

INQUEST INTO THE DEATH OF

L I S A S H O R E

THE EVIDENCE OF MR. STEPHAN BAUER

TAKEN NOVEMBER 9, 1999

BEFORE DR. JAMES CAIRNS, DEPUTY CHIEF CORONER

CORONER'S COURT, TORONTO

A P P E A R A N C E S:

Counsel for the Coroner	MARGARET BROWNE, MS.
Counsel for the Shore Family	FRANK K. GOMBERG, ESQ.
Counsel for the Hospital for Sick Children, et al	PATRICK HAWKINS, ESQ. RENEE A. KOPP, MS.
Counsel for Dr. M. Schily	ANNE POSNO, ESQ.

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1 MS. BROWNE: Mr. Coroner, during the lunch I
2 spoke with Counsel and we are all agreed, if it's all
3 right with you, Mr. Coroner, that with the next
4 witness, Mr. Bauer, that Mr. Hawkins lead him. He is a
5 witness from the Sick Children's Hospital who will
6 explain certain instrumentation and since he has
7 already spoken with Mr. Hawkins, he could perhaps go
8 first in the examination?

9 THE CORONER: Is that agreeable to all our
10 Counsel?

11 MR. GOMBERG: Yes.

12 THE CORONER: I have no objection to that at
13 all. It may help to enlighten the jury. Mr.
14 Hawkins, can I leave it to you, please?

15
16 MR. STEPHAN BAUER, AFFIRMED

17 EXAMINATION IN-CHIEF BY MR. HAWKINS:

18 Q. Mr. Bauer, you are the manager of
19 patient care equipment services or medical engineering
20 at the Hospital for Sick Children?

21 A. I am.

22 Q. Can you tell this jury a little bit
23 about your educational background?

24 A. I will. I'm an electrical engineer. I

1 graduated in 1990 from the University of Waterloo in
2 the program of electrical engineering, with a Bachelor
3 of Applied Science. Subsequent to that education, I
4 continued as a Masters of Health Sciences at the
5 University of Toronto, that's a Masters of Health
6 Science in clinical engineering, that's a specialty.

7 Q. And you obtained that, I see from your
8 CV, in August of 1992?

9 A. That is correct.

10 Q. And since August of 1992, have you
11 worked in the field of biomedical engineering?

12 A. Immediately upon my graduation from the
13 University of Toronto program, I went to the British
14 Columbia Institute of Technology, and there I was
15 involved in three facets of clinical engineering, if
16 you will. One involved consulting work at an in-
17 hospital setting; one involved research and development
18 of medical devices; and the third element was
19 instruction to biomedical engineering technologists in
20 medical device technology.

21 Q. And presently you're the manager of
22 biomedical engineering at the Hospital for Sick
23 Children; how long have you been doing that?

24 A. That's correct. I have held that
25 position since June of 1997.

1 Q. If I can have a copy of Mr. Bauer's CV,
2 which all Counsel have, we'll mark that as an exhibit.

3 THE CORONER: Thank you.

4
5 EXHIBIT NO. 11: CV of Mr. Stephan Bauer

6
7 BY MR. HAWKINS:

8 Q. Now, Mr. Bauer, is it your department
9 that is responsible for the purchase of biomedical
10 equipment at the hospital?

11 A. That is true. We look at the entire --
12 all medical device technology coming into the hospital,
13 while it's in the hospital in terms of its servicing,
14 and as it leaves the hospital at the end of its life
15 cycle.

16 Q. So you are responsible for the entire
17 gamut from when the product is looked at until it's
18 purchased, through its use and ---

19 A. That's correct.

20 Q. --- through the end of its life cycle?

21 A. That is correct.

22 Q. Can you just describe to me in general
23 terms the process which the hospital goes through
24 before it purchases a piece of biomedical equipment?

25 A. The process is quite extensive. There

1 is, obviously, an initial clinical need that is --
2 either comes from a clinician or nurse or one of the
3 clinical areas or my department could say there's new
4 technology that needs to be evaluated on the market.
5 We therefore, after that time when we realize and try
6 to get some capital funding for that project, in
7 principal, anyway, develop a detailed technical
8 specification for that equipment. That technical
9 specification will tell us what the device is supposed
10 to do, how it's supposed to do, how it will be used.

11 Upon the completion of that specification,
12 that document becomes part of the tendering document
13 that would be sent out to manufacturers that would be
14 possible suppliers for that technology. Once that RFP
15 (ph) comes back, we do -- we look at the responses and
16 then based upon those responses, we would initiate a
17 clinical study of those devices for whatever purpose.
18 That clinical study can range in time between -- for
19 weeks to months, depending on the device and depending
20 on it's implementation. That is part of the process.

21 Once that clinical study is completed,
22 we again gather all the stakeholders; that would be
23 clinicians, purchasing, finance people, around the
24 table and based upon the technical specifications
25 response to the request for purchase, we would make a

1 clinical decision to purchase a specific technology.

2 Q. And I'm going to talk or we're going to
3 spend a lot of time talking about the Corometric
4 monitor. Before the Corometric went into use at the
5 hospital, did it go through that process?

6 A. It would probably have gone through
7 that process. I was not at the hospital at that time,
8 but considering the extent of the diffusement of that
9 monitor throughout the wards, it would have gone
10 through that process, as well.

11 Q. And to get us into the Corometric, I
12 understand that you have in the past taught courses in
13 biotechnology?

14 A. More specifically, biomedical
15 engineering technology. Biomedical engineering
16 technologists are people that are primarily responsible
17 in the hospital setting, anyway, for the servicing of
18 medical equipment. My role as an instructor in
19 biomedical engineering technology was specifically
20 that, to link the clinical side with the technology and
21 hopefully at the output of two years or three years
22 have someone that is very capable of troubleshooting of
23 maintaining a wide variety of medical devices.

24 Q. And I understand you put together a
25 presentation for the jury in the sort of basics of

1 heart rate monitoring, and, in addition, how the
2 Corometric goes about doing it?

3 A. Yes, I have done that.

4 Q. Okay. Maybe I'll turn it over to you
5 and you can take us through that presentation or take
6 the jury through that presentation.

7 A. I will do so. I'm an engineer and some
8 of the things I'm going to tell you about are more
9 complicated. I'd ask that if you have questions, I
10 don't know if it would be easier to get an explanation
11 if you have a question right away, because I don't want
12 people to get lost.

13 I'm going to start at the beginning.
14 This is a representative drawing of a heart, that's the
15 thing at the top. That's the organ in your body that
16 is responsible for ensuring that blood is pumped
17 throughout your body. That heart is basically a large
18 muscle. That muscle works through electrical impulses;
19 basically cells in the muscle are very susceptible to
20 excitation, electrical stimulus. As those muscles are
21 stimulated, they will contract and you can consider
22 what a heart does, it pumps blood. The contraction of
23 that heart muscle is important for the proper pumping
24 of blood through your body.

25 The electrical signature of the heart is

1 what we call an electrocardiogram. An electrocardio-
2 gram is the result of what we call a number of action
3 potentials. Those action potentials are basically all
4 the muscles firing off in some sequence and so what we
5 do get, and I'll go through this in some detail, we
6 have what's called a pacemaker node, known as a
7 sinoatrial node, and that is basically a pulse or a
8 generator of a spike and that's what keeps your heart
9 pumping, and there is literally systems, nervous
10 endings of the nerve system which tells you to speed
11 up, tells you to slow down. There's chemical,
12 electrical, that's not my field, but that's the node
13 that causes your heart to keep pumping. That's a node
14 that when it fires off, produces an action potential
15 that you can measure on the surface of your body. I'll
16 get into that in a little bit of detail.

17 As that contracts and as that
18 (inaudible) node fires off that signal, the wave form,
19 the electrical wave form spreads throughout the atrium.

20 The atria are the two small chambers at the top of
21 your heart which basically act as a reservoir, so what
22 they do is they contract first and their contraction
23 forces additional blood into the ventricular, basically,
24 fills them all the way to the top.

25 That atrial muscle contraction also has

1 an electrical signature. As we progress down here,
2 there's another AV node which is also a node, basically
3 all the action potential comes to that point, after a
4 certain delay it, too, will fire off. That is there
5 for the purpose of co-ordinating the ventricular
6 contraction. That AV node then sends off the signal
7 which goes down to the bottom of the heart through
8 what's called a common bundle (ph) and what basically
9 happens then is the whole ventricles are given a
10 electrical stimuli and almost simultaneously contract.

11 That simultaneous contraction is the
12 major work of the heart which basically forces the
13 blood out of the heart into the rest of the body. That
14 contraction also, the ventricular muscle also sends off
15 acts of potential. The summation of all these acts of
16 potentials is what looks like this wave, which is
17 reproduced here; that is known as what's called an
18 electrocardiogram. An electrocardiogram is basically
19 the electrical signature of a pumping heart. The
20 normal morphology, this is typically what a ECG wave
21 form will look like.

22 There are a number of components. The P
23 wave, if you look at how that's lined up, is basically
24 the contraction of the atrium. A QRS wave, TQRS wave,
25 T is how it's (inaudible), QRS wave is basically the

1 larger signal, which would be the larger muscle
2 contraction, the strongest muscles, which are the
3 ventricles.

4 Further on we have what's called a T
5 wave and that is basically after the ventricles have
6 contracted, they have to relax again, that's called a
7 repolarization of those cells, technically. It also
8 has electrical signature, that's what the T wave looks
9 like. This combination of signals (inaudible), your
10 heart beats, you will be able to, if you hook the
11 electrocardiogram, get a wave form out that looks like
12 this. That's how we generate an electrocardiogram.
13 And normally, of course, these contractions of the
14 heart would correspond to specific physiological
15 effects in the atria and the ventricles.

16 As the atria contract, you would expect
17 that the blood in the atria would undergo pressure.
18 And you can see the pressure is like, actually, as the
19 atria contract, it corresponds to the electrical
20 activity of the atria contraction. As the ventricles
21 contract, you would expect the blood pressure in the
22 ventricles also to increase. That corresponds to the
23 QRS complex. That combination of contraction of the
24 atria and then of the ventricles is what gives you a
25 pulse rate. As the ventricles contract, you can

1 actually feel it by pulsating or wherever you want to
2 take that pulse. That's how your heart works, very
3 generally speaking, very simply speaking.

4 JUROR #5: What kind of machine was that?

5 THE WITNESS: This is not a machine.

6 JUROR #5: It's not a machine.

7 THE WITNESS: This is just physiology.

8 JUROR #5: Okay.

9 THE WITNESS: Good question. This signal is
10 a signal that exists on me right now and the
11 machine can pick up. And on the machine I
12 have electrical signature, if I put an ECG
13 monitor on, I will get a signal that looks
14 something like that.

15 JUROR #5: Yes.

16 THE WITNESS: Electrocardiogram is the
17 actual recording of the wave form of the
18 heart. The Corometric monitor, it's very
19 important to stress, is not an electrocardio-
20 gram. The Corometric monitor is a heart rate
21 monitor. A heart rate monitor differs from
22 an electrocardiogram in that the heart rate
23 monitor does not have a printout of this; in
24 fact, the heart rate monitor doesn't
25 understand what this is about, it's not

1 designed to understand what this is about.
2 What it is designed to do, what it's purpose
3 is, is to count beats. How it does that,
4 generally speaking, is it looks -- what it
5 tries to detect is this big, big wave form,
6 called the R wave, and by looking at
7 successive R waves, it can calculate the
8 timing between the two R waves and come up
9 with what's called a (inaudible) intervals.
10 If you invert the (inaudible) intervals, this
11 is in seconds, if you invert that, you get
12 something called ergs, or cycles per second,
13 just like a 60 erg cycle; the heart beats at
14 60 ergs, it's 60 beats per minute. So all
15 the heart rate monitor is intended to do is
16 to count the interval between -- again, to
17 stress that it does not -- you do not see
18 this on a heart rate monitor, all you will
19 see is this, is the pulse and all you will
20 get at the output of the Corametric's
21 monitor, and that's the device under
22 question, is a heart rate.

23 How it comes up with that heart rate is
24 electrical engineering. This is a signal.
25 What I'm going to do, maybe just briefly, is

1 show you how it works. Do you want a
2 demonstration of the Corametric?

3 THE CORONER: I think that's more
4 appropriate.

5 THE WITNESS: I brought my own.

6 THE CORONER: I don't want to confuse the
7 jury with PQRS.

8 THE WITNESS: Oh, I realize that. And
9 again, I stress that a Corametric just tells
10 you the rate at which a monitor -- which the
11 heart pulses, that's all it's intended to do.
12 This, as we've seen before, is a Corametric
13 monitor.

14 JUROR #5: Is this the device that's at the
15 end of the bed?

16 THE WITNESS: This is this device which
17 you've seen before.

18 THE CORONER: Yes, this is the device that
19 has been referred to throughout the inquest,
20 and this is the device or one exactly similar
21 to it, will be the device which you will hear
22 much more evidence about, as well.

23 THE WITNESS: Yes, as we go through. This
24 is called a Corametric monitor, it's also
25 referred to as an apnea or heart rate

1 monitor. Corometric is actually the
2 manufacturer of the device, commonly referred
3 to in our hospital as a "Corometric monitor"
4 or a "model 502" which I don't even think is
5 also common knowledge. It's a Corometric
6 monitor, it's considered, or the apnea
7 monitor. If you say a "Corometric monitor,"
8 if you say, "apnea monitor," this is to my
9 knowledge what it's referred to.

10 This device, overall, connects up to a
11 patient. In order to connect up to a
12 patient, you have to connect up to -- we've
13 had reference to what's called "patches;"
14 basically electrodes. Electrodes are devices
15 that allow you to pick up electrical signals
16 on your body. In order to pick up electrical
17 signals on your body, you have to connect
18 your body to a monitor and that's done
19 through the patches. It's done through what
20 is called leads, that's these things here.
21 It's also got a cable ...

22 This Corometric monitor, as you can see,
23 I'll turn it on, it will beep, shows numbers,
24 that's all it shows. The numbers it shows
25 when it actually powers up, there's two

1 numbers shown there, there's two numbers
2 shown there, those two numbers correspond to
3 alarm settings on the monitor itself. When
4 you initially power up, it will show a 70,
5 20, 240 and 20. "70" corresponds to the
6 what's called the low heart rate alarm, the
7 bradycardia alarm. If the heart rate goes
8 less than 70, it will alarm. If the
9 respiratory rate goes less than 20, it will
10 alarm. If the heart rate goes higher than
11 240, it will alarm. If the respiratory rate
12 goes lower than 20, it will alarm. Those
13 settings ---

14 JUROR #1: Could you give us those numbers
15 again, please?

16 THE WITNESS: Oh, that's just examples.
17 Those numbers are actually set on the bottom
18 of the monitor. A nurse would go in, open
19 that up, that door up, and set the monitor,
20 the alarm.

21 This particular Corometric or apnea
22 monitor has three alarms that the nurses are
23 allowed to set. One is the apnea alarm; an
24 apnea alarm means there's from five seconds
25 to thirty seconds, and it can be shut off.

1 Apnea is a cessation of breathing. If a
2 patient stops breathing, if it's set at 20,
3 like it was, if the patient stops breathing
4 for more than 20 seconds, after a short
5 delay, just to make sure there's no noise,
6 the monitor will alarm. The apnea alarm can
7 also be shut off.

8 The high heart rate alarm can also be
9 shut off. It has a range between 120 beats
10 per minute to 240 beats per minute. It can
11 also be shut off with a key. The low heart
12 rate alarm cannot be (inaudible). The low
13 heart rate can be anywhere between 30 beats
14 per minute and 100 beats per minute, it
15 depends on the patient, it depends on what
16 the nurse is looking for, it's their call.

17 When a nurse gets this, obviously the
18 only thing you're going to get on the output
19 of this, if it is working and functional, is
20 the heart rate and the respiratory rate. I
21 will demonstrate them to you. There are
22 other alarms built into this monitor.

23 Obviously this monitor is working and it's
24 not plugged in. There's a battery in the
25 monitor which will go for six hours before

1 the monitor shuts off; six hours, if it's
2 fully charged. The monitor will not shut off
3 because of the low battery without actually
4 alarming.

5 JUROR #2: So unplugged it can still
6 function?

7 THE WITNESS: It still functions quite fine.

8 I will give you a demonstration. If it's
9 working, it's going to get really loud.

10 Thirty minutes before the battery goes dead,
11 the monitor will alarm. It will also give
12 you a visible display that there's a low
13 battery. You then plug it into the wall,
14 press the reset button and then the alarm
15 will be cancelled, the monitor will then work
16 off normal AZ power.

17 The monitor has other built-in safety
18 features. There's a self-test that the
19 monitor, as you see we're going through right
20 now, works on. If it correctly goes through
21 that self-test and it doesn't alarm like it's
22 alarming right now, if you hear the beep, it
23 means the monitor is working, okay, so that
24 is one check that the nurse will do before
25 she connects it up to the patient.

1 There are other indicators. On the
2 front, it will show you a little flashing
3 light whenever there's a heart rate. It will
4 also show you a little green light whenever
5 it picks up a respiratory, a breath. It will
6 show you, as well as audibly, as well as
7 visually, show you a low heart rate alarm, a
8 high heart rate alarm and an apnea alarm. It
9 also tells you if there is a loose lead. For
10 example, right now, the leads are not
11 connected up. It will continue to alarm and
12 will continue to alarm until the battery goes
13 dead, that the thing is not connected up to
14 anything or that these electrodes are not
15 connected up to anything. That will continue
16 until (inaudible) you can't miss that.

17 Again, this does not put out this
18 rhythm, you cannot see this rhythm here, all
19 you see is a heart rate, it's designed to do
20 that, it's not designed to do anything else.

21 It won't even differentiate -- and I'll get
22 into this later -- it won't even
23 differentiate between wave forms. As long as
24 it has a wave form that meets certain
25 algorithmic process, a certain algorithm, it

1 doesn't matter what you put into this, it
2 will beep, it will keep picking up a heart
3 rate. That will be important a little later.

4 Yes?

5 JUROR #2: Before you finish with that, we
6 were curious if there's any charts or graphs
7 or any kind of a register on that to say if
8 it's been turned off, what time?

9 THE WITNESS: This is, gladly to say, not a
10 Y2K device, which means that there is no way
11 for this monitor to record time, date
12 ordinates.

13 JUROR #2: So if it was unplugged or turned
14 off or whatever ...

15 THE WITNESS: You would not know if it's
16 turned on, turned off, the monitor makes no
17 note of it, unlike the pump which we'll get
18 into. The pump actually has a (inaudible).
19 I should note, there is a printer option for
20 this, which the hospital did not purchase.
21 It also does not show time or date of events.

22 All that printer is supposed to do is give
23 you something that looks like that, if you
24 have that option; the hospital chose not to
25 purchase it, because basically you've got

1 this printer spewing off a lot of stuff and
2 you'd have to have someone right there to
3 look at it and unless someone is there and
4 looking at it, it doesn't make much sense.

5 JUROR #2: I have another question for you.

6 If, that evening, for whatever reason, if it
7 was unplugged for six hours, it would be
8 letting off -- it would be registering a
9 guard light, even if it was unplugged?

10 THE WITNESS: If it was unplugged from the
11 wall, it would still hold its charge. This
12 monitor has been with the Coroner for a
13 month, years, it's still fine.

14 JUROR #2: And then -- I may have another
15 question, but I'll get back to you.

16 THE WITNESS: Do you understand what this is
17 for? Do you understand what it does? That
18 Corometric monitoring of the heart rate won't
19 (inaudible).

20 JUROR #2: I have one more question, I just
21 remembered. If it did run out of battery
22 power, it gives off a warning thirty minutes
23 before it runs out.

24 THE WITNESS: It will alarm every thirty
25 seconds for thirty minutes.

1 JUROR #2: But how is it recharged or is it
2 the hospital procedure that it is constantly
3 charged?

4 THE WITNESS: You just plug it into the wall
5 and it will constantly recharge itself. As
6 long as it is plugged into the wall, the
7 battery will prop itself up and it will
8 recharge.

9 JUROR #5: So there's no way of turning it
10 off?

11 THE WITNESS: Unless you turn it off.

12 JUROR #5: Somebody could pushed that.

13 THE WITNESS: The monitor is such that if
14 it's connected up to a patient correctly and
15 it's functioning, it's passed the self-test
16 which means if there's an audible alarm, it
17 cannot shut off by itself, it has to be
18 pressed or even if the monitor fails
19 internally, it will alarm.

20 JUROR #5: So if it shuts off, then it
21 doesn't do nothing?

22 THE WITNESS: If you turn the ignition off
23 on your car, it does nothing.

24 JUROR #5: There's an alarm when you shut it
25 off?

1 THE WITNESS: There's no alarm when you shut
2 it off.

3 JUROR #5: When you shut it off, the nurse
4 doesn't know that that machine is shut off,
5 if the alarm didn't come to them or it
6 doesn't have an alarm?

7 THE WITNESS: It doesn't have an alarm.

8 JUROR #5: Okay.

9 MR. HAWKINS: When you shut it off, it does
10 not alarm?

11 THE WITNESS: When you shut it off, it does
12 not alarm.

13 JUROR #5: It does not alarm?

14 THE WITNESS: No.

15 JUROR #2: So if it is on, there will be a
16 light on of some sort whether it's hooked up
17 to a person or not, there will be a light?

18 THE WITNESS: That is correct.

19 JUROR #5: So a doctor would enter the room
20 and see the light?

21 JUROR #2: So if a doctor noted ---

22 THE WITNESS: There would be an indication
23 on the front that it was ---

24 JUROR #5: On.

25 THE WITNESS: That it's got something on the

1 front.

2 JUROR #2: And, I'm sorry, if you could just
3 show me once more how you turn it off?

4 THE WITNESS: There's a power button right
5 here.

6 JUROR #2: And that just turns it off.

7 MR. HAWKINS: Maybe you can show them the
8 button?

9 THE WITNESS: Yes. On/off. If the leads
10 come off, it will keep alarming because
11 obviously the monitor cannot function if the
12 leads are off.

13 JUROR #2: Unless it's turned off.

14 THE WITNESS: Unless it's turned off or
15 unless the nurse reconnects the leads and
16 then hits the reset button.

17 JUROR #5: So as soon as the doctor enters
18 the room, he can see if that machine is on or
19 off? Does he have to turn the table?

20 THE WITNESS: That's -- I can't answer that.
21 It depends where they put it.

22 JUROR #2: There aren't any flashing lights,
23 other than that?

24 THE WITNESS: Whenever there is a breath or
25 a heart rate, it will flash.

1 JUROR #2: It will.

2 JUROR #5: Provided it's on.

3 THE WITNESS: It's important to understand
4 and I will emphasize again that when this
5 monitor was designed, it was designed as a
6 heart monitor. The algorithm it uses to
7 determine heart rate is textbook material,
8 it's stuff I taught at BCIT, at the British
9 Columbia Institute of Technology, it's
10 standard algorithm, standard process. What
11 I'd like to do, if I can, is take you through
12 one step of that process so I can show you
13 what the monitor is actually looking for.
14 This is a little more complicated. This is
15 what's called a block diagram.

16 THE CORONER: Mr. Hawkins, is there a value
17 to going -- I'm not wanting to -- is there a
18 value to the complexity that we're going to
19 go into?

20 MR. HAWKINS: I believe there is, Dr.
21 Cairns, yes.

22

23 BY MR. HAWKINS:

24 Q. Perhaps Mr. Bauer, what I can suggest,
25 is rather than start with that diagram, I understand

1 you've got a picture here of a representation of what
2 it does, which I think it is important for the jury to
3 understand.

4 A. What this slide shows is some work we
5 did in our lab to show how a Corometric works. We took
6 a Corometric apart and we connected up what's called a
7 simulator, a patient simulator. In this case, the
8 patient simulated only a heart beat, an electrocardio-
9 gram, that is being displayed down here on this device
10 which is a lab device, it't not a clinical medical
11 device. This heart rate is detected by this Corometric
12 monitor up here as 80 beats per minute. The signal
13 processing that's done in this block diagram in detail
14 is what these slides tell. The output of that is the
15 display at the front of the monitor, it says, 80 beats
16 per minute or whatever it says. That's the purpose for
17 it. If you put it in a wave form, you get out a heart
18 rate.

19 Q. And in simple form, what it does is take
20 the wave form that's coming off the patient's heart and
21 process that down through five steps to a heart rate?

22 A. Right. What the final outcome of this
23 heart rate, is a pulse trail which you can sort of see
24 up here, that's just -- it's a pulse. Whatever this
25 wave form says, there's this peak. That algorithm is,

1 as I said, pretty textbook. This block diagram is
2 pretty much textbook.

3 What the monitor doesn't differentiate
4 is the wave, you can't see what the wave form is. I
5 can put in any wave form into this monitor and get out
6 a heart rate. This wave form that's at the bottom is
7 not a heart rate, this is just a triangular wave form.

8 That triangular wave form with certain properties that
9 you can't see on the monitor could fool -- could look
10 to the Corometric monitor as a heart rate. It has to
11 have certain characteristics in order to pass by the
12 processing stages in order to get the heart rate out.
13 A slight variation of that wave form -- unfortunately,
14 I didn't get the wave form. A slight variation of this
15 wave form, in this case, the same heart rate, but just
16 adjust the base out a little bit more, make the
17 triangular a little wider, and it vastly changes the
18 electrical signature of that wave form from the
19 Corometric perspective. This algorithm is standard
20 state of the art stuff, this is why Corometric uses it,
21 it's textbook.

22 Q. So the algorithm that the Corometric
23 uses to process the electrical signals, you're saying
24 it's textbook and standard. Do all heart rate machines
25 use the same type of algorithm?

1 A. They use this or very similar. There is
2 some minor variation in terms of the actual detection
3 of the pulses, but ...

4 Q. Okay.

5 A. Basically, it's the -- the purpose of
6 these stats, if I can go back to this, is to eliminate
7 noise. The bane of the engineer's existence is noise.
8 Hospitals are noisy signals. The magnitude of this
9 ECG signal is a millivolt; that's one one-thousandth of
10 a volt. Your flashlight battery works on 1.5 volts,
11 that's a 1.5 volt cell. One one-thousandth of that is
12 about the magnitude, typical, of what you're going to
13 get when you get electrical signal. If you've ever
14 taken your radio near a big generator, near a source of
15 a motor or something like that, what do you get?
16 Noise, that's the problem.

17 These steps are here to eliminate noise.

18 These steps filter out the noise in such a way that
19 hopefully at the end, predominantly at the end, you get
20 a clean heart rate. That algorithm is fixed.

21 Q. Now, Mr. Bauer, we've heard evidence
22 here that at the time of the arrest and we heard from
23 Ms. Matthews and we heard from Dr. Catre this morning
24 that there was a Corometric monitor hooked up to Lisa
25 through leads when they came into the room. Neither of

1 them could tell us whether the monitor was turned on or
2 not when they walked into the room. Assuming we've got
3 a properly functioning monitor that's hooked up to
4 Lisa, do you have any explanation as to why the heart
5 rate alarm would not alarm?

6 A. There would be two or three
7 explanations. The first explanation is if the alarm
8 didn't work, if there was no audible indication that
9 there was alarm. Obviously the nurse will not see
10 here, the light, in another room. The self-check,
11 whenever this is connected up to a patient, there is an
12 audible indication that it is working. I think we will
13 also hear evidence later that there was an apnea alarm
14 going off; that means the audible part of this monitor
15 was working. The only reason for this -- one of the
16 reasons for this not to be heard was that that audible
17 alarm wasn't working. That's not a consideration
18 because it wasn't -- as I said, if it was on a patient,
19 it was working. Subsequent to ---

20 MS. BROWNE: Sorry, would you repeat that?

21 I didn't get that.

22 THE WITNESS: Sure, if a nurse puts this on
23 a patient ---

24 MS. BROWNE: Right.

25 THE WITNESS: And hears the audible

1 alarm ---

2 MS. BROWNE: Yes.

3 THE WITNESS: --- that means the audible
4 section of the monitor is working.

5 MS. BROWNE: Yes.

6 THE WITNESS: All right, you hear an alarm,
7 the transducer, the speaker basically makes a
8 sound and you hear that it's working. That
9 is sufficient evidence to say that it's -- if
10 it has passed the self-test, you can hear the
11 alarm. The monitor, once connected up, once
12 turned on and passes its self-test, if you've
13 heard that beep, will not shut off by itself
14 without telling you if it's a battery
15 problem, a power problem, it will tell you
16 before thirty minutes. If it's a problem
17 with the monitor itself, it will beep and it
18 will alarm steady, it will (inaudible). If,
19 for some reason, there's a problem with the
20 patient, if there's a low heart rate,
21 whatever, it will also, and then you'll have
22 to shut it off. There's no other way to turn
23 it off if it's working. Subsequent to this
24 investigation, we did a fairly -- we've gone
25 through our PM cycle again, we have not found

1 any, in the last year, any monitor whose
2 audible section of the monitor has failed.

3 JUROR #5: There is no defects?

4 THE WITNESS: We have not found any defects
5 that would point to audible failure. I'm not
6 saying there are no defects, there are
7 problems, but nothing that would indicate
8 that the alarm would go off and not be heard.

9 The other explanation, besides being
10 turned off, someone turned it off by itself
11 or someone turned it off, would be that the
12 monitor thought it saw some kind of
13 electrical signal that it interpreted through
14 that algorithm as a proper heart rate. And
15 what I did is last Wednesday I saw a
16 recording of the patient, which I guess we
17 will talk about in more detail later on, and
18 I took the way form that was printed from the
19 patient, this is from a different monitor, I
20 think you've heard evidence there was another
21 monitor connected up, that monitor was
22 allowed to print out and spit out a way form.

23 What I've done is I've mimicked the best I
24 can that way form. That way form, and we'll
25 get into this, I'm sure, in more detail, is

1 similar to that way form down here.

2 THE CORONER: Mr. Gomberg?

3 MR. GOMBERG: We're hearing about this now
4 for the first time, all of us, and I want to
5 address this and I think it should be done in
6 the absence of the jury.

7 THE CORONER: I wonder if we could excuse
8 the jury for five minutes, please?

9

10 --- THE JURY IS EXCUSED.

11

12

13 THIS IS TO CERTIFY that the foregoing
14 is a true and accurate transcription
15 of my recordings and notes, to the
16 best of my skill and ability.

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Barbara A. Pollard
Certified Court Reporter