from the accurate mass they look to be associated but they are eluting at very different times. We have got two more compounds there, have we not?
Yes.
I think if we can summarise the position as at late 2015 --
THE CORONER: Sorry, are you happy with all of that?
A. Yes, I accept all of that, yes.
MR MOXON BROWNE: I think the position at the end of 2015 is that having made a good trawl of what you can get out of both elegans and sempervirens, and from different parts of the plant, no match was found, even a remote match, with what was found in Alexander's stomach?
A. Correct.
Q. Nor was anything found that remotely matched what was found in the sempervirens root in 2013?
A. I just need to check I have understood your second point.
Q. Yes.
A. Is your point that the compounds picked up in the initial analysis are different from the compounds picked up in the later analysis?
Q. Yes, if you look at the thumbnail on page 258, you can see -- the coroner can make up his own mind whether that is comprehensive or whether it is just a selection -- at all events there is nothing there that seems to have anything to do with what was found in the root bark in 2013, that I can see.
A. I would rather not comment at this time about that without considering it more carefully.
Q. Okay, well we will move on from there.
So far --
THE CORONER: Can you just explain why --
A. Because we have this chronology difficulty, and I need to understand how they actually match their peaks. I just don't want to take this point too far based on what I have seen.
MR MOXON BROWNE: I want to just put to you in summary, if you can comment -- if you don't feel you can comment please say -- that by the time the tests had been completed in 2015, looking back at the results from 2013, when we had an identified substance that had been extracted from Alexander's stomach, from the viewpoint of late 2015, instead of having just one unidentified substance with a 359.1965 weight, we have five.

A. I agree with you on that point.
Q. What they are and what they have or don't have to do with gelsemicine is not something that you or I think probably Professor Simmonds can be very confident about?
A. Sorry, did you say what they have --
Q. What they have to do is gelsemicine?
A. We don't know which if any of them may be gelsemicine.
Q. No.
That is about what the possibilities are. I now want to just explore with you, and then we can stop, whether there is any evidence that it is actually probable that the unidentified substance is connected with gelsemium. I want you to help with that.
A. Yes.
Q. Because if the theory is this probability is wrong, we need to know. Do you understand?
For that purpose I would like to look at the work that was done comparatively recently by Dr Kite when he retested the stomach contents. For that I would like to look, please, at the test in 2016. We need to look at that in the second of the expert's bundles and we have to move to another bundle. Expert's bundle 2 at page 368. I will get rid of that.
A. I have bundle 2, which tab did you say?
Q. I don't have tabs but I have a page number which is 68.

I am told it is tab 49.
How Lucas can tell that by looking at a computer I don't know.
368, I hope is that right.
Would you excuse me a moment, sir, I am just trying to find where I am. Yes, I am on the right page, that is good.
What is done quite recently in 2016 is that very kindly the Kew people went back and did a fresh test on the stomach contents. The first thing is that they found a substance in that second test which was, I am going to suggest, pretty obviously the same thing that they had found in 2013. We see that on page, I think, 369, it is above figure 4 and it is the second spectra down, the second data down, which shows a peak emerging at 6.39, 359.1960.
A. Yes.
Q. We are off a little bit on the elution time, we can easily put that down to drift, that is not a problem in saying it is the same given the passage of time and so on.
We are a little bit off on the accurate mass but we are well within five parts per million, and so the conclusion of Dr Kite was that that is the same thing. I think you would agree with that?

A. That is reasonable, yes.
Q. Reasonable. That tells us that there is something there, it is still sitting there, after all those years, saying, "What am I? I haven't gone away". And he found it again.
This time he was able, at the request of the coroner, to look at matters in a little more detail. The first thing he did was to give us data for the I think accurate mass of -- sorry, he subjected it to electronic collision energy and got a major fragment?
A. He conducted tandem MS/MS, he fragmented the molecule and then obtained an accurate mass on the 180, that previously he just put as 180.
Q. Yes, but this time he was able to weigh it --
A. More accurately.
Q. We see on page 368 that he gets 180.1020.
368 at the top, 180.1020, which I understand to be -- he says above that:
"The accurate mass of the fragment was measured at M/Z 180.1020."
That is new information, he hadn't done that in 2013.
A. I hesitate because I was looking on the subsequent page, when it is 180.1016.
Q. We will come to that. I think we will find that is

different. Coincidentally similar but a different beast.
I just want to concentrate on the size of the fragment. It produces a fragment at 180.1020, new information which we hadn't had before.
Now we look and see what happened when the substances were eluting. We see on the table above figure 4 that you get the ion 359.1960, but at the same time, eluting at the same moment, that is 6.39, you get an ion 180.1016. It is that coelution that has encouraged Dr Kite to say what we could be looking at here is dimerisation, it is the coelution of 180.1016 and 359.1960 which says what we could be looking at here is a cluster. Right?
A. Sorry, were you saying that is what led him to the conclusion?
Q. Think it is not the only thing I think but it encouraged him to conclude that we might be looking at a cluster, that he has coelution of an ion which if doubled will give you the right answer.
A. Sorry, I am not clear about the logic at the moment. I have a chromatographic peak and I think the question being asked is, is it 179 plus 1 or is it double that amount plus 1.
Q. No. What I am drawing your attention to is the fact

that when the stomach contents were tested again in 2016, our friend from 2013 popped out again and we see that at 6.39 minutes?
A. Yes.
Q. It is 359.1960.
At the same time as that popped out, eluted, we got an ion of 180.1016, we see that above. That is called coelution, because it happens at the same moment?
A. It may be a question of terminology. We would normally say coelution if two different compounds come out at exactly the same time. The signal is actually concurrent, which leads us to believe it is coming from the same chemical compound.
Q. Yes, and then he has given us information as well on this table that also at 6.39 something came out that weighed 360.1996.
A. Thank you.
Q. There is quite a lot happening at 6.39 minutes. You have three different things happening?
A. That is the power of mass spectrometry; you see a lot of information.
Q. Yes, what I want to ask you is anybody looking at this would, I suggest, be struck by the similarity between the accurate mass of the fragment the major fragment that was found from Alexander's stomach contents in

2013, let's say 180.1020 and the elution of an ion at 6.39 of 180.1016, they are within four parts per million. There would seem to be a connection between the two?

A. Yes, indeed, yes.

Q. Can you explain what that is or is it just a coincidence?

A. I would two possibilities.

There is a remote possibility that two different compounds come out at exactly the same time or more likely than not it is just one compound that comes out at that time and its mass spectrum contains both the whole molecule and fragments.

The other proposition being put here is that we are seeing a dimeric peak point, with two molecules put together, so 179 plus H is the 180 and then two by 179 plus H is the 359.

Q. Can we just look at the first of those?

A. Yes.

Q. I think you were saying, if I followed, that what might have been happening at 6.39 minutes is that you get the ion 359.1960 and at the same time a fragment comes out?

A. Yes, but what is going through the liquid chromatograph is a compound, it is not the monomer or the dimer, it has to be the dimer if it is a dimer or that bigger

molecule if that is the case.

Q. Can a compound such as 359.1965 fragment inside the body, in other words can it metabolise so as to produce a fragment?

A. When a compound metabolises, then more often than not you put an oxygen on the molecule, it gets a bit bigger, sorry, I will speak up.

When a compound is metabolised by the body, more often than not you get components attached to it like an oxygen in particular or sometimes a sugar. You can get groups taken off from the compound, particularly -- I am trying not to be too technical in my response. Sometimes the molecule will break up into parts, that's correct, it is a possibility that that will occur.

Q. I am just going to pause you there and remind you of some of the evidence from Dr Kite. We were talking about why there didn't seem to be any evidence that sorrel had been recovered from the various samples that were analysed from the contents of Mr Perepilichnyy's digestive tract. If I understood him correctly he was saying that he thought they would fragment or metabolise in the body so that they would be difficult to recognise. That indicated to me that this process of fragmentation, which can be induced by electrical energy, can also happen naturally?

A. They are very different process that are going on.

Q. But they have the same result?

A. Insofar as being able to see it or not see it, I guess one could say it is the same or similar, but to take a compound and -- if your thesis is, could the peak at 180 be a metabolite? I would say I don't see any evidence for that.

Q. No. No, I haven't got a thesis, I am just trying to understand.

A. Okay.

Q. It could be but you don't have any evidence for that?

A. We don't know what this peak is at 6.9 minutes.

Q. If it isn't a metabolite, what is the other explanation for it being so similar to the fragment?

A. Well, the assumption, or one assumption, is it is a dietary constituent that we don't know what it is, something that he has eaten at some time, either knowingly or unknowingly.

Q. Just to complete the picture, I think we are left with what looks like a coincidence between the size of the fragment and the size of the ion that eluted, for which might be explanations which are technical.

A. Yes.

Q. I just want to put a third step into it, which might be presented to put another coincidence. I want to take

you to the Nardin paper which I think we looked at and when we have done that we are nearly finished. We will find that in the third I think of the experts' core bundles at page 715.

715 will enable us to ascertain that this is from the Journal of Mass Spectrometry, which is a peer reviewed and very well-regarded journal. I am told it is in bundle 2, so I have misled you. Anyway, it is page 715 in the top right-hand corner.

THE CORONER: Do you have that? It is divider 87.

MR MOXON BROWNE: I know you had to do an awful lot of work in a very short space of time, did you have an opportunity to glance at this article?

A. I have looked at this paper.

Q. Did you read it?

A. I beg your pardon?

Q. Did you read it? I know you were provided with it, I wondered whether you had a chance to read it?

A. I did review it a while ago now.

Q. We will take the questions slowly.

Looking at the title on page 715, we see they are using high resolution mass spectrometry orbitrap. I have certainly heard the word "orbitrap" used in context with the work done at Kew, is this comparable?

A. It is comparable. The orbitrap is a high resolution

mass spectrometer, one capable of getting these elemental compositions.

Q. I think we were told by Dr Kite that the collision energy used to produce fragments by Nardin and her colleagues was different from that used at Kew. Can you help with that?

A. I think it was not just the energy, it is the way the molecule is caused to fragment. There are two main approaches.

One is to collide the molecule into inert gas, typically nitrogen.

The other method is to resonate the species, the ion, in with a lighter gas. One is a more gentle but slower process and that gives rise to very different MS/MS data.

Q. I fully appreciate that and I don't want to take any false points or in what is already quite a complicated case to take any points that are not right. It is a different method used and I think I am right in suggesting, but please confirm, that the method of collision energy used by the Italians is rougher, it produces more fragments than the method used at Kew?

I think the difference between the two, I can give you the labels, is --

A. I do not recall which is the more energetic of the two.

Q. Anyway, there is a difference --

A. There is a difference certainly, but I am not sure which is which.

Q. The short point, just so if it is irrelevant we can get it out of the way, we see on page 721.

A. Yes.

Q. Where we have thumbnail for various plants that Nardin and her colleagues were looking at. One of those was gelsemium. I don't know whether, when you glanced at the article, you appreciated that gelsemium was one of the plants they were looking at?

A. I had appreciated that, yes.

Q. You had appreciated that?

A. Yes.

Q. They extracted from the gelsemium -- it was an elegans plant, what it was doing growing in Italy I don't know but it was an elegans plant I think. They got a substance from it called gelsempervine. We see from page 721 there are two different types of gelsempervine, one AC and one BD. Would you like to look at that?

A. I am just looking for a better copy than I have.

Q. Yes, I am struggling a bit.

Down the bottom there, first of all can I respectfully tell you or remind you, you can check this later, that the formula for gelsempervine is almost

identical to that for gelsemicine, it is instead of being C20H26, it is C22, so there are two extra carbon atoms. I do not minimise the importance of that but it is a very similar formula, they are clearly closely associated?

A. Yes, that is very common for that to happen.

Q. Yes. It is, if we can just pause for a moment, I think you call them the radicals, it is the N and the O which is what wags the dog, there are a number of carbon atoms. The number of carbon atoms and the number of hydrogen atoms can vary but what really differentiates these substances is the radicals, the oxygen and the nitrogen?

A. I don't follow.

Q. A lot of these chemicals, these alkaloids, have very similar formulae. I am suggesting to you that what actually differentiates the substances importantly, is not so much the number of carbon atoms, the number of hydrogen atoms, which can vary, the really important thing -- I called it the tail that wags the dog -- is the number of oxygen and the number of nitrogen atoms, they are the ones that really do the work?

A. Not necessarily just that. It is the structure of the molecules that differentiate them.

Q. Yes, well, I am sure that is right.

Anyway it is a similar formula. The simple point I wanted to draw your attention to is when subjected to collision energy of the type that the Italians were using, which differed as I understand it from the method used at Kew, but when subjected to collision energy the major fragment was produced at 180.10 -- so difficult to read, 180.1011 in one case and 180.10 -- what is the another one? Anyway --

A. 1009 and 1011.

Q. What we have is a fragment pattern that seems to closely match both the fragmentation pattern that was observed when the ion recovered from Alexander's stomach was subjected to collision energy and the ion which coeluted with the C20H26 in 2016.

This seems to be a third coincidence, that we have within a matter of parts per million, we have a fragment which is virtually the same as that which was observed at Kew. I was just wondering whether now we don't have three coincidences and what the explanation for that might be?

A. Let me check that I have understood your point. Are you saying that because there is an ion at 180.something, that could be the same as the peak at 6.9?

Q. No.

A. You are not saying that?

Q. No, I am not. I am saying that the peak at 6.9, when fragmented, produced as you recall --
A. 180 amongst other things.
Q. 180.1020, I am say that this closely related substance found by the Italians in a gelsemium plant, when that was subject to collision energy it produced a fragment which was virtually the same?
A. Yes, that is what I was suggesting.
Q. Both of those are also within a few parts per million of the substance that coeluted in 2016?
A. Yes, but we know that Kew did not find that when they looked at the various gelsemium species. I think it is generally common ground that there are many combinations for that elemental composition or that accurate mass. At this time it is my opinion that I do not know what that peak at 6.9 -- what the compound is.
Q. The proposition I am putting to you is not very complicated and it may well be wrong, we are looking for your help as to if it is irrelevant we can get rid of it.
A. Sure.
Q. It seems that substances closely from gelsemium, closely allied to gelsemicine and its isomers, when subjected to collision energy will produce fragments almost identical to the fragment that was produced when Alexander's

stomach contents were subjected. I am asking you whether you think that is just a coincidence or whether the simplest explanation is that all these three things are linked and they are linked to gelsemium?
A. I think looking at the MS/MS data in isolation does not tell us exactly what the compound is --
Q. No.
A. -- you have to work the other way round.
Q. If I can put it in this way. The coroner will be considering whether there is a possibility that the substance found in Alexander's stomach was something to do with gelsemium.
He may also in that, as part of that exercise, be interested in whether there was any evidence that points, there is obviously -- well, he may conclude there is that possibility --
A. Yes.
Q. -- but he may be interested in the question of whether there is something that positively indicates that. What I want to get your help on is whether this triple coincidence is something that helps us to say not that it is proved, shown or certain but that it is something that looks odd and requires explanation, which I don't think you are giving us?
A. I would say it is more likely than not to be

a coincidence, but if I was doing the work myself I would look at this and exclude it as a possibility to the best of my ability.
Q. Yes, and that hasn't happened, plainly?
A. That has not happened.
THE CORONER: Why do you say more likely than not coincidence?
A. Because you are going to get plenty of examples of where you can get MS/MS data that look similar but not identical. For me to get a reliable result, I would wish to do some contemporaneous experiments. I run my unknown sample, I run my standards in the same day or experiment if possible.
If I have to rely on my own equipment with a big difference in time, I would need to take some steps to get coincidence on the data again. That is not the accurate mass because, as Dr Kite has pointed out, you can calibrate the mass very accurately across time and between instruments.
If I cannot get the same material, I might use a reference collection, which is exactly what Kew has done, compare with standards.
It does not I should say exclude the possibility that someone has manipulated a compound to increase the amount of one compound or another and then administered

it.
MR MOXON BROWNE: I think finally this, if Dr Kite is correct, that the ion C20H27N2O4 is in fact a cluster, then we are looking at trying -- it may be relevant to try to identify what the components of that cluster are. We know what the formula would be, but as you pointed out, there are numerous substances that answer that formula.
Am I right that by feeding in the accurate mass rather than the formula into a computer, you could narrow down the range of options very quickly?
A. No, that is not correct. I think you may have misunderstood that this elemental composition has a theoretical mass. The instrument then will measure an accurate mass and within a certain tolerance, typically five parts per million, you can work out what are the possible elemental compositions that would fit that number.
If I put in elemental composition then that is actually more precise than if I put in my measured accurate mass. It is better to put in elemental composition than to put the number into the computer.
Q. There are, are there not, database which list the accurate masses in order of closeness to the figure that you feed in, tell you, "This is the same, this is almost

the same"?
A. That is a slight complication in terminology, the exact mass is going to be the mass of that elemental composition. Accurate mass databases could be measured masses, which will have a bit more error to it.
Q. Yes.
A. I think you were putting to me that a better way of doing it was to put the number in, I was not accepting that.
Q. I was.
A. Yes.
Q. A question that was put to the toxicology experts, which they deferred to other experts, which is effectively I think for this purpose you, you might be able to help, is whether it is right that the compound, I think I am right to call it a compound, C10H13, half, could be a number of things which are commonly found in foodstuffs, one of them I think is maltoxazine, something like that, which is found in cereal, and another one called salsolinol, I think, which is found in chocolate. I think it is also the case that MDMA, ecstasy, matches although I want to say emphatically nobody is suggesting, least of all me, that Alexander was consuming ecstasy. I just mention that that is one of the possibilities.

I think it is right that the spectra for these common substances are easily obtainable, so if anybody thought well, it is probably maltoxazine, it could be, it would be the work of a minute to find out what the spectra look like. The Human Metabolome Database for example give it -- I think you were shown examples over night, I hope you were.
A. I would say that databases are useful to guide but for certainty one really needs to use reference material.
Q. "Reference material" was that?
A. Yes, you need to get hold of the substance and run that concurrently with the unknown.
Q. That has been one of the problems in this case. That, if I may say so, was pointed as long ago as 2014, that there is no certified reference for any of these isomers, you have to do it all empirically?
A. It is possible to purchase gelsemicine.
Q. Yes, but not the isomers?
A. Not all of the compounds, correct.
Q. That is the problem. All the time we can say I haven't found it, but nobody can say it is not there.
A. Not, certainly, to be able to say it is not there.
Q. No.
A. It is a possibility.
MR MOXON BROWNE: Thank you very much, Professor.

Questions from MR STRAW
MR STRAW: Professor, just two very short areas, please.
I think you mentioned earlier, you commented on the comparatively small amount of the unidentified ion discovered in the stomach sample. Is that right?
A. I don't recall saying that but I think it is a small amount, yes.
Q. Were you aware that Dr Ratcliffe who performed the first post mortem on 14 November disposed of the stomach contents and it was only --
A. Yes, I had read that.
Q. You were aware of that?
Flushed out the stomach and it was only when Dr Fegan-Earl came to do the forensic post mortem on 30 November that the samples of the stomach were actually taken. Were you aware of that?
A. Sorry, I missed the second bit of what you said.
Q. It was only when Dr Fegan-Earl came to do the forensic post mortem on 30 November that the stomach sample that we are looking at was taken?
A. No, I don't recall reading that. But ...
Q. Have you seen as well Professor Ferner's opinion that the gelsemium alkaloids in the samples may have been destroyed or converted while they were stored over the months before they were tested at Kew?

A. Unfortunately, no, I hadn't seen that.
Q. Is that something that falls within your expertise or is that something that is better left for Professor Ferner?
A. I couldn't comment about this alkaloid and its degradation.
Q. All right.
Finally, paragraph 43 of your report, you say:
"Without knowledge of the structure of the compound [we are still talking unidentified compound found in the stomach contents] it would not be possible to find out whether it is toxic."
Essentially, we cannot exclude this having been a toxic compound. Is that correct?
A. Correct.
Q. Okay.
MR STRAW: Okay, thank you very much.
Questions from MR COHEN
MR COHEN: I have a small number of questions for you, almost all on the topic of cluster molecules.
Just so I am clear on the terminology, you have remembered referred to "dimers", Dr Kite referred to "clusters". There is no difference though is there?
A. No, "dimer" is slightly more specific than a cluster. It simply means two molecules put together, a cluster could be one, two, three.

Q. And a "monomer" is one?
A. Is one.
Q. When you have dimers forming in the process of mass spectrometry, it is right, isn't it that not all of the ions will dimerise necessarily?
A. It is unlikely that they would all be dimers.
Q. In any run of the machine, you might detect both the dimer and the monomer at the same time?
A. Exactly that.
Q. The monomer we discussed with Dr Kite gets, for these purposes, the shorthand M+H+?
A. Just to add one point, that would be if the dimer is formed at the point of ionisation. For a monomer and a dimer to go through the liquid chromatograph at the same time is highly unlikely.
Q. I see. But the monomer is M+H+ and the dimer 2M+H+?
A. Yes.
Q. You were asked questions by my learned friend Mr Moxon Browne in which he asked whether it was a coincidence that the peak at 180 found in 2016 was very close to the peak in 2013. Do you recall those questions?
A. Yes. Yes.
Q. It is right, isn't it, that one explanation for that could be that on each occasion they were finding the

monomer and that the other peak at 359 was the dimer?
A. Let me just check I have understood. That you have both the monomer and dimer going into the mass spectrometer, being analysed in the mass spectrometer?
Q. Yes.
A. Provided it was formed in the ion source, yes.
Q. Yes.
The final question is that Mr Moxon Browne asked you about the reasons why Dr Kite had concluded that this was likely to be a cluster?
A. Yes.
Q. And told you, I am sure inadvertently, that there was no suggestion that they had coeluted in 2013. Do you remember that?
A. I remember commenting about the word "coelution".
Q. No data in 2013?
A. Yes. Yes.
Q. If we look in volume 3 of the expert bundle, page 831, which I think is probably at tab 95.
A. Which tab?
Q. I think it is 95, 831.
A. Yes.
Q. This is the answer to questions put to them by Dr Kite and Professor Simmonds.
Question 25, if I read you a passage they note:

"In the analysis performed in May 2013, low resolution scanning between M/Z 125 and 2000 was recorded in the same analysis as the high resolution scanning and explains ..."
I am looking at the wrong question, I mean question 23.
MR MOXON BROWNE: No. It isn't 23.
MR COHEN: Sorry, yes, question 25:
"The low resolution data showed that in the analysis performed on AWF 32 in May 2013, M/Z 180 exactly coeluted with M/Z 359 at 6.88 minutes max peak height."
So the point is that although you may not have seen the data, Dr Kite and Professor Simmonds report that actually they did witness coelution in 2013?
A. Yes.
Q. You would agree with me that that would be another point that would lend credence to their view that this was a cluster?
A. This would be dimerisation in the ion source, not at the point of injection.
Q. Indeed.
A. Would fit that hypothesis.
Q. You agree it is another point in favour of their answers on the likelihood or otherwise of it being a cluster?
A. I can see their reasoning --

Q. Yes.
A. -- it does not persuade me to say certainly that is the right conclusion.
Q. I understand.
A. Yes.
Q. You agree that this would be another point in favour of that reasoning, that is the simple question?
A. I agree with that.
MR COHEN: Yes, thank you.
MR SKELTON: Sir, unless you have any questions, that concludes Professor Cowan.
THE CORONER: Thank you very much.
A. May I be released, sir?
THE CORONER: Yes, of course.
A. Thank you.
MR SKELTON: Sir, the next witness is Professor Simmonds.
PROFESSOR MONIQUE SIMMONDS (sworn)
Questions from MR SKELTON
MR SKELTON: Professor Simmonds, thank you, will you state your full name, please?
A. Monique Sheelagh Jacquard Simmonds.
Q. Your position at Kew is what?
A. I am the deputy director of science with responsibility for some of the aspects of the uses of plants, the chemistry and associated toxic features of plants.

Q. How long have you been at Kew?
A. I have been at Kew since 1985.
Q. What is your chair in?
A. My chair is in biological interactions, which is to do with the interactions between plants and animals.
Q. Can I ask you how often you have had occasion to address the kind of issues that you have been asked to address in this particular case?
A. Quite often. By that I mean once every few years asked to provide some information about toxicity that might be involved in a trial or a police case.
Q. On a few occasions you have cause --
A. Yes.
Q. There are a number of documents before the court. I will not read them all out but you are familiar with them, they are in the bundles and you will have seen them many times.
Dr Kite performed the analyses for the most part in your laboratory?
A. Yes, he did.
Q. Why did he do those?
A. When we started the work I was in charge of a group that would be looking at the chemistry of any form of inquiry that would come into Kew. I had a series of experts on different areas and Geoff Kite was an expert on mass

spectrometry.
Q. What are you an expert on that he is not an expert on?
A. I am more an expert on the kind of historical uses of the plants, the general chemistry. I am not an expert on mass spectrometry; that is his expertise.
Q. Just leaving aside the mass spectrometry for a moment, what specifically in terms of expertise do you bring to bear on the analysis of Mr Perepilichnyy's case which Dr Kite hasn't brought to bear?
A. I think my general expertise in this area would be looking at which plants should we be looking at that potentially could contain toxins. Therefore what are the types of compounds that we would be looking for, if we were going to undertake an extract which is important in the fact that which method might we use, do we therefore use mass spectrometry or do we use another method.
Q. Such as?
A. It might be that we use gas chromatography, which could have been another person in the team, or it could have been NMR, nuclear magnetic resonance, which again would have been another person in the team that would have undertaken that.
Q. Or DNA testing, presumably?
A. Pardon?

Q. Or DNA testing?
A. DNA testing -- right, when we started the project in 2013 we could have been undertaking some DNA, but really you do need to know what you are looking for. Within a, if you are talking about a gut context, it is often the chemistry that is the indicator, but yes, we could have done DNA.
Q. You can not search blind for DNA?
A. It is very complex to do that, yes.
Q. Could you just clarify, while we are on the subject of that, what you are presently testing and if you are able to, although I don't want to put you on the spot, when you are likely to have a result for us?
A. We have been asked now to look at some of the stomach contents and material from Reading University, bits of plant material that were isolated, to look at the DNA. We are now using the new forms of DNA next sequence generation, and we are hoping that we will get some results in possibly a fortnight. I am hoping by the end of next week we have an understanding on whether we have enough DNA to be able to undertake analysis or not.
Q. What are you looking for in that sample. Do you have to target it -- sorrel has been a plant extract that has been of particular significance in the context of this Inquest, because it is alleged to be one of the items

that was put in the soup that Mr Perepilichnyy consumed. Will you be able to look for sorrel for starters or other things?
A. I am afraid the simple question that we need to ask at the beginning is: do we identify plant DNA from all the human and the bacterial material DNA that will be in the contents?
From that we will then go on to look at the potential for identifying the sorrel and then expand it from there.
Q. Thank you.
You mentioned other types of testing. In this particular case -- I don't want to jump too far ahead -- why did you go down the mass spectrometry route and not the other two types of testing that you mentioned?
A. Because of the types of compounds that we are looking at, the liquid chromatography mass spec would most likely be the appropriate route to go, it would be able to get an ion profile out of that that we would most likely be able to match to a compound. It is a method that we have used quite successfully in this type of analysis.
Q. When you say type of compound, do you mean a toxic alkaloid?
A. An alkaloid or it could have been a diterpenoid, a range

of other compounds derived from plants that could be associated with toxicity.

Q. Thank you. You have been here all morning I think --

A. Yes.

Q. -- so you have heard Professor Cowan's evidence and I think you also will have read his report?

A. Yes.

Q. He identified the fact that as far as he was aware there are a huge number of compounds that exist, not just in theory but actually exist, that will have the same molecular form, either as the single molecule that has been described or identified by Dr Kite or the cluster ion that he has identified?

A. Yes.

Q. Do you accept that as a proposition?

A. If you are using a general chemistry database you will get much wider, yes, I do.

We deal mostly with the natural product database, which would give us a smaller number.

Q. Can you clarify what -- so the wider chemist will contain synthetics?

A. Synthetics, from not always -- yes, mainly synthetics, yes.

Q. What are natural products or what are in the natural products database?

really reflects, you know, the emphasis you could say on organic chemistry.

Q. You were directing your research towards products which have been identified as derived in the natural world from plants or from a narrow number of animal species?

A. Yes, we were really concentrating on plants.

Q. Yes. You cannot rule out a huge swathe of compounds that are synthetic within the outside world, because they could be man made by chemists?

Thank you. Could you explain the spectral library which I think is a term you used in your initial report. What is that?

A. Because we have been studying using mass spectrometry techniques for a number of years at Kew, we have built up a library of what we call spectra, of the profile of compounds in plants. Not all identified. Some are identified, so when we are interested in a particular compound, we will then go and isolate it, characterise it, get a structure for it and its associated mass. That would then be added to our library.

Because the fragmentation patterns vary quite a bit from machine to machine, these are not commercially available. The mass spectrometry library that we have developed is really specific to the equipment that we have at Kew.

A. Natural product database, you will find compounds from plants, from fungi, also from algae, from frogs.

Q. Frogs did you say?

A. Yes, frogs. Or snakes.

Q. The type of poisons that one might see on a --

A. Yes, it does contain poisons, as well as other compounds.

Q. What about the kind of chemicals or compounds one might find in the human body, the stomach, the gastric tract et cetera?

A. You could say they would be natural and therefore they would be in that database. I don't think they are all in that database. I think there are other database that would contain compounds associated with the human gut.

Q. And food --

A. Food, chemicals from things like cabbage, et cetera.

Q. For "natural foods"?

A. Natural foods, you will often find them in those databases, yes.

Q. If one compares the 4,000 to the much narrower number that one might find in the database, why is there such a huge difference between those two numbers?

A. I suppose because the -- there are a lot of organic chemists who are interested in, you know, producing compounds of a range of different masses. I presume it

Q. I see, so you would be comparing apples and pears if you start to look at other people's databases?

A. There are comparisons you could make, but for us when we are wanting quite quickly often to look at whether we have a known or unknown compound in a plant, we have set it up to match our equipment, we have set up the mass spectrometry library to meet our equipment.

There are shared patterns and they are published, that is why you publish your retention time, your fragmentations and information about the equipment that you have used and also the column type.

Q. Thank you.

Can I understand the thinking that went through your mind when you first did the started to initiate the testing. I think you identified five alkaloids associated with gelsemium, can you explain how you came to identify those?

A. Can I step back a stage?

Q. Please do.

A. We were asked to look if we could determine any potential toxins from the plants, without any indication what the plant would be, other than the fact that the activity, the potential toxins, could have occurred over a short period of time. We were looking therefore for a compound, potential toxin that possibly would act in

a short period of time, a few hours, and not would accumulate in body over, say, days, weeks.

Based on that information we put together a series, like a minor database of potential plants that we were aware of that contain toxins, which then contained gelsemium.

Q. Pausing there, plants which you at Kew were aware of or one is aware of in general?

A. That we are at Kew and therefore from the literature. We went through the toxicity literature that we have at Kew and then through some other databases, so we gathered that information about which plants and therefore which potential toxins were known, so we had an open mind when we started the analysis.

MR SKELTON: Thank you.

I will pause there, if I may, for lunch.

THE CORONER: Yes.

2.05.

(1.01 pm)

(The Luncheon Adjournment)

(2.15 pm)

MR SKELTON: Professor Simmonds, I think you were explaining before the lunch break how you started your investigation in terms of your thinking about what you were looking for and the references you looked at. Can

you take us back a step so we can get the context again, please.

A. When we were requested to look for some potential plants toxins, we did a review of those plants that might contain toxins that could act over a shorter period of time, based on our knowledge and the literature. As a result of that we put together a list of about 120 different plant-derived compounds, or ...

Q. Thank you. Your next stage was to?

A. We then ran these samples that were -- the next stage was to find out a little bit more about those, the molecular weight et cetera of those compounds from those plants and then if there was know mass spectral data to put in a little file together that would assist us for the analysis. That is partly the mass spectral library that we put together.

We then undertook an analysis of the samples that were sent to us for analysis.

Q. Yes, and that was your initial report?

A. That is the initial report.

Q. So Dr Kite did the LCMS analysis?

A. Yes, he did.

Q. And you produced a report which summarised the results?

A. Yes.

Q. Could you just explain. You tested what you had for the

stomach contents but were you aware at that stage of what you were testing, in terms of where the sample had come from or how reliable the sample itself was?

A. All we had at that stage was the information given to us that sample number and stomach or the various other parts that we were given no history about other than that it came from the deceased. So we were at that stage unaware that it was not the major stomach contents.

Q. Just for clarification, the evidence is that Dr Ratcliffe, the first pathologist who performed a post mortem, performed a non-forensic post mortem and flushed away the stomach contents initially and. You were given effectively what was left in the stomach after that?

A. We were unaware of that at the time.

Q. Can you explain what difference from your perspective it makes to the reliability and comprehensiveness of the results that you obtained?

A. Can I kind of refer back to other cases that we have looked at when we are dealing with toxins. The toxins are usually there present in quite high amounts. If we have homogenate from the stomach. The first run that we did, we realised that we were dealing with the chemistry was at very, very low level, there was no obvious peak associated with any of the compounds that we might

suspect to be in the stomach.

Q. Can you explain what you mean by an "obvious peak"?

A. Sometimes when you are running -- so you get an extract, you have no idea what the concentration is of that particular extract. Sometimes when you run an extract on the equipment you can overload it, so you get what might be termed kind of a just a large peak, maybe and flat top, because you cannot differentiate it. We didn't get anything like that, initially we just got, you could say, a lot of baseline, so we had to run more sensitive to be able to do the analysis.

Q. Are you qualified to give a view on whether or not the absence of the large peaks or consistent large peaks is significant when it comes to deciding whether or not Mr Perepilichnyy was poisoned?

A. I am just -- kind of assumptions here, because I am not a qualified toxicologist. But again in cases where we have looked at say toxins in horses or ponies, the level of the toxin has been quite apparent because if it is going to be absorbed from the guts, it would have to be there in reasonably high concentrations depending on its ability to be absorbed et cetera and the time taken for it to be absorbed.

Q. Going back to the issue of the stomach contents being thrown away, the fact that you were not testing the

major stomach contents may mean that that judgment cannot be made in this case?
A. Yes, we did not know that at that time.
Q. Does it mean you cannot form that judgment in this case?
A. We can't, no, because we were dealing with what would appear to be the remnants of what was in the stomach contents.
Q. You ran the data and obtained your MS/MS, your results?
A. Yes.
Q. You then used that data to go back to your library?
A. Yes, we ran it against the library and discounted a lot of peaks. We couldn't find any of the compounds that matched some of the other plants so gelseminine(?) was the only match that we so to speak potentially had, I just want to really emphasise "potential".
Q. Just again to understand the limits of what your library contains, the fact that you haven't found it in your library, what does that mean in terms of positing whether or not there may be a plant alkaloid out there which does match but you just don't know about it?
A. That is an absolute possibility. I mean our library search was quite extensive and of course we did make reference to the national product library, once we had a mass spec, to see if it met anything in the Natural Product Library.

Q. Is the Natural Product Library a constantly evolving entity?
A. Yes, it is. As soon as scientists have found other natural product, chemists and they published then the producers of the Natural Product Library will be going through the literature and adding that data to the database.
Q. Again, hypothetically might it be the case that the compound you did find will be identified at some point in the future as a natural product?
A. If it is plant derived.
Q. Potentially it could be identified as a synthetic product some time in the future based on the further research into those forms of compound?
A. Yes.
Q. You identified I think that there were five alkaloids associated with gelsemium and you mentioned those, or Dr Kite mentions them in his report at page 231 and then specifies them later in answers to some questions in December 2014. Is that correct?
A. Yes.
Q. Just looking at those alkaloids, can I take you to the answers on under tab 43 at page 245, please.
A. Tab 43?
Q. Bundle 1.

A. 245, yes.
Q. Having previously mentioned that there were these alkaloids, then I think in answer to questions their identity was made clear. Are these the ones you were talking about as being associated with gelsemium?
A. Yes.
Q. Based on what did you take the view that gelsemicine is the predominant alkaloid associated with human toxicity?
A. From information in the literature.
Q. Is it conceivable that that is not correct?
A. Yes. But it is based on what is currently known.
Q. Mr Moxon Browne put questions earlier on the premise that there may well be alkaloids associated with gelsemium which haven't yet been identified. I think that is something which you have said yourself; is that correct?
A. Yes.
Q. Can one hypothesise about the potential toxicity of alkaloids that have not been identified?
A. No.
Q. So it may in fact be the case that it does contain some form of toxic alkaloid, not gelsemicine, which as yet the academic studies have not identified?
A. Or other alkaloids with no toxicity.
Q. Yes.

When you get a toxic plant, do you tend to get a multiplicity of toxic alkaloids or is there usually one that predominates?
A. There is often one that is a predominant one, but you do get an array of them that are part of the biosynthetic pathway, possibly to the most toxic.
Q. Just looking at the other four that are mentioned on page 246 after gelsemicine, is there literature on the toxicity of those? Or is there sort of literature by inference and --
A. Literature by inference. I am unaware of a comparative toxicology study.
Q. What we have is a positive literature associated with gelsemium, but it isn't clear that the others aren't in some way toxic? Is that a fair summary?
A. I think you need to have an expert on toxicology to answer that.
Q. Thank you.
To summarise your work that you then conducted, you then started to look at the gelsemium species?
A. Yes.
Q. You started off on the sempervirens and then tested the elegans as well?
A. Yes.
Q. There is another one, rankinii, I think?

A. Yes.
Q. First of all, is that possible to get hold of it?
A. Right, once we had identified, you know, that this is somewhere we needed to look a little bit further, we did look at the Kew collection of verified plant material. This is the herbarium collection.
The samples that we had of other species within the genus were poorly documented, so they were not fully verified. That is why we have really kept to two species of which we had multiple samples that we could use for the analysis.
Q. And is there a particular differentiation between the two that you do have when it comes to the presumed gelsemicine?
A. Until we started this work, I was not aware of a comparative study that would take the different parts of the plant and study its chemistry. When we started this comparative work, that was one of the first studies to be undertaken.
Q. What was the result?
A. The result is as presented in this report. We have not done an in depth study to characterise every compound, we are talking about working on dried herbarium samples, of which we have small amounts, so we take a few milligrams of plant material from the leaves, the bark

or other parts and then grind that up and make it into a solution for analysis.
If we want to do an exhaustive study, we would require a large amount of plant material, initially it would be fresh and then we would dry it under the appropriate conditions. We did try -- that is one of the delays in the work -- to get living material from, say, China or from India but after many attempts, unfortunately we were not successful.
Q. How does the fact that you are using pre-dried material affect the reliability of the testing?
A. We know that those compounds are stable from information in our literature but also from our knowledge of dealing with alkaloids. That these are quite stable over time in dried --
Q. When you say "these are", how do you know --
A. The main compounds that we suspect, based on their molecular weight, mass in the mass spectrometry data, that we are dealing with, the information on those compounds is that they are stable.
Q. What about the -- I mean are there known unknowns? Could there be alkaloids in the gelsemium which would show up positively and quite strongly on mass spectrometry but which, because it has gone through degradation --

A. We have no knowledge of that because we were unable to compare living material with dried.
Q. Based on your knowledge of other plants and how the fresh material compares to the dried material, is that a hypothesis which is possible?
A. With our knowledge of alkaloids, they are pretty stable compounds if dried correctly in herbarium samples. That is why when we do this, we can undertake this type of study on dried herbarium samples, so they are usually very stable.
Q. Are you therefore saying that actually you are quite confident that you have the principal alkaloids of gelsemium within the testing you did?
A. Yes.
Q. You tested the different parts of the plant for clarification as well, as we will come on to see in the table. That is presumably because different parts may have different alkaloids?
A. That's right, and different layer concentrations, yes.
Q. Were you looking at any particular part of the plant in gelsemium particular or --
A. Traditionally it has been the bark of the plant that has been used, so we did concentrate on that.
Q. That is what the literature says?
A. That is what the literature says, yes.

Q. You had some samples and you obtained other samples. You then ran I think 17 samples in total -- there was some confusion at one point about the number.
A. Yes, because there were sub samples of some.
Q. One doesn't need to dwell on that, I don't think.
Then you found, as we have seen, the four isomers.
A. Yes.
Q. If I can take you to the table which has been the focus of quite a lot of attention during the course of this Inquest, it is on page 276 which is right at the back of 246.
Do you have that?
A. Yes.
Q. Can I just ask you first of all, there are four isomers here, isomer 4 says "Probably gelsemicine".
A. That's right.
Q. Could you explain how you have come to that view and how confident you are about it -- sorry, first of all I should ask, is that your view?
A. Yes, I mean I went through this data with Dr Kite and I came to the same conclusions as he did.
Q. Thank you.
How confident are you that the isomer 4 that has been isolated there, and then we can see the data, the MS/MS data et cetera there, is probably gelsemicine?

A. I would support the report as written.
Q. Why is it gelsemicine though?
A. It is probably -- we haven't -- it is a tentative identification, we cannot be 100 per cent sure because we did not have a standard to run at the same time.
Q. You cannot be 100 per --
A. Therefore that is why we have used "probably".
Q. I am trying to understand how you get to probably. Why of the various alkaloids that was isolated within the tests that you conducted on the 17 samples is that probably gelsemicine?
A. Partly it is from the mass spec data, the ions which are slightly different and the peak area, that the fact that that one is supposed to be the dominant one that occurs in the plant. The others are usually there in smaller amounts and that partly is seen by the column there on the peak area.
Q. Does the literature then demonstrate that gelsemicine is the predominant alkaloid, because I think you said it was the predominant toxic alkaloid but was it the dominant alkaloid? Or have you made a presumption there which may not necessarily be right?
A. I am just trying to go back in time looking at the literature.
It is the one that is reported most frequently and,

yes, it is associated with its toxicity.
What I am not sure about is whether people have just homed in on that particular alkaloid. I think it is the most abundant in the plant.
Q. Okay. It may be that really nailing that question is something that you have to do by looking again at the literature and I think that is probably beyond asking you to do live as it were in the witness box, but I think it may be an important point because as you appreciate Professor Cowan said well, looking at the tests we have done, I accept that the tests run by Dr Kite found isomers or compounds which are not the same as the one found in Mr Perepilichnyy's stomach.
You looked at gelsemium in two forms, you found various isomers and none of them matched satisfactorily the unknown compound found in Mr Perepilichnyy's stomach. He is prepared to go that far. Where he couldn't go is further down the plant biology element and I am trying to understand what you have brought to the mass spectrometry and it sounds like it is literature which we don't have in front of us today?
A. No, we don't have that in front of us, the comparative data from the literature that has been done in earlier studies.
Q. Okay.

I understand.
Without having that literature before us, is it possible for you to say beyond reasonable doubt that the compound found in Mr Perepilichnyy's stomach was not gelsemicine?
A. Based on the retention time and the mass spectrum fragmentation pattern, no, it is a different compound.
Q. If it is gelsemicine, then it is beyond reasonable doubt that what is found in the stomach is not gelsemicine?
A. From my interpretation of the data, yes.
Q. If it is not gelsemicine, whatever it is is not the same as what was found in the stomach?
A. Yes. Yes. It is a different compound.
Q. It is a different compound.
Can I just go back to the issue of what the compound is. It hasn't been identified. How common will you find a molecule based on MS/MS testing of plant material which you cannot identify?
A. A high proportion of the compounds, especially if you are dealing with an understudied plant, are not identified.
Q. When you go back to your data or go back to the dictionary, or database, you don't find it listed, it is new?
A. There might be something in the database that indicates

the same mass but it hasn't been confirmed that that is that compound in that particular plant because it hasn't been found in that plant before. What we would normally do is to hopefully isolate the compound and then confirm that it is, it matches for sure that particular compound in a plant.
Q. Are there instances where you go through that exercise and it doesn't bear fruit in terms of identification?
A. Yes. Many times we are only able to give tentative identifications. In many papers on natural product chemistry they are tentative.
Q. In this particular case, as I understand it from what Professor Cowan was saying, it is no longer going to be possible to reliably go back and retest the compound to try and work out what it is.
A. It doesn't match any of the compounds that we have available to us. When we gave the first report, we were wondering if somebody who is an expert on the chemistry of the stomach might be able to analyse it and identify it from our data.
Q. It could be a form of digestive compound?
A. It could be, yes. That is not our expertise.
MR SKELTON: Thank you.

Questions from MR MOXON BROWNE

MR MOXON BROWNE: Professor Simmonds, I represent Legal & General, the insurance company.

Were you aware that in the spring of 2013 there is evidence before the coroner that it was the intention of Surrey Police to send to you some samples of vegetable material from Mr Perepilichnyy's stomach, so that you could identify them -- were you aware of that plan?

A. We were aware that samples were going to be sent to us, yes.

Q. With the general objective of trying to find out what it was that Mr Perepilichnyy might have eaten on the day of his death?

A. Yes.

Q. The starting point for an inquiry --

A. Yes.

Q. -- you were supposed to help with that?

You are nodding, is that your understanding?

A. We knew that we were going to be -- a request was made for us if we could analyse some plant material from the gut contents.

Q. Yes. I think you were sent, with the original batch of material, a jar of a particular type of Russian or Ukrainian sorrel?

A. That's correct.

Q. Called ST/04 I think. You did have a look at that and I think you concluded, although short of certainty, that it did indeed contain sorrel as it said on the label?

A. It contained compounds that would be associated with sorrel. Yes.

Q. Did you understand why you had been asked to perform that function, why had you suddenly been sent this jar to look at?

A. From the information that we had been given, it was an indication that not that particular jar but sorrel had been used in a meal that the deceased had taken.

Q. Yes. As you understood it, the purpose of sending you this jar was to advance an inquiry as to what Mr Perepilichnyy might have had for lunch?

A. Yes. To see if we could find that in the stomach. Yes.

Q. Yes. You I think did analyse the jar of sorrel and you have told us that you found compounds in there that were not exclusively indicative of sorrel but certainly consistent with sorrel?

A. Yes.

Q. I think it is the case that sorrel has an acrid, peppery taste, it has been described, it is probably associated with quercetin, which is basically tannin, I think?

A. With quercetin, yes.

Q. Quercetin is basically tannin; is that correct?

A. I would be reluctant to say. Tannin is a very, very widely used term. I wouldn't link those two directly together.

Q. Let's stick with quercetin, quercetin I think is commonly found in all kinds of foodstuffs but there is a particular type of quercetin which is something something glycoside which is, again, not exclusively connected with sorrel but is something approaching a marker?

A. It is found in sorrel. I would be reluctant to say it is a marker because it occurs in other plant material.

Q. That I appreciate.

It was in fact the presence of that particular form of quercetin in the jar that persuaded you with a reasonable degree of confidence that that was indeed sorrel?

A. Yes.

Q. I think it is right that you didn't find, I am not going to call it a marker because you don't agree with that, but this indication, this indicative substance in the stomach contents?

A. Yes.

Q. Nor did you find it in any part of the digestive tract?

A. Yes.

Q. That's correct?

A. From memory, yes.

Q. Does that indicate that Mr Perepilichnyy had not eaten sorrel for lunch or does it indicate that what you were doing wasn't an appropriate way of finding that?

A. We had no idea how much had been used. And that would often indicate the sensitivity of the equipment, it would very much depend on how much had been consumed and when.

Q. Well the coroner has a certain amount of information which I would like to put to you.

The first is that when Dr Ratcliffe opened the stomach there was in the stomach partly digested food, so some of the food that he had apparently recently eaten was still in his stomach. That is the first point.

The second point is that people at Reading University had abstracted vegetable material from both the first part of the digestive tract and the second part. That would seem to indicate that what he had eaten, part of it was still in his stomach and part of it had begun to pass into his digestive tract. I think that the person who was involved with the lunch said that there was something like maybe 300 grams had gone in, quite a lot. I am just wondering whether you are saying that there is a possibility, or probability, that

within two, three, four hours of consumption of sorrel, all trace of it would have disappeared from his stomach, from his digestive tract and indeed from his blood?

A. I am afraid I don't know the retention time of quercetin, how long it would remain in the gut. Of course at that stage we did not know that we hadn't got say the main contents of the gut to look at.

Q. Yes. Mine is a slightly different question, which is whether if he had eaten quite a lot of sorrel for lunch, all trace of it would have disappeared within two or three hours?

A. No, you would have expected to have found some in the gut.

Q. I think that quite recently the vegetable material that was abstracted from the digestive tract that was supposed to have been sent to you was discovered and now has been sent to you and you are planning to use DNA techniques to see if you can identify it.

Just wondering, you now have, as far as I understand it, some small particles of solid vegetable material, that's right, which you are going to do the DNA testing on if you can.

A. Yes.

Q. Why can't you just use conventional gas chromatography mass spectrometry, you have the solid stuff, surely that

is enough?

A. I actually have not looked at the size of the sample, we would need a small amount. I believe it is very small, the amount that we have. We did discuss whether we did chemistry on it or we did the DNA and the decision was we would try the DNA.

Q. Yes. My understanding is that the GS/MS techniques are capable of detecting minute quantities of compounds.

A. Yes.

Q. Whereas for DNA, as you have said, you need something you can get a hold of. Why aren't you using that tried and tested technique?

A. Because a decision was made that we would go the DNA route and then, if there is any material left over, we could look at it for LCMS.

Q. I understand.

Is it possible that in that initial series of tests on the stomach contents on the upper and middle part of the upper digestive tract and on the blood, that the techniques you were using were simply not appropriate, limits of detection were not appropriate, for detecting even quite large quantities of vegetable material?

A. We have published frequently on the quercetin type of compounds, so it is a compound we have a lot of experience of working with. We would know that the

equipment is able to detect this group of compounds.

Q. Yes. Well, obviously we must await and will await the DNA testing but at the moment are you saying, without the benefit of that are you saying you think it is unlikely that sorrel formed part of his last meal?

A. I cannot make any comments than that, all I know is that samples we looked at did not contain the quercetin compounds that we would expect.

Q. I do understand, but I recollect that a few minutes ago you said that if he had consumed sorrel you would have expected to see it.

A. Yes. I can talk about the samples that we received, that we did the initial analysis on, which we now know were, you know, the stomach contents had already been removed, you could say, from that.

Q. Yes.

THE CORONER: Is there a certain level that your tests won't pick up?

A. Yes, there is a lower level of detection. I can't tell you exactly what that would be but yes.

MR MOXON BROWNE: Could I next take you to page 276 of bundle 1 of the experts, which is a table. I am having a little difficulty in understanding what this is and I would like you to help me.

I see down the left-hand side, my copy appears to

have been truncated but do we see tissue and then root bark, leaf, fruit wall, et cetera?

A. Yes, you have the BI number, then the species, then the tissue of the plant that was examined.

Q. You have the BI, the accession number which I haven't, I just have root bark ...

Then going across, do we have four lots of data in four columns, we don't read all the way across we go up and down up and down. Is that right?

A. Yes, four columns, isomer 1 and isomer 2, 3 and isomer --

Q. I am having a little difficulty in hearing and it is my fault. What did you say?

A. We have four columns.

Q. Right.

If we take the first one, root bark, what is the accession number there, it is not written on my bit of paper?

A. 25441.

Q. The second one, leaf?

A. 25499.

Q. And fruit wall?

A. 25499.

Q. And the root bark?

A. 25500.

Q. Yes, now where is the data for the root bark? Where am I supposed to look to see what you found in relation to that particular item?
A. If you go for root bark and go across there was nothing present associated with isomer 1.
Q. Why do you call that isomer 1?
A. We had to give them some --
Q. Is it marked anywhere on this chart that that is isomer 1?
A. On this chart?
Q. This chart that I am looking at, there is a lot of talk about isomer 4 and I couldn't find it.
THE CORONER: It says at the top.
MR SKELTON: Sir, a lot of the problems with this is Mr Moxon Browne's problems rather than the witnesses and I wonder if he ought to get another copy of the page.
We have passed it out before.
THE CORONER: I know, we are spending a lot of times establishing the differences between Mr Moxon Browne's copy and yours.
MR MOXON BROWNE: I am not sure it is entirely my fault.
THE CORONER: It would be less of your fault if you have exactly the same copy as she has.
MR MOXON BROWNE: It would. It would. I think someone is going to give me one.

Has no one got one I can borrow?
A. Do you have a ruler or a pen.
THE CORONER: So you can read across?
A. Yes, thank you.
THE CORONER: There will be.
A. Thank you very much.
MR MOXON BROWNE: Yes.
Where do you say on this chart is what you have presumed to be gelsemicine?
A. The one that we have put is probably is isomer 4, that last column.
Q. Yes. Is that 359.1977, 11.89? Is that 359.1977 --
THE CORONER: When you go further down I think it is, isn't it?
A. I think it is, yes.
MR MOXON BROWNE: Is that the one you are talking about?
A. Can you just take me through that again?
Q. Yes, I am wondering whether what you have identified as probably gelsemicine is from gelsemium sempervirens root bark with an accession number ending 491 with an accurate mass of 359.1977 and an elution time of 11.89, is that right?
A. Retention time, yes.
Q. We are agreed that what you think is gelsemicine eluted in your late 2015 tests between 11 and 12 minutes?

Correct?
A. The one that we have identified is probably that compound, yes.
Q. Yes, thank you.
I was looking for that information. Thank you very much.
Can we go back then to 2013. When you found an ion from Mr Perepilichnyy's stomach eluting at 6.90. You make the assertion which seems, if I may say so, obviously right that that cannot be the same as what you found in 2015 eluting between 11 and 12 minutes, because the elution time is so different.
A. Yes, it is very different, yes. On that particular run, yes.
Q. At the same time, and having discovered that what you had found in the stomach in point of accurate mass, that is to say 359.1965, the Dictionary of Natural Products told you seemed to be associated with gelsemium, you took a sample of root bark from gelsemium sempervirens --
A. Yes.
Q. -- and subjected that to analysis. That gave you I think four results, you heard Professor Cowan give evidence about this I expect, four peaks?
A. Yes.

Q. What do you think they were?
A. We are not 100 per cent sure because we did not spike them with any compounds, because we don't have any standards so they could be alkaloids from the plant, yes.
Q. They could be alkaloids from the root bark?
A. Yes.
Q. They have got exactly the same or pretty well the same accurate mass as gelsemicine but they cannot be gelsemicine, can they, because the elution time is completely wrong?
A. It is different from the run that we did on the previous data we were looking at, yes.
Q. I think we have all seen that. What I was putting to you was that because of that they cannot be gelsemicine?
A. I can't say that they can't be.
Q. No, but it doesn't look like it, does it?
A. I think what you need to do is to run those samples at the same time to be absolutely sure.
Q. Are you suggesting that your machine -- there could have been drift in point of elution time because it was done on a different occasion?
A. They were done on different occasions, yes.
Q. You cannot get drift, can you, of that kind for three, four, five minutes?

A. You do not usually get drift unless something has changed.
Q. It looks much more likely doesn't it that in 2013 you found some alkaloids in the root bark which had not previously been identified. Nothing particularly surprising in that?
A. We have no evidence that they were unknowns, because of the mass linking up with what was already in the literature, we took them as not being an unknown.
Q. The mass certainly answered --
A. Yes.
Q. -- but when you later came to have a detailed look, you couldn't find anything that even remotely matched what you had found in 2013, which is why I call them unknowns.
A. But I think if I could go back and somebody could give me the number of the sample that we looked at in 2013, we reran it in the later batch. I just don't have that data in front of me.
Q. Well I am afraid I didn't know that you had done that. You got that old one from 2013 and ran it again?
A. Yes, we ran it again.
Q. That is an interesting piece of information which I cannot help you with, but perhaps we can put that on the back burner for the moment.

A. That was a form of control.
Q. Yes, I understand.
What I am suggesting to you, the net result of what you did in 2013 was you started out with one unidentified ion which you have got from Mr Perepilichnyy's stomach and you ended up with five unidentified ions, including four that you got for some root bark because you were never able subsequently to retrieve anything like that from your gelsemium plants. It was a one off?
A. We did not replicate exactly the same traces as we did on the initial analysis.
Q. What I am putting to you is that the material that you obtained in 2015 bears no relationship, there is not even a suspect to match what you found in 2013. If there is, please tell me.
A. I would have to compare the two numbers, which I would need somebody to give me that to be able to just do it now but, yes, we often rerun a sample when we are looking at further analysis to just see if there is any drift, see if there are any differences.
Q. Yes, I think you wrote your report in two halves, one you wrote I think in June/July 2013, and then you wrote an addendum or an extra bit dated 28 August 2013. Do you remember that?

A. Yes.
Q. I just want to see how that addendum came about. Did you feel that you had adequately expressed the views you had come to in your first report? Did you feel there was any necessity to provide an addendum or did someone suggest it to you?
A. Somebody asked if we have any further information to add to the report.
Q. Yes. Can we just see how that evolved. Could Professor Simmonds be provided with bundle 5, volume 4. I call them the Hermitage documents but they are HOLMES documents really.
Thank you.
Professor, if you would be good enough to look at page, I think it was 1339.
This is an email from someone called Ray Fysh to you, dated 10 August 2013. If we just remind ourselves that is after you had written your report but before you produced the addendum.
A. Yes.
Q. Correct?
A. Yes.
Q. He is saying:
"Dear Professor Simmonds, a couple of things if I may. As you are aware we are just tidying up a few

loose ends for the senior investigating officer and the coroner and one of the aspects that DCI Pollard has requested is to clarify the situation with the unknown compound."
I think you had been having a series of exchanges with representatives of Surrey Police before this, do you remember that?
A. Yes.
Q. The first thing he says is:
"Would it be correct in reporting the following. Although the analysis of the stomach content but none of the other samples analysed gave a result that indicated the possible presence of a compound related to the plant alkaloid gelsemium. Further tests by analysing a control sample of gelsemium sempervirens conclusively showed that the compound was not related to gelsemium or any other known plant poison."
That is first proposition.
Then the second proposition is:
"Looking at the MS/MS with M/Z 180 [that is the major fragment from what you found] to what may turn out to be glycosidated material and it was therefore the compound minus the glycoside would have a molecular weight of 196, if it is a glycoside this I am afraid would invalidate the molecular form of C20H27N2O4."

Do you see that?
A. Yes.
Q. Do you remember getting those suggestions from Mr Fysh?
A. I can remember, yes, vaguely, getting them yes.
Q. As far as the first proposition is concerned, of course what your tests have done and showed pretty certainly was that the sample from the contents of Mr Perepilichnyy's stomach was not the same as what you extracted from a particular part, the root bark of a particular plant, ie one growing at Kew of a particular species which was gelsemium sempervirens. That was all you have ever said?
A. Yes.
Q. As I understand it, you couldn't say that it conclusively showed that the compound was not related to gelsemium, you were nowhere near that, were you?
A. We couldn't show that there was anything in that plant that was related to the stomach contents.
Q. No, quite. That was your conclusion. That didn't demonstrate, did it, that the compound wasn't related to gelsemium, it could have been related to all kinds of compounds from gelsemium, including that from the leaf, maybe from elegans, all kinds of things?
A. Our sample that we looked at at that time was the species identified here. We take it then, if one of the

toxins that was reported to be in that plant, then we could show that we had not found it.
Q. Yes, and you appreciate saying, "I haven't found it in the root bark of sempervirens" is not the same as saying, "The compound is not related to gelsemium", that a very different and much wider proposition?
A. Yes, but the comment here is a control sample, it is not saying that it is not the whole of the species, it does say a control sample we looked at.
Q. You did a control sample, you drew conclusions from that which I have put to you and I think which we all understand, which appeared in your report. I am simply saying that the proposition here that that showed that the compound was not related to gelsemium, to put it mildly, somewhat overstated the case?
A. Yes, I mean -- yes, we cannot fully say it was not related.
Q. No. Indeed you didn't put that in your report?
A. No.
Q. You didn't adopt the suggestion?
A. No.
Q. No. The second suggestion that the MS/MS points to what may turn out to be a glycosidated material and therefore minus the glycoside et cetera. You didn't adopt that either, did you?

A. No.
Q. Do you think that is wrong or have you no view?
A. I have no view.
Q. Thank you.
Can we then just briefly consider, we have nearly finished, the answer to the questions that were posed to you in December 2014 which you answered in May 2015. To look at those, we need to go in bundle 1. We can put away this 5.6 and go back into bundle 1 of the experts. It is at page 245.
Do you remember that document?
A. Yes.
Q. These came to you I think, or were certainly issued by the coroner on 15 December. You didn't answer them it would seem until May 2015. Can you remember why that was?
A. There was a delay in being able to do some of the analysis, et cetera. I think that was most likely why there was a delay there.
Q. I didn't hear the last bit, sorry.
A. We had equipment problems and I think that was why there was a delay.
Q. Yes. I think if I can help you Professor Simmonds that may account for the delay between May 2015 and October of 2015, when we have heard from Dr Kite that you had

equipment problems and everyone was waiting for the further tests, and indeed the whole Inquest was waiting and that took a long time. I am talking about the earlier period, between being given questions in 2014, December, and your answers in May. If you don't remember, it doesn't matter.
A. I can't remember for sure why there would be a delay on that.
Q. Were you told by for example the coroner's officer that the Inquest itself was due to start on 17 May I think?
A. There was a delay in us having that information. I think we had emails to that effect, that emails were definitely sent to us, we got those, but there was a period when I was unaware of the dates.
Q. You didn't know that the Inquest was due to start in May?
A. I did not know at the early stages.
Q. Very well.
These have been looked at but basically the questions were all directed, as I am sure you realised, in the same direction which was basically that in 2013 you had looked at the wrong species, you had looked at sempervirens whereas your best chance of finding isomers that might match what was found in the stomach was in elegans. I think you agreed with that.

A. We had two choices of plants to look at, we took the one that was most available to us at Kew.
Q. Yes.
A. And it was also reported to contain some of the compounds, as starting material.
Q. Obviously the coroner was very reluctant to adjourn the Inquest but you were really recommending, weren't you, that further tests be done on elegans?
A. We wanted to make sure that we had ruled out any potential toxins that might have been occurring, with the knowledge that these plants are not particularly well studied.
Q. Yes.
I think at question 12 on page 248:
"Could the compounds detected in the sample of Mr Perepilichnyy's stomach contents have come from a species of gelsemium other than gelsemium sempervirens such as elegans?"
You say:
"Yes, this is an option that could be considered ..."
Especially saying that elegans is a known toxin plant. You seem to be encouraging the idea of further tests?
A. I wouldn't say I was encouraging. We would want to do

an exhaustive study to rule things out, yes.
Q. Well you did do a thorough study in the late autumn of 2015, you didn't look at rankinii but you looked at elegans as well as sempervirens and you looked at different parts of the plant, as we have seen.
The net result of all of that was, as I have put to you, that you didn't find anything that matched what you had found in the root bark in 2013, and we have seen the thumbnails and you cannot find it.
A. We didn't repeat exactly the same trace as that we found in that initial study, the trace is not the same in 2015 as it was in 2013.
Q. Do you say you didn't repeat the trace? You didn't find the same trace but you did the same type of test on the same type of material, you used root bark from sempervirens, you used root bark from elegans and you used material from leaves and seeds but none of it looked anything like what you had found in 2013?
A. Material varies quite a bit in its chemical composition depending on which bit of the root you take. So it is highly unlikely you would get exactly the same profile from a trunk taking a sample there and taking a sample there. It will not be exactly the same.
Q. You are now aware, aren't you, you may not have been in 2013 but you are now aware that according to the

literature, gelsemicine is found in both sempervirens and elegans whereas the isomers, according to the literature, are only found in elegans?
A. From those studies, yes.
Q. The literature may not be accurate but that is what it suggests.
If that is right, if one adopts that as gospel, what we have from 2013 is not one unidentified peak but four identified peaks, that is what we are?
A. We have not given an accurate identification of the peaks, of the peak that we have identified, we give a tentative identification, is that what we term isomer 4.
Q. That is in 2016. I am still I am afraid in 2013.
A. We identified what could be one of the alkaloids in the earlier study. It is not -- this is, we never say that this is absolutely that compound.
Q. No, I know you don't. You have said that what eluted between 11 and 12 minutes in 2006 is what you identify as gelsemicine, it is not the same as what you found in 2013 and so we can perhaps put that, the possibility that any of those four is gelsemicine, perhaps we can put to one side. You still have four to account for, what are they?
A. We don't know what exactly they are.

Q. What it means is, isn't it, that you find all sorts of things in the roots and other parts of gelsemium and that you don't know what they are?
A. Yes, it is an understudied plant.
Q. That's an understatement, did you say?
A. It's an understudied plant.
MR MOXON BROWNE: Understudied, yes.
Yes, thank you very much.
Questions from MS HILL
MS HILL: Professor, I have a couple of questions on timing and then Mr Straw has a couple of other questions if that is all right.
Could I ask for Professor Simmonds to be given what I think we are calling the Branch correspondence bundle, please. It is page 60 please, of that bundle, Professor.
A. I do not have the bundle yet.
Q. You are being helped.
A. Page?
Q. Page 60. Numbering on the top right-hand side, please.
A. Yes.
Q. Just is to assist you, Professor, this is a bundle of correspondence that was provided by Dr Branch but some emails from you are in this correspondence. I just have a couple of questions about some dates if I may. Do you

see at the foot of page 60 an email from you of 14 May 2013 to the Surrey Police team, copied to Mr Fysh at Reading. Do you see that?
A. Yes.
Q. I think this is an email, isn't it, where you are alerting the team to the possibility of your finding of gelsemium. Is that right?
A. Yes, that is really at the initial stages when we have something, before we do the detailed analysis.
Q. That is my question, if I may. Could I just check this, that your email of 14 May indicated that you found something that you wanted to investigate further. Is that right?
A. Yes.
Q. Then if you scroll forward in the bundle, please, just to assist your memory and I am sure it is a little bit of time ago so it may be hard to remember otherwise, go forward, please, to page 103.
Do you see that on 21 June, on that date, I think Mr Craggs got in touch with you and asked you about your report and when your report might be ready?
A. Yes.
Q. Then we see your report I think at page 104, do you see that?
A. Yes.

Q. Although it is dated 13 June, it is no criticism of you, Professor, but if you go back please in the bundle to page 102, does it look rather like you provided that report on 13 July.
As I say it is not a criticism, it is just a statement of fact, if you look at the email on 102, you say:
"Dear Nick, sorry taken rather longer than it should ..."
Saturday, 13 July, it appears that you provide the report on that day?
A. I presume it was sent on that day then, yes.
Q. Does it appear that the date of 13 June may not be correct, it may be 13 July?
A. It was I think prepared on that date. 13 June would have been the date that it was prepared.
Q. But it was sent to the police on 13 July?
A. It looks like that that was the date that it was actually sent.
Q. As far as you are concerned, your investigations of the possibility of gelsemium were certainly continuing throughout the whole of June. Is that right?
A. No, it looks like the report would have been prepared and for whatever reason, it was not sent until that Saturday.

Q. I see, so as far as the police were concerned, they wouldn't have known until 13 July the detail of your report. Is that right?
A. Yes. As far as I am aware, yes.
Q. Were you aware of any announcement being made by Surrey Police at around that time about the conclusion of their investigation or not?
A. No, I was unaware.
MS HILL: Thank you.
Questions from MR STRAW
MR STRAW: Professor Simmonds, in one of your reports you note that the work undertaken by Dr Kite is not an exhaustive analysis of all potential toxins. Does that remain the case, and, if so, can you explain in what respects it is not an exhaustive analysis?
A. As I indicated at the beginning of my evidence, that we had put together a list about 120 potential toxins, there are more toxins from plants around than we have analysed in that report.
Q. Just to pick out three other reasons for that.
Dr Kite has told us that the method of analysis wouldn't necessarily pick up all toxins from plants or fungi; is that correct?
A. Absolutely correct, yes.
Q. Secondly, you have told us this morning that the library

with which you compared the suspect ion in the stomach doesn't necessarily contain all toxins?
A. That is right.
Q. Similarly, you were not analysing non-natural things, so whether that is toxin anions, toxic gases?
A. We didn't look at any of those, we concentrated on the plant toxins.
Q. Do you have the expert bundle, number 1, in front of you and if not --
A. I should have.
File number 1, yes?
Q. Tab 44, please. This is a series of questions asked by the Chief Constable of Surrey. Can you see question 1 says:
"If a toxic alkaloid contained in one of the plants of genus gelsemium were orally ingested by a person with fatal results ..."
Then I am going to down to (iii) at the bottom:
"Would that alkaloid be subsequently detectable post mortem in the urine of that person? If so, for how long and by what means?"
I think your answer is:
"It could be that compounds from gelsemium could be detected in the urine and that is why we asked for the sample to test it. It arrived on 30 July 2015.

"As indicated ... there is very little information about the levels of alkaloids in gelsemium, let alone how they break down in different conditions."

A. Yes.

Q. Does that remain the case as well?

A. Yes.

Q. Is it right that it is possible that there had been gelsemium in the stomach but that it had broken down by the time it came to be tested?

A. That is a possibility.

Q. In another report, I can take you there if that would help but just for speed, you say:

"It is highly unlikely that the urine samples would contain the intact alkaloids because they would most likely be broken down."

Can you explain that in any more detail? Does that mean that it is most likely that they would be broken down in the period between the death and when they came to be tested?

A. No, it is as they go through your alimentary canal it is highly likely that they would be broken down subject to the conditions that are in your gut.

Q. Thank you.

The unidentified compound in the stomach, is it likely that Mr Perepilichnyy ingested a substance that

contained that compound?

A. That is not the only route of course, it could be a breakdown product but if it is associated with diet, you would assume that he would have eaten it, yes.

Q. I think if it helps, the way you put it in one of your reports, this is 247 if you would like to go to it, you were asked:

"Does the presence of the ion in the deceased's stomach at autopsy oblige the conclusion that at some point prior to his death the deceased ingested some substance containing a compound?"

Your response I think was:

"Yes, the data would suggest that the deceased had ingested a substance that contained a compound with that molecular formula."

Is that correct?

A. Yes. Rethinking about it of course, you know, it could be a breakdown as associated with the time of decomposition, et cetera.

Q. Is it likely that the compound came from sorrel, mericarps, caraway or potato?

A. I really cannot make any comment on that.

Q. Could you have a look, please, we were at page 249 I think in tab 44, could you have a look over at page 251.

A. 251, yes.

Q. Question number 4, the question is:

"The suspect compound [the unidentified compound in the stomach that is] has a molecular weight of 358 and a possible molecular formula ... is it possible that this compound is derived from a constituent of the following harmless things that the deceased may have ingested prior to his death, sorrel leaves, mericarps, caraway and potato."

Then is that your answer underneath that?

A. Yes:

"A search of the databases at Kew and of commercial databases that provide information about the chemistry of different plants showed no record of compounds in these plants that have the above formula. Thus it is not unlikely."

Q. Sorry, does it say "Thus it is not likely"?

A. "It is not likely."

Q. Okay.

That unidentified compound then, I think you have said already but it could have been toxic, is that correct?

A. I can make no comment on that.

Q. Is it right you cannot say anything about the toxicity, you don't know whether or not it was toxic?

A. I don't know what it is.

Q. The unidentified compound I think was originally matched in terms of its mass with five gelsemium alkaloids; is that correct?

A. Could you say that again, please?

Q. You have told Mr Skelton a little earlier that the unidentified compound in the stomach, its mass matched that of five alkaloids from gelsemium?

A. It was a mass that linked to -- that was the only -- when we did the analysis of the gut, that was the only link with gelsemium.

Q. Since then, has it been matched to a further alkaloid, scopolia?

A. Not in our ...

Q. It may help if I take you to your joint report.

A. Yes, sorry, we did look -- yes, at further analysis. Could you just take me to the --

Q. Yes, of course. Don't worry, there is so much information, it is not a memory test, it is your joint report --

A. Yes.

Q. -- which is in a different bundle I am afraid. It is in expert bundle 3, tab 95, please, page 832, question D28. Do you say there:

"It is agreed that the molecular formula of the

compound found in the stomach is in accordance with an alkaloid. The Dictionary of Natural Products lists six compounds with that formula, five are alkaloids from gelsemium, and one is an alkaloid from scopolia."

A. Yes, that is a later -- when we were writing this report, we looked back at the natural product database, yes.

Q. Dr Kite's analysis of the 17 or so gelsemium samples that you obtained found four isomers within that. He said to us, what that meant is since there were only four isomers within the samples tested, some of the six mass matching alkaloids were missing. Would you agree with that?

A. Are missing? We were only able to match four, I am not quite sure I would use the word "missing". There wasn't a total overlap.

Q. Yes, so you had four isomers, but since there were six alkaloids whose mass matched that in the stomach, we know that two of those alkaloids at least --

A. Sorry, in the stomach?

Q. Yes, there were six alkaloids which --

A. In the stomach?

Q. Six alkaloids whose mass matched the compound found in the stomach, so we have on the one hand the unidentified ion in the stomach and then on the other hand the five

alkaloids from gelsemium and then scopolia, so six all together, whose masses matched. Do you follow?

A. Yes, I follow.

Q. We have those six, but because there are only four isomers within the gelsemium plant samples, we know that we cannot have all of the six.

A. Yes, because there are two that are not linked, yes.

Q. Yes.

Would it follow from that that it cannot be excluded that the unidentified compound in the stomach was one of the missing alkaloids that weren't within the plant samples you tested?

A. Yes, that could be. We have not looked for these other compounds.

Q. In particular the alkaloid from scopolia, so the new one that has come up, would that appear in the gelsemium samples?

A. From looking at the database I think it is a different compound that is not present in the gelsemium.

Q. Did you test any samples from the plant scopolia?

A. I would have to go back and have a look at the database we put together to actually confirm that.

Q. Okay, so from what you can tell us today --

A. I know we provided the court with the list of all the plants that we did look at. I don't think we looked at

that.

Q. If it is not on that list --

A. Then we didn't look at it.

Q. -- then you didn't test for it and then therefore it cannot be excluded presumably that the stomach compound was scopolia?

Are some alkaloids from scopolia poisonous?

A. Speltamine(?) I think is toxic, I couldn't tell you comparatively how toxic they are. I mean it is known to be a toxic plant and the main ingredients in it are alkaloids.

Q. Did you say scopolamine there?

A. Yes.

Q. Is that the comparatively well known alkaloid that has been said to have been used by Dr Crippen to murder his wife?

A. From memory, yes.

Q. Is the scopolia plant sometimes called nightshade?

A. Yes.

MR STRAW: That is everything, thank you very much.

Questions from MS BARTON

MS BARTON: Professor Simmonds, a couple of issues on the chronology if I may. I appear on behalf of the police.

Were the police very anxious to get the results of the toxicological tests in order to advance their

inquiries?

A. Do you mean the chemistry?

Q. All of the expert tests, the chemistry, yes?

A. They were -- yes, they were keen to get our chemical data, yes.

Q. The person who was liaising with your organisation was Mr Craggs of the police, do you recall?

A. For some of the time, yes, and then it was a Ben?

Q. Yes.

A. Yes.

Q. They were making contact, were they, on a fairly regular basis to see how your inquiries were progressing?

A. I would have thought it was every few months.

Q. Because what we see with the report that was sent on 13 July is the report itself was actually dated 13 June, isn't it?

A. That's right.

Q. Within that report it makes reference to tests that had been conducted by Dr Kite on 20 May?

A. Yes.

Q. We see that, if you need to check that, it is at page 230 of volume 1.

Is it likely that the results of those tests were in fact communicated to the police before the final report was actually written up and sent because you knew how

important the results of the test were?
A. It is highly unlikely that we would communicate something without having the report --
Q. Without?
A. Without sending the report.
Q. The report that Mr Kite has done, is that a technical report that stands separately from the one that you later wrote, dated June?
A. The technical that we normally put them together --
Q. Yes.
A. -- because I would write a summary of his report after going through it in detail.
Q. You see, we have heard some evidence from the senior investigating officer in the case that by 7 June he was saying that the compound detected in the stomach contents, there was no evidence to support it being a toxic compound. We know that by 20 May your expert, Dr Kite had concluded there was no support for the compound detected in the stomach being gelsemicine. Where else would he have got that from if he didn't get it from Kew?
A. He couldn't -- unless somebody else was involved in analysis, I don't think he could have got it anywhere else.
Q. What we do know is that the result of the test that

Dr Kite did in fact were available to Kew by 20 May, don't we?
A. Yes.
Q. Yes. Thank you.
A. The preliminary data, yes.
MS BARTON: Yes.
Further questions from MR SKELTON
MR SKELTON: May I take you back, you were asked some questions by Mr Moxon Browne about the 2015 testing of material that may have been available in 2013 --
A. Yes.
Q. -- and the retesting issue.
May I just take you back to that, please. If you go to page 230, under tab 41, please?
MR MOXON BROWNE: 230?
MR SKELTON: 230 under tab 41, yes.
MR MOXON BROWNE: Thank you.
MR SKELTON: Dr Kite's analysis dated 20 May 2013, do you have that?
A. Yes.
Q. At the bottom you see exhibit 22915, gelsemium sempervirens?
A. Yes.
Q. Thank you.
If you scroll on through that analysis to page 236

please, is that the results of it?
A. Yes.
Q. You have two peaks, mass 359 and then MS/MS of 328?
A. 328?
Q. If the two peaks --
A. The middle trace, yes.
Q. The two peaks in the middle and then I think the MS/MS data is on either side; is that right?
A. Yes.
Q. You can see on one there is a 197 and a 328 and on the other a 328; is that correct?
A. Yes.
Q. Thank you.
Could you now look under tab 46 at page 266, please. Actually just for clarification, this is a report from Kew dated 1 February 2016 from you and Dr Kite?
A. Yes.
Q. Which is an update on a previous report?
A. Yes.
Q. At page 266, there is a table set out --
A. Yes.
Q. -- which lists all your samples.
A. Yes.
Q. The third one down, which has a little star next to it --

A. Yes.
Q. -- is 25492.
A. Yes.
Q. Now I didn't find the answer to what the star is but I am hoping you will be able to help me in a moment as to why it has a star.
If you go forward to page 268.
A. I am running out of fingers.
Q. You don't have to keep your finger in the old one, you can go straight to 268.
There is question 6, do you see that?
A. Yes.
Q. The last sentence, it says:
"It should be noted that sample 25492 is from the same sample batch as 22915."
A. Yes, that's right.
Q. Has what has happened here, that while testing all the new material that you have got hold of in the interim period, you have got back to the 2013 sample and taken a further sample from it to test at the same time?
A. Yes, and the key to be able to work that out, if you look at page 266, the number 25492, under collection number, it has an EBC number.
Q. 90489?
A. That is it, that is economic botany collection number,

90489. If you go back to the technical report on May 2013, the BI number, 22915 is from that same economic botany collection number, 90489. We have a repeat sample as a form of control from our initial analysis to the 2016 analysis.

Q. Thank you.

That is the answer to where you located the original sample and retested it.

Can I now just show you what I think are the results and just ask if you can interpret them for me.

What I didn't take you to was the elution time. Perhaps it is just worth before we go to the second result, looking at that, under, again, tab 41, please.

A. Tab 41, yes, page?

MR MOXON BROWNE: Page?

MR SKELTON: Page 236.

A. Yes.

Q. Could you just explain the elution time there of the --

A. If you take elution time in the middle.

Q. Yes.

A. There is 359 peak, 9.75.

Q. Yes. What about the other peak?

A. The 389 at 8.68. Is that the one you mean?

Q. 359 is it?

A. 359, 8.68.

Q. There are two peaks at 8.68 and there is one at 9.75?

A. Why is.

Q. As we say, the MS/MS in both cases is 328?

A. Yes.

Q. And a smaller peak of 297?

A. Yes.

Q. Then if you go to the isomers that were tested in 2015, could you look on page 276 which is the final page of tab 46. Do you have that?

A. Yes.

Q. About two-thirds of the way down I think we find 25492; is that correct?

A. Yes.

Q. Is that the original sample?

A. Yes.

Q. Or sorry, it is a resample of the original sample?

A. It is a resample, yes.

Q. Thank you.

Scrolling across, I think we don't find any results in isomer 1 or isomer 2 columns --

A. That's right.

Q. -- but we do find results in both isomer 3 and isomer 4?

A. That's right.

Q. The masses, 359.1987 in one and 359.1966 in the other?

A. That's right.

Q. The elution times are different from the original elution times, we had previously 8.68 and 9.75 and now we have 11.51?

A. And -- yes, 10.2 and 11.51, yes.

Q. Yes.

I think Dr Kite explains why that may be the case, in that you have -- you had had a change of equipment for starters?

A. We would have different columns on the --

Q. And a different form of preparation using different solutions?

A. Yes.

Q. Is the MS/MS the same, and is that significant?

A. You have a 328, looks exactly the same, 328. 328 -- lost it now. (Pause)

Q. On one we have --

A. 297.

Q. 328 and 297 on isomer 3?

A. You have exactly the same as last time.

Q. Exactly the same MS/MS.

A. The same as last time.

Q. What does that say to you?

A. They chemical composition is very, very similar from one to another.

Q. Notwithstanding the different elution times?

A. The different elution times.

MR SKELTON: Thank you.

Sir, may we have a short break, I have not had the chance to speak to Dr Rice.

THE CORONER: It is all obviously complicated material. I am just anxious, I am looking at the press representatives -- I just hope everybody has understood exactly what has been tested when, because it would be possible to get a very misleading impression from some of the things that are said if you were not clear what was actually being looked at at a particular time, whether it was stomach contents or a sample that Kew already has, you see, it would be possible to get it very wrong, wouldn't it, that is what just has been going through my mind, but if you are all clear.

Had the same thought occurred to you.

A MEMBER OF THE PRESS: It had occurred to us, if it is possible to refer to your counsel if we need clarification or even if a report could be available for us to refer to should we have any questions, that perhaps would be a great advantage to us.

THE CORONER: I will have a think about it, but it is on my mind.

Yes, we will certainly have a break. Yes.

(3.40 pm)

(A short adjournment)
(4.25 pm)
MR SKELTON: Sir, the next witness is Dr Rice, we are within striking distance of the usual court time that we conclude, sir. Dr Rice is able to stay a little late, so hopefully we will try and conclude him this afternoon.
THE CORONER: Whatever suits everybody is what we will do.
MR SKELTON: Thank you.
DR PAUL RICE (sworn)
Questions from MR SKELTON
MR SKELTON: Dr Rice, would you give your full name, please.
A. Dr Paul Rice.
Q. And your position?
A. I am currently chief medical officer at the DSTL laboratory at Porton Down.
Q. DSTL stands for?
A. Defence Science and Technology Laboratory.
Q. How long have you held that position?
A. I have held that position for the last four years.
Q. Are you a pathologist by training?
A. Yes.
Q. You have become a specialist in certain types of toxicology?
A. Yes, mainly to do with the medical and toxicological

effects of biological and chemical weapons.
Q. It is axiomatic that much of your work is necessarily sensitive because you work in the defence sector?
A. It is, yes.
Q. As you are aware, this Inquest is a public enterprise and therefore evidence which is based on open source information can be elicited in open at this Inquest but evidence based on matters which you have received which are sensitive or confidential to the work you have conducted on behalf of your organisation cannot be aired today. You understand the distinction?
A. I do.
Q. Will you please signal or explain if we get to the point where you feel that you are unable to give an answer based on open source material?
A. Yes, of course.
Q. Thank you.
You I think were involved, although not central, to the Operation Daphne conducted by Surrey Police into the death of Mr Perepilichnyy?
A. Yes, I was called to a single meeting back in I think it must have been December -- I can't remember the exact date but early December 2012.
Q. What was the reason that you were brought in?
A. I was invited to attend that meeting purely to go

through a large spreadsheet on which a number of potential poisons, toxins, had been listed by the police and whether or not we could actually eliminate some of them from their investigation. My understanding was that I was just called to that meeting to comment on the materials that were in that spreadsheet that were or can be defined as chemical weapons.
Q. Chemical weapons, what categories is one looking at? Obviously we have heard something about organophosphates which can be pesticides or can be used as nerve agents.
A. There are three main classical categories.
The toxic gases that you breathe in, the examples being the gases we used during the First World War such as chlorine and phosgene.
You then have the blister agents, so things like sulphur mustard, mustard gas, which predominantly affect the outside of the body causing burns to the skin.
Then the next big category is the agents we call nerve agents, which can be absorbed through the body in many different ways but essentially affect the nervous system.
Q. Are they all organophosphate compounds?
A. The nerve agents are all organophosphates, yes.
Q. Thank you.
Obviously, Operation Daphne has to some extent been

eclipsed by the further investigations that have been done during the course of this Inquest, so I am going to focus primarily on the elimination as far as you can give a view that has occurred during that process. Particularly by reference to your joint statements, which we will come on to, because you met Professor Ferner and Dr Perry recently?
A. That's correct.
Q. Can I just start by some background.
You were aware that Dr Perry performed particular tests through LGC Forensics and HFL sports science and the primary purpose of those tests was to look for drugs of abuse, medications, cardiac glycosides and other substances which may be used to kill a human being?
A. Yes.
Q. You were aware obviously of Kew performing particular texts on plant toxicology and I think you have been here today during the evidence of Professor Simmonds?
A. Yes, I have, yes.
Q. And Dr Black at Reading University looked for heavy metals and anions as well?
A. Yes.
Q. Finally can I show you, because it hasn't featured in evidence at the moment in any great detail, some testing which was performed by the Atomic Weapons Establishment.

If you have bundle 2 of the expert bundle in front of you, under tab 52, please, page 407 --
A. Sorry, could you say the tab number again?
Q. Tab 52, page 407.
This is one of the conclusions of Dr Fysh's involvement in 2013 where he summarises some of the testing that is undertaken. You can see there, at paragraph 6.3, there is reference to radionuclide poisoning?
A. Yes, I see it.
Q. It says in effect that prior to the second post mortem being carried out the body of Mr Perepilichnyy was monitored for alpha and beta contamination with no detectable amount found. Personal clothing was also deemed free of contamination and that work was carried out by the AWE?
A. Okay, yes.
Q. Then further testing was done of internal body tissue which was sent to HPE. You can see that the results of that are recorded underneath, which says that in addition external alpha beta monitoring and gamma spectrometry of post mortem specimens didn't demonstrate the presence of any radioactive material at a level that could be harmful to health and certainly not in lethal doses?

A. Yes, I see that.
Q. Broadly speaking, that covers the toxicological investigations that took place, Dr Perry's work, the Kew work, Dr Black's work at Reading and the AWE work primarily. I am right in thinking that as far as you were concerned, certainly when you were involved in the Operation Daphne, there was no positive identification of a poison?
A. That's correct.
Q. What was identified by Kew, and has been the subject of a lot of discussion during the Inquest hearings, was an unknown compound which had a similar atomic mass to a gelsemium derivative but which ultimately Kew ruled out as being gelsemicine or connected to gelsemium as far as they could test the samples. I don't want to rehearse any of that, you obviously heard quite a bit of evidence about it already today.
A. Yes, I have.
Q. Can I ask you generally and if you cannot express a view on this then please don't speculate, but as far as, if one conducts toxicology of someone that you suspect has died from poisoning or toxicology from someone who hasn't and you are looking for compounds and trying to identify what is in their stomach or in their intestine, will one commonly find compounds for which you don't

have an immediate identity?
A. I think that is almost certainly true, yes. Particularly if you are using these very sophisticated techniques of mass spec/mass spec where you are looking for, you know, basically molecular weights that have a whole range of different structures.
Q. Do you give that answer from your general knowledge as a physician specialist in pathology and toxicology or --
A. Just from a position of general knowledge in terms of those kind of techniques and what kind of molecular weights and structures that they can throw up. Some of those are going to be unknown in terms of particularly their effects.
Q. The other aspect of course of the testing which I think you are aware of and you discussed with your fellow experts was the imperfection of the samples. For example, the stomach contents were thrown away because a forensic post mortem was not conducted and so what was left was effectively washings from the stomach that were tested. That, from your perspective as a toxicologist, will inevitably affect the ability to test?
A. Yes, I think with any death which there isn't an immediate cause for, one tries to retain as much of the body as possible for further toxicological testing and that is normally what the position would be at the

first post mortem. If structurally you cannot see an immediate cause of death, that you would then have to start thinking about other causes and that would involve toxicology and retaining the relevant samples to allow you to do that toxicological testing.
Q. The other aspect was that the preservation itself of the samples was not perfect.
A. I am not quite sure how those samples were stored. I mean I have seen evidence but I couldn't comment on whether or not those were appropriate storage conditions.
Q. I think it has been agreed that there had been some adulteration of some of the samples and so on and that from your perspective is going to inevitably undermine the efficacy of the test?
A. Yes for certain substances, as is the time delay, I would suggest, between the time the person died, the time at which the first post mortem was conducted, and therefore the time at which the first samples were taken, and then the subsequent samples that were taken at the second autopsy, you know, that time period for me is very important.
Q. Focusing on the timing, one of the points made by Dr Perry, with whom I think Professor Ferner agreed, was that a poisonous agent such as cyanide needs to be

tested within a relatively small window of time, about a week or so, in order for you to draw a reliable conclusion that it has or has not been used.

A. Yes, and I would concur with that view.

Q. The fact that cyanide was not tested during that period of time means that it cannot be ruled out, for example?

A. It cannot be ruled out, no.

Q. Although one of course must look also to other potential signs and symptoms?

A. Yes.

Q. We will come on to the totality of the elimination but broadly speaking you have your toxicological testing, you have pathology, you have clinical signs and symptoms --

A. Yes.

Q. -- you have method of administration and availability insofar as you can ascertain those --

A. Yes.

Q. -- and you have got things like perhaps testing on the family for genetic testing. I think we heard from Dr Sheppard that it is possible to test the family members to see if you can identify genetic channelopathy which you could then use to identify channelopathy with the deceased, which may then help to you rule out a toxicological cause?

A. Yes.

Q. Thank you.

In Mr Perepilichnyy's case, I think that you and Dr Ferner have ruled out the possibility of a cumulative action poisoning, in other words a poison which had accumulated or been administered secretly and accumulated over a long period of time to the point of toxicity. Could you explain your basis for coming to that conclusion on the balance of probabilities?

A. We did consider that as a possible route but administering small amounts cumulatively over a long period of time, you ultimately reach a point where the person starts becoming unwell and starts showing signs of that illness.

Reading the evidence as I have, it appeared to me that there was very little evidence of this slow accumulation and him having periods where he felt unwell prior to the day that he died. Therefore I think we were fairly confident that based on the overall clinical picture here, that the likelihood of a continual administration of a low level of a poison that basically accumulated in the body, was not strong.

Q. The expectation is that if a cumulative poison is given, it is likely to be demonstrated by clinical signs and symptoms before the critical event?

A. Yes.

Q. On that basis, one excludes on the balance of probabilities that as a form and in particular in Mr Perepilichnyy's case, we know that he went for a run, which I think is probably one of few things we can be clear about.

A. Yes.

Q. He decided that he felt well enough to go for a run?

A. Well enough to run, yes.

I think the classic example here if I may is arsenic poisoning where people have small amounts of arsenic put in their food over long periods of time, you eventually start looking unwell as well as feeling unwell and it may then be several weeks before you actually die. That is not the sort of picture that I get from the evidence that I have read in this particular case.

Q. It is not a cumulative action poisoning, then the two other possibilities are a fast-acting poison, which are administered in the hours or minutes before he dies?

A. Yes.

Q. Or a delayed-action poison which has been administered some time before that but hasn't come into effect until he goes on his run?

A. Yes, some poison formulated in such a way that you could give it to somebody, it wouldn't have an immediate

effect but as it reacts with things in the stomach or in the intestines slowly releases a lethal amount of poison, some time away from actually administering it.

Q. One can hypothesis one can that it could be a poison that was administered in the day before in France or the morning in the airport for example, it is possible?

A. That is -- that remains a possibility.

Q. If one tries to go further backwards, does it become less and less probable?

A. I think it becomes less and less likely, yes, because of how do you control for that much longer time delay?

Q. Are delayed-action poisons generally ingested through food and drink and then become active or can you have a delayed-action poison that is administered by another means.

A. I think I am talking about in terms of delayed action is you have a poison but the way in which you administer it, the formulation in which it exists is different and allows it to be slowly absorbed. An example would be to put a sugar coat round it or a fatty coat round it and then ingest it, such that the actual release of the lethal amount of poison which is contained within that coated pill is released some time after they have actually ingested it. That is what I mean by slow acting.

Q. Yes, but ingestion is the ordinary route for that kind of poisoning?
A. Normally, yes.
Q. An example given by Dr Perry would be paracetamol, which can be ingested in large quantities and not have immediate effect until some time when you get catastrophic liver failure?
A. Yes.
Q. Of course you will find that, it is --
A. You would expect to see it in the stomach contents, the slow absorption of that massive amount may have structural effects on the stomach and its lining for example. You would expect to see evidence on that.
Q. What kind of poison would you use that isn't an ingested poison?
A. That acts more slowly?
Q. That has a delayed action, yes.
A. I don't know of any poisons but the pharmaceutical industry are continually formulating drugs that can be injected into the muscle which slowly release the drug over a period of weeks or months. Such that the person doesn't have to take a tablet every day, they have a single injection which then lasts them for the next month or so.
Q. My question really was focused on whether or not there

was other things, not like tablets or fluids that you are actually taking in that way, but for example a gas or an injection. Phosgene for example is something which doesn't necessarily have an immediate fatal effect but it may have an immediate clinical effect of some kind and later become fatal. Is that right?
A. Yes, phosgene is a good example of a gas which you can inhale, you may initially experience some irritation, because it is quite an irritant gas, so a bit of coughing and streaming of the eyes. But then, depending on how much you have inhaled, it might be 6, 8, even 12 hours before the full effects of the gas that you have actually inhaled become apparent in terms of its toxic effect, truly toxic and potentially lethal effect, actually.
Q. Before we come on to the elimination, just to go back to what we know about Mr Perepilichnyy. We in effect don't know because we don't have any account from him or his doctors about how he felt in the preceding days or indeed on the day, but we do know that he didn't report anything untoward as far as we can tell certainly to his family, that was the evidence that we received and he did go out for a run.
A. Yes.
Q. That narrows it down to certain types of poison which

either he had taken previously and it had been delayed action or it had been a fast-acting poison somehow administered. We don't have any obvious signs on pathology of forcible administration?
A. No.
Q. But Professor Ferner I think agreed it would be possible for someone to be given a poison inadvertently through food and drink or for example through a pinprick of some kind or indeed just a splash of fluid while you are out and about which can then activate and kill without you realising, a trite statement it may be but is that true?
A. Those are all possibilities, yes.
Q. As far as elimination is concerned, the screening Dr Perry did looked broadly for opioids and the like, I have also mentioned things like heavy metals, I have mentioned atomic radiation of some kind that was tested for, drugs of abuse as well, all of which appears to have been screened out by those tests as I understand it.
I am just trying to work without what one has left that one can consider, further poisons which you I think consider to be eliminated. If you want to look on your joint statement, I don't know if you have a copy of that. Do you have your own copy of it or do you need to rely on the bundle copy?

A. I need to rely on the bundle.
Q. It should be at tab 98 of bundle 3, and it is printed horizontally. Page 877 and following, although I am not using the bundle paginated version.
A. Yes, I have it.
Q. You have it, thank you.
If we refer to the internal pagination, I would just like to take you back to the things that you have ruled out, so page 15?
A. Yes, I am there.
Q. And overleaf, page 16 I think it continues on to. Just taking phosgene gas, which is something you deal with under "Specific poisons", that in effect is it ruled out on the basis of absence of the sort of precursor symptoms, partly?
A. Yes.
Q. Then what about the -- can one in fact, aside from that, can one rule it out on the basis of the findings during the final phase of Mr Perepilichnyy's life, when he did demonstrate pulmonary oedema which can be consistent with toxicity?
A. Yes, from my personal perspective, somebody dying of pulmonary oedema is not a very pleasant sight. We notice from the reports of the ambulancemen that he was coughing up a little bit of fluid but not that much and

he had some phlegm in his mouth. Somebody who is actually just about to die because of overwhelming pulmonary oedema the fluid just pours out of them and that is why I would rule out phosgene on clinical grounds, because from my experience of seeing animals die of phosgene poisoning, what is described in Mr Perepilichnyy's case is not consistent with phosgene poisoning. Plus the fact that when you look in detail at the pathologists' reports from both the first and second post mortem, there are other things that you would see microscopically in the lung, so looking at thin sections of the lung tissue under a microscope, that were not seen that you would most certainly expect to see in a fatal case of phosgene poisoning.

Then you add to that, well, how are you going to administer the phosgene to him? That is not easy, particularly in an open space, so taking all of those into consideration together, that is why I argued that you could -- I think, fairly comfortably eliminate it.

I mean Professor Ferner is right in that, you know, the symptoms, as far as we know them, you know, wouldn't preclude it but I think they probably would.

Q. Thank you. Dr Black has ruled out heavy metals?

A. Yes.

Q. You do not dissent from his view?

A. No, I think the analysis for all of those was negative, and clearly negative.

Q. Dr Perry has ruled out opioids?

A. Yes.

Q. Again, you do not dissent from her conclusions on that?

A. No.

Q. You defer I think to the Kew plant experts when it comes to gelsemium?

A. Yes.

Q. And its --

A. I do not have any experience at all or expertise in that area.

Q. Of plant alkaloids broadly?

A. Not of plant alkaloids, no.

Q. Sildenafil was raised as a possibility but if that --

A. Certainly not any experience in that area either, sir.

Q. I think Dr Perry said that that was sub toxic in any event, as far as she could see.

A. That is what I believe she said.

Q. Just seeing what one has left, if you go back to page 15, please, we have different forms of cyanide. Is it the case that cyanide potentially can be administered quickly without leaving any pathological trace beyond potentially some smell, which I think only a minority of people can actually notice?

A. About a third of the general population have the gene for smelling it, yes.

Q. The definitive testing needs to be done within a few days of death, which was not done?

A. On most biological samples yes, that is true.

Q. You cannot eliminate that on the balance of probabilities?

A. No, I mean they did check for it but at the time the tests were done, the negative result, well, you can just cannot interpret it.

Q. It is unreliable?

A. It is unreliable.

Q. Azides, could you just explain what an azide is and how one tests for azides?

A. It is a very reactive ion, so it is basically a trivalent nitrogen ion, so cyanide is CN-, azide is N3- and then you have phosphide, which is the P3- ion. They are all reactive ions basically.

Q. You can test for azides if you do it deliberately, as it were. It doesn't get picked up, you have to look for it. Is that right?

A. That's right.

Q. Again, is it the case that there is a window of opportunity for testing an azide?

A. Yes, much the same way as for cyanide.

Q. Just moving on ahead to phosphide, is that the same position?

A. Yes.

Q. You need to actively look for azides, phosphides and cyanides?

A. I think you have to have in your mind those three poisons because if you don't think about them, you will never make the diagnosis because there can be delays in actually testing for them which is crucial, as we have seen.

Q. At this stage it would not be possible to exclude those conclusively?

A. That's correct.

Q. Is there in fact a specific test for phosphides, that you know of?

A. Not that I know of.

Q. Do you hypothesise that there probably is?

A. I don't know, to be honest.

Q. But you are content to give an answer that in any event it would be too late to test for compounds such as phosphide?

A. Yes.

Q. As far as organophosphates are concerned, again it was agreed I think by Professor Ferner, and I think as you have said, there are two types, the pesticide type and

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

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

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

activity would be blocked and most importantly the brain stem which controls your respiration, so classically death from organophosphates and particularly the nerve agents occurs because you stop breathing.
Q. You mentioned I think the symptoms of seizure?
A. Yes.
Q. Do you have what looks like an epileptic fit then of some kind?
A. Yes.
Q. As part of the end result of the crisis?
A. Yes.
Q. Sorry, are you saying that it is likely that with a poisoning you go through that, those symptoms, you go through the crisis exhibiting those symptoms?
A. Yes.
Q. Can one therefore infer that the absence of evidence of that entire range of symptoms means that organophosphates on balance can be ruled out here?
A. I don't think you can be absolutely certain and rule them out but somebody dying acutely of nerve agent poisoning, and some of the organophosphate pesticides, those symptoms are so remarkable it would be difficult to overlook them.
Q. If it is the case that Mr Perepilichnyy didn't demonstrate the range of cholinergic crisis symptoms

that you have described, including for example seizures, incontinence et cetera, is it more likely than not that it was not organophosphates? You don't have to be certain, but is it more likely than not that it wasn't?

A. More likely than not, certainly.

Q. Thank you.

You were asked in your joint statement to consider who might have access to nerve agents. If you want to look at page 23 of your answers, at paragraph 65, please.

A. Yes.

Q. As you are aware, in this case it is alleged that Mr Perepilichnyy had become involved with a fraud in Russia and that those who may have been directly responsible for the fraud may have had an animus against him which motivated them to kill him, that is a possibility which has been raised in this Inquest, that agents of the Russian state of some kind may have been responsible for his death.

From your perspective, based on open source material, is it the case that the Russian state or agents of the Russian state could have access to organophosphate nerve agents?

A. That is a possibility, yes.

Q. I think you go on to say in that answer, just for

completion, that they are potentially fatal in very small doses indeed?

A. Yes.

Q. Is it the case that there are some nerve agents, organophosphates, that can be really a spec of fluid that can, if it gets into your system through the eyes or indeed through the skin can result in a fatality?

A. Yes. The one that comes to mind is VX, which members of the court may have heard about in relation to a recent death in a Malaysian airport. The lethal dose of that particular nerve agent would be a small droplet applied to your skin that you would have difficulty in actually seeing. It would be a droplet of around about a millimetre in diameter.

Q. So relatively easy to administer and fatal in very small doses?

A. Yes, over a period of time, because you have to absorb it through the skin, and that is what takes time.

Q. Without again trespassing into areas beyond what is known openly, is it the case that there are some poisons which are going to be impossible to detect?

A. Yes.

Q. So known unknowns?

A. Yes.

Q. Presumably there are some states which are actively

going to be looking to make those poisons for reasons which we are all familiar with?

A. Possibly, yes.

Q. Just to sum up then, there is no positive evidence that Mr Perepilichnyy was poisoned in this case, notwithstanding the battery of tests which were conducted which I have taken you through?

A. Yes.

Q. Do you accept the hypothesis that either he died from a cardiac arrhythmia or he died from poison?

A. I think those still remain possibilities, yes. Two possibilities.

Q. Is it the case that if one becomes unlikely, the other becomes likely, is that a proper assessment of the logic of the death, if it's only to take those two potential causes, that if one is unlikely, the other must necessarily become likely?

A. Yes, I would agree with that. It works both ways round, I think if you are absolutely certain and you can absolutely eliminate poisoning, then your diagnosis becomes one of sudden cardiac death but vice versa, if the expert opinion is that sudden cardiac death is unlikely, it then puts more emphasis on poisoning as the only other cause of death that you have left to you.

Q. And --

A. I think is that the dilemma that we are in.

Q. Just taking the totality of the evidence as you have seen it or the information available about the timing of Mr Perepilichnyy's death and the supposition that it could have been a delayed-action poison or a fast-acting poison, the means of administration that are available for certain types of poisons, whether a nerve agent or a gas like cyanide, or cyanide in a different form, the signs and symptoms he demonstrated pre-death which are very few, obviously, pathological signs until the final collapse.

A. Yes.

Q. The findings of the pathology and then the toxicology testing, are you able to come to a view on the balance of probabilities as to whether it is likely or unlikely that poison is the cause of death?

A. I don't think you can, with 100 per cent certainty, eliminate poisoning as a cause of death. However, given all the things that you said in terms of summarising the position, I would still put the balance of possibility being on a sudden cardiac death.

Q. Can I just clarify in terms of your opinion, could you just confirm -- I didn't take you to it -- that you stand by the conclusions that you expressed in your report originally to the court. I haven't taken you to

it because it has been eclipsed by the overall --
A. Okay.
Q. The report is dated 20 December 2016.
A. Yes.
Q. Do you also stand by the opinions expressed in your joint statement with your fellow experts?
A. I do.
Q. Is there anything that I have not asked you about or which doesn't appear in those documents that I have just referred to which you think is of significance for the learned coroner in his determination on how Mr Perepilichnyy died?
A. I can't think of any other matters.
MR SKELTON: Thank you.
Questions from MR MOXON BROWNE
MR MOXON BROWNE: Dr Rice, I think you have reminded us that your involvement in this investigation was pretty slender, you attended I think one meeting?
A. Yes, I did, sir.
Q. I think you were also asked for some advice?
A. Yes, outside the meeting by correspondence with one of the police officers leading the investigation.
Q. Yes I think you were able to help either at that stage or certainly in the course of the coronial investigation by saying that you know that no tests for weaponised

biological warfare weapons were carried out at Porton Down?
A. That's correct, we were not asked to test any samples.
Q. No, and I think you are also aware that Dr Perry has said that no tests of that kind were carried out at her establishment?
A. Yes, I believe I saw that in her earlier evidence, that they hadn't undertaken those tests for --
Q. As far as you know, no such tests were carried out?
A. Correct.
Q. There seems to have been a perception by those who were writing reports on the whole picture that perhaps relevant tests had been done which would have revealed the presence of weaponised organophosphates. Do you know where that idea came from?
A. No.
Q. Not from you anyway?
A. Certainly not from me, no.
Q. I think you were involved, but I am not at all sure exactly how, in whether or not it would be appropriate to eliminate the possibility of the use of weaponised nerve agents in this particular case, by reference to various criteria.
A. I have subsequently seen the criteria that were applied and what resulted in the production of Dr Fysh's report.

I wasn't involved in any of those meetings where that report was put together.
Q. No.
A. The criteria they were using looked very reasonable to me and it would be --
Q. It is not so much the criteria they were using, it is the way they were applied, particularly to nerve agents. Let's not worry too much about what Mr Fysh may have said, let's just concentrate on your views today.
It was suggested to you by Mr Skelton that the Russian state -- well, he was seeking your opinion as to whether or not they would have access to nerve agents. Your reply, I would suggest, was a very cautious one, was possibly, there is no doubt is there that the Russian state has easy access to these types of weapons?
A. The reason I answered "possibly" was that we know the UK, the US and the former Soviet Union stock piled huge quantities of these particular chemical agents.
Q. Yes.
A. We have all undergone and are -- I believe in the Russian state case, still undergoing the destruction of those agents as part and parcel of being signatories to the Chemical Weapons Convention. I currently don't know the status of the destruction process in the former Soviet Union. That is why I said possibly, because they

may not have got rid of all their stockpile.
Q. They may not have got rid of all of them?
A. All of their nerve agents, no.
Q. That really wouldn't be a reason, would it, for eliminating this particular form of poison, that there would be some difficulty in getting hold of it, possibly they got rid of it all but that wouldn't be a reason for eliminating it if you are not sure about --
A. No, but I think what I would say there, sir, with due respect, is that these are not generally widely available materials. I think I would use --
Q. I am not suggesting that, I am suggesting that they would be available to the Russian state?
A. Yes, possibly.
Q. Possibly?
A. Yes.
Q. Yes.
THE CORONER: Sorry, I am afraid was there anything else you wanted to say, you were saying not generally widely available but then you were interrupted. You went on to say but possibly to the Russian state or to the Russian state, had you said all you wanted to?
A. Yes, I think I have, thank you.
MR MOXON BROWNE: I think that you gave evidence at the inquest into the death of an aircraftman at Porton Down

who died as a result of sarin poisoning?
A. Yes, sir, I did.
Q. Certainly the reports of that inquest suggested that he died as a result of a dab on the arm with sarin.
A. He had sarin applied to his forearm over pieces of clothing that he was wearing on his forearm, yes.
Q. Yes. That would seem to indicate, would you agree, that difficulty of administration certainly wouldn't be a reason for eliminating that type of poison in this case, it sounds as if it is very easy to administer, albeit at some risk to the assailant?
A. But in the death of the aircraftman at Porton Down, he "voluntarily" allowed them to apply the material to him. He had some understanding that he was partaking in an experiment and that was part of the experiment.
Q. Yes.
A. I don't think --
THE CORONER: Do --
A. -- there is a read across from that and the current situation. What I was erring towards in terms of administering something like a nerve agent, the person who is administering it has to handle it and there are certain dangers in doing that. But you also have to administer it in such a way that it would act rapidly.
Q. Yes.

A. Depending on what the nerve agent is and what physical form it is in, you would pick certain routes of administration. If you wanted to kill somebody very quickly you would want to inject it. Not apply it to their skin.
THE CORONER: Did you say you would want to inject it, I just didn't hear?
A. You would want to inject it, sir, if you were wanting to have a very rapid lethal effect.
MR MOXON BROWNE: Can you tell us a little bit more from your open source knowledge about the death of the Korean gentleman which you mentioned. Certainly according to reports that was not sarin but a nerve agent called VX.
A. VX, yes.
Q. Which I think is very, very poisonous?
A. Yes, it is probably one of most potent nerve agents that we know of.
Q. Yes. Can you tell us a bit more about how that was administered, as you understand it?
A. All I can tell you is what I have read --
Q. Yes.
A. -- in the newspapers, that apparently somebody had some of the agent in their hand and they rubbed it in his face and particularly in and around his eyes.
Q. They actually rubbed it in his face as opposed to threw

it, is that --
A. Yes.
Q. Do you know how long it took for him to exhibit symptoms?
A. Not exactly. Only what was reported in the press, which was 15 to 20 minutes.
Q. Yes, and do you know, in the same way, how long he lived for?
A. I don't.
Q. Do you know what symptoms he exhibited before he died?
A. No, just symptoms of collapse. He collapsed.
Q. You couldn't say for example whether he exhibited a -- do you get a cholinogenic crisis as a result of VX?
A. Yes, you do.
Q. Do you know whether he exhibited the suite of symptoms or not?
A. I don't, I don't.
Q. Thank you.
Do you agree with the proposition that the difficulty of administration of a nerve agent would not be a reason for eliminating that particular poison in this case?
A. No, but I think it makes it less likely.
Q. Yes.
Just for completeness, I think there is information

available about the terrorist attack using sarin in the Tokyo subway in the 1990s which you know about.
A. Yes.
Q. I think the technique there was to burst polythene plastic bags containing sarin, so that doesn't sound --
A. The agent was in three polythene bags that were all left on underground trains. The bags were ruptured by poking them with an umbrella allowing the liquid to escape and sarin, unlike VX, is a very volatile liquid, it is very similar to petrol. If we were to spill some on the carpet down there it would very quickly evaporate and have an effect on us all very quickly.
Q. As it came through the air?
A. As it evaporated and formed a vapour which we all inhale. If I had have put VX on the carpet, if I put a similar amount of VX on the carpet, we would still be able to sit in this courtroom probably until at least tomorrow and suffer no ill effects because it is not volatile. It will just sit there.
If you were to go up and touch the carpet or lick the carpet if you were stupid enough, then you would absorb the agent and it would have its effect. For the nerve agents it does depend on which one you are talking about as to which way you would administer it to have a rapid effect.

THE CORONER: Can I just ask you --
A. Does that make sense?
MR MOXON BROWNE: Perfectly.
THE CORONER: The sarin you were giving as an example and saying if in this courtroom and on the underground, if you were outdoors and so on --
A. You would have to put a lot more down --
THE CORONER: That is what I was --
A. -- the dilution in the air but in a fairly confined space, you know, a reasonable amount of it would evaporate very quickly and cause effects in all of us.
MR MOXON BROWNE: I am taking, amongst other things, from what you are saying that VX is much more potent, much more poisonous than sarin but on the other hand much less volatile, or not volatile at all.
A. It is far less volatile and therefore it is mainly deemed to be a contact hazard --
Q. Yes.
A. -- you have to touch it.
Sarin is more volatile and therefore it is an inhalational hazard, you breathe in the vapour. Breathing something in often has effects very much more quickly than actually touching something and getting it on your skin because you then have to absorb it through the thickness of your skin which takes time. For VX,

the symptoms would take longer to come on, because it has to get through your skin.
Q. Yes.
A. That time can be several hours.
If you were to inhale sarin, you would expect to see the effects within one or two minutes and you could be dead within three minutes. VX is slightly more toxic than sarin but not hugely so.
Q. I want finally, on the question of elimination criteria, to ask you about the suite of symptoms of the cholinogenic crisis. Mr Skelton pressed you a little on the question of a seizure or epileptic fit and that the absence of evidence of such a fit might tell against that account, that explanation.
It is by no means I think an inevitable feature of a cholinogenic crisis, it sometimes happens but --
A. No, it is not inevitable but it is one of the signs that if you are exhibiting it, it does go along with all the others in helping you make the diagnosis.
Q. Yes, so if it is there, it would tell in favour, but I am suggesting to you if it is not there, it doesn't really tell very strongly against?
A. Agreed.
Q. Thank you.
Let's look at what some of the symptoms are.

I think you haven't mentioned it but I think hypothermia, that is cold to the touch, apparently a cold body is one of the features. You are obviously aware that two witnesses independently observed that Mr Perepilichnyy's body was cold.
There is a feature of the release of mucous?
THE CORONER: Forgive me interrupting. Did you say coldness is a consequence, did you say?
A. Of nerve agent poisoning?
THE CORONER: Is that what the suggestion was?
MR MOXON BROWNE: Yes, it was.
THE CORONER: You may have not understood, that is the suggestion.
A. Sorry, I misinterpreted what you were trying to suggest.
MR MOXON BROWNE: I was not trying to suggest anything.
I thought it was common ground and I may be wrong, please correct me if I am, that hypothermia belonged in the suite of symptoms of a cholinogenic crisis, it is one of things that you list as --
A. It can be, yes.
Q. Can be?
A. Yes.
Q. Right. I had misunderstood that.
Another feature is the free running of mucous and saliva. A piece of new information we received from the

paramedics who attended that in addition to finding a mixture of mucous and saliva in the mouth, which I think you knew about, there was also what was described as drooling, that is as I understand it saliva and/or mucous actually coming out of his mouth, "drooling" was the word that was used. That is I would suggest a classic symptom of a cholinogenic crisis.
A. The evidence I have seen, it was some mucous in his mouth.
Q. I am telling you that the coroner has heard evidence from the paramedic, and Mr St Clair-Ford, and I am saying you have not heard that and I am telling you.
A. I haven't seen that evidence or heard that evidence.
Q. Now I tell you that there is that evidence and the coroner will make of it what he will. I am suggesting to you that that is symptomatic of the cholinergic crisis, drooling?
A. Yes.
THE CORONER: To what extent? I mean I think I have a recollection of what the evidence was about it but to what extent -- I mean a very marked extent or --
A. Very marked extent.
THE CORONER: Then you had better just tell us.
A. Once you have seen an animal poisoned with one of these nerve agents you don't forget it, because they bring up

and drool vast quantities of fluid. It is not just a little bit of dribbling, it is constant production over several minutes, hours of very excessive amounts of fluid.
THE CORONER: The whole time?
A. Yes.
THE CORONER: Hold on.
MR MOXON BROWNE: I think all of us have seen on the television the horrible effects of sarin poisoning in Syria. The picture which we have seen on the television, please comment, is of shivering and saliva dripping from the mouth. That is what we are talking about.
A. Yes.
Q. I am suggesting to you that the evidence the coroner may recall is that I think in the short time that he was observed was two tablespoons of drooling coming out of his mouth. Is that relevant or not?
THE CORONER: It didn't sound like that is the sort of amount you were talking about.
A. No, I would have said more than that.
THE CORONER: You are talking about a lot more than that.
MR MOXON BROWNE: Are we?
THE CORONER: That is what you have said, bring up vast quantities, very large amounts of --

MR MOXON BROWNE: Over what period?
THE CORONER: The whole time is what the witness just said. That is why I said it sounded different from my recollection of a tablespoon or two.
A. It depends on the dose, quite clearly. You may not see any drooling at all if death occurs very rapidly, which it can with an inhaled nerve agent.
With the ones that go through the skin, over a longer period of time, those kind of symptoms can go on for many, many minutes if not hours and in vast quantities.
Q. Yes.
A. More than a teaspoon.
Q. I do appreciate that but, as I think you know, Mr Perepilichnyy did not live very long under the observation of the people who we are talking about, in that time, however, it is a matter of minutes or slightly longer, he was observed to be drooling, that is really what I am putting to you. Not what may have happened over hours.
A. Equally we don't have any good evidence of what he appeared like before he collapsed either.
Q. We don't have any evidence at all.
A. And I recognise that.
THE CORONER: We have some, I think.

MR MOXON BROWNE: I would like to suggest to you that taken in the round, that is to say hypothermia, drooling, and the other symptoms that we have -- shivering, whatever that means, I think another person used the word "shuddering", are consistent with, although not exclusively consistent with, a cholinogenic crisis.
A. Yes, but if we are talking about a cholinergic crisis, then I would have expected to see other symptoms which have not been reported, was the point I was trying to make.
Q. Perhaps we can examine those, there is the question of a seizure?
A. Yes.
Q. Miosis is mentioned?
A. Yes.
Q. We heard evidence from Professor Ferner that the eyes dilate in death. Is that within your professional knowledge?
A. Yes.
Q. So that --
A. But the classic sign of nerve agent poisoning is not a dilatation of the pupils it is a constriction of the pupils.
Q. Quite, that I understand, miosis.
A. That was not observed as far as the evidence --

Q. No, what I am putting to you is the observation of Professor Ferner, that if you die your pupils dilate and since we don't know when the observation was made, it doesn't seem to tell either way.
A. They do eventually.
Q. Dilate?
A. Yes.
Q. What do you mean by that?
A. Well it takes some time, they don't dilate immediately. Depending on the cause of death. I would suggest that if you are suggesting that the cause of death here is nerve agent poisoning, I would expect the pupils to remain constricted for some time after death.
Q. That is useful.
I am not suggesting anything, I am simply exploring the possibilities with you. We are not I think at odds.
A. Thank you.
Q. All in all, and given the comparatively short time that this gentleman was in the hands of the paramedics, I would suggest that the suite of symptoms he exhibited, although by no means exclusively consistent with nerve agent poisoning was certainly not inconsistent with it?
A. I would agree.
Q. Thank you.
At the end of your evidence, and I think it is the

first time you have said this, it was elicited from you an opinion about the likelihood that Mr Perepilichnyy had died from a cardiac channelopathy. From what aspect of your expertise does that opinion derive?

A. Well, just the circumstances around him actually collapsing and dying quite quickly.

Q. Yes. You would presumably defer to the opinions of the experts in that field?

A. Most certainly. Most certainly.

THE CORONER: Sorry, what is it you are relying on? What is it you are drawing attention to?

A. Nothing in particular. I mean it was just in relation to a question that Mr Skelton asked about, on the balance of probability ... you know, between poisoning and some sudden cardiac event, which we know has no structural basis. What we are then talking about is some kind of arrhythmia, channelopathy is just one cause of, you know, those arrhythmias. From all the evidence I have seen, all I am saying is personally I would favour a cardiac death rather than a poisoning, but from the evidence we have, you cannot 100 per cent rule out either cause --

MR MOXON BROWNE: No.

A. -- as far as I am concerned.

Q. Just so that we are not misunderstanding anything you

are saying, it was suggested to you that this may be a situation in which the coroner may come to the conclusion that either Mr Perepilichnyy was poisoned or that he died from a channelopathy. Your response to that was that you thought that either explanation was possible. That was your words.

A. Correct.

Q. I think that if we just adopt, as I think you were doing, what I might call a binary analysis, because although what you said was true, you could probably add, if it be your opinion, that there isn't any other likely cause that presents itself?

A. That is true.

Q. Although both are possible, the fact that it has to be either one or the other really is a matter of high probability?

A. Yes.

MR MOXON BROWNE: Thank you.

Thank you, sir.

THE CORONER: Can you just help me, death from a nerve agent, I just want to understand what you are saying. You told us about the pupils that you expect to be narrow for some time, is that right?

A. Hmm.

THE CORONER: Just looking at the evidence you gave earlier

the eyes and the nose running, coughing, secretions, unable to control bladder and bowels, just making sure I've got it right, epileptic seizure, slowing of heart, reduction of blood pressure and then you stop breathing.

Then I think what you said to Mr Moxon Browne was that what there was here was not inconsistent with such a crisis. Can you just explain why you say -- I mean how many of these things do you have to have and if you don't have them it becomes inconsistent with it? Do you follow what I am asking?

A. Yes, I do, sir, I do.

How can I be helpful? (Pause)

I think in retrospect, knowing the time at which he died, so the point at which these observations were made were shortly before death. What I would expect based on experience, both in animals and in man, that you should have seen most of those symptoms, as that cholinergic crisis complex. You should, but it comes down to the reliability of the people that were observing him, you know, he may have shown some of those symptoms unobserved, we just don't know.

That is why I answered the way I did.

THE CORONER: No, well I have heard evidence about that and I shall have to take a view about it. Suppose the picture -- just assume for these purposes there is

a reliable picture of what state he was in, if it is reliable you would expect to see most of the symptoms?

A. I would suggest so, yes. At the point so close to his death.

THE CORONER: Yes.

If you don't see most of those, without necessarily ruling it out, does it make it less likely or does it --

A. I think it makes it less likely. I wouldn't rule it out, to be fair to Mr Moxon Browne.

THE CORONER: Yes. All right.

Who is next?

Questions from MS HILL

MS HILL: Dr Rice, just a couple of questions about the evidence that Dr Perry gave.

I have her evidence in front of me and it appears that although she discussed generally the opioid issue, if I can call it that, she gave evidence that the possibility remained of etorphine being a viable possibility in this case. Does that accord with your understanding or would you just defer to her expertise on it?

A. No, I think I would defer to her expertise on etorphine, it is not a compound that I am familiar with.

Q. You also are not a cardiologist, are you?

A. No.

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

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

the expert has answered that stray outside his area of expertise. I just put a marker down.
MR SKELTON: That is why I said "are you able to say".
MS HILL: The questions have already been asked of this witness in a similar vein.
MR SKELTON: You are not able to say?
A. Sorry?
Q. You are not able to say?
A. I am not able to say, no.
MR SKELTON: Thank you.
THE CORONER: No one else? No.
There we are. Thank you very much indeed.
A. Thank you.
THE CORONER: Thank you.
Is that all for now?
MR SKELTON: It is, sir.
THE CORONER: 10.00 tomorrow.
MR SKELTON: Yes, please.
(5.39 pm)
(The Inquest adjourned until 10.00 am the following day)

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