

THE HIGH COURT

[2010 No. 230 P]

EOIN DUNNE (AN INFANT) SUING BY HIS MOTHER AND NEXT FRIEND FIONA MURPHY

PLAINTIFF

AND

COOMBE WOMEN AND INFANTS UNIVERSITY HOSPITAL

DEFENDANT

JUDGMENT of Ms. Justice Irvine delivered on the 1st February 2013

1. The plaintiff, Eoin Dunne ("Eoin") was born at 6.35am in the Coombe Hospital in Dublin on the 30th July, 2002 and is the son of Fiona Murphy and Mark Dunne. The couple have four other children aged thirteen, eight, six and three years respectively. Fiona Murphy ("Dr. Murphy") is a medical doctor and anaesthetist by profession.

2. Eoin suffers from severe dyskinetic cerebral palsy. He has extensive physical problems and is wheelchair dependent. He cannot crawl or walk and can only sit unsupported for a brief period of time. Eoin is entirely dependent and requires assistance with dressing, feeding and toileting. Save for an episode of a condition known as rhabdomyolysis, which he experienced in February 2012, his general health since birth has been very good and stable.

3. In these proceedings it is maintained that if it were not for the defendant's negligence in and about the care it provided to Eoin during the first, approximately, twenty minutes of his life, he would not have sustained the injuries which now afflict him. Putting the case at its most simple, it is asserted that Eoin was born in what I will describe as only moderate condition, probably due to the stresses exerted upon him while coming through the birth canal in the final minutes prior to his birth, and as a result of which he did not breathe spontaneously and required resuscitative assistance. It is accepted that positive pressure bag and mask ventilation was commenced within the first minute of life and that chest compressions were started shortly after he was one minute of age as his heart rate was then below 60 beats per minute ("BPM"). It is alleged that bag and mask ventilation was unsuccessful probably due to failure on the part of the midwife to obtain a seal between the mask and the infant's face and/or the incorrect positioning of the head or jaw and/or her inexpert use of the anaesthetic breathing bag ("flow bag") which was used to deliver positive pressure ventilation. As a result, Eoin's condition deteriorated to the point that he required emergency intubation. It is claimed that it was not until Eoin was ten to fourteen minutes of age that the paediatric registrar, Dr. Ramesh, arrived to assist with the resuscitation and that it was several more minutes before a proper airway was established. At that stage, Eoin was in such poor condition that it was not until he was about twenty three minutes of age that his heartbeat was restored. It is alleged that by reason of this failed and/or delayed resuscitation Eoin experienced a period of near total acute hypoxic ischaemia which commenced no earlier than two to three minutes in advance of his birth and ended when his heartbeat was restored, and that this is what caused the injuries from which he now suffers.

4. The defendant has at all times maintained that it is not responsible for Eoin's injuries. It denies all allegations of negligence and asserts that his injuries have nothing whatsoever to do with a failed or delayed resuscitation. It maintains that Eoin was born unexpectedly flat having regard to his mother's uneventful labour and that it immediately provided competent and timely resuscitation over all of the period commencing approximately one minute after his birth and continuing up to the time when his heartbeat was restored. It maintains that Eoin was intubated for the first time when he was five minutes of age and that he was reintubated when he was eight minutes of age as he did not respond to oxygen delivered via the first endotracheal tube. The defendant maintains that the reason Eoin sustained brain damage is wholly unrelated to the care which it provided to him in and about the time of his birth.

5. As to the cause of Eoin's injuries, the defendant, in advance of the trial and during the first tranche of these proceedings, maintained that it was highly likely that these were caused by an hypoxic ischaemic event which occurred in the hours or days before delivery or that something else had happened prior to his birth that would account for the fact that he became brain damaged despite the delivery of competent and timely resuscitation. That causation case was later abandoned in light of investigations carried out following the episode of rhabdomyolysis, which Eoin experienced in February 2012. Thereafter, the defendant maintained that Eoin was probably born with an underlying mitochondrial disease, muscular or neuromuscular disorder, or some other type of complex genetic defect such that he did not breathe spontaneously at birth or respond normally to the defendant's timely resuscitative efforts and thereby sustained his present injuries during a period of hypoxia in and about the time of his birth.

6. This judgment relates solely to the issues of liability and causation as on the morning of the hearing of the action the court acceded to an application made by the defendant for a split trial. Those issues were tried in two tranches of evidence over some 43 days. The reason for the break in the evidence was that approximately three weeks into the proceedings Eoin became ill and it was necessary for the parties to assess the extent to which that illness i.e. rhabdomyolysis, might be relevant to those issues.

7. During the rather lengthy hearing, the court heard evidence from a very significant number of expert witnesses and I think it may be helpful at the outset to set out the names of those experts and identify their respective qualifications.

Bibliography

Plaintiff's Expert Witnesses

Prof. Peter Flemming, Consultant Paediatrician and Neonatologist. He is the Professor of Infant Health and Developmental Physiology at the University of Bristol. He has spent 35 – 40 years studying the physiology of processes which can affect resuscitation.

Dr. Janet Rennie, Consultant Neonatologist with a special interest in brain injury in babies. She has held numerous academic positions and has written chapters in many major British textbooks. She has also authored or co-authored a number of textbooks of relevance to the present case, including those entitled '*Manual on Neonatal Intensive Care*' (4th Ed.) and *Rennie and Robertson's Textbook of Neonatology and Neonatal Cerebral Investigation*.

Dr. Peter Buchan, Consultant Obstetrician and Gynaecologist, now retired. He was Clinical Senior Lecturer in obstetrics and gynaecology at the University of Leeds and was on the clinical teaching staff of the Department of Obstetrics and Gynaecology at the University of Edinburgh. He was also in active practice as an obstetrician for 40 years.

Prof. Alan Hill, Consultant Paediatric Neurologist attached to the University of British Columbia and Vancouver. His speciality is

hypoxic ischaemic injury in the newborn.

Prof. Marcus Likeman, Consultant Neuroradiologist with a special interest in the imaging of the brain and spine of children. He is the Consultant Paediatric Neuroradiologist at Bristol Royal Hospital for Children.

Dr. Michael Smith, Consultant Paediatrician attached to the neonatal intensive care unit at the Children's Hospital in Sheffield. He is Honorary Clinical Senior Lecturer in Paediatrics and Honorary Lecturer in Neurology at the University of Sheffield School of Medicine. He has authored many articles including several on children with cerebral palsy.

Dr. Robert McFarland, Clinical Senior Lecturer and Consultant Paediatric Neurologist at Newcastle University and Newcastle Upon Tyne Hospital, NHS Foundation Trust. He established a mitochondrial diagnostic laboratory and is one of six paediatric neurologists providing a national screening service for mitochondrial disorders.

Dr. Norman McConachie, Consultant Neuroradiologist at Nottingham University Hospitals, NHS Trust 1995. His subspecialty expertise is paediatric neuroradiology.

Defendant's Expert Witnesses

Prof. Gerard Berry, Professor of Paediatrics in Harvard Medical School. He is the Director of the metabolism programme in the division of genetics in Boston Children's Hospital and also the Director of the Biochemical Genetics training programme for Harvard Medical School.

Dr. William Reardon, Consultant Geneticist at Our Lady's Hospital for Sick Children in Crumlin, Dublin. He has authored many chapters on clinical genetics and the practice thereof in several major specialist textbooks.

Dr. Rosemary Manning, Consultant Paediatrician attached to Tallaght Hospital. She is also a Senior Lecturer in Medicine in Trinity College Dublin. She has had a number of years of experience in dealing with metabolic disorders, particularly in and around the years 2005 and 2006 in the course of a two year post in Temple Street Hospital.

Dr. Colm O'Donnell, Consultant Neonatologist in the National Maternity Hospital and in Our Lady's Hospital for Sick Children in Crumlin. He has authored several chapters in textbooks referable to neonatology matters including the resuscitation of the newborn infant.

Dr. John F. Murphy, Consultant Neonatologist at Holles Street and Consultant Neonatologist and Paediatrician at Temple Street Hospital. He has been tasked with redeveloping the neonatal services in Ireland and is national HSE clinical lead in neonatology.

Dr. Valerie Smith, a qualified nurse and midwife with a Ph.D. in Midwifery Studies from Trinity College Dublin.

The Hearing: The First Twenty Days

8. I do not intend in this part of the judgment to summarise all of the evidence as that would be an enormous undertaking. When I set out my findings later in this judgment, I will refer to the evidence which most influenced those findings. At this point I will do no more than give a brief outline of the evidence heard before the proceedings were adjourned on Day 20.

The Plaintiff's Evidence

9. The plaintiff's mother Dr. Murphy and his father Mark Dunne gave evidence as to the circumstances surrounding his birth. Dr. Murphy recollected hearing one of the midwives say, on delivery, that his heart rate was 100. She referred to the fact that after Eoin was born he was placed on the bed in front of her. She thought he looked dusky and pale and he was not moving. Mr Dunne also gave evidence that the plaintiff did not cry, did not take a breath and did not move at this time. Dr. Murphy became concerned and the midwife took Eoin away to the resuscitaire to give him oxygen using a mask and flow bag. She said that she could see Eoin during this period of his resuscitation and was concerned that he was not responding. His chest was not rising and falling. Dr. Murphy said that she remembered the SHO, Dr. Lewis, arriving into the delivery suite when Eoin was between five and eight minutes of age. She maintained that it was a long time before Dr. Ramesh, the paediatric registrar, arrived. She became panicky and wanted to get out of the bed to assist. Dr. Murphy was convinced that the medical records which note Dr. Ramesh's arrival as having occurred when Eoin was five minutes of age are wrong. She said she was keenly aware of the time on the wall clock and when the ten minute stage was reached without the arrival of a doctor capable of intervening she was extremely worried. She thought Dr. Ramesh arrived when Eoin was approximately ten or twelve minutes of age and her husband felt he arrived when he was about thirteen or fourteen minutes of age. Dr. Murphy told the court that Eoin's heart rate did not pick up until he was approximately 23 minutes of age and later that day she made a note to this effect.

10. The plaintiff's experts were agreed that this was not a case of foetal hypoxic ischaemic injury but a case of neonatal hypoxic ischaemic injury. Each was satisfied that Eoin's injuries were sustained as a result of an hypoxic ischaemic episode which occurred at and immediately after his birth. All were agreed that there was simply no evidence to support the defendant's assertion that Eoin's injuries were sustained due to an hypoxic ischaemic event prior to birth. They relied upon his mother's normal pregnancy and labour in support of their respective opinions. Nothing sinister such as the presence of meconium had been noted during labour and the CTG trace of Eoin's heart was entirely normal until approximately three minutes prior to his delivery.

11. As to the line of examination pursued by the defendant regarding causation, Prof. Flemming stated that he had never seen a baby silently injured *in utero* without signs or symptoms and he could not imagine a mechanism whereby a baby could sustain an injury caused by a 10 to 25 minute period of hypoxia and then continue to develop normally *in utero* thereafter. He expressed surprise that the defendant could put forward a case that somehow Eoin could have had a major hypoxic ischaemic event which could then have resolved spontaneously without a trace of any abnormality appearing on the CTG prior to birth.

12. The plaintiff's experts were satisfied that Eoin's condition at birth was reflective of the stresses to which he had been subjected during the previous three minutes. There was likely to have been intermittent cord compression in the second stage of labour. The cord can, according to Mr. Buchan, slip beside the head and become caught and the baby then becomes moderately asphyxiated. The fact that the foetal heart was heard and regular at 6.33 did not mean that the heart rate had not declined. From the records, Mr. Buchan understood that Eoin's heart rate at birth may have been 60 beats per minute and if this was so it was likely that his heart rate had continued to fall during the last two to three minutes prior to his delivery. It was his opinion that the CTG trace was becoming suspicious by 6.32. He told the court it was often the case that a baby might develop a reflex bradycardia as a result of compression of the foetal head during its mother's final expulsive efforts to deliver it.

13. Prof. Hill, Prof. Flemming, Dr. Rennie, Mr. Buchan and Mr. Smith were all agreed that Eoin's condition at birth was such that he

ought to have responded promptly to positive pressure bag and mask ventilation if it had been delivered effectively. They were each of the opinion that Eoin had been born in reasonably good condition and was just mildly asphyxiated. This was evidenced, they said, by the apgar score of five assigned to him at one minute of age, which included a score of two for tone. Professor Flemming and Dr. Rennie referred to the fact that while Eoin was awarded zero for respiration he was in fact making attempts to breathe. Dr. Rennie stated that, even taking into account inter-observer variability in the assessment of apgar scores, if Dr. John F. Murphy were to give evidence to the effect that this baby was in a collapsed condition at birth he would be incorrect. In support of her opinion she also relied upon the fact that Eoin's blood gases at birth were essentially normal and that once he reached thirty minutes of age, he experienced no further problems affecting his heart or lungs. According to Prof. Flemming, at the time of birth Eoin's diaphragm muscle was ready, once oxygen was delivered to his lungs, to assist in the supply of that oxygen to his vital organs.

14. The plaintiff's evidence was that the likely reason for the deterioration in Eoin's condition and the drop in his apgar score to one at five minutes was due to the fact that bag and mask ventilation had not been effectively delivered. The court heard that there were about ten ways in which bag and mask ventilation could fail. Particular emphasis was placed upon the importance of obtaining a seal between the mask and the baby's face and the difficulty of positioning the baby's head correctly so as to ensure its airway did not obstruct. Prof. Flemming and Dr. Rennie stressed the complexity of the task of delivering positive pressure to inflate the lungs using the flow bag in use in the Coombe Hospital at the time of Eoin's delivery.

15. A number of witnesses referred to the fact that 10% of all babies are born with apgar scores of four, five or six at one minute and need some assistance from bag and mask ventilation. Further, Mr. Buchan relied upon a paper entitled '*Outcome of Resuscitation Following Unexpected Apparent Stillbirth*', authored by D.M. Casalaz & Others, which reviewed the outcome of resuscitation in the case of 45 babies born in unexpectedly poor condition and who had been allocated an apgar score of zero at one minute and of whom 93% were successfully resuscitated. He relied upon this paper as evidence in support of the fact that, in the vast majority of cases, resuscitation improves the condition of infants over the first five minutes of life. Indeed, each of the plaintiff's experts stressed how it was possible to keep babies who had no heart rate whatsoever perfused by use of bag and mask ventilation for extended periods of time without them sustaining injury. Mr. Smith referred to carrying out this procedure himself on one occasion for some 75 minutes during which period he managed to maintain adequate perfusion of the infant. It was stressed that it was merely a question of getting oxygen delivered to the baby's lungs and then a matter of ensuring that the then oxygenated blood was circulated throughout the body using chest compression.

16. Babies born with brain damage, the plaintiff's experts advised, are no more difficult to resuscitate than babies who are born without brain damage. Accordingly, if bag and mask ventilation and cardiac compression had been effectively delivered in this case, or if Eoin had been ventilated using an endotracheal tube within the first ten minutes of his life, he would not have sustained the injuries which now afflict him. Mr. Smith stressed the importance of Eoin's normal cardiovascular system which was fully operational not long after he was twenty minutes of age. This being so he stated that had the oxygen been delivered to his lungs there was no reason why Eoin's cardiovascular system had not been activated at "time zero". The plaintiff's expert witnesses were agreed that it was unlikely that Eoin's lungs were inflated until Dr. Ramesh passed the second endotracheal tube and the question was the time at which that tube was in place, as its positioning brought to an end the hypoxia and ischaemia which had been continuing up to that time.

17. As for the defendant's assertion that the midwives observed Eoin's chest rising and falling while he was receiving chest compression and bag and mask ventilation, Dr. Rennie stated that his chest simply could not have been rising and falling during a period when his apgar score fell from either five or six down to a score of one.

18. The plaintiff's witnesses accepted that regardless of competence, an endotracheal tube may end up in the wrong place and if the heart rate does not come up immediately, another tube should be put down. Accordingly, there was no criticism of any delay as may have resulted from the fact that Dr. Ramesh had found it necessary to pass a larger endotracheal tube, the first tube having failed for whatever reason to deliver oxygen to Eoin's lungs. The plaintiff's experts were agreed however, that had the second tube (which a subsequent x-ray showed was definitely in the correct position) been in position at eight minutes of age as contended by the defendant, Eoin's heart rate would have recovered within one to two minutes and because his heart was normal, lung inflation should have allowed him to respond quickly. However, on the plaintiff's account this recovery did not occur until he was approximately twenty three minutes of age. If Eoin's heart only started to pick up at twenty minutes of age, the second tube could not have been in position, as contended for by the defendant, at eight minutes. Further, if there had been such a lapse of time between the second intubation and the rise in Eoin's heart rate, Dr. Rennie told the court it was likely that many more observations and entries would have appeared in the medical chart to reflect that interval. The only steps documented over that period were the administration of one infusion of intravenous adrenalin and one infusion of sodium chloride. She said she would have expected the notes to reflect the activities of a doctor looking for other reasons as to why Eoin was not responding over that twelve minute period. Dr. Ramesh disputed this and said that the various steps taken by him accounted for the time spent.

19. Prof. Flemming was adamant that the notes in the medical chart which record that the second endotracheal tube was in situ at eight minutes and that air entry was good at fifteen minutes did not "hang together". It was clear, he said, that the second tube had been placed in the correct position as Eoin responded to the oxygen delivered through this tube. Hence, the note that air entry was good at fifteen minutes was consistent with reintubation occurring at that time as opposed to when he was eight minutes of age. It could never, according to Prof. Flemming, have taken twelve minutes for Eoin to respond to effective intubation.

20. It was agreed by the plaintiff's experts that if Dr. Ramesh had arrived and commenced intubation by the time Eoin was five minutes of age, he could not be faulted. However, they said that if he had arrived at that time it was inconceivable that Eoin could have gone on to experience the type of damage which he did, even if it had taken him a further three minutes to reintubate him. Eoin's moderate hypoxia at birth was, according to Prof. Flemming, converted into severe catastrophic asphyxiation due to a failure on the part of the defendant to deliver adequate and timely resuscitation over the first seventeen or so minutes of his life.

21. The plaintiff's expert witnesses felt that the timings on the drugs chart were likely to be more reliable than those contained in the rest of the neonatal notes. Prof. Flemming stated that the details of any drugs given in the course of resuscitation are always written contemporaneously. Noting the drug, the dosage administered and the time at which it is given is critical. It is essential to know when the last dose was given so as to know when the next dose can be administered. A drug chart is meaningless if entries are made retrospectively. Mr. Smith stated that sometimes the drug, its dosage and time of delivery will be written down on a loose leaf sheet or cardex and then formally written up later. At this resuscitation, according to the plaintiff's experts, there were sufficient participants to allow for emergency resuscitation whilst still having a contemporaneous note taken of the time at which the respective drugs were delivered. From the timings that had been allocated to the various steps taken in the course of the resuscitation, they felt it was likely that the times entered on the drug chart were written in the course of the resuscitation or noted elsewhere and transcribed into the chart after the emergency was over. In particular, Dr. Rennie explained that it was highly likely that it was the IV dose of adrenalin that kick-started Eoin's heart, and according to the drug chart that was given when Eoin was 22 minutes of age. That timeline was also consistent with Dr. Murphy's evidence to the effect that Eoin's heart rate picked up when he was

approximately 23 minutes of age, evidence she had given before the significance of the timings on the drug chart had become apparent.

22. Apart from maintaining as a matter of fact that there was no incompetence or delay in relation to the resuscitation, the plaintiff's experts were each challenged regarding the cause of Eoin's injuries. It was put to them that Dr. Colm O'Donnell would contend that Eoin's injuries had been sustained as a result of an hypoxic ischaemic incident which occurred in the hours before delivery and that Dr. John Murphy would state that it was his opinion that the cause of Eoin's injuries was unclear but that the damage may have occurred some hours or days before the delivery. Counsel advised that the defendant would also advance the possibility that something unknown had occurred prenatally that had caused Eoin not to respond to resuscitation. Each of these propositions was roundly refuted by the plaintiff's expert witnesses.

23. The plaintiff's witnesses and in particular Prof. Flemming made it clear that had effective bag and mask ventilation been carried out in the initial stages intubation probably would not have been needed. Furthermore, if the intubation had been successfully established at eight minutes as contended for by the defendant, Eoin could not have experienced a period of hypoxia sufficient to cause the type of injuries from which he now suffers.

24. Prof. Hill and Prof. Flemming were ad idem that the longer a baby suffers from deoxygenation the more difficult it is for oxygenation to restart the metabolic process. The deterioration in Eoin's blood gases which were normal at birth to a PH of 7.17 at 7.30pm and the initial deterioration in his apgar scores were reflective of him having sustained a prolonged period of hypoxic ischaemic injury immediately after his birth.

Brief Summary of the Defendant's Factual Evidence

25. Midwife Flemming who had been a midwife since 1988 and Nurse Mary Kelly, who was a student midwife at the time, were present at Eoin's birth. At 6.33, Midwife Flemming believes she listened to the foetal heart and heard it to be regular. She said there were some early decelerations present but she was satisfied that Eoin's heartbeat was normal. When he was born he looked like he was breathing in but then did not breathe out. At birth, Midwife Flemming thought Eoin was about to cry and the fact that he was making an effort and made a grimace suggested to her that he had some reflex irritability. She became concerned about his condition as he was not moving on the bed where he had been placed by herself and Nurse Kelly. Midwife Flemming said that she then asked Nurse Kelly to get help and call the paediatrician while she took Eoin from the bed over to the resuscitaire where she commenced positive pressure bag and mask ventilation. According to Midwife Flemming, Midwife Manning arrived almost immediately. She stated that Dr. Lewis, the SHO who had been called by Nurse Kelly on her instructions, arrived when Eoin was three minutes of age. She stated that when she asked Nurse Kelly to call her, she had expected that Dr. Lewis would be in a position to participate in the resuscitation. Midwife Flemming went on to say that before Dr. Lewis arrived, but after Midwife Manning had arrived, she had stated that she needed the Registrar. This was the second call for help. By that, she meant that she required assistance from the Registrar and the emergency team from the Special Care Baby Unit. Under cross-examination, Midwife Flemming agreed that her note, which stated that the paediatric SHO and the Registrar were called at the same time to come stat, was incorrect and should have recorded that the call to the Registrar had been made at a time later than that which had been made to the SHO. Her note should have read that the Registrar was later called to come "stat".

26. According to Midwife Flemming, Dr. Ramesh arrived when Eoin was five minutes of age. If he had not arrived for twelve minutes she would have been agitated and if he had not come for seventeen minutes there would have been a hospital inquiry as she would have reported the matter to the Master. She wrote her note regarding Eoin's labour retrospectively and after she had spoken to Prof. Turner.

27. Midwife Flemming confirmed that it was she who was responsible for Eoin's one minute apgar score of 5, but not for his later scores. She had initially given Eoin a score of 6 but having reviewed that score with Dr. Ramesh she later amended it downwards to 5. Midwife Flemming also confirmed that she completed the incident report form the following day and advised that this was done to alert the hospital to the fact that Eoin had been born ill and had required admission to the intensive care unit ("ICU"). She stated that this type of form was not intended to capture a full account of the incident being reported and that the advice given to staff members was that the details inserted should be brief

28. Midwife Flemming said that the drug chart was not always filled in contemporaneously and that it depended upon the number of people who were present. She did not remember seeing it the day Eoin was born. She said that it was normally brought to the resuscitation in the paediatrician's briefcase.

29. Nurse Mary Kelly felt that there had been no problem with Eoin's heart rate at birth but he appeared to her to be extremely pale. She confirmed that Midwife Flemming asked her to get paediatric help and her evidence in relation to this issue differed somewhat to that which had been given by Midwife Flemming. She told the court that Midwife Flemming told her to call "the paediatrician, the SHO". In response to this request, she pulled the cord bell in the delivery suite and she pressed the SHO button on the internal phone. She did not press the button on the phone which would have commanded the presence of the paediatric Registrar. After she pulled the cord bell, Midwife Manning arrived. In relation to Midwife Flemming's second request for help, Nurse Kelly stated that she was merely asked to "put out the call" which she understood to mean to get the assistance of the Neonatal team. As a result of this request, she went to the nurses' station to get help. Nurse Kelly confirmed that Dr. Murphy was anxious to get out of bed to help the midwives as she had become alarmed at the developing situation but she advised her to lie down so that she could deliver the placenta. She stated that she believes that Dr. Ramesh had arrived and was conducting the resuscitation at the time she delivered the placenta and that she did this at 6.47. There were so many people in the room at that stage she was anxious to leave. As to the time of Prof. Turner's arrival she stated that she remembered someone making reference to the administration of sodium bicarbonate and that she thought that Prof. Turner was not there at that stage.

30. Midwife Manning told the court that she was first approached about the events concerning Eoin's birth eight or nine years after the events and that she had not made any note in the medical chart. She recalled that when she arrived Eoin was on the resuscitaire and he looked pale and floppy. She listened to his heart rate which was less than 60BPM and she then instigated cardiac compressions. Midwife Manning stated that when carrying out chest compressions on an infant you can feel the lungs ventilating and expanding and that in the present case she had felt Eoin's lungs expanding. Prior to Eoin's birth, Midwife Manning had only performed chest compressions on three other occasions. According to Midwife Manning, Dr. Ramesh arrived before the nurses from the Special Care Baby Unit. One of these nurses then took over the task of providing cardiac compression. Midwife Manning stated that she believes she was with Dr. Ramesh assisting him when the placenta was delivered. She said there was no delay before the arrival of Dr. Ramesh and that if there had been it would have been a huge incident.

31. Notwithstanding the fact that he was first consulted about Eoin's case in 2011, Dr. Ramesh told the court that he remembered the events in question because of the extensive and aggressive nature of the resuscitation. Furthermore, he had made a

retrospective note of what had occurred on the same day having spoken to Dr. Lewis, Nurse Nancy Carroll, Dr. Griffin and Dr. Gray. Dr. Ramesh stated that if a delay such as is alleged in this case had occurred, questions would have been asked of him and of the midwives and he would have wanted to know why he wasn't called earlier.

32. Dr. Ramesh stated that he believes he was paged when Eoin was four minutes of age and arrived to the delivery suite when he was five minutes of age. He felt it was likely that he was in the NICU when he was called to attend. He said that he had worked his timings back from what midwives had told him and that he would also have got the time of his arrival from the resuscitaire. Dr. Ramesh stated that, on arrival, he took over the bag and mask ventilation. He examined Eoin, listened to his heart and intubated him. He gave him a first dose of adrenalin and then a second dose of adrenalin at which stage he asked that Dr. Griffin, Consultant Paediatrician, be called. As Eoin did not pick up, Dr Ramesh told the court that he then reintubated him, gave him intravenous adrenalin followed by sodium chloride to expand his circulation and later sodium bicarbonate to correct his acidosis. He felt he was busy all of the time checking Eoin throughout the twelve minutes or so between the second intubation and the time his heart rate recovered.

33. Dr. Ramesh stated that Eoin was about 20 minutes of age when his heart began to pick up. He confirmed that this occurred after the intravenous adrenalin was administered and the recovery was improved by the administration of the sodium chloride and sodium bicarbonate. Dr. Ramesh seemed to initially agree with Dr. Rennie's evidence that sodium bicarbonate is normally administered after circulation has been restored and that it is not a cardiac stimulus.

34. Dr. Ramesh said that he did not sign the drug chart during the resuscitation and he didn't know if the timings were on the chart when he signed it.

35. Dr. Ramesh also stated that it would be normal for the midwives to call the first responder i.e. the SHO if the baby's tone was good.

36. Dr. Ramesh accepted that he had been told inaccurately that the Eoin had been born flat by Midwife Flemming. He agreed that he had not been given his one minute apgar scores during the resuscitation and he had not been made aware of Eoin's apparently rapid deterioration between one and five minutes of age. He had also not been informed that his base line heart rate had been 125 beats per minute, two to three minutes before his birth.

37. Prof. Turner, Consultant Obstetrician, who was providing locum cover to his colleague Dr. Hugh O'Connor at the time of Eoin's birth, stated that he was called to the delivery of a baby who was born "unexpectedly flat". He felt it was implausible that there could have been any delay in Dr. Ramesh's arrival and in the carrying out of the resuscitation and believes that had there been any significant delay, it would have been reported to him by the midwifery staff. He felt that he had been with Dr. Murphy for about ten to fifteen minutes before he wrote his note in the chart. Prof Turner said that he could not be sure as to the stage the resuscitation was at when he arrived. He also confirmed that after Eoin's birth Dr. Murphy made no complaint to him about any delay on the part of the staff in arriving to carry out the resuscitation.

The Adjournment of the Proceedings

38. When the plaintiff fell ill with rhabdomyolysis in February 2012, the proceedings were adjourned to enable the parties to assess the extent to which that illness might impact upon the causation issue in the case. The defendant sought and subsequently obtained expert reports from Dr. Rosemary Manning, Dr. William Reardon and Prof. Gerard Berry regarding the significance of Eoin's recent illness in the context of the proceedings. Having obtained those reports it did not obtain any supplemental expert opinion from Dr. John A. Murphy or Dr. Colm O'Donnell as to the cause of Eoin's injuries. Indeed, Mr. McCullough S.C., Counsel for the plaintiff, on the 20th July, 2012, in the course of an interlocutory hearing relating to the defendant's application to introduce new evidence, drew the court's attention to the fact that the reports of these original experts appeared to be in conflict with the new evidence which the defendant wished to advance in terms of causation. However, regardless of this fact, the court ultimately made an order on the 31st July, 2012, permitting the defendant to introduce new evidence in line with the expert reports exhibited on the interlocutory application.

39. Undoubtedly, the defendant's causation case was complicated by Eoin's illness in February 2012, and its position not made any easier by the fact that a number of test results emerged after its new experts had provided their reports. Regardless of that fact, the court's determination of the causation issue proved extraordinarily difficult and its task was greatly complicated by the fact that the defendants' case made in oral evidence was not clearly flagged in its expert reports and changed very substantially over the course of the hearing. Indeed, in the written submissions delivered on behalf of the plaintiff after the conclusion of these proceedings, the shift by the defendant in its causation defence was somewhat over enthusiastically described in the following manner, namely:-

"The defendant initially defended this action based upon pre-delivery hypoxia after which it moved to a number of specified mitochondrial disorders; then a primary mitochondrial respiratory chain disorder; then a genetic recessive mutation; then ultimately, as the basis for any of those suppositions diminished to vanishing point, a genetically derived metabolic disorder which was so unprecedented as never yet to be known, recorded or explained by the world wide scientific community".

It is accordingly relevant, I believe, to briefly chart the evolution of the defendant's causation position in the course of the proceedings as each of its experts were cross examined at length regarding the content of their reports in the course of their oral evidence

40. In her expert report of the 19th June, 2012, Dr. Manning concluded that Eoin was probably born with an underlying metabolic condition which was most likely to be a mitochondrial respiratory chain disorder. She felt it could be MERRF, NARP, MELAS or Alper's, all mitochondrial disorders, but advised that without additional testing the precise nature of the disorder could not be identified. Dr. Manning was also satisfied that Eoin had experienced an episode of rhabdomyolysis as a newborn and again in February 2012. As to the cause of his injuries, her report went no further than to state that the existence of a mitochondrial disorder would explain why he was "unexpectedly flat at birth". She did not state how the existence of any such disorder would have interfered with Eoin's response to timely and effective resuscitation. Neither did she express a view as to whether his present disabilities were a direct consequence of such disorder or alternatively were due to acute hypoxia consequent upon that disorder adversely affecting his response to resuscitation.

40. Dr. Reardon, in his report dated the 15th May, 2012, stated that there been no adequate investigation into whether or not there was a metabolic explanation for Eoin's condition at birth or for his abnormal biochemical results. He concluded that his birth presentation could represent an inherent abnormality and felt that he should be tested for Pyruvate Dehydrogenase ("PDH"), a condition which would explain the enzymatic changes in his Creatine Kinase ("CK"), Lactate Dehydrogenase ("LDH") and serum lactate

in the neonatal period. If that test proved normal, he felt that consideration ought to be given to the existence of mitochondrial disease.

41. Notable in Dr. Reardon's report was his statement to the effect that while the MRI findings would support a diagnosis of hypoxic ischaemic encephalopathy, these were not exclusive to that diagnosis and such findings could be caused by other conditions such as metabolic/genetic aetiologies which had not been investigated. From this statement, it is clear that Dr. Reardon was at that stage questioning whether or not Eoin's clinical condition was the result of some underlying metabolic disturbance rather than the result of a hypoxic ischaemic event caused by his failure to respond adequately to resuscitation.

42. Finally, Prof. Berry in his report dated the 10th July, 2012, concluded that Eoin suffered from a multi-organ disease process that was genetic in nature and that this included encephalopathy, metabolic myopathy and subclinical cardiomyopathy. He also felt that Eoin's episode of rhabdomyolysis in February 2012 was consistent with the existence of a respiratory chain defect and that an echocardiogram carried out at that time, which showed left ventricular hypertrophy, was consistent with the presence of mitochondrial disease. He put a mitochondrial respiratory chain defect at the top of his differential diagnosis stating that other recessive biochemical genetic diseases were also possible. He was of the view that whole exome sequencing was likely to yield the correct biochemical genetic diagnosis. Prof. Berry did not accept that the radiological evidence was consistent with Eoin having experienced hypoxic ischaemic damage.

43. What is immensely striking about the aforementioned reports, in the context of the evidence ultimately advanced, is that none of these experts gave any clear indication that they accepted that Eoin's abnormal neurological outcome was a result of an hypoxic ischaemic event. They appear to have been focused upon trying to provide an explanation for the defendant's contention that Eoin's allegedly poor condition at birth and his failure to breathe spontaneously was in some way particularly unique in the context of his mother's normal labour. Further, in speculating upon the type of condition which might have been responsible for Eoin's condition at birth, none of them explained how the presence of any such condition would have precluded him from responding to timely and effective resuscitation. Neither did they identify any mechanism that could have accounted for such failure.

44. The aforementioned causation reports were consistent with a number of statements made by counsel on behalf of the defendant on the 20th July, 2012, in the course of its application to admit new evidence. At that time, the defendant's position as to causation was stated by Ms. Egan S.C. to be as follows, namely:-

"Ms. Egan: we're saying that the brain injury was suffered before birth and now it seems it was probably suffered before the birth as a result of a metabolic disorder. Genetic disorders are metabolic disorders. Mitochondrial disorders are metabolic disorders...

Ms. Egan: we're saying the brain injury was essentially suffered before birth as a result of metabolic disorder, or it's very possible. We cannot establish metabolic disorder; we don't have the test to do so.

Ms. Egan: sorry judge I can't answer that directly except to say that the damage to the brain was suffered before birth, the damage that we see on the MRI was suffered before birth. We now feel, based on the recent episode, it is very possible this was as a result of a metabolic disorder."

45. From this pronouncement, it seemed likely therefore that when the case resumed the defendant would be asserting that the damage to Eoin's brain preceded his birth and was not caused by an hypoxic ischaemic event. In this regard it is important to note that in the course of the first tranche of the proceedings Professor Likeman, Consultant Neuroradiologist, had been called on the plaintiff's behalf to give evidence. His evidence which was uncontested by the defendant was to the effect that the CT scan on day one of life showed classical evidence of significant cerebral oedema consistent with recent hypoxic ischaemic injury. The only disagreement between the parties was as to the timing of that event.

46. In the context of the defendant's expert reports, which appeared to be focusing upon the existence of a mitochondrial or metabolic abnormality which was present at birth as being responsible for Eoin's neurological damage, the plaintiff obtained a report from Prof. Robert McFarland, Consultant Paediatric Neurologist, who is responsible for an internationally recognised centre for mitochondrial disease. Further, because Professor Likeman was unable to attend the resumed hearing, a supplementary report was obtained on the plaintiff's behalf from Dr. Norman McConachie, Consultant Paediatric Neuroradiologist, in support of the contention that Eoin's injuries were caused by a near total hypoxic ischaemic event at the time of his birth. The plaintiff also obtained supplemental expert reports from Prof. Flemming, Mr. Smith, Dr. Rennie and Prof. Hill.

47. Against the backdrop of the aforementioned reports, it came as some surprise to the court the statement made by Mr. McGrath S.C. on the defendant's behalf on the resumption of the case to the effect that it was now accepted that Eoin's abnormal neurological outcome was entirely caused by an hypoxic ischaemic event and that it would be the defendant's case that it was the presence of mitochondrial disease or a metabolic disorder that caused him to respond otherwise than in a normal fashion to timely resuscitation. This is how Mr McGrath S.C. signposted the defendant's substantial shift in position:-

"Mr. McGrath: judge, before my friend embarks on that there is one issue that I think I might be able to simplify, and that is that in the light of the evidence that we now have about a possible metabolic explanation, judge, the defendant now accepts the case that has been made from the plaintiff, by the plaintiff, from the outset that the damage occurred, the irreversible brain damage occurred after the delivery of the plaintiff, in other words, that it occurred during the period of attempted resuscitation, judge. So the suggestion which had been...put forward up to now that it could have been an event pre-labour or early in labour is not being pursued."

48. This statement, as to the timing of Eoin's injuries, was, I believe, inconsistent with that which had been advised to the court by Ms. Egan S.C. in the course of the application seeking to admit new evidence, and was also in direct conflict with the causation opinions which the defendant had obtained from Dr. John Murphy and Dr. Colm O'Donnell which had been put to the plaintiff's experts in the course of the first phase of the proceedings. Further, as to the cause of Eoin's injuries, Mr. McGrath's statement did not marry comfortably with the substance of the evidence contained in the expert reports furnished to the court for the purposes of seeking to admit new evidence.

The Resumed Hearing

49. When the proceedings resumed before the court on the 9th October, 2012, each of the plaintiff's witnesses were recalled to address the test results and clinical findings relied upon by the defendant's experts in support of their various opinions as to the existence of some underlying mitochondrial, metabolic and/or genetic disorder. Each held fast to their view that the only logical clinical explanation for Eoin's injuries was a near total acute hypoxic ischaemic event caused by a failure on the part of the defendant

to deliver timely and effective resuscitation.

50. The plaintiff's expert witnesses did not consider Eoin's condition or his failure to breathe spontaneously at birth to be unique or extraordinary. His condition did not warrant, in their opinion, those responsible for his care seeking to explain it by reference to some sinister underlying genetic or metabolic disorder. They were emphatic that even if the plaintiff had been born with any of the disorders contended for by the defendant's experts the existence of any such disorder could not have accounted for his failure to respond to timely and effective resuscitation. Under cross-examination, a number of the plaintiff's witnesses repeatedly stated that they had never come across such a case in practice and that they knew of no mechanism by which a mitochondrial disease, metabolic disorder or genetic defect could make it more difficult to resuscitate a baby and they had never read about such a case in any medical literature.

51. Each of the defendant's expert witnesses gave evidence as to the type of underlying disorder they believed was responsible for the fact that Eoin sustained a near total hypoxic ischaemic event in the period immediately after his birth and their evidence in this regard is dealt with in more detail later in this judgment. However, it was not until day 27 of the resumed hearing that the defendant, for the first time, sought to advance, in cross-examination, any mechanism to explain how the presence of a metabolic, mitochondrial or other genetic disorder could have adversely impacted on Eoin's ability to breathe spontaneously at birth or to respond to timely and effective resuscitation. The court at that stage was advised that Prof. Berry had relayed this information to the defendant's solicitors in response to the plaintiff's expert evidence just referred to. Regardless of the fact that these explanations had not been put in cross examination to Dr. McFarland, Dr. Rennie, Prof. Flemming or Prof. Hill, the court agreed that Prof. Berry would ultimately be at liberty to introduce this evidence subject to permitting a number of the plaintiff's witnesses to be recalled so that they might have an opportunity to comment on the same. At the time the court made this ruling it was of the belief that Prof. Berry would say Eoin's failure to breathe at birth and respond to timely and effective resuscitation could be accounted for in the following manner:-

(a) that as a result of the likely involvement of a mitochondrial disease or metabolic disorder at birth the brainstem was in some way affected such that Eoin was slow to respond to resuscitation;

(b) that the nerves travelling from the brain to the respiratory muscles and diaphragm could have been impacted upon so as to inhibit resuscitation;

(c) that as a result of mitochondrial disease or some other metabolic disorder there could have been an error in Eoin's neuromuscular function thus interfering with his ability to respond to resuscitation; and

(d) that Eoin has some genetic abnormality of his muscles such that his response to resuscitation was impeded.

52. The complications with the defendant's causation evidence did not end with the brief history just recorded as Prof. Berry, when he came to give evidence, said that the four mechanisms last referred to did not relate to Eoin's case and were merely efforts on his part to identify the circumstances in which it was possible that some child might not breathe at birth or respond to resuscitation.

53. Overall, the oral evidence given by the defendant's experts was, I have to say, at times, substantially at variance with the opinions which they had expressed in their reports. As already stated, some of those changes can be explained by the fact that a number of test results only became available after they had prepared their reports. For example, by the time Dr. Manning gave her evidence, the conditions which she had advanced as the most likely reason for Eoin's failure to respond to resuscitation i.e. MERRF, NARP, MELAS and Alper's had all been ruled out by genetic testing. When giving his evidence, Dr. Reardon most reasonably also departed from the view expressed in his report that Eoin's presentation at birth was most likely to be a result of Pyruvate Dehydrogenase ("PDH") deficiency as this had also been ruled out by testing. Likewise, Prof. Berry, as a result of an MR spectroscopy, the report of a second echocardiogram and the PDH analysis just referred to, also departed from his original opinion which had placed a mitochondrial chain defect at the top of the differential diagnosis, while leaving over the possibility of other recessive biochemical genetic diseases.

Decision

54. While the burden of proof is on the plaintiff to establish his case on the balance of probabilities, I must of course consider as part of my deliberations whether it is likely that Eoin was born with any of the conditions or genetic abnormalities advanced by the defendant's experts. It matters not that they were not *ad idem* as to the nature of Eoin's likely co-existing disorder, the presence of rhabdomyolysis at birth or as to the significance to be attached to his neonatal test results. However, prior to setting out my conclusions on this issue, I will briefly refer to the more significant aspects of the causation evidence given by each of the defendant's experts.

55. Dr. Manning told the court she believes that Eoin probably suffers from a mitochondrial disease, as evidenced by the fact that at birth he developed rhabdomyolysis, a condition which he experienced for a second time in February 2012. She supported her opinion by relying upon his elevated serum lactate levels at birth and in February 2012, his elevated CK at birth and markedly elevated CK in February 2012 and his elevated LDH as well as the presence of blood in his urine at birth.

56. Dr. Manning stated that Eoin had demonstrated clinical signs and symptoms consistent with underlying mitochondrial disease. She expressed herself satisfied from his clinical records held by the Central Remedial Clinic that he suffers from muscle weakness, exercise intolerance and that he has demonstrated developmental delay. In addition, she was of the opinion that Eoin has suffered a loss of certain skills and has potential hearing and eyesight difficulties, all of which she believes support her opinion. In particular, she was satisfied that Eoin meets the criteria for mitochondrial disease as outlined in an article entitled *Mitochondrial Disease Criteria* authored by Morava et al.

57. Dr. Manning described Eoin's rhabdomyolysis in February 2012 as an acute massive metabolic meltdown, the severity of which strongly supports the presence of an underlying mitochondrial disease. She told the court she had never come across a child with rhabdomyolysis who had a CK reading of 60,000.

58. As for the plaintiff's contention that Eoin's rhabdomyolysis in 2012 was caused by a combination of dehydration, viral infection and fever in a child with cerebral palsy, Dr. Manning stated that she had never come across rhabdomyolysis as a result of dehydration and she had seen many children with significant dehydration when she worked in Cherry Orchard Hospital in Dublin.

59. Moving outside the confines of the evidence which had been flagged in her expert report, Dr. Manning said that 30% of children with mitochondrial respiratory chain disorders present in the neonatal period needing resuscitation and that in Eoin's case, it was the profound lactic acidosis brought about by his underlying mitochondrial disease that had made him difficult to resuscitate.

Professor Berry

60. Prof. Berry told the court that the two key elements in this case that remain unexplained are firstly why Eoin did not breathe at birth and secondly, why he developed rhabdomyolysis in February 2012. The fact that a baby, after a normal labour did not breathe at birth or respond to oxygen delivered by a midwife and went on to develop a secondary depression was, in his opinion, usually indicative of some antecedent problem. He said it was "ridiculous" that it had taken Eoin 23 minutes to respond to resuscitation and this meant that there had to be something intrinsically wrong with him. He felt that some stimulus had interacted with his genetic makeup as a result of which he was unable to breathe at birth and that the same type of problem had resurfaced again in February 2012 when he developed rhabdomyolysis. He believed it was a confluence of factors that had triggered this most recent event. Fever, dystonia, sodium valproate and some underlying complex disease process were possibly responsible for this episode.

61. As to why Eoin did not breathe at birth, Prof. Berry was of the view that this was most likely due to brainstem dysfunction. He told the court that when the umbilical cord is cut there is a small area of the brainstem called the pre-botzinger complex which is to the respiratory system what the pacemaker is to the heart and it must fire to allow the newborn to adapt to life outside the womb. This, he said, must not have fired in Eoin's case, probably because of the presence of a complex genetic disease process.

62. Prof. Berry agreed that brainstem dysfunction could not explain everything that had occurred around the time of Eoin's birth as he accepted that once oxygen is effectively delivered you should be able to "get a baby back again right away" and the fact that this did not occur suggested to him that some other problem exists. He ultimately concluded that Eoin did not respond to resuscitation due to the presence of a complex genetic disease process involving five genes in which some type of mitochondrial disorder and perhaps intrinsic muscle problem were also playing a role. While he accepted that Eoin does not have PDH deficiency he stated that he does have reduced PDH activity and this factor could also be impacting upon the disease process. This type of genetic disorder, according to Prof Berry, could explain his condition at birth and also his episode of rhabdomyolysis in February 2012.

Evidence of Dr. William Reardon

63. Dr. Reardon was of the opinion that Eoin's low tone, absence of movement and inability to breathe at birth are pointers to the existence of an inherent underlying metabolic abnormality affecting his muscle function. He said that he knew of children with inherent neuromuscular problems who had difficulty establishing respiration at birth. In particular, children born with congenital myotonic dystrophy often need a lot of assistance to establish breathing at birth, but once they do, they do not experience any further difficulties in this regard. Dr. Reardon was satisfied that Eoin's muscle function since birth has not been normal. He cannot walk and has not established normal feeding or bowel movements. He stated that he believes the primary pathology in this case is likely to be a muscular or neuromuscular condition with the secondary pathology deriving from hypoxic ischaemic events. He also accepted that the primary disease for which he contends has not as yet been identified.

64. The episode of rhabdomyolysis in February 2012, Dr. Reardon stated, may constitute evidence of an underlying muscular or neuromuscular condition. Further "straws in the wind" which would be consistent with the existence of such a defect would be the second echocardiogram study carried out in 2012, which shows that Eoin's heart is functioning at the upper end of normal and the fact that his PDH level is 50% less than that which would be considered normal. This latter finding he stated is of significance insofar as PDH interacts with muscle biochemistry and if you have an abnormality of the metabolic performance of the muscle, you may see a secondary abnormality in the PDH level, as is the position in Eoin's case. He said that the presence of a squint would also focus the mind on the possibility of the existence of a mitochondrial abnormality.

65. Dr. Reardon told the court that as a geneticist, he is always looking for something that is hidden and has yet to be diagnosed. His focus is not on treating the patient or trying to make them better. He told the court that new diseases that have never been recognised are being identified on a regular basis and that exome sequencing is the method used to identify genetic abnormality. If such an abnormality on a gene is identified, the geneticist then assesses what is known about that gene in the normal population in the hope of being in a position to identify how it will affect the patient concerned. He felt that if Eoin had a muscle biopsy, micro array study and exome sequencing, the answer to why he did not breathe at birth might be forthcoming.

66. Dr. Reardon accepted that it was possible that viral infection caused Eoin's rhabdomyolysis in February of this year. However, equally plausible as the cause of that condition, he stated, was the existence of a primary muscle disease of genetic origin. The muscles, in the presence of such a condition would, he said, be predisposed to undergo rhabdomyolysis in the presence of some stress such as dehydration.

67. Dr. Reardon found it difficult to explain why, even if Eoin was born with an underlying muscle defect as would be consistent with eyewitness accounts that he did not move normally at birth, he could not be adequately resuscitated at birth. While he referred to his own experience of certain parallel situations where children with known established primary muscle abnormalities had difficulty in establishing respiration on their own, he did not describe them as having any difficulty in responding to assisted ventilation. He finished his evidence by stating that in his view, Eoin's brain had already been compromised at birth as his tone was low and he did not move, even though he accepted that his neuroradiological findings were consistent with an hypoxic ischaemic event. He told the court that if Eoin's brain was normal, it was hard to understand the eyewitness accounts of his failure to move at birth and why his tone appeared to be so low.

Eoin's Condition at Birth

68. One of the significant features of this case is the fact that the medical experts retained by the parties each took a very different view of Eoin's condition at birth and I believe their opinions in this regard played a substantial role in their ultimate conclusions and coloured their whole approach to the causation issue. The plaintiff's experts advanced their opinions based upon an acceptance that Eoin was born in moderately good condition, even if he was less well than might have been anticipated having regard to the fact that his mother had an uncomplicated labour and the fact that there was little evidence to suggest that he had been subjected to any particular stress other than perhaps over the final two to three minutes prior to his birth. While he did not breathe spontaneously at birth they took the view that his physical condition was such that he should have responded to effectively delivered bag and mask ventilation and other resuscitative measures if delivered in a timely manner.

69. In contra distinction to the approach taken by the plaintiff's experts, the defendant's experts proceeded on the basis that Eoin's physical presentation immediately on delivery and over the first minute of life was clinically somewhat unique in that he did not start to breathe spontaneously and had an unexpectedly low heart rate against the backdrop of an apparently stress free labour. He did not cry and did not move. Indeed, the questions raised by the defendant's solicitor of Dr. Manning, Dr. Reardon and Prof. Berry following their engagement may also have unwittingly encouraged them in this regard. Dr. John Murphy, Consultant Neonatologist, furnished his opinion on the basis that Eoin was severely depressed at birth and that his condition thereafter had remained critical. In his report, he described his condition at birth as something akin to a resuscitated still birth. Dr. O'Donnell commenced his opinion based upon a conclusion that Eoin had sustained severe asphyxia prior to birth. He made no mention of Eoin's one-minute apgar score or the apparent clinical decline in his condition between one and five minutes of age when his apgar score dropped to one. Most

importantly, in my view, both doctors had concluded that Eoin's condition at birth was reflective of a brain injury sustained in the days or hours before his birth rather than over the period immediately following his birth as was accepted by the defendant on the resumption of the proceedings in October 2012.

70. As a result of his illness in February 2012, Eoin's condition and behaviour at birth became the focus of attention for Dr. Reardon, Professor Berry and Dr. Manning. Dr. Reardon and Professor Berry told the court that one of the big questions they felt needed to be answered was why Eoin did not immediately breathe at birth and the significance of this question appears to have emanated from their belief that his presentation and behaviour at birth was extraordinarily unique and unprecedented having regard to the background facts.

71. Because the causation opinions of both sets of experts are so intimately linked to their understanding of Eoin's condition at birth, I have decided that this is a convenient point at which to set out my conclusions regarding this aspect of the dispute between the parties. In coming to my conclusion on this issue I wish to make it clear that I have not decided this issue in isolation or in advance of the other issues in the case but have reached my conclusions following a careful and detailed consideration of the all of the evidence and the submissions of the parties on all issues.

72. I am not satisfied as a matter of fact that Eoin's condition at birth was anything as poor as projected by the defendant's experts. Eoin was awarded an apgar score of five out of a possible score of ten at one minute. He was awarded one for heart rate, zero for respiration, two for tone, one for stimulation and one for colour. In fact he had initially been awarded a score of six, including one point for respiration, but this was later reviewed down to zero. Indeed, Dr. Rennie called into question the fact that Eoin was given no score for respiration in circumstances where he was making gasping efforts to breathe at birth.

73. It is significant that Eoin was awarded full marks i.e. two for tone, given that it is universally accepted that tone is reflective of the health of a baby's central nervous system. The uncontested evidence was that tone is not difficult to assess but that it is only on handling that a valid assessment can be made because a baby without tone will have a floppy head and limbs which are obvious on handling. In the present case, Midwife Flemming and Nurse Kelly both appear to have handled Eoin following his birth. After he had been placed by Nurse Kelly on the bed in front of his mother, Midwife Flemming later picked him up from the bed and brought him over to the resuscitaire. She had plenty of opportunity during Eoin's first minute of life to assess whether or not he was floppy. Further, and when giving their evidence neither Midwife Flemming nor Nurse Kelly suggested that his tone was anything other than normal. While Dr. Rennie accepted that there is always a degree of inter-observer variability in relation to apgar scores, the fact that Eoin may have appeared immobile or flaccid when placed on the bed in front of his mother while displaying significant pallor, is not, I believe, sufficient reason to displace the score allocated to him for tone based on handling.

74. It is also important to note that detailed consideration was given to Eoin's apgar scores and they cannot be considered to be the product of hurried or unconsidered judgment of their authors. The evidence was that in the aftermath of the emergency these were reviewed and indeed the one minute apgar, which had initially awarded Eoin a score of six, was reduced to five. Furthermore, that re-evaluation was carried out in consultation with Dr. Ramesh. To my mind the fact that the apgar scores were reviewed when the crisis was over is significant in circumstances where the evidence of Midwife Flemming and Nurse Kelly as to Eoin's condition in his first minute of life was at odds with that which was used by the defendant's experts as the starting point for their respective professional opinions.

75. In considering Eoin's condition at birth, I have to say that I found it difficult to accept the evidence of Dr. O'Donnell in which he took issue with the validity of the one minute apgar score, stating that it appeared to him that the assessment was based on Eoin's condition before he was one minute old, a point not raised by any of the other witnesses in the case. Further, he felt that the one minute apgar, particularly in respect of the score allocated to tone, was not consistent with the evidence as to Eoin's condition. Thus, his evidence was in conflict with that given on the defendant's behalf by midwife Flemming. In this regard it is noteworthy that counsel for the defendant never asked midwife Flemming if she had any reservations about either the overall score or its component parts. Neither was she canvassed as to the possibility that she may have made her evaluation earlier than was appropriate or overestimated the extent of Eoin's tone. While it had been put to the plaintiff's experts that the description by a number of witnesses of Eoin's condition immediately following his birth cast some doubt on the score of two which he had been allocated in respect of tone and that apgar scores are prone to inter-observer variability, it was never signalled that the defendant intended to lead evidence which would seek to undermine Midwife Flemming's assessment of tone or call into question the entire validity of the one minute apgar score as in fact occurred.

76. The failure of the defendant to seriously challenge the plaintiff's witnesses as to the validity of the one minute apgar score or raise the issue with midwife Flemming is hard to explain in the light of Dr. O'Donnell's evidence. However, it may be the case that the defendant decided not to pursue the issue of the validity of the one minute apgar score dictated by concerns that if it discredited the competence of Midwife Flemming to make a timely and valid assessment of Eoin's condition at one minute of age, it might cast a cloud over her likely competence to recognise and manage an evolving emergency situation while at the same time keeping a deteriorating baby well perfused.

77. In relation to Eoin's overall condition at birth, I think it is relevant to note that when Midwife Flemming initially called for assistance she called for the person described in evidence as the first responder, which in this case was the SHO Dr. Lewis. In this regard, I was told by Dr. Ramesh that it was standard practice for the midwife to call the first responder if the baby was born in relatively good condition. However, if a midwife thought that more advanced resuscitation might be required then it was her duty to call the second responder i.e. the Paediatric Registrar. The fact that Dr. Lewis was the responder first contacted leads me to believe that Eoin's condition at birth was nothing as critical as was advised by Dr. John Murphy or Dr. O'Donnell in their evidence. I am satisfied if he had been born critically ill or was in that condition at the time Midwife Flemming put out the first call for help it would have been Dr. Ramesh that she would have told Nurse Kelly to contact using the specially designated line on the phone in the delivery suite.

78. There was some emphasis placed upon the fact that Eoin was noted in a number of medical notes as having been "unexpectedly flat" at birth. However, of some significance is the fact that nobody present at Eoin's birth made a note to that effect. Insofar as he was described in that manner in the notes made by Prof. Turner, Dr. Griffin and Dr. Ramesh, none of them actually witnessed Eoin's condition at or immediately after birth. There is obviously a dispute as to when Dr. Ramesh arrived, but the earliest time at which he witnessed Eoin's condition was when he was five minutes of age, at which stage his apgar had dropped from five to one. Professor Turner, on his own evidence, did not arrive until the resuscitation was nearly over and Dr. Griffin only saw him after his transfer to the Special Care Baby Unit. Accordingly, the retrospective notes made by these medical practitioners are at best an account of what they may have been told by someone else or what they assumed had been the position at the time of Eoin's birth. Further, it is common case that all of these medical practitioners discussed what had occurred before they wrote their respective retrospective notes so that fact that the same note appears in three separate places in the medical chart is of little evidential weight.

79. In addition to his tone during his first minute of life, it is also relevant to note that Eoin apparently drew himself up as if he was going to breathe and he made a grimace. Midwife Flemming stated that this grimace demonstrated reflex irritability on Eoin's part and as a result he was awarded one point in respect of his response to stimulation out of a maximum of two points. That grimace, according to Dr. Rennie, is an important feature insofar as it evidences the existence of brainstem activity at birth, particularly in circumstances where his brainstem reflexes were clearly depressed by the time he was 23 minutes of age following a period of hypoxic ischaemia.

80. I listened carefully to the evidence of Dr. John Murphy that the combination of a slow heart rate and a failure to breathe in a newborn is uncommon and normally indicates an acutely unwell child. I also have considered his evidence that Eoin should have been born with a heart rate of perhaps over one hundred beats per minute and that a heart rate of less than sixty at one minute would be a cause for concern, particularly in circumstances where Eoin did not breathe spontaneously at birth. Indeed, having considered all of the evidence tendered by the defendant on this issue I am unconvinced that Eoin was acutely unwell at the time of his birth. I much prefer and find the evidence of the plaintiff's experts on this issue to be much more credible. While Eoin may not have breathed spontaneously at birth, once he attained 30 minutes of age he was robust in every respect, save that by that time he had sustained brain damage consequent upon a period of near total acute hypoxic ischaemia. Indeed, the defendant in its own evidence emphasised the fact that Eoin's heart was heard and regular in the minutes prior to his birth. We also know from the evidence that there is nothing wrong with Eoin's respiratory, circulatory or cardiac systems as they have functioned properly since his heartbeat was restored at about twenty three minutes of age.

81. When trying to assess Eoin's condition at birth, particularly having regard to the evidence of Dr. John Murphy and Dr. O'Donnell, I have looked through the neonatal records for evidence to support their conclusions that he was born in remarkable or uniquely poor health. However, after Eoin's birth, none of his doctors appear to have considered it necessary to investigate why he had been born in any particular condition. The records do not generate the impression that Eoin's condition in the first minute of life was anything extraordinary but rather give the impression that he was born in a suboptimal state having regard to his mother's normal labour. Indeed, I believe that little regard has been paid to the significant decline in Eoin's apgar score between one and five minutes of age. Further, regardless of whether or not I accept the evidence of Dr. O'Donnell and Dr. John Murphy as to the purpose of the incident report form completed by Midwife Flemming, I believe it is telling nonetheless that there is nothing in her summary of the incident to indicate that Eoin was born in a parlous or critical condition albeit that it is clear that by five minutes of age he was in significant difficulties.

82. In coming to my conclusion that Eoin's condition at birth was not particularly unusual or unique, I had the assistance of a number of very distinguished paediatricians and neonatologists who told me that approximately 10% of babies require some form of resuscitative assistance at birth and that Eoin was just one such baby. However, I was also told by Dr. O'Donnell on behalf of the defendant that only 0.06% of children require the type of intensive intervention involving cardiac compressions that was delivered to Eoin and that fact is of course of importance. It is regrettable that this statistic was not referred to by the defendant's experts in their reports nor put to any of the plaintiff's witnesses in cross examination and consequently the court did not have their assistance as to the significance which I should attach to such evidence. While Dr. O'Donnell's evidence may well be viewed as supportive of the defendant's contention that Eoin was born in a condition much worse than is reflected by his apgar score at one minute, his evidence on this issue is not of major significance if I were to come to the view that the reason he went on to require the intensive intervention ultimately delivered was due to the fact that he did not receive timely and effective resuscitation during his first fifteen or so minutes of life.

83. Having considered all of the evidence, I am satisfied as a matter of fact that Eoin was born less well than was expected having regard to his mother's labour, but nonetheless in moderate condition with a valid apgar score of five or thereabouts at one minute of age. There are many reasons why a baby may be born in such a condition and a number of these were identified by the plaintiff's experts and are referred to at paragraphs 11-13 of this judgment. However the defendant has also put forward a number of hypotheses to explain not only Eoin's condition at birth but also why he did not breathe spontaneously or respond to timely and effective resuscitation. This being so I still have to decide why Eoin was born in only moderate condition and why he went on to sustain catastrophic injuries during a period when the defendant maintains he was receiving resuscitation of a nature that should have fully protected him from sustaining hypoxic injury.

84. While I now intend to deal with the defendant's hypotheses regarding certain medical conditions which it believes may afflict Eoin, I want to make it clear that I did not consider the defendant's causation case as a separate entity. To the contrary, I determined all of the issues in the case against the backdrop of the entirety of the evidence including Eoin's medical records, biochemical findings and clinical history.

Mitochondrial Disease

85. The only medical expert who was of the opinion that it was likely that Eoin suffers from what may be described as a classical mitochondrial disease was Dr. Manning. Prof. Berry stated that the evidence was against such a proposition while contending for some mitochondrial component to the complex genetic disorder which he believes Eoin may be suffering from. Nonetheless, having regard to Dr. Manning's evidence I will briefly deal with this issue.

Eoin's Neonatal Records and Test Results

86. Dr. Manning considered that the elevated levels of lactate found in Eoin's blood after birth might indicate the presence of classical mitochondrial disease. She referred to the lactate level documented at 59 hours of age which was 3.7 millimoles per litre (reference range 0.6 – 2.4) and stated that it could reliably be inferred from this reading that Eoin probably had a much higher lactate level in his first hour of life. While she accepted that the lactate reading of 3.7 could be consistent with an hypoxic ischaemic event, given that it had not normalised at 59 hours, she believed some other disorder was at play such as perhaps rhabdomyolysis. She did not accept that two seizures, which she stated had occurred within the first eleven hours of life, and chest compression could account for those biochemical findings.

87. As to the significance of Eoin's blood lactate measurements in the neonatal period, I prefer the evidence of Dr. McFarland, Dr. Rennie, Prof. Flemming, Prof. Hill and Mr. Smith to that of Dr. Manning. I am satisfied that his lactate levels were typical of a child who had experienced an hypoxic ischaemic event immediately after birth, had been subjected to a lengthy period of chest compression and resuscitation and thereafter had experienced a number of seizures the last of which occurred at 33 hours of age rather than as stated by Dr. Manning at 11 hours. Mr. Smith and Dr. Rennie advised that a lactate as high as 25 in a child with hypoxic ischaemic injury would not be considered abnormal, particularly in a child such as Eoin who had experienced two seizures in his first 33 hours of life. Prof. Flemming stated that lactate levels of eight or ten were common after a complex resuscitation in a child with no metabolic disorder. I also accept the evidence advanced on the plaintiff's behalf, which was not contested by Prof. Berry or Dr. Reardon, that the fact that Eoin's elevated lactate levels cleared quickly is incompatible with the hypothesised presence of a condition such as mitochondrial disease. In such circumstances the lactate should have continued to rise during the neonatal period rather than self

correct as it did within the first three days of life.

88. In rejecting Dr. Manning's evidence that Eoin was probably suffering from an underlying mitochondrial disease or a like primary metabolic disorder at birth, I have taken into account the fact that Prof. Berry did not consider that Eoin's elevated levels of lactate following his birth were evidence of such a condition. However, I acknowledge that Dr. Reardon felt that the lactate and CK levels were potential "straws in the wind" that might cause a geneticist appraised of Eoin's condition at birth to consider whether he had some underlying condition that was responsible for his apparent failure to respond to resuscitation. Further, Dr. Manning did not produce any literature or refer to any case studies in support of her contention that the lactate levels just referred to would give cause for concern as to the existence of such a condition.

89. Dr. Manning was of the opinion that Eoin's level of CK of 1,472 (normal range 0 – 170) was potentially evidence of an underlying mitochondrial defect and she told the court that that raised levels of this particular enzyme are often seen in children who experience an episode of rhabdomyolysis. However, Prof. Flemming, Mr. Smith and Prof. Berry were agreed that Eoin's raised CK levels at birth could be accounted for solely by reference to the compression of his chest muscles in the course of resuscitation.

90. As to the significance of the CK readings in the neonatal period I feel that the witness who best explained the significance of these results was Dr. Rennie, whose evidence on almost every issue I found to be exceptionally clear, considered, measured and objective. Firstly, I accept her evidence that the normal range for CK is not that which was expressed by Dr. Manning in her report, i.e. 0 – 170 and that the appropriate reference range for a baby is in fact 0 – 1,200 as confirmed by Dr. Reardon. I further accept Dr. Rennie's evidence that a measurement of 1,400 in the context of chest compression is not at all surprising and that unless one got a reading of over 5,000, one would not start to look for an alternative explanation. I further accept unreservedly Prof. Fleming's evidence, which was echoed by Mr. Smith, that Eoin's raised CK in the neonatal period fits perfectly with the profile of an infant whose muscles would have been squeezed and compressed in the course of the resuscitation. In coming to my conclusions on this issue, I again note that no literature or medical texts were produced by Dr. Manning in support of her opinion that a CK level of 1,472 might justify any further investigation whatsoever in the context of an infant who had required chest compression in the course of resuscitation.

91. Dr. Manning also relied upon Eoin's elevated LDH of 1,294 (reference range 230 – 450) in support of her opinion that Eoin had experienced an episode of rhabdomyolysis at birth and may suffer from mitochondrial disease. LDH, she told the court, is an enzyme which can become elevated in the presence of muscle damage such as occurs in the course of rhabdomyolysis.

92. I cannot accept Dr. Manning's opinion that Eoin probably suffered from an episode of rhabdomyolysis at birth and indeed Prof. Berry agreed that the biochemical test results would not support that opinion. I am satisfied from the evidence that had Eoin experienced such an episode he would have developed ever increasing lactate levels which would not have been brought under control and which would inevitably have led to his early death.

Other Test Results

CSF – Lactate

93. Another potential biochemical marker for the presence or absence of mitochondrial disease is, according to Dr. McFarland, the lactate concentration present in the Cerebral Spinal Fluid ("CSF"). A high reading would be evidence in support of the presence of mitochondrial disease. No CSF lactate analysis was done at the time of Eoin's birth. However, his CSF lactate level was established twelve days after his admission to hospital in February 2012 and was found to be normal. While I accept the defendant's evidence that some children with mitochondrial disease may manifest with only mild or intermittent elevation of lactate levels and that a normal lactate level in the CSF is not definitive evidence of the absence of underlying disease, this test result is nonetheless of some evidential weight, when placed against the backdrop of the other evidence, to suggest that Eoin does not have mitochondrial disease.

MR Spectroscopy

94. In coming to my conclusion that Eoin does not suffer from any underlying mitochondrial disease, I have also taken into account the result of what is described as an MR Spectroscopy which was carried out on the 28th February, 2012. That is a non-invasive technique used, *inter alia*, to obtain biochemical information about the tissues of the human body. After some discussion about the accuracy of a note in the hospital chart regarding the results of that test, the undisputed evidence was that if a patient has mitochondrial disease, the image produced by the MR spectroscopy will demonstrate the presence of what is described as a double lactate peak. In this regard the evidence of Prof. McConachie and Dr. McFarland was that this scan was entirely normal, further evidence of the absence of mitochondrial disease.

MRI Scans

95. The results of Eoin's MRI scans are relevant to each of the hypotheses advanced by the defendant's experts. The first MRI scan was carried out on the 17th January, 2003 and the second on the 28th February, 2012. According to Prof. McConachie, these show a pattern of brain damage that is to be expected in a child who suffered a near total asphyxiating event at birth. There is no evidence of any other damage on these scans to support the existence of any underlying or co-existing mitochondrial disease or metabolic disorder. Dr. McFarland, in discussing whether Eoin had been born with some underlying defect of the brain stem, stated that a defect sufficiently serious to impede resuscitation would be expected to be noted on an MRI scan. Dr. Likeman, Consultant Neuroradiologist, gave evidence that the five month CT Scan was consistent with a period of hypoxia of ten to fifteen or maybe twenty minutes but no more than that and the defendant did not challenge this evidence. Thus the radiological evidence fully supports and is consistent with the plaintiff's case both on causation and as to the duration of the insult.

96. Prof. Hill, who is not a consultant radiologist but is a consultant neurologist with experience in reading MRI scans, told the court that in his opinion you would expect to see evidence of mitochondrial disease in approximately 15% or 20% of the totality of cases involving such disorders. Dr. McConachie told the court that most children with mitochondrial disorders affecting their central nervous systems have demonstrable abnormalities on their MRI scans. However, he did say that only a minority of the totality of children who suffer from mitochondrial disease will have identifiable changes on their MRI scan.

97. Dr. McConachie also confirmed that if the mitochondrial disease affected the central nervous system you would expect to see progression or changes in the brain over many years and there are no such changes evidenced in this case.

Eoin's Development and Clinical Profile up to February 2012

98. Dr. Manning relies upon Eoin's clinical profile up to February 2012 in support of her opinion that he may be suffering from a mitochondrial disease. In this regard she gave evidence as to Eoin's developmental progression, acquisition and loss of skills, clinical progress, feeding, eyesight and hearing difficulties.

99. Having considered the evidence in relation to Eoin's development and clinical presentation up until February of this year, I am satisfied that he does not fit the profile expected of a child born with classical mitochondrial disease, a proposition with which Prof. Berry did not disagree. I accept Dr. McFarland's evidence that mitochondrial disease, if it presents at birth, is usually of the most severe variety and almost always results in continued deterioration and resultant death. Even if it does not present at birth but is diagnosed within the first two years of life, children falling within such category are usually subject to relentless and/or progressive deterioration even if their health stabilises from time to time. They are also prone to presenting with an exaggerated response to minor illnesses in the course of their decline. Eoin has not experienced a relentless deterioration in his health and neither has he presented with exaggerated responses to minor illnesses.

100. I accept Dr. Murphy's evidence that Eoin's general health has been good over the years. He has had reason to attend the Accident and Emergency Departments of a number of hospitals for a few hours on several occasions over the last number of years. However, he was never detained in hospital overnight. In particular, in 2008, he started vomiting and became dehydrated to the point that he was taken to the Accident and Emergency Department of Temple Street hospital where he was also seen in relation to a similar event in March 2011. However, his attendance on each occasion was apparently driven by the ongoing difficulties experienced by his parents in keeping him hydrated.

101. As to Dr. Manning's opinion that Eoin has regressed in terms of his development and has experienced a loss of skills previously learned I have to say that I much prefer the evidence of Dr. Murphy and Prof. Hill on this issue. Dr. Manning did not have the benefit of examining Eoin and insofar as her evidence was based on a number of entries in the medical records, I have to say that I do not consider her conclusions overall to be well founded.

102. In evidence, Dr. Manning stated that Eoin suffered from terrible problems with feeding and had problems with recurrent vomiting. She felt that the vomiting was evidence that he was losing his swallow facility. That loss was in her opinion evidence of regression. However, in the course of cross examination, it became clear from the medical records that the incidents relied upon by Dr. Manning were all explicable by reference to ordinary day to day infection or activity. Indeed, the progress reports from the Central Remedial Clinic were consistent with Dr. Murphy's evidence to the effect that Eoin had continued to make slow but meaningful progress in terms of his ability to swallow and eat, albeit that he had always been a poor feeder.

103. I reject Dr. Manning's evidence that the fact that Eoin is soon to commence peg feeding is evidence of regression in his development. I accept Dr. Murphy's evidence that Eoin has always been difficult to feed, that getting even small amounts of food into him takes an inordinate amount of time and that as his need for additional calories has grown it has become progressively more difficult to keep up with his needs. I accept the evidence of Dr. Rennie that the fact that Eoin is due to commence peg feeding is not evidence of regression and that the approach to peg feeding over the years has changed. It is now believed that the peg feeding of children with Eoin's type of disability should be introduced earlier rather than later as it stops the child running into a range of difficulties which might otherwise develop through lack of nutrition.

104. I also reject Dr. Manning's evidence as to the possible presence of a metabolic disorder or mitochondrial disease based upon her evaluation of the medical records insofar as they relate to Eoin's hearing, eye sight and energy levels. With regard to his hearing, Dr. Manning's evidence was that without a formal hearing test she could not be satisfied that Eoin can hear given that he cannot speak. However, I am satisfied that the records from the Central Remedial Clinic referred to in evidence are replete with entries which confirm that Eoin can not only hear but that he can also follow television programmes. They also demonstrate that he enjoys listening to music and that he engages with his peers in a manner that is only consistent with an ability not only to hear but to comprehend what is going on around him. Ms Mulligan, a physiotherapy assistant at the Central Remedial Clinic who has spent a lot of time with Eoin, stated in the course of her evidence that she was satisfied from her engagement with Eoin that he could both hear and understand her.

105. Dr. Manning relied upon Eoin's intermittent squint as evidence supporting the possibility that he suffers from a mitochondrial disease or metabolic disorder, as involuntary eye movements are often found in children with such conditions. Dr. Reardon also stated that the presence of an occasional squint might give a clue as to the possibility of an underlying inherent metabolic abnormality. In these circumstances, Dr. Manning felt that Eoin's eyesight needed to be tested under sedation.

106. As to the significance of Eoin's squint, I was told by his mother that Eoin only suffers from a squint when he is tired. Prof. Flemming told the court that approximately 10% of children suffer from a squint when they are tired and in these circumstances I believe that I should not attach any significant weight to the presence or absence of an intermittent squint. Furthermore, Eoin's eyes have been tested on many occasions, albeit in the absence of sedation. In fact, a full ophthalmic examination was carried out in the context of his recent illness and at a time when his treating doctors were live to the possibility that he might be suffering from a metabolic disorder. Those tests were normal, a fact that is noted in the hospital records. I think it is highly likely that if those responsible for Eoin's care thought a further ophthalmic assessment was warranted that this fact would have been recorded. Dr. Manning was of the opinion that Eoin may suffer from involuntary eye movement, a condition sometimes found in children with mitochondrial disease. However, in evidence the court heard that Eoin has been assessed in the Central Remedial Clinic for the use of an eye gaze computer and he has been found capable of holding his gaze so as to discriminate between pictures on his screen. There has apparently never been any suggestion that his eye function is less than satisfactory and I heard no concrete evidence supporting the existence of involuntary eye movements of the type that might suggest an underlying mitochondrial disease or like metabolic disorder.

107. I accept Dr. Murphy's evidence that while Eoin's developmental progress has been slow, his intellectual capacity and comprehension is growing and he is now engaging with television programmes and material which he could not have comprehended several years ago. He has been approved and is undergoing training for the use of a powered wheelchair which is operated using a head switch. Eoin is capable of using a speech and language computer called a Dynavox which scrolls through a menu and allows him to select his chosen topic by means of a head switch. He has not successfully mastered this equipment to date but I accept Dr. Murphy's evidence that this is because of difficulties encountered with mounting the computer and providing him with a head switch which is suitably positioned.

108. I accept, as was put to Dr. Murphy, that there are occasional notes within the medical records which suggest that Eoin has not made progress in certain developmental areas. For example, he is still prone to emotional outbursts and is continuing to have difficulties at school. However, having regard to the evidence of Dr. Murphy herself, which was largely supported by Prof. Hill who examined Eoin on two occasions, and having regard to the extracts from the medical records which have been referred to in evidence, I could not reasonably come to the conclusion that Eoin has experienced the type of regression that would suggest the presence of primary mitochondrial disease or like metabolic disorder. In this regard, Dr. Murphy stated that since Eoin's birth, no clinician has ever suggested to her that his development was behind that which might have been expected for a child who had sustained an acute hypoxic injury at birth.

109. In considering whether Eoin suffers from underlying mitochondrial disease, I was greatly influenced by the evidence of Dr. McFarland to the effect that he knows of no mitochondrial disease that could fit the profile of behaviour relied upon by Dr. Manning. He told the court that a mitochondrial disease that was sufficiently significant to impact on Eoin at birth could not thereafter have failed to re-emerge for a further ten years.

110. While Dr. Manning relied upon an article entitled *Mitochondrial Disease Criteria* authored by Morava *et al* in support of her conclusion that Eoin met the diagnostic criteria for mitochondrial disease, I am not satisfied that I can accept her evidence in this regard. Firstly, many of the clinical signs and symptoms which are referred to in that article and in respect of which qualifying points are allocated are often seen in children with cerebral palsy. Secondly, as already stated, I do not accept that Eoin has experienced developmental delay or loss of skills. Neither was it established that he suffers from what is described as exercise intolerance. These were all matters relied upon by Dr. Manning in advising that he fell within the relevant diagnostic criteria. Further, if one accepts that Eoin did not have rhabdomyolysis at birth, as is conceded by Prof. Berry and Dr. Reardon, then to my mind Eoin's symptoms prior to February 2012 could not qualify him as having mitochondrial disease by reference to the diagnostic criteria in the aforementioned article.

111. Having regard to the aforementioned evidence I think it is highly improbable that Eoin suffers from any mitochondrial disease while leaving open the possibility that he may have some other type of genetic muscular or neuromuscular disorder or complex genetic abnormality in which the mitochondria may be implicated, as contended for by Dr. Reardon and Prof. Berry.

Rhabdomyolysis and Mitochondrial Disease

112. The significance of rhabdomyolysis in this case principally arises from the fact that in February 2012, Eoin was admitted to Temple Street Hospital grossly unwell. In the course of his hospitalisation, he was diagnosed as suffering from rhabdomyolysis as evidenced by an extremely deranged CK count of approximately 60,000 (normal values 20 – 155). Prof. Berry stated that this diagnosis demands that the court consider that there may be an underlying problem that was responsible for Eoin failing to breathe at birth and for his poor response to timely and effective resuscitative measures.

113. As to the cause of this episode of rhabdomyolysis, Prof. Berry felt that it was probably a confluence of factors including fever, dystonia and an underlying complex genetic disease process probably triggered by the use of sodium valproate. This drug he described as being potentially toxic to a patient suffering from mitochondrial disease. Dr. Reardon also believed that this illness might signify the presence of an underlying primary disease of the muscle which has not been identified heretofore and which could explain why Eoin did not breathe at birth and remained unresponsive to resuscitation. Dr. Manning, as already advised, was of the opinion that this was Eoin's second episode of rhabdomyolysis and was suggestive of the presence of mitochondrial disease, a proposition with which neither Prof. Berry nor Dr. Reardon were in agreement.

114. It seems that central to the validity of the hypotheses advanced by the defendant in this case is whether or not the episode of rhabdomyolysis in 2012 was, as is asserted by the plaintiff, a once off event due to a serious viral illness in a significantly dehydrated child with dyskinetic cerebral palsy or more likely to be evidence that Eoin was born with some underlying disorder of the nature described by Prof. Berry, Dr. Reardon and Dr. Manning. Each of these witnesses, armed with the knowledge of Eoin's rhabdomyolysis of February 2012, has gone back over Eoin's neonatal records at birth and his clinical and developmental process to see if there is other evidence or, as Dr. Reardon put it "straws in the wind" that might suggest the presence of some underlying disorder.

115. It was not contested that there are a number of inherited disorders that can cause rhabdomyolysis and these include mitochondrial disease, myopathies, malignant hyperthermia syndromes and fatty acid and glycogen disorders. However, Dr. McFarland stressed that it is also accepted that rhabdomyolysis may also develop as a result of a number of other possibilities such as trauma, immobilisation, seizures, severe viral illness, hyperthermia or metabolic disturbance.

116. Having carefully considered all of the evidence in relation to this issue, on the balance of probabilities, I do not accept the defendant's contention that Eoin's rhabdomyolysis diagnosed in February 2012 is evidence that he was born with some underlying mitochondrial disease, metabolic disorder or other type of unprecedented genetic disorder.

117. For reasons already stated in this judgment, I am satisfied that Eoin does not suffer from mitochondrial disease and accordingly I am not prepared to ascribe his episode of rhabdomyolysis to such a condition. Indeed, Dr. McFarland told the court that while rhabdomyolysis is sometimes seen in conjunction with underlying mitochondrial disease, in the vast majority of cases it develops independently of any such condition.

118. Having heard the evidence of each of the witnesses tested on the issue of the cause of Eoin's rhabdomyolysis, by far the most cogent and impressive evidence given was that of Dr. McFarland, whose opinion was largely supported by Dr. Rennie, Prof. Hill, Prof. Flemming and Mr. Smith. I accept his evidence that this episode was much more likely to have been caused by a combination of hyperpyrexia, hypovolemic shock and viral infection rather than some genetic defect, muscular abnormality of genetic origin or mitochondrial disease. I will now refer to some of the facts and evidence which have informed this conclusion.

119. When Eoin was admitted to hospital on the 16th February, 2012, he had a temperature of 41.1 C (105.98F). He was admitted in a state of respiratory distress. Clinically he was assessed as being 15% dehydrated. That degree of dehydration, according to Professor Flemming, is almost incompatible with life and can lead to circulatory collapse. Even 10% dehydration is, he told the court, potentially life threatening. X-rays taken showed that Eoin had changes to his lungs consistent with a right-sided lower respiratory tract infection. He also had symptoms of gastroenteritis, was hypoglycaemic and was considered to be in pre-renal failure. Eoin required intravenous fluid resuscitation and was given antibiotics. Following hydration he gained one stone in weight in a matter of days and was discharged on the 28th February, 2012, in good condition and has had no further episodes of ill health up to the present time.

120. In reaching my conclusion as to the cause of Eoin's rhabdomyolysis in February 2012, I have taken into account his moderately raised white cell count of 16 (reference range 4.5 – 13) and a similarly modestly raised CRP (C-Reactive Protein) of 27 (reference range 0 – 10). These two factors were relied upon by the defendant in support of its contention which was put to a number of the plaintiff's experts that he was not suffering from an illness which was sufficiently serious, in the absence of some underlying condition, to cause him to develop rhabdomyolysis. In this regard, I accept the evidence of Dr. Rennie and Prof. Flemming that these tests are not of any real significance in the context of Eoin's viral infection as they are principally markers relevant to bacterial infection, something Eoin did not have at the relevant time. I am also satisfied that Eoin's renal problems and his abnormal liver enzymes were a direct result of his dehydration.

121. My conclusion as to the likely cause of Eoin's rhabdomyolysis is, I believe, supported by a study of approximately 191 paediatric patients presenting with a single episode of rhabdomyolysis over a ten year period and which study is the subject matter of a paper

entitled *Acute Paediatric Rhabdomyolysis: Causes and Rates of Renal Failure* authored by Drs. Mannix, Wright and Baskin. Of the 191 cases studied, in 73 instances viral illness was deemed to be the precipitating factor. 49 cases were considered to have been provoked by trauma, 10 were as a result of connective tissue disease, 8 were due to drug overdose and only 7 in total were ascribed to one type of metabolic disorder or another. Of those 7 cases, three patients had underlying metabolic disorders of a type which has been ruled out as a possibility in the present case. Only one member of this total group of 191 patients was diagnosed as having mitochondrial disease. Accordingly this study gives little support to the defendant's contention that this episode of rhabdomyolysis in February 2012 is probably linked to the fact that Eoin suffers from mitochondrial disease, an underlying muscle disorder or some unprecedented complex genetic disorder.

122. Insofar as Prof. Berry relied upon the extremely deranged levels of Eoin's CK readings in support of his opinion that Eoin may suffer from an unprecedented genetic disorder, he did not produce any literature to support the court drawing any particular inference from those particularly raised levels. Further, notwithstanding the fact that he is probably one of the world's leading geneticists, he was unable to give one example where a reading such as this has been considered to be evidence of the existence of any type of genetic disorder potentially involving a number of genes and perhaps implicating the mitochondria and/or reduced pyruvate dehydrogenase.

123. In reaching my decision, I have had regard to the fact that Eoin's CK level in February 2012 was extremely deranged for several days and that on one interpretation of the material set forth in the aforementioned study, one might reasonably assume that a patient with such significant abnormalities would be considered to be at greater risk of having a previously undiagnosed metabolic disease. Even allowing for that assumption I do not think it likely that this episode of rhabdomyolysis in February 2012 is evidence of any underlying disorder.

124. In reaching my decision on this issue, I have also taken into account that two of Prof. Berry's hypothesised triggers for this episode, namely sodium valpouate and dehydration, were not new to Eoin in February 2012. Dr. Murphy's evidence was that Eoin had always had difficulties with hydration and that he was hospitalised on two occasions in recent years prior to February 2012 by reason of this problem, albeit only for a few hours. Likewise, he was taking sodium valpouate for two years in advance of this episode of rhabdomyolysis in February 2012. Perhaps it is surprising therefore that if Eoin suffers from some unprecedented complex genetic disorder for which dehydration and sodium valpouate are triggers that he did not experience such an episode prior to February 2012. I do not think it unreasonable, given that Eoin is now ten years of age, to attach some weight to the fact that such an episode of rhabdomyolysis did not erupt prior to February 2012.

125. Having regard to the evidence of Dr. Manning, I have also considered the possibility that Eoin's development of rhabdomyolysis in February 2012 might be considered to be an exaggerated response to a minor illness, such that I should conclude that he has an underlying metabolic disorder or mitochondrial disease even though that line of argument seems to be at odds with the defendant's assertion that Eoin was really not sick enough at the time of his admission to hospital this year to have developed rhabdomyolysis as a consequence of that illness. Having considered all of the evidence in relation to this issue, I am satisfied that Eoin's illness in February 2012 was certainly not one that could be described as trivial. He had a viral illness, a very significant fever, gastroenteritis, a chest infection and dehydration to the point of potential circulatory collapse. Indeed, his medical profile is very consistent, in terms of symptoms, with the viral condition described in Table 1 of the Mannix article. Accordingly, I am satisfied that the illness of February 2012 was effectively a once off illness and does not fit the clinical pattern of a child who has an underlying mitochondrial or metabolic disorder.

Dr. Reardon: Underlying Muscular Abnormality of Genetic Origin

126. I have considered very carefully the evidence of Dr. Reardon to the effect that he believes it is possible or even likely that Eoin suffers from a metabolic abnormality of the muscle of genetic origin which may account for his condition at birth and his delayed response to resuscitative measures. He emphasised Eoin's unexplained condition at birth when he failed to breathe or cry and his episode of rhabdomyolysis with a very high CK reading in February 2012 as being consistent with the existence of such a disorder. He referred to the potential significance of Eoin's second echocardiogram which showed his heart to be functioning at the upper end range of normal and to his reduced PDH which he stated one might expect to be present as a secondary abnormality in a child suffering from a primary metabolic abnormality of the muscle. In addition, he relied on Eoin's abnormal biochemical neonatal test results and an intermittent squint as "straws in the wind" which when looked at alongside the other evidence could explain what happened at birth by reference to an inherent metabolic abnormality.

127. As Dr. Reardon stated in evidence, he set out to look for something which was atypical or abnormal which might signal an alternative possibly genetic explanation for what occurred in this case rather than the obvious one. Indeed, this is what he was asked to do by the defendant's solicitors. He started from the premise that Eoin's condition at birth was relatively unique and remained unexplained. This is notwithstanding the fact that he agreed with Prof. Flemming that tone is a marker for brain activity and the fact that a baby did not breathe at birth was not of itself necessarily an indication that something catastrophic had happened. He certainly did not pursue his consideration of Eoin's case on the basis that he had been born in moderate condition but then deteriorated significantly over the first five minutes of life and allegedly continued to deteriorate thereafter by reason of ineffective and/or delayed ventilation.

128. Of some significance is the fact that nowhere in Dr. Reardon's initial expert report did he refer to the possibility that Eoin suffers from a metabolic condition affecting his muscles even though at that stage he was aware of Eoin's rhabdomyolysis, a condition which causes a patient's muscles to breakdown.

129. As for evidence of the existence of the type of muscular abnormality contended for by Dr. Reardon, apart from Eoin's rhabdomyolysis in February 2012 Dr. Reardon was not able to identify anything really concrete in Eoin's clinical history to encourage me to support his opinion. Insofar as he has relied upon Eoin's failure to breathe at birth, the uncontested evidence was that approximately 10% of babies require bag and mask ventilation.

130. Insofar as Dr. Reardon relies upon Eoin's extended period in a poor condition immediately following his birth, he failed to explain how the presence of an underlying muscular disorder could have impeded Eoin's response to resuscitation, given that positive pressure ventilation pushes oxygen into the lungs, and as a result, oxygenated blood is then circulated throughout the body and to the brain with the benefit of cardiac compression. During all of the period when he was receiving positive pressure ventilation, Eoin would have been forced to breathe, regardless of the condition of his muscles. He was not being left to his own devices or to rely upon his own musculature for this purpose. Indeed, the plaintiff's experts stressed how easy it is to oxygenate or ventilate a paralysed baby or a baby whose muscles are not working as they do not struggle and resist ventilation. To demonstrate this point, Dr. Rennie drew the court's attention to the case of the actor, Christopher Reeve, who was kept alive for several decades by artificial ventilation although he was paralysed from the neck down.

131. In support of his opinion, Dr. Reardon relied upon the fact that children with certain types of inherent neuromuscular problems have difficulty establishing respiration and may need ventilatory support, often for several days, and thereafter experience no respiratory problems. He instanced hypotonic dystrophy as an example of one such condition. I have to say that I am not satisfied that I can place much weight on this aspect of Dr. Reardon's evidence in circumstances where, firstly, he agreed that Eoin does not suffer from this condition. Secondly, the children whom he described as requiring extensive ventilatory support following birth all appear to have responded normally to the resuscitation provided and he gave no example of any child who suffered any adverse effect not to mention brain damage due to their failure to respond timely and effective resuscitative measures. Thirdly, all of those children, unlike Eoin, were subsequently diagnosed with some such disorder and had signs and symptoms referable thereto, unlike Eoin, who for the ten years after his birth, had no obvious signs of such underlying disorder. Further, insofar as Dr. Reardon told the court that he had seen well grown babies die in the delivery room due to an underlying metabolic abnormality, it was clearly possible in those cases to identify the disorder that caused the catastrophe at birth. In the present case, the underlying disorder contended for is one which appears to have had a temporary effect of approximately thirty minutes duration.

132. Mr. Smith, like so many of the plaintiff's experts, made it clear that if you cannot generate a heartbeat with bag and mask resuscitation, ventilation of the lungs by intubation combined with cardiac compression will establish cerebral perfusion. A disease affecting the muscles is simply no explanation as to why Eoin sustained brain damage in the course of his resuscitation. Further, Dr. McFarland explained that even if Eoin had any metabolic condition affecting his muscles or neuromuscular function, children with these conditions are no harder to resuscitate. He explained that the chest wall will expand in response to positive pressure ventilation. He stressed that children born with myopathies do not have difficulty with resuscitation. The plaintiff's written submissions helpfully set out the number of ways in which Dr. McFarland refuted the defendant's theories on why it would have been difficult to resuscitate Eoin. He stated that if Eoin had been born with an underlying neuro-muscular disorder, cardio-resuscitation would have been easier, that if he had been born with a respiratory chain defect, resuscitation wouldn't have been impeded as intubation could be performed, if he suffered a brain-stem defect or mitochondrial disorder or metabolic disorder, again he would have been easy to ventilate and if he had been born with cardiac myopathy, he wouldn't have been difficult to resuscitate. Dr. Rennie made it clear that once you intubate there is nothing voluntary about a baby's response. She questioned the existence of a muscular disorder that would have a temporary impact lasting less than 30 minutes and never appear again for another ten years. Even in February 2012, Eoin had no problems with ventilation of his lungs.

133. While Dr. Reardon sought to rely upon Eoin's second cardiogram which is at the upper end of normal as potential evidence in support of some underlying abnormality of the muscles, I have to say I am not impressed as to the importance of this finding. I believe that if there was any real weight to be attached to this finding I would have heard about the significance of this test result from a cardiologist, particularly in circumstances where that result is within normal range.

134. Insofar as Dr. Reardon relied upon a reduced PDH reading as a potential indicator for the presence of some underlying disorder, no case study or literature was advanced to the court to support this proposition. Further, I have to say that I prefer Prof. Flemming's evidence as to the significance, if any, that I should attach to this reduced PDH reading. I accept his evidence that having regard to the workings of the relevant biochemical pathways, any such reduction could not have adversely affected Eoin's response to resuscitation if the same had been delivered in an effective and timely fashion.

135. Insofar as Dr. Reardon relies upon the fact that Eoin cannot walk, control his bowel or feed normally as evidence of some type of significant muscle dysfunction over a ten year period, it is regrettable that none of these matters were referred to in his expert report and were not put to any of the plaintiff's witnesses as evidence of his opinion as to the existence of some underlying muscular dysfunction unrelated to his cerebral palsy. Further, I think it is highly likely that if these clinical signs had been put to the plaintiff's experts as evidence of some underlying muscular abnormality that those experts would likely have stated that these findings were entirely consistent with what was to be expected in a child with cerebral palsy who had experienced a near total hypoxic ischaemic event at birth and should not be recast as evidence of some underlying muscle dysfunction, particularly in circumstances where the defendant now accepts that Eoin's injuries were caused by such an event. In addition, Eoin has been seen by many eminent medical practitioners over the years in respect of his cerebral palsy and these include Prof. Joe MacMenamin, Dr. Mary King, Dr. Hensey and Dr. Lynch, none of whom apparently ever suggested that Eoin had any clinical signs of some other type of muscular or neuromuscular problem.

136. For all of the aforementioned reasons, I cannot accept Dr. Reardon's evidence as to the existence of some underlying muscular disorder.

Prof. Berry

137. The qualifications of Prof. Berry as a geneticist are to say the least impressive. The fact that he is also a paediatrician with real hands on experience in dealing with babies and neonates mandates that the court pay detailed attention to his evidence as to why Eoin became brain damaged after his birth.

138. Having considered in great detail all of the evidence which Prof. Berry had to offer, I am not satisfied on the balance of probabilities that Eoin suffers from a complex genetic disorder of the type hypothesised by him.

139. Like Dr. Reardon, Prof. Berry's starting point was that there was something particularly unique about Eoin's condition at birth. As already stated, I prefer the evidence of the plaintiff's experts on this issue. I accept that Eoin was born with a depressed heart rate and in worse condition than expected due probably to intermittent hypoxia during the last two to three minutes prior to his birth. I cannot accept, however, Prof. Berry's evidence that the stress of an intermittent tachycardia during Eoin's last ten minutes in the womb may, for example, have triggered the genetic disorder for which he contends.

140. Two of the big issues, as advised by Prof. Berry, which I accept I have to decide, are why Eoin did not spontaneously breathe at birth and why he developed rhabdomyolysis in February 2012. He also referred to Eoin's difficulties after birth and stated that it was "ridiculous" that he had not responded to resuscitation delivered over the first 23 minutes of his life and that one was therefore driven to look for some underlying reason to explain why that was so. However, what Prof. Berry did not factor into his opinion was the fact that Eoin's condition at birth may not have been as poor or as unique as he believed. 10% of babies do not breathe spontaneously at birth and in many instances, whether due to a failure to make a seal between the mask and face, the incorrect positioning of the head or jaw and/or difficulties with providing positive pressure through the flow bag, occasionally babies do not recover and go on to require intubation. Neither did he consider the possibility that there may have been a delay in Eoin receiving an adequate supply of oxygen due to delayed intubation and/or due to the fact that the first endotracheal tube for whatever reason proved ineffective. Furthermore, when Prof. Berry was questioned about conditions that could prevent a baby from breathing at birth he stated that he was giving his evidence from an amateur's point of view both in respect of perinatal breathing and resuscitation.

141. His statement that a baby with primary depression will readily respond to a few whips of oxygen again fails to take account of

the requirement that the oxygen be effectively administered. This does not always happen, as is clear from the complications which are described in detail in the material opened to the court emanating from the textbook on Neonatology authored by Rennie & Robertson. For example, in relation to heart rate, that text advises as follows; "however, if a baby is limp, not breathing and the heart rate is less than 100 beats per minute, positive pressure ventilation is needed. If the heart rate does not increase promptly, the most likely reason is that the positive pressure ventilation is ineffective. If the baby remains bradycardic despite ventilation with PEEP moving the chest, then chest compressions should be given. However, the most likely reason for continued bradycardia is that the respiratory support is inadequate". It goes without saying that during the period of ineffective ventilation the baby will start becoming hypoxic and is at risk of catastrophic injury unless it is replaced with effective intubation. It also seems to be accepted that the longer the period of hypoxia the longer it will take for the baby's heart rate to recover.

142. In terms of Prof. Berry's evidence in general, he changed his opinion on what might be at the root of Eoin's condition a number of times. Initially he expressed the opinion that Eoin had a defect in the pre-bötzinger complex but later stated that when he initially mentioned this impairment he had only offered the same on an illustrative basis. He then moved to the view that Eoin suffered from some sino-atrial defect prior to advancing the hypothesis that Eoin suffers from a genetic disorder as yet unknown to the scientific and medical community but which involves five genes and in which condition some mitochondrial defect or reduced PDH may be playing a role.

143. I must also say that the ease with which Prof. Berry abandoned a number of the statements he had made in his original expert report was surprising. In his evidence to the court he did not seek to stand over many of the matters which the court had been told, in the course of the defendant's application to admit new evidence, would constitute the substance of his evidence, namely:-

- (i) That Eoin suffers from metabolic myopathy;
- (ii) That Eoin had a history of severe perinatal asphyxia and shock;
- (iii) That Eoin did not have cerebral palsy due to pure hypoxic ischaemic damage to the basal ganglia and thalami;
- (iv) That the CT and head ultrasound scans were not consistent with catastrophic hypoxic ischaemic damage;
- (v) That there was great significance to be attached to the fact that there was a notable loss of volume of the posterior limb of the internal capsules on the MRI scan at five months;
- (vi) That there was significance to be attached to certain changes in the watershed regions of the brain; and
- (vii) That the symmetrical bilateral lesions on the MRI were not typical of acquired hypoxic ischaemic lesions stating that some degree of asymmetry was to be expected.

144. Prof. Berry readily admitted in his evidence that he had learned a bit more about MRI scanning over the summer months of 2012 and was now satisfied that Eoin's radiological picture exactly corresponded with a case of near total hypoxic ischaemic injury. He also accepted that there was nothing on the MRI scan by way of a footprint to demonstrate mitochondrial disease which often leaves one. Insofar as the first of Prof. Berry's four hypotheses was put to Dr. McConachie as the mechanism to explain why Eoin did not respond to timely resuscitation i.e. damage to the brain stem, Dr. McConachie stated that damage of that nature would have left a separate footprint on the MRI scan. I accept the evidence of Dr. McConachie that in the majority of cases a mitochondrial or metabolic disorder affecting the central nervous system will show up on an MRI scan.

145. I considered with a great deal of care all of the evidence proffered by Prof. Berry in support of his belief that Eoin suffers from an underlying complex genetic disorder involving five genes but having done so I must say that he has not been able to convince me that there was some stimulus that interacted with Eoin's genetic make up to cause him to be unable to breathe at birth and which again resurfaced ten years later in February 2012. While he stated that for the ten minutes prior to delivery or right up to the delivery, there could have been a constriction of the umbilical cord and that the reduction in oxygen flow could have been enough to kick-start this complex genetic disease he readily admitted that he knew of no such case where this had occurred.

146. While I accept Prof. Berry's evidence that a complex genetic process may not leave a footprint on an MRI scan, the fact that there was no such footprint in Eoin's case lessens my enthusiasm to opt for the existence of such a disorder, particularly when that disorder is also as yet undiscovered, unprecedented and has not yet been encountered by Prof. Berry or any of his colleagues. It is even harder to do so in the context of Prof. Berry's evidence given on Day 35 of the hearing when he stated that he did not know why Eoin did not breathe in the first place and does not know why he did not respond to resuscitation.

147. I also reject Professor Berry's evidence that Eoin's genetic disease process may have played a role in his failure to respond to timely and effective resuscitation because he was not in a position to explain to me how or why this could be so. I am satisfied from the evidence that even if Eoin had a flaccid paralysis as described by Prof. Berry, he should have been capable of resuscitation. In this regard, I should say that I reject the defendant's submission that the court cannot assume that the plaintiff's system would behave in a traditional or logical way in the presence of a genetic disease, particularly having regard to his recovery from a cardiac and respiratory point of view at approximately 23 minutes of age. To do otherwise, in the absence of any evidence demonstrating that the presence of genetic disease has ever been known to alter a baby's ability to breathe at birth or respond to ventilation, would be a failure on the part of the court to attach appropriate weight to the medical evidence stating that there was no physiological reason why this should be so.

148. While Prof. Berry, Dr. Reardon and Dr. Manning have put forward a number of specific hypothesis which I have rejected, I have not, however, ignored the fact that implicit in their evidence is their belief that Eoin suffers from some type of inherent metabolic abnormality of a genetic origin which impacted upon him at birth and again in February 2012. Even if such an abnormality does not fall neatly within the three specific types of disorder which I have just dealt with, nonetheless, for the same reasons that I rejected the specific hypotheses which they advanced, I am not satisfied that Eoin suffers from any other type of underlying disorder or condition.

General

149. In coming to the aforementioned conclusions, I have also been marginally influenced by the fact that none of the medical practitioners responsible for Eoin's care from the time of his birth until his hospitalisation in February 2012 ever considered his development or clinical course to be anything other than entirely in keeping with that to be expected of a boy with dykinetic cerebral palsy brought about as a result of a near total asphyxiating event. Neither did those medical practitioners who looked after Eoin at the time of his birth seem to consider that his biochemical findings in the neonatal period might be indicative of the presence of any such inherent disorder.

150. Another matter of some relevance is the fact that all of Eoin's medical records since birth have been in the possession of the defendant's legal and medical advisors for many years. I must assume that the neonatal test results and clinical records now relied upon as evidence of some underlying disorder were scrutinised prior to February 2012, yet, up to that point no one suggested that these test results or indeed his clinical and developmental course thereafter might suggest the presence of any such condition. This is so regardless of the fact that until February 2012, the defendant was at a loss to explain how, on its account of events, Eoin had failed to respond to timely resuscitative measures.

151. Notwithstanding the extremely impressive credentials of the defendant's experts none of them has been able to explain to me how it is that if Eoin has a genetic disorder or metabolic condition which profoundly affected him at the moment of his birth, he had previously behaved normally in the womb in terms of his movements and cardiac activity and after the first 30 minutes of his life, appears to have had no adverse effects from such a disorder until February of this year.

152. As already stated, the defendant's witnesses have not been in a position to adequately explain why an infant born with a genetic or muscular disorder or even with mitochondrial disease could not be resuscitated. The evidence of Prof. Flemming, Dr. Rennie and Mr. Smith, was very clear that the existence of any type of disorder such as that hypothesized by Prof. Berry, Dr. Reardon and Dr. Manning would not stop such a baby being resuscitated.

153. While the onus of proof is on the plaintiff to establish the cause of Eoin's injuries, it is of significant import that the defendant has not been in a position to point to any literature or case study to show that any baby born with any of the types of disorder contended for by its experts did not breathe spontaneously at birth, failed to respond to effectively delivered positive pressure ventilation or experienced hypoxic ischaemic injury as a result of such a condition.

154. In reaching my conclusion that Eoin was not born with any underlying defect of the nature advised by the defendant's witnesses, I have considered the defendant's submission based upon the decision in *Wisniewski v. Central Manchester Health Authority* [1998] Lloyd's Rep Med 223, that I should draw adverse inferences from the failure on the part of the plaintiff to call as witnesses certain medical practitioners, such as Dr. Owen Hensey, Dr. Clare Leonard and Professor Eileen Treacey who treated Eoin following his admission to Temple Street Hospital in February 2012.

155. I have to say that I do not find the defendant's submission in this regard to be persuasive. Firstly, I do not believe that the court would have been assisted to any significant extent by evidence from any of these witnesses. Their opinions, had they been asked to give evidence, would have been just a number of additional opinions tendered by suitably qualified consultants based upon the same material and information as was available to all of the other experts engaged in the proceedings. In this regard, it is important to note that all of Eoin's hospital records, including all documentation, correspondence and test results arising from his hospitalisation in Temple Street Hospital were made available to the defendant's legal advisers so that its experts might determine the extent to which his illness at that time might be relevant to the causation issue. Secondly, it has not been demonstrated that any opinion which Eoin's treating doctors might have given, if called as witnesses, could not, with equal validity, have been offered by its own experts, having regard to their access to the same information and material as was available to Eoin's treating doctors. Thirdly, the defendant has not pointed to any specific prejudice arising from the plaintiff's failure to call these witnesses. There is, for example, no suggestion that Eoin's treating doctors had exclusive knowledge of facts or information material to the defendant's causation case which would have put them in a unique position, in terms of knowledge, such that without their evidence the court would be impeded in its task. Finally, the defendant admitted into evidence all of the Temple Street records without the necessity for formal proof at a time when it might have required the plaintiff to prove those records, thus making Eoin's doctors available for cross-examination. Indeed, one of the records it admitted was that made on the 19th July, 2012, which noted: "Investigated for mitochondrial disorder. All investigations to date negative".

156. In coming to my conclusions, I have also been asked to draw negative inferences from the failure on the part of Eoin's parents to have him undertake a substantial number of tests which would, it was submitted, have placed the court in a much better position to decide why he sustained a period of profound hypoxia at and immediately after birth. Because the burden of proof remains on the plaintiff in these proceedings, there is clearly no onus upon the defendant to prove that Eoin was born with any of the underlying disorders for which it contends. However, it was submitted on the defendant's behalf that the court was prejudiced in its ability to determine the causation issue as it could not rule out or even adequately adjudicate upon the defendant's various hypotheses advanced as to the cause of Eoin's injuries in the absence of the testing advised by its experts.

157. I have not been persuaded for a number of reasons to follow this approach. This is a case concerning a plaintiff who has been subjected to significant testing for the purposes of seeking to ascertain whether he was born with or suffers from some underlying disorder. In this regard, it is clear from the Temple Street Hospital records that in the course of Eoin's hospitalisation in February 2012, a number of investigations were recommended and carried out with a view to considering the possibility that he was suffering from some type of underlying metabolic disorder. As of July 2012, such investigations as had been undertaken had proved negative. Further, a number of conditions which were mentioned in the defendant's expert reports as possible underlying metabolic disorders were ruled out by testing carried out in advance of these proceedings. These included MERFF, NARP, MELAS, Alper's and classical PDH.

158. I am also satisfied from the evidence of Dr. Murphy that she has at all stages cooperated in any tests advised by Eoin's treating clinicians for the purposes of seeking to establish whether or not he suffers from any underlying disorder and that she has done so believing that this is in Eoin's best interests, regardless of the effect that any such test results might have on the impact of these proceedings.

159. In relation to the presence or absence of mitochondrial disease, the defendant sought to encourage the court to conclude that Eoin's parents, for reasons possibly to do with the present proceedings, had deliberately withheld their consent to a muscle biopsy, the test most likely to determine the presence or absence of that condition. Having considered the evidence on this issue, it is clear that a muscle biopsy can only be carried out under a general anaesthetic, a procedure that carries a significant risk of mortality for a patient such as Eoin. In my view, for a defendant to suggest that an adverse inference should be drawn from the fact that a plaintiff did not, having regard to such risk and the lack of any therapeutic benefit therefrom, undertake such a procedure to disprove a hypothesis advanced by the defendant as to the presence of an extremely rare condition, is unsustainable. Further, as a matter of fact, the medical records establish that Eoin's parents had consented to him having such a biopsy when he was hospitalised in February 2012, as at that time he was scheduled for a general anaesthetic for the purposes of other essential therapeutic intervention. The only reason why the biopsy was not carried out at that time was because Eoin was on a drug which would have rendered such a biopsy contra indicated in terms of risk. The fact that he has since not pursued a muscle biopsy is entirely reasonable. Perhaps it is also worth recording that notwithstanding the protestations of the defendant that he ought to have this investigative procedure carried out for the purposes of ruling out mitochondrial disease, both Professor Berry and Dr. Riordan accepted that such a test would not, in any event, in their opinions, have been of any particular evidential value in the proceedings.

160. For reasons set out in my short *ex tempore* judgment delivered on the 15th November, 2012, I am not prepared to draw any adverse inferences from the fact that Eoin has not participated in what has been described as exome sequencing. As stated in that judgment, no formal request was ever made by the defendant in advance of these proceedings requesting that Eoin would submit to that type of testing and neither was any application made to the court in that regard. Further, the defendant did not establish in the course of evidence how long that testing process might take and the extent to which the significance of such testing could be assessed without the necessity of involving other family members. Insofar as the defendant sought to have the court infer that Eoin's parents had not accepted advice given by their own doctors that Eoin pursue such testing, Dr. Murphy gave evidence that while a Paris laboratory, which had carried out other tests on their behalf, had offered to do exome sequencing, she had been told by Eoin's treating consultant that to pursue such a route would be like looking for a needle in a haystack. That is precisely how a number of the plaintiff's experts described the likelihood of any clear outcome being achieved from this type of testing.

161. Finally, it is important to note that the defendant in this case has not been able to point to a medical condition which is known to medical science and for which there is a test that, if carried out, would resolve the causation issue in these proceedings. Even if Eoin was subjected to all of the testing advised by the defendant's experts, and even if such testing pointed towards a certain medical condition, none of the defendant's experts have been able to say how the presence of such a condition would have had the effect of temporarily interfering with his ability to respond, like any other baby, be they brain damaged, paralysed or otherwise, to positive pressure ventilation and intubation if delivered in a timely and effective manner.

162. I do not accept as a matter of principle that a plaintiff must ensure that prior to coming to court to pursue a claim for medical negligence that he has carried out all tests that the defendant may claim are necessary to rule out every hypothesis that might be advanced by that defendant as to the cause of his injuries.

163. In all of the aforementioned circumstances, I am not satisfied that there are any adverse inferences which I should attach to the failure on the part of Eoin's parents to pursue exome sequencing.

The Plaintiff's Case

164. The fact that I have concluded that Eoin does not suffer from an underlying disorder of the type contended for by the defendant does not determine the liability issue. I still must decide whether the injuries he sustained following his birth were caused by the negligence of the defendant in the manner alleged. This requires me to resolve a great deal of evidential conflict as to what probably happened at the Coombe Hospital during the first 30 minutes of Eoin's life.

165. There were three major areas of contention between the parties referable to the period surrounding Eoin's birth. The first was regarding Eoin's condition at birth and I have already resolved this issue by concluding that he was born somewhat unexpectedly in poorer condition than was anticipated but without any underlying disorder such as was contended for by the defendant. The second area of contention is what is likely to have happened to Eoin between the time of his birth and the time when Dr. Ramesh, Paediatric Registrar, arrived to assist in his resuscitation. The third is the time at which he arrived for such purpose and what happened thereafter. I intend to deal with the latter two issues together.

166. Both in the course of the trial and in their written submissions, the parties referred extensively to various entries in the medical records in support of their account and timing of events over the first 30 minutes or so of Eoin's life. However, having listened carefully to the evidence and with knowledge of the fact that all of the relevant records were written retrospectively after an emergency had occurred, possibly with the exception of some contemporaneous note as to the drugs administered during the resuscitation, and in circumstances where many of the participants had liaised with each other prior to the creation of those records, I believe it would be unwise to take for granted the accuracy of their contents. This is particularly so, I believe, in the case of timings or periods of time which are referenced to Eoin's age in minutes as opposed to those that appear to have been logged by reference to the clock in the delivery suite.

167. The fact that the medical and nursing notes in many instances are inconsistent with each other, and in some cases replete with errors, has made the court's task in resolving what occurred during Eoin's first 30 minutes of life more difficult than might otherwise have been the case. Furthermore, insofar as the reliability of the oral evidence is concerned, nearly all of the defendant's non-expert witnesses were only contacted seven or more years after the events in question and none of them had made earlier statements from which they might otherwise have been in a position to refresh their memories. Also, notwithstanding the completion by Midwife Flemming of an incident report form recording an adverse event, apparently no investigation into the circumstances surrounding Eoin's birth was ever carried out. This is highly surprising if what happened to Eoin and the reason for his injuries are as unique as is suggested by the defendant to these proceedings. Even on Dr. Ramesh's account of what occurred, he agreed that a clinical review was warranted in this case having regard to the injuries sustained in the period immediately after Eoin's birth. Hence, the events before this Court had not been revisited by most of the defendant's witnesses as to fact until such a time as they were approached to give evidence in these proceedings. In these circumstances, while the relevant witnesses may have been doing their best to give an accurate account as to what took place immediately after Eoin's birth, I think it is likely that many of them may have been doing so not based upon their actual memory of what occurred but rather from memories prompted and/or influenced by the medical records which, on the evidence, I believe are unreliable.

168. Notwithstanding these reservations, I will refer briefly to some of the points made by the parties in relation to the timeline of events which they contend for by reference to a number of the entries in the medical chart. However, it would be impossible to go through each of the timings, notes and submissions relied upon by the parties. Accordingly, the fact that certain matters relied upon by the parties in their submissions may not be directly addressed in this judgment does not mean that they were not considered and weighed in the balance when I reached my conclusions.

169. Dr. Murphy stated that Dr. Ramesh did not arrive until Eoin was approximately ten or twelve minutes of age. Her evidence was based upon the timings she took from the wall clock, her own impression of the passage of time and the note that she made on the evening of Eoin's birth that he had been exposed to a period of bradycardia amounting to 23 minutes. Her husband, Mr. Dunne, felt that Dr. Ramesh may not have arrived for thirteen or fourteen minutes. His evidence in this regard was referenced to his memory of the timings that had been displayed on the clock on the resuscitaire. Counsel for the plaintiff sought to support such timings, firstly by reference to the time ascribed to the administration of the various drugs in the drug chart. The court was urged to accept the reliability of these as they appeared to have been charted by reference to the time displayed by the clock on the wall in the delivery suite as noted by their author. Further, each entry in the chart, including the timings at which various drugs and infusions were given, were signed for by Dr. Ramesh, as well as Nurse Carroll and Nurse O'Connor.

170. A number of the plaintiff's expert witnesses advised the court that the drug chart was probably written up contemporaneously with the events noted or if not was completed immediately thereafter from less formal notes made during the resuscitation, which would have included the time at which each intervention had taken place. A contemporaneous note of the dosage of a drug and the

time of its delivery, they stated, was critical to the welfare of the infant's safety. Without such a note, the doctor would not know when to deliver the next dose of any drug or how much he could give. In support of the probability that the drug chart was completed contemporaneously or the information therein contained written down elsewhere contemporaneously, reliance was placed upon the fact that there were eight people present at the time of the resuscitation. Accordingly, there was no reason why the drugs and the time at which they were administered would not have been written down as they were given.

171. In asking the court to accept the timings on the drug chart as accurate, the plaintiff has urged the court to take into account and draw adverse inferences from the fact that the defendant decided not to call Nurse O'Connor, who probably wrote the timings into the drug chart, as a witness, regardless of the fact that it knew that those timings were of great importance in the proceedings. This default was of even greater significance in circumstances where the defendant had pursued a defence which had as its foundation a timeline of events that were in the teeth of its own chart which it agreed could be admitted into evidence by agreement.

172. Counsel for the plaintiff submitted that if the timings in the drug chart are correct it was inconceivable that Dr. Ramesh had arrived at 6.40 i.e. five minutes after Eoin's birth. Those timings were more consistent with the evidence of Dr. Murphy and her husband as to the extent of the delay in his arrival. The timeline on the drugs chart would suggest that the first dose of adrenalin was delivered approximately eighteen minutes after Eoin's birth, the second 20 minutes after his birth and the IV dose of adrenalin at 6.57, i.e. 22 minutes after his birth. It was submitted that this evidence was also in keeping with Dr. Murphy's evidence that Eoin's heartbeat picked up when he was about 23 minutes of age and her husband's evidence that it picked up maybe a little later than that. It was also consistent with Dr. Rennie's evidence that she felt it was the intravenous adrenalin which caused Eoin's heartbeat to come up within a minute or two of that infusion.

173. The plaintiff also relied upon Dr. Griffin's note recording that she was called at approximately 6.50 as evidence supporting Dr. Murphy's claim and that of her husband as to Dr. Ramesh's arrival at about 6.47 or thereabouts. Dr. Ramesh stated that he had asked that Dr. Griffin and the team from the Neonatal Intensive Care Unit be called before he sited the second endotracheal tube which he states he did at 6.43. The timing on Dr. Griffin's note was, on the plaintiff's submission, stated to be much more consistent with his arrival at about 6.47 and with his call for assistance being made a couple of minutes later before he reintubated Eoin.

174. Insofar as the defendant is concerned, it relied upon the oral evidence of Midwife Flemming, Midwife Manning and Nurse Kelly as to the time at which Dr. Ramesh arrived to the emergency. In this regard, the defendant relied upon a number of notes in the medical chart which attest to Dr. Ramesh's arrival when Eoin was five minutes of age. His own note and that of Dr. Lewis also record his arrival when Eoin was five minutes of age. Further, the note of Nurse Carroll records Dr. Ramesh intubating Eoin at five minutes of age, thus appearing to attest to his presence at that time.

175. The defendant also relied upon Nurse Carroll's note, which she completed retrospectively back in the neonatal unit, to establish the timeline of events and treatment following Dr. Ramesh's arrival. That note was relied upon as evidence supporting the defendant's assertion that Dr. Ramesh's arrived when Eoin was five minutes of age, that his first intubation occurred at five minutes, his reintubation at eight minutes and the pick up of his heart at 20 minutes of age.

176. The defendant maintained that the timings on the drug chart could not be relied upon as it was probably not filled in contemporaneously. Dr. Ramesh gave evidence that he signed his entries in this chart after the event and he did not know if the timings were on it at that time. Nurse Carroll told the court that the drug chart was always completed back in the ICU after a baby was stabilised. She said that in the case of an emergency situation, if there was a scribe free to make a note, the details might be written down on a piece of paper from which the chart would be later completed. It was submitted that the fact that the chart incorrectly records the sequence in which the sodium chloride and sodium bicarbonate were administered was further evidence that the timings in this chart could not be relied upon. Further, as to the extent to which the court could rely upon the accuracy of timings in the drug chart, the defendant relied upon the evidence of Dr. John A. Murphy as to his experience of what normally happens in the course of an emergency resuscitation. He stated that somebody would usually try to jot down the details on a bit of paper but it was always the case that the chart would be written up after the event. It also relied upon Dr. Colm O'Donnell's evidence that the drug chart is never completed contemporaneously and that a contemporaneous note would only be made in approximately 50% of cases.

177. Counsel for the defendant also submitted that if the timings in the drug chart were correct, Eoin would have sustained such a lengthy period of hypoxia that he could not possibly have recovered from the event. Counsel relied upon a potential period of hypoxia of 27 or possibly even 32 minutes. Those periods comprised the two minutes prior to Eoin's birth added to a delay of ten to fifteen minutes for Dr. Ramesh's arrival and a further period of twelve minutes in respect of Eoin's resuscitation as measured according to the timings in Nurse Carroll's note. In its written submissions, the defendant made the point that Dr. Ramesh's note records Eoin's heart rate increasing to 80 beats per minute at 20 minutes of age and given that his heart rate would not have come up beyond 100 beats per minute until he had received further cardiac compressions, Dr. Ramesh's note in fact corresponds with Dr. Murphy's diary note as to the duration of Eoin's bradycardia.

178. I have referred to the aforementioned matters solely for the purposes of providing an example of the efforts made by both parties to support their oral evidence by reference to the timings in the medical records. There are many other instances which were relied upon by the parties in their submissions and all of these were considered by me prior to reaching my conclusions.

179. The defendant also asks the court to consider whether the plaintiff's claim that there was a delay in Dr. Ramesh's arrival is consistent with the failure on the part of Dr. Murphy and Mr. Dunne to make any complaint in the aftermath of Eoin's birth and their actions in sending thank you notes and/or presents to a number of the parties concerned.

180. As is to be expected in a case which has come to hearing ten years after the events in question, not all of the evidence has been consistent internally on either side of the case. Again, it is simply not feasible in the context of this judgment to do more than give an example of the court's difficulties in this regard. One such example can be demonstrated by reference to the evidence of Prof. Turner and Nurse Kelly, both witnesses called on behalf of the defendant. Prof. Turner told the court that he wrote his note in the hospital chart at 6.55am at which stage he felt he had been in the delivery suite for about ten to fifteen minutes and the resuscitation had been completed. The defendant used this evidence to support its argument that the timings on the drug chart had to be incorrect as it recorded that the second dose of adrenaline was administered at 6.55, prior to reintubation. If Prof. Turner's evidence that he had been present for ten or fifteen minutes before he wrote his note at 6.55 is correct he would have arrived between 6.40 and 6.45. However, when Nurse Kelly was questioned as to the time of his arrival she stated that she knew he was not there when the sodium bicarbonate was administered and on the defendant's timing of events that had happened several minutes later than 6.45. Further, Nurse Kelly stated that she always wrote down the time at which she delivered the placenta on a piece of paper and in this case she noted that she had delivered the placenta at 6.47. She said it then took her approximately another three

to five minutes to swab down Dr. Murphy and tidy up the sheets before she left. She thought that the cleaning up process would have happened between 6.50 or 6.52. Nurse Kelly stated that Prof. Turner had come in and had been standing at the sink opposite her for a minute or two before she left. Accordingly if I accept her evidence I would have to conclude that Prof. Turner arrived at least ten if not fifteen minutes later than he stated when giving his own evidence.

181. For me, one of the greatest difficulties encountered in these proceedings has been to decide upon the likely time at which Dr. Ramesh arrived to intubate Eoin, particularly having regard to the fact that he is noted in a number of the records as having arrived when Eoin was five minutes of age. However, regardless of these entries and of the fact that the same were supported in many instances by the oral evidence of a number of witnesses, I am not satisfied on the balance of probabilities that he arrived at that time. In this regard, I will refer to those matters which have most informed my decision.

182. The first matter of relevance is that the three members of the defendant's nursing/midwifery staff who were present when Dr. Ramesh arrived made no note in the medical chart referable to this issue. Clearly, Midwife Flemming made no contemporaneous note of what happened during Eoin's first few minutes of life because she was caught up in this emergency in which she was required to carry out the difficult task of providing bag and mask ventilation. Further, when she came to write her retrospective note later that morning, she did not make any entry referring to the time at which Dr. Ramesh arrived. In addition, the incident report form which she completed the following day makes no mention of his arrival at all or the time at which intubation was started or completed. Further, Midwife Flemming was contacted about the events surrounding Eoin's birth for the first time in 2010. Having regard to all of these factors I simply cannot accept her evidence that she remembers Dr. Ramesh arriving and noting that Eoin was then five minutes of age by reference to the time displayed on the resuscitaire. I believe it far more likely that her evidence as to his time of arrival was influenced by what she later read in the hospital chart when preparing for giving evidence in these proceedings and perhaps from her engagement with other potential witnesses on this issue.

183. Midwife Manning, who apparently arrived a minute or so after Eoin's birth, also made no record of Dr. Ramesh's time of arrival in the chart or indeed any note in relation to this apparently unique medical event in which he became hypoxic, notwithstanding the fact that he was allegedly in receipt of effectively delivered positive pressure ventilation and cardiac compression from shortly after his birth. She was first contacted about the events of 2002 some eight to nine years later. Likewise, Nurse Kelly, who delivered Eoin, did not make any note in relation to Eoin's birth after his delivery. Her oral evidence was to the effect that Dr. Ramesh arrived no later than would have been normal in an emergency situation. As to the evidence of both of these witnesses regarding the timing of Dr. Ramesh's arrival, once again I believe that after so many years their evidence is unlikely to reflect their actual memories of the events in question and is more likely to be evidence which has, perhaps unintentionally, been influenced by the content of the hospital records and their engagement with other witnesses involved in these proceedings.

184. The only other person present when Dr. Ramesh arrived was Dr. Lewis, the SHO. She was not present for Eoin's birth but her note records that she arrived when he was three minutes of age and Dr. Ramesh when he was five minutes of age. Where she got these timings from is unclear given that she was not called to give evidence. What was established in evidence however was that Dr. Lewis and Dr. Ramesh discussed the events of the morning in question prior to writing their respective notes and this being so it may well be that the timings in her note are no more than a repetition of the note made by Dr. Ramesh based on what he had been told as to his time of arrival by the midwifery staff. Perhaps it is of marginal significance in the context of my view as to the overall unreliability of the notes in this case that Dr. Lewis's note is incorrect in recording the number of doses of adrenaline which were administered and it is silent as to Eoin's first failed intubation.

185. As to the documentary evidence available in relation to Dr. Ramesh's time of arrival, his own note records his attendance at the resuscitation when Eoin was five minutes of age. In evidence, he told the court that he made that note retrospectively, having discussed Eoin's case with Nurse Nancy Carroll, Dr. Lewis, Dr. Griffin, Consultant Paediatrician; and Dr. Gray. In the course of his evidence, Dr. Ramesh stated on two occasions that his note recording his arrival at five minutes was probably based on what the midwives had told him and he would have proceeded on that basis. Later, he asserted that he would have established the time of his arrival from the clock on the resuscitaire. However, towards the end of his cross examination, Dr. Ramesh reverted to his earlier evidence stating clearly that his timings had not been taken from any clock and that he had no recollection of looking at the clock and noting that time. Indeed, by the time Dr. Ramesh completed his evidence, I certainly was not satisfied, on the balance of probabilities that the time of his arrival as per his written note had emanated from a timing noted by him on either the clock or the resuscitaire.

186. Nurse Carroll's note is also relied upon in support of the time of Dr. Ramesh's arrival insofar as it states that he intubated Eoin at five minutes of age. However, Nurse Carroll told the court that in giving her evidence she was entirely dependent upon her note which she had compiled at about 8.00 or 8.30 on the morning of Eoin's birth and that she had no recollection of events beyond it. She said that she was not present for Eoin's birth and had not arrived by the time Dr. Ramesh had administered the first dose of adrenaline through the first endotracheal tube. This is why she had not signed for this drug in the drug chart. Accordingly, at best Nurse Carroll's evidence as to Dr. Ramesh's time of arrival was something she was told by a third party. For the same reason, her note that Eoin was intubated at five minutes of age is of little evidential value and this is important as it is only her note which seeks to attach a specific time to Eoin's first intubation.

187. I regret to say that I am not prepared to place much evidential weight on the note of Nurse Carroll because it is inaccurate in so many respects. Firstly, it is noted that Eoin cried at birth which is incorrect. Secondly, it states that Dr. Ramesh intubated Eoin with a size 3.5mm tube when in fact he used a 3mm tube in the first intubation. Thirdly, she records that 0.3ml of adrenaline was given to Eoin as his first dose when in fact what he received was a dose of 0.1ml. Fourthly, she records that two further doses of adrenaline were given via the endotracheal tube at two minute intervals when in fact the third dose was given intravenously. Of further import is the fact that Dr. Ramesh stated that he gave the second dose of adrenaline via the endotracheal tube before he reintubated Eoin. This means that the sequence of actions in Nurse Carroll's note are also incorrect insofar as she refers to the second and third doses of adrenaline being administered after reintubation. This seriously calls into doubt whether she had even arrived by the time Eoin was reintubated. Strangely, she never recorded the time of her own arrival or the time at which she or her colleague, who I am assuming was Nurse O'Connor, was contacted to come to this emergency. Her sole basis for stating that she had arrived by the time that Eoin was reintubated was her note which recorded that the endotracheal tube had been taped into position and that this task was the responsibility of a member of the nursing staff. However, Midwife Flemming, Midwife Manning and Dr. Lewis were also in attendance at that time and any one of them could have completed this task. Further, Dr. Ramesh in his own evidence stated that he only put out the call seeking assistance from the nurses in the NICU just prior to reintubating Eoin and this evidence might also suggest that Nurse Carroll, who appears to have been part of the neonatal nursing team, may not in fact have been present when Eoin was reintubated.

188. The incongruity of Nurse Carroll's note does not end there. She records that air entry into Eoin's lungs was down when he was eight minutes of age, presumably the finding that caused Dr. Ramesh to reintubate, and that air entry was good at fifteen minutes of age. Why was air entry not checked immediately after reintubation and only noted as being good seven minutes later? Dr. Ramesh in

his evidence stated that following intubation, the first thing you do is listen with a stethoscope to establish that air entry has been achieved. Accordingly, if reintubation took place at eight minutes, as alleged, one would expect there to be a note recording whether air entry was evident as a result. Further, if the air entry was good at fifteen minutes, it must also have been good at eight minutes, given that this second tube, it is agreed, was clearly sited in the correct position. The note that air entry was good at fifteen minutes suggests to me that the second endotracheal tube had been inserted only moments earlier. In this respect, I agree with Prof. Flemming that the timings of these two notes relating to air entry do not sit comfortably together.

189. I also accept Dr. Rennie's evidence that if, as the defendant maintains, it took twelve minutes for Eoin's heart rate to respond after reintubation, there would be much greater detail in the notes of Dr. Ramesh and Nurse Carroll referring to additional investigations and/or treatment that would have been implemented over that period. I accept her evidence that if Eoin's heart rate did not come up within a minute or two of the administration of IV adrenalin that Dr. Ramesh would have been mandated to deliver a second dose of IV adrenalin and to have considered a further reintubation. I also accept her evidence that it is likely that in such circumstances his notes would reflect his ongoing search for a cause for Eoin's extraordinary slow recovery such as the possibility that he had a pneumothorax or that the equipment was defective. The paucity of entries in Dr. Ramesh's note to reflect this twelve minute period suggests to me that Eoin's recovery after reintubation was nothing as long as that advised. I accept Dr. Rennie's evidence that Eoin's heartbeat picked up within a minute or two of the first IV dose of adrenalin which is likely to have been about six minutes after Dr. Ramesh first intubated Eoin. I believe it highly unlikely that if Eoin's heart had not responded within minutes to that dose of adrenalin, particularly in the light of Dr. Ramesh's knowledge as to the effects of hypoxia, that beyond the continuous monitoring of the situation, he would have taken no steps other than the administration of a further dose of sodium chloride over the 12-minute period between reintubation and the recovery of Eoin's heart rate to 80 beats per minute.

190. Another factor of some importance in relation to the timeline of events in this case is the fact that Dr. Ramesh spoke with Dr. Lewis and Nurse Carroll before they wrote up their respective records. I think it is probable that in circumstances where none of them were present at Eoin's birth, their notes may be no more than a reflection of their estimation as to Dr. Ramesh's time of arrival on the day in question or perhaps a reflection of what they were told at or after the event by members of the nursing staff who themselves had made no notes referable to his arrival.

191. Unlike the other documents to which I have referred I believe it is probable that the timings on the drug chart are likely to reflect the time at which the various drugs and infusions were administered and therefore I think that these timings are of assistance in establishing approximately when Dr. Ramesh arrived and when Eoin was successfully ventilated. In coming to this conclusion, I accept that the drug chart was probably not completed at the time of the resuscitation and that it was likely completed and signed by Nurse Carroll, Nurse O'Connor and Dr. Ramesh in the NICU after Eoin had been stabilised. However, I think it highly probable that Nurse O'Connor, who was not called to give evidence, made some type of contemporaneous note of the times at which the various drugs and infusions were administered and later transcribed them into the formal drug chart.

192. While I accept the evidence given by Dr. John A. Murphy and Dr. Colm O'Donnell that in an emergency situation the formal drug chart is unlikely to be completed in the course of the resuscitation, they were both agreed that somebody should be taking a contemporaneous note of the drug's and the times at which they were given, even if, as Dr. O'Donnell stated in evidence, this was only achieved half of the time. However, I do not think I should lose sight of the fact that in this case, a formal drug chart was completed and each entry which included a time was signed off on by Dr. Ramesh, Nurse Carroll and Nurse O'Connor.

193. I have to say that in respect of this issue concerning the reliability of the timings on the drug chart, I was more impressed by the plaintiff's expert witnesses as to the reasons why I should accept the probability that the timings that appear on it are correct. I accept their evidence as to the importance of somebody keeping a contemporaneous note and that without it the safe delivery of drugs to vulnerable babies cannot be assured. Further, I accept their evidence that the fact that an emergency was taking place was no excuse for a contemporaneous note not being made, subject to the presence of sufficient staff numbers, as the system is designed to operate in an emergency and to afford the protection to the baby in the course of the emergency by reason of the fact that somebody is keeping a note of what is happening as it happens. In the present case, on the defendant's evidence, there were at least four nurses present at the time these drugs and infusions were administered, in addition to Dr. Lewis who was not taking an active part in the resuscitation. There appears therefore to be no reason why Nurse O'Connor or one of the other nurses would not have been making a contemporaneous note of the time at which the respective drugs were administered.

194. The fact that the timings recorded in the drug chart appear to have been entered by reference to a time taken from a clock, makes it probable in my mind that the nurse concerned reliably ascertained the actual time at which each of the drugs was administered and that the timings in the chart are not retrospective estimates. Further, the fact that the relativity of the times to each other are correct, having regard to the dosage of the drugs and/or infusions administered and the time required for such purpose, is also important. In coming to my conclusion that the timings on the drug chart are probably correct I have, as urged by the defendant in its written submissions, considered the significance which I should attach to the fact that the order in which the sodium bicarbonate and sodium chloride were administered, is incorrectly noted in the chart. In the absence of hearing from Nurse O'Connor on the matter, a difficulty faced by the court solely by reason of the defendant's failure to call her as a witness, and having regard to all of the other available evidence, I think that this error most likely occurred in the course of the transposition of the information into the drug chart from a less formal note that I believe was probably made by Nurse O'Connor during the resuscitation. I therefore reject the defendant's submission that I should discount the validity of the timings on the drug chart because of that error.

195. In coming to my conclusions as to the validity of the times which appear on the drug chart, I did not find it necessary to engage to any great extent with the principles of law which emerge from decisions such as *Herrington v. British Railways Board* [1972] AC 877 and *Hawkes v. St. Vincent's Hospital & Ors.* [2006] IEHC 443. However, from those decisions, it is clear that in certain circumstances, a court is entitled to draw adverse inferences from the absence or silence of a witness who might be expected to have material evidence to give on a particular issue. This principle is of relevance to the defendant's failure to call Nurse O'Connor as a witness in the present case.

196. From as early as the fourth day in these proceedings which were at hearing for some forty three days, the centrality of the drug chart to the dispute between the parties as to the time at which Dr. Ramesh arrived to the resuscitation was blatantly obvious. That dispute is core to the liability issue in the proceedings. No other witness was able to give evidence as to whether the drug chart or any less formal record was kept noting the time at which the various steps were taken during the resuscitation. Nurse O'Connor's testimony, had she been called, was clearly material to the court's decision as to the weight it could attach to the timings on the drug chart and would also have been key to its conclusion as to the reason why the sodium bicarbonate and sodium chloride appeared in the incorrect order on the drug chart, a matter that the defendant sought to rely upon to undermine the timings on the chart. Of even more significance is the fact that while the defendant or one of its servants or agents authored the timings on the drug chart, it pursued its defence of these proceedings based on a timeline which was strongly in the teeth of those timings and in circumstances where it had admitted this document into evidence without the necessity for formal proof. It is further relevant to note that no

evidence was led to explain Nurse O'Connor's absence as a witness, notwithstanding the fact that the defendant challenged each and every one of the plaintiff's expert witnesses on the basis that the timings she had recorded in the drug chart were incorrect.

197. In the aforementioned circumstances, it seems to me that it is likely that the defendant made a tactical decision not to call Nurse O'Connor and I think the only logical inference to be drawn is that her evidence was not going to sit comfortably with the case which it was advancing. However, even without drawing any adverse inferences from the defendant's failure to call Nurse O'Connor, I am satisfied on the balance of probabilities that the timings on the drug chart are accurate in respect of each of the actions therein mentioned, with the exception of the sodium bicarbonate and sodium chloride to which I have already referred.

198. In reaching my decision as to the likely time at which Dr. Ramesh arrived to resuscitate Eoin, I had to decide on the credibility of Dr. Murphy and Mr. Dunne as witnesses. I had to wrestle with a number of particular concerns, some of which were referred to by the defendant in its submissions. These include why no complaint was made to Mr. Hugh O'Connor, Prof. Turner or the hospital authorities about their belief that there had been a delay in Eoin's resuscitation and why they had sent gifts to a number of staff members who had been involved with Eoin's birth. I also had to consider the extent to which I could rely upon Dr. Murphy's recollection of the timing of events surrounding Eoin's birth when the evidence established that she had been incorrect in her recollection, firstly, as to position of the resuscitaire, and secondly, as to the positioning of the wall clock in the delivery suite.

199. In the course of the proceedings, Dr. Murphy gave evidence on three occasions. Mr. Dunne gave evidence on just one occasion. Having carefully listened to their evidence and having assessed their demeanour in the course of that process, I am satisfied that the account they gave as to what occurred during the first 30 minutes of Eoin's life in the delivery suite is a fairly accurate record of what actually happened. Their evidence, I believe, is corroborated to a significant extent by the timings in the drug chart. In this respect, it is important to record that both Dr. Murphy and Mr. Dunne had given their evidence before the timings in the drugs chart and their importance became clear. It was not until Dr. Rennie gave her evidence on Day 4 of the proceedings that the significance of this chart, which had not previously been noted by any of the experts, became apparent. Their evidence was also consistent with the expert medical evidence as to the period over which the hypoxia which caused Eoin's injuries was sustained and the time at which he ultimately responded to effectively delivered resuscitation. In the traumatic circumstances that were evolving in the days and weeks after his birth and at a time when Eoin's likely prognosis was not clear, I can well understand two highly emotional parents who were hoping for the best, involving themselves in activities which included the sending of gifts to staff members, a matter upon which they were not entirely agreed, and in their failure to make a formal complaint about Dr. Ramesh's delay in arriving to the resuscitation.

200. In reaching my conclusions as to the credibility of Dr. Murphy as a witness, I believe that as an anaesthetist she, more than almost anybody else, would have been acutely aware of just how long Eoin could withstand a lack of oxygen before he would become brain damaged. I believe that her efforts to get out of bed to assist in the resuscitation is only consistent with a belief on her part that Eoin's chest was not rising and falling and that he was not being successfully ventilated in the course of the bag and mask ventilation being provided by Midwife Flemming. While I was initially circumspect as to her ability to see what was happening to Eoin on the resuscitaire because of its position in the room, I am satisfied from the evidence of Nurse Kelly, wherein she described how closely Dr. Murphy was following the events from her bed, that she must have had a reasonably good view of what was happening to Eoin regardless of the positioning of the midwife/midwives or of the resuscitaire, at least until Dr. Ramesh arrived.

201. Dr. Murphy was also present in the courtroom for almost the entirety of the 43 days in which these proceedings were at hearing and nothing that I saw in relation to her behaviour or demeanour over that period would cause me to call into question the likely truthfulness of her evidence. She made appropriate concessions and gave evidence of events that she must have known were unfavourable to the case being made on Eoin's behalf.

202. In reaching my conclusions, I do not for one moment believe that Dr. Murphy's memory or that of Mr. Dunne is flawless or that the timings which they speculated upon were necessarily correct to the minute. Indeed, in the context of all of the timings in these proceedings, I think it is artificial to believe that in an emergency situation or in legal proceedings ten years removed from events that the court should engage in an exercise whereby it accepts or discounts the evidence of witnesses based upon minute discrepancies in timings. In the present case, I think it is necessary for the court to look in great detail at all of the timings which are relied upon by the respective parties and to listen carefully to the arguments made about them. However, most of all I believe it is important for the court to look at those timings in the context of the overall case being advanced by the party in the hope that they may assist in determining what actually caused Eoin to sustain the injuries from which he presently suffers.

203. This is a case of two scenarios. The plaintiff contends for an initial period of ineffective positive pressure bag and mask ventilation followed by a significant and critical delay in ventilation by intubation followed by a recovery which commenced at approximately 23 minutes of age after the administration of intravenous adrenalin. The other scenario is of a baby born with some as yet unknown medical condition which caused him not to breathe at birth and who, by reason of that condition managed to sustain an acute hypoxic ischaemic injury over a period during which the defendant maintains he was at all times adequately perfused with oxygen.

204. Having considered all of the evidence in this case, I am satisfied that Eoin's medical profile during his first 30 minutes of life is only consistent with that of a baby whose condition declined substantially as a result of the failure of the midwives to deliver effective bag and mask ventilation and whose position was further compromised by Dr. Ramesh's late arrival and his inability to intubate Eoin successfully on his first attempt. I think it is highly unlikely that Eoin had a uniquely slow response to effectively delivered resuscitation and ventilation over an entire 20 – 23 minute period in the course of which oxygen was being pushed into his circulatory system. Regardless of the presence of any disorder of the type advanced by the defendant, how can it be, if Eoin's chest was rising and falling from one minute of age as a result of oxygen being forced into his lungs, that he sustained a period of oxygen deprivation of more than twelve minutes duration during the first 20 or 23 minutes of his life? Indeed, this might be an appropriate point at which to refer to the fact that there is no note anywhere in the medical records which charts the claim made by Midwife Manning that Eoin's chest was rising and falling when bag and mask ventilation was being delivered, an omission that seems to be quite extraordinary in the context of the circumstances surrounding his injury.

205. It is common case that once oxygen is delivered to the lungs, it automatically passes into the circulatory system and is delivered to the brain via cardiac compressions. Regardless of the activities of the midwives, if Dr. Ramesh had arrived at five minutes of age and had, as alleged, obtained a valid airway into the plaintiff's lungs at eight minutes of age, Eoin could not have sustained the brain damage which now afflicts him. He would have had no option but to respond to the oxygen being delivered to his lungs, circulatory system and brain. It seems to me that the period of hypoxia which caused the damage must have preceded Eoin's reintubation and that his injuries could not have occurred had that event occurred when he was eight minutes of age.

206. Taking all of the evidence into account, I think it is probable that Dr. Ramesh arrived when Eoin was possibly close enough to fourteen minutes of age. It was not clear from the evidence how long it then took him to examine Eoin's oropharynx, his vocal chords,

to check for secretions and assess his overall condition before proceeding to intubate. Neither was it obvious from the evidence as to how long Dr. Ramesh continued with positive pressure ventilation prior to intubation, in circumstances where he told the court he had taken over this task from the midwifery staff on his arrival. However, I am satisfied that he had the first endotracheal tube in position at 6.52 or thereabouts and that thereafter he continued to manage Eoin's resuscitation in accordance with the timeline identified in the drug chart. I reject Dr. Ramesh's evidence that it took him at least ten minutes following reintubation to deliver the IV adrenaline, sodium chloride and sodium bicarbonate. He initially stated that he had managed to reintubate Eoin in a matter of seconds, had been immediately successful in obtaining IV access and had only needed an additional couple of seconds to establish it was working. In these circumstances, I am satisfied that Eoin's heart started to pick up when he was approximately 23 or 24 minutes of age i.e. at about 6.58 or 6.59, that being six to seven minutes after the time at which I believe the first endotracheal tube was inserted.

207. I appreciate that in reaching the aforementioned conclusions, I have rejected the evidence of a number of witnesses who stated that Dr. Ramesh arrived when Eoin was five minutes of age. I have already set out the reasons why I feel much of the oral and documentary evidence on this issue is so fragile. Clearly, in the aftermath of an emergency situation, many of those involved, even if using their best endeavours, might have difficulty recalling with accuracy the timings at which various events occurred, particularly when they may not have been present at the relevant time and may have been relying on third parties for their information. Indeed, Dr. John Murphy, in his evidence, stated that it was a difficult problem in any hospital to get the timing of any event exactly correct in an emergency situation.

208. As to the reasons behind Dr. Ramesh's late arrival, there are a substantial number of possibilities, most of which have been canvassed in the plaintiff's written submissions. I do not believe that it is necessary, however, for me to try to elect between these possibilities as I believe there is an unexplained and very significant gap in the defendant's evidence in relation to the circumstances in which Dr. Ramesh was called to this resuscitation.

209. The chronology of events prior to Dr. Ramesh's arrival is unclear. I am satisfied, however, that Midwife Flemming did not manage to deliver effective positive pressure ventilation to Eoin from the time she commenced that process until such time as she was later relieved of that task by Dr. Ramesh. Any number of difficulties may have been responsible for such failure and that is clear from the evidence of Professor Flemming, Dr. Rennie and Dr. O'Donnell.

210. Further, any such failure does not necessarily import any want of care on the part of the operator. The court heard that it was often difficult to get an adequate seal between the baby's face and mask, that the positioning of the head and jaw so as to provide a clear airway was not easy to achieve, and that the use of the flow bag was an extremely difficult task even in experienced hands. It was very obvious from the evidence of Dr. O'Donnell that because positive pressure ventilation is known to fail for a wide range of reasons, as advised in the chapter of Rennie and Robertson's textbook which deals with resuscitation, that a hospital such as that operated by the defendant must be in a position to have a senior member of the paediatric staff who is capable of intubating a baby available within five minutes of birth. Dr. Smith and Dr. Rennie both agreed that if Dr. Ramesh had arrived by the time Eoin was five minutes of age this would represent an acceptable standard of care in the circumstances of this case. It follows that there was a mandatory obligation on the midwifery staff to be in a position to identify an evolving emergency situation and to ensure that the call for assistance was made promptly and through the correct channels so as to ensure the arrival of the correct member of the paediatric staff within that period.

211. There is any number of reasons that might explain why Dr. Ramesh arrived to the resuscitation as late as I believe he did. It may be the case that Midwife Flemming was surprised at Eoin's deterioration following his birth and somehow delayed in seeking assistance. What is clear is that when she directed Nurse Kelly to call for assistance at whatever time that occurred, it was Dr. Lewis that was called. Midwife Flemming believed that she would be in a position to assist with the resuscitation when in fact that was not the case. It is therefore possible that it was not until Dr. Lewis arrived that Midwife Flemming realised she was not in a position to assist with intubation and thereafter requested Nurse Kelly to put the call out for help to the Registrar. Alternatively, it could be that Midwife Flemming did not recognise the significance of Eoin's deterioration given that it was standard practice to call the first responder if the baby's condition was viewed to be reasonably satisfactory. It is perhaps worth restating at this point my surprise that Dr. Lewis was not called to give evidence as to when she was contacted or arrived and as to what occurred when she did, notwithstanding Dr. Murphy's evidence that she did not arrive until Eoin was between five and eight minutes of age. Given that it was accepted by both sides that she arrived before Dr. Ramesh, the time of her arrival was clearly very material to the liability issue.

212. Another possible cause for Dr. Ramesh's late arrival may emanate from the fact that for some reason, Nurse Kelly did not use the telephone in the delivery suite to contact him directly as she had done when she sought to contact Dr. Lewis. The court heard evidence that written on that phone were the contact numbers for the SHO and the Registrar in case of emergency. Instead, Nurse Kelly went out to the Nurses Station where she apparently called out to her colleague Ita Burke, to get help. The high point of the defendant's evidence in relation to how and when contact was made with Dr. Ramesh was Nurse Kelly's evidence that she saw Ita Burke with her hand on the telephone as she retreated back into the delivery suite. Rather unusually, to my mind having regard to the dispute as to Dr. Ramesh's delay in arrival, not only did the court not hear evidence from Dr. Lewis but it heard no evidence from the very member of staff who it is allegedly made contact with Dr. Ramesh. Thus, the court has been asked to infer from Nurse Kelly's evidence of seeing Ita Burke with her hand on the phone that it was at that point that immediate contact was made with Dr. Ramesh who then arrived on the scene a minute later.

213. What may be worth noting in the context of possible delay is the fact that the emergency request for additional assistance was not confined to the Registrar, but was one which required Nurse Kelly to ensure that both the Registrar and the specialist nurses from the Special Care Baby Unit would arrive with immediate effect. Midwife Manning stated that there was no bleep system in place to contact the Special Care Baby Unit at that time and they had to be called over the phone. I have heard no evidence from the person who contacted Dr. Ramesh or the nurses in the Special Care Baby Unit. I don't know the order in which they were contacted or by what method. Was there a delay in getting through to Dr. Ramesh? I have to say that the defendant's evidence in respect of this important aspect of the case was extraordinarily fragile absent evidence from Ita Burke on the issue.

214. I am satisfied that Dr. Ramesh may well believe that he arrived when Eoin was five minutes of age. However, it could be that through no fault of his own he was not contacted until much later than he believes he was. Another possibility is that the midwives did raise the call for emergency assistance within the expected timeframe, but for whatever reason, Dr. Ramesh did not arrive until an unacceptable period of delay had elapsed. What may be relevant here is the fact that although an extremely high number of babies are delivered in the hospital – about 8,000 per annum – there was only one paediatric registrar on duty.

215. I am accordingly satisfied that the defendant was negligent in failing, having regard to Eoin's condition at birth and over the first minute of his life, to have a senior member of its Paediatric staff capable of carrying out an intubation of a newborn present and in attendance by the time Eoin was five minutes of age and that it was that delay that caused Eoin to sustain all of the injuries which now afflict him.

Summary of Findings

216. I am satisfied that Eoin was born in moderate condition at 6.35 on the 30th July, 2002, and at the time of his birth was not suffering from any inherent defect or genetic abnormality. His apgar score of five, including two for tone, is I believe a score that was validly ascertained and was reflective of the fact that he had experienced some decelerations in the last two to three minutes prior to his birth, perhaps due to cord compression or other stresses associated with his passage through the birth canal.

217. I am satisfied that having regard to his condition at birth, including his normal blood gases and knowing that he had no cardiac or pulmonary problems, Eoin should have responded to positive pressure ventilation had it been effectively delivered. I am also satisfied that positive pressure even if conducted by skilled midwives regularly fails due to difficulty in obtaining an adequate seal between the mask and the baby's face, the correct positioning of the head and/or the difficulties associated with the operation of the flow bag which was in use in the defendant's hospital at the time. Having regard to the decline in Eoin's apgar score over the first five minutes of life, I think it is highly likely that a failure to deliver effective bag and mask ventilation was responsible for this deterioration. However, I do not believe that his deterioration over that period can be ascribed to any negligence on the part of the midwifery staff concerned.

218. Because positive pressure ventilation is fraught with difficulties, it is incumbent upon a maternity hospital to have its midwifery staff sufficiently trained to identify a baby's potential need for intubation and to have a system in place such that it can ensure that within five minutes of a baby developing respiratory distress that a senior member of the medical staff capable of intubation will be in attendance. On the balance of probabilities, I believe that for whatever reason, be it a delay in the summoning of Dr. Ramesh, a delay in his receipt or response to such a call or a combination of any of these complications, he did not arrive to assist in Eoin's resuscitation until he was something approaching fifteen minutes of age.

219. I am satisfied that once Dr. Ramesh arrived, he acted with all due diligence in seeking to achieve effective ventilation. I do not believe that there was anything untoward about his election to use a 3mm tube when he first intubated Eoin and he is not to be faulted in respect of whatever period of delay occurred between the insertion of the first and the second larger tube which ultimately established an effective airway. However, it is undoubtedly the case that Dr. Ramesh's failure to successfully intubate Eoin with the first tube added approximately three minutes to the already significant delay in getting oxygen to Eoin's lungs, bloodstream and brain.

220. On the balance of probabilities, I believe that Dr. Ramesh intubated Eoin for the first time in or around 6.52, and that in response to his prompt administration of intravenous adrenalin following reintubation Eoin's heartbeat started to recover when he was about 23 or 24 minutes of age.

221. If the defendant, its servant or agents, had acted with reasonable care for Eoin's welfare, there is no reason why he should not have been effectively ventilated by the time he was nine minutes of age and had this occurred he would not have gone on to develop the injuries which now afflict him.

222. For the aforementioned reasons, I must find the defendant negligent in their failure to ensure that Eoin received the type of intubation and ventilation which was mandated within the first ten minutes of his life.