



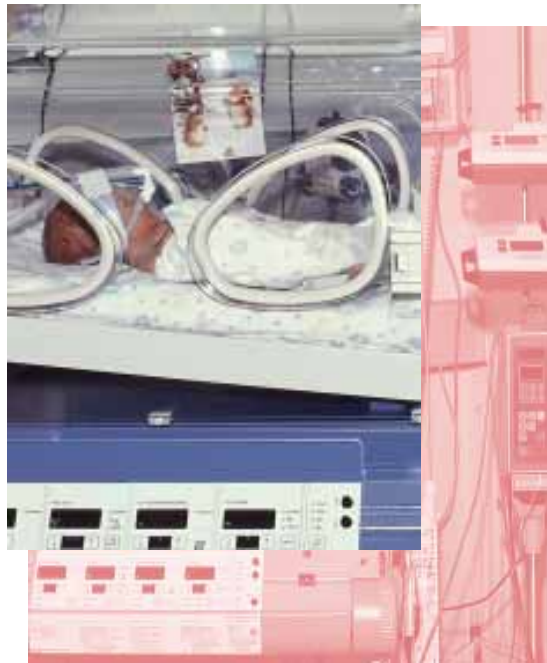
## Morbidity versus Mortality

**Investing in any sort of equipment - but particularly life-support equipment - can be a nightmare.**

Weighing the pros and cons, comparing this benefit against that price - it can all too quickly become a numbers game. In the end, the deciding factor can come down to what the buyer feels safest with, and very often, it's the brand name.

### what's in a name?

A well-recognised - in other words, well-publicised - name promises reliability, confidence, back-up. But does it always live up to its promises? And are buyer expectations always fulfilled - let alone justified? Maybe it would pay better



life or death are not the only issues

dividends to choose by specifications, rather than play safe with a 'name'.

Which raises the question 'safe for whom?' The answer might be very

different from someone whose life or health, rather than their job, depends on the right choice.

### a matter of degree

The big problem is, that with life-support equipment like pulse oximeters, it can be very difficult to quantify performance in terms of, say, patients dying or surviving. Surviving an operation, or a premature birth, is not just a yes/no affair. A lot of accompanying damage can occur - or be avoided - depending on the accuracy of the pulse oximeter probe. A probe which reads low can lead to too much oxygen being given, and excessive levels of oxygen can

Continued on page 3

## Noise cancellation: two problems, two solutions

**Two of the patents held by CEM are currently generating a lot of interest in the pulse oximeter and allied equipment world.**

CEM's ongoing programme of research and development has come up with answers to two problems regularly encountered in pulse and blood monitoring. One is a technique to cancel the 'noise' created by patients' movements, which otherwise makes it extremely difficult to get an

accurate reading. This is a particular problem with babies, and with patients coming out of anaesthetic, who often make involuntary movements before they are fully conscious.

At the other extreme of pulse measurement, serious runners wanting to monitor their heart-rate during training were finding that the thud of their feet interfered with the readings. The answer, designed, developed and

Continued on page 2

### Inside this issue:

**Take a Deep Breath...**

Page 2

**Lightman latest  
International distributors  
Website update**

**New vari-hinge probe - coming soon**

Page 3

**Accuracy - more than a 'Beat That' exercise**

Page 4



photos - see inside p3

## Take a Deep Breath...

**A lot of time in the health care sector is spent monitoring the amount of oxygen in patients' blood. But why is it so important: where does it go, and what does the body do with it, once you've taken a deep breath?**

The action really all takes place in the cell, where the object of the entire exercise is to produce the energy we need to keep living. And oxygen is a key ingredient in the process.

The starting point could hardly be simpler; an organic compound, plus oxygen, a little carefully controlled combustion, and that's about it. This is respiration, and the end result - adenosine triphosphate, or ATP - is, quite simply, the fire of life. ATP is what actually creates the energy to drive the cell, and ultimately all the living processes. And this is regardless of the size or complexity of the organism, or whether it's animal or vegetable. The big difference between plants and animals is that plants use starch as their organic starter compound, while animals use glycogen.

The efficiency of the system is indisputable. True, a handful of life forms get by without oxygen, but it's a hugely inefficient route. Add oxygen to the equation, and the amount of energy released leaps by a factor of 10 or 20.

### getting there

For organisms with just a small number of cells, diffusion of gases - oxygen in, carbon dioxide and water out - is a perfectly adequate transport system. Bigger animals, though, call for bulk distribution methods - a blood system to fetch and carry, lungs to oxygenate the blood. Even so, once the blood reaches the capillaries, diffusion takes over once more, to get oxygen to the cells.

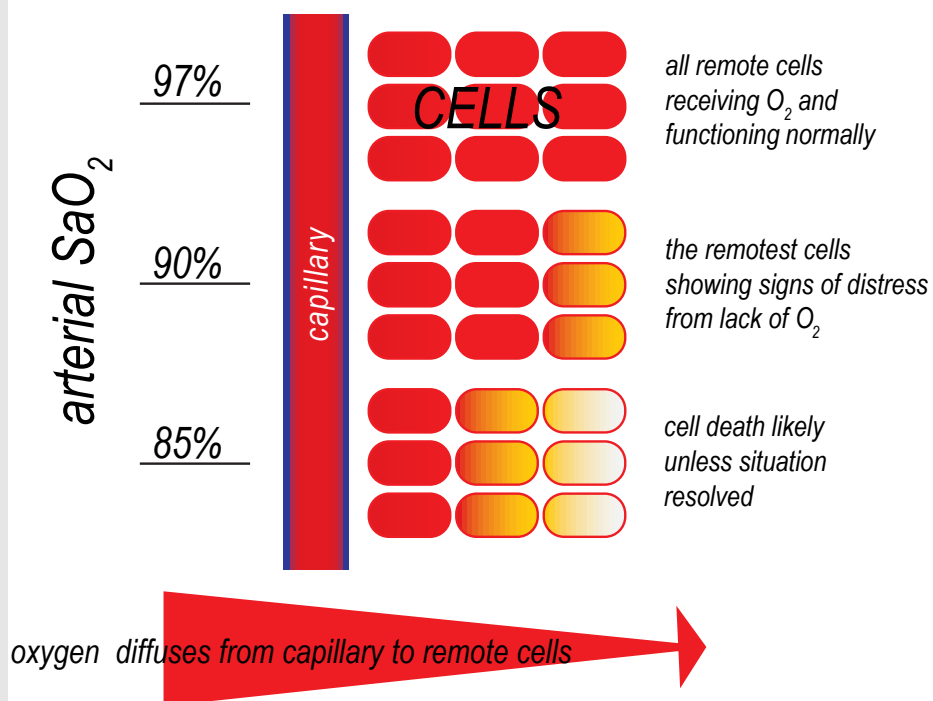
Regardless of the complexity or otherwise of an organism, the diffusion processes are driven, not

by any mechanical process, but by concentration gradients across the cells. In order to keep a steep enough gradient to get O<sub>2</sub> to every single cell, animals with a blood system need to start with a high level of oxygen saturation (SaO<sub>2</sub>) in the arterial blood.

To give some idea of the total change in partial pressure of O<sub>2</sub> in humans, fully oxygenated blood

as a whole may vary from minor local damage - losing a few cells at extremities to necrosis, say - to brain damage (the brain is very energy and oxygen hungry; three minutes is the most it can last without oxygen), or death.

Against this sort of background, the importance of accuracy in monitoring blood oxygen levels gains a new perspective.



### Falling blood oxygen - the effect on remote cells

with an SaO<sub>2</sub> of 97% at the lungs represents a partial pressure of 100mmHg. Within the mitochondria, where the final stages of the ATP cycle take place, it has dropped to about 4mmHg.

### life on a tightrope

ATP production can take place between a partial pressure of 4mmHg and 1mmHg - not a very wide margin. To put things into perspective, an arterial SaO<sub>2</sub> below 90% can mean the partial pressure of O<sub>2</sub> in mitochondria dropping below 1mmHg. In this territory, ATP reserves rapidly run out. Some degree of cell death is inevitable. The consequences to the organism

Continued from page 1

### Noise cancellation: two problems, two solutions

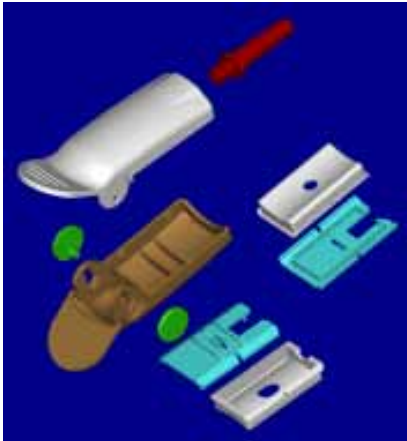
patented by CEM, was a pulse responsive device which cancels out the footfalls, leaving an accurate measure of heart-rate.

CEM believes research and development plays a fundamental role in the company's success, both present and future. The degree of accuracy achieved by its pulse oximeter probes have been possible thanks to extensive R&D. Meanwhile, new products such as the Lightman (see p3) are set to maintain the standards.

## New vari-hinge probe - coming soon

**CEM's new pulse oximeter probe, with its unique vari-hinge design, will be on the market very soon.**

The vari-hinge is the logical



solution to the parallel versus fixed-hinge dilemma, combining the superior optical contact of the former with the robust constitution of the latter.

But the user benefits don't stop there. A great deal of care has gone into the selection of materials. Consequently, the probe is completely latex- and PVC-free, and the rubber insert is fully bio-compatible.

Even the smallest design features have had the same degree of thought put into them; for

example, the finger grips on the probe are parallel ridges, which are very easy to keep clean.

The standards of accuracy are, of course, everything you've come to expect from CEM; in other words, a less than 1% error range.

Many years of refurbishing OEM probes have highlighted to CEM the type of faults which occur all too commonly. Faults which should never get past the design stage. CEM has taken full advantage of starting their design from a clean



computer 3D modelling of new vari-hinge probe

sheet, and with a clear idea of everything a first-class pulse oximeter probe should embody. Which is exactly what they've come up with.

### Lightman latest

**A breakthrough in the application of optics theory was the key to the miniaturisation needed to design and produce the pocket-sized Lightman pulse oximeter probe tester.**

**The result - an elegant alliance of design and optics science - is set to rewrite the maintenance manuals for pulse oximeter probe testers. The portability and ease of use of the Lightman allows for check-ups on probes as frequently as is felt necessary, and without having to take them out of circulation at all. Routine checks like this will pick up faults, and detect wavelength drift, well before they become noticeable to the user.**

**True to form, CEM has refused any compromise between size and accuracy. The Lightman measures to  $\pm 0.1\text{nm}$ , and produces a read-out which is not only as accurate, but also as clear to read as conventional spectrometers.**

**And there's more: the Lightman includes practicality among its many virtues. It is simplicity itself to use. The probe does not need to be positioned on the sensor with mathematical precision, so the read-out can be trusted, even under less than ideal working conditions.**

**This is a piece of equipment which the medical world has been waiting for, for a long time. The waiting is almost over.**

### International distributors

**CEM's network of international distributors continues to grow. Latest additions include China, India and South Africa. CEM exports not only its probes, but also the technology to allow manufacture under licence.**

### Website update coming

**New-look; bigger; more pages than ever - and that's just our website. You will be able to find up-to-the-minute information on our existing products, as well as developments in the pipeline, and product launches. Visit us at [www.electro.co.uk](http://www.electro.co.uk)**

Continued from page 1

### Morbidity versus Mortality

result in cataracts and visual handicap in premature babies. On the other hand, the decision to start or increase ventilation could be delayed if the probe reads high. The extent of any brain damage, and the consequent degree of handicap, will of course depend on the degree of inaccuracy in the probe.

### either side of the error margin

But talking in terms of error margins blunts the message. What does all this mean to the real end user - the patient? Hanging on

probe accuracy - other things being equal - is whether a man walks out of hospital, or never walks again; whether a woman can say 'Goodbye, and thanks', or would rather say 'Someone screwed up', but can't talk; whether a baby can look forward to learning its letters, or learning Braille.

In other words, an awful lot depends on tiny differences in readings, and a well-known brand name cannot and should not substitute for accuracy. That, and that alone, must be a buyer's deciding factor.

## Accuracy - more than a 'Beat That' exercise

**Numbers impress. Numbers sound convincing; they carry weight; they invite comparisons.**

**Sometimes straightforward stuff - 0-60mph in 12 seconds, 10 seconds, 8 seconds; 35mpg, 25mpg, 10mpg.**

But it's not always so easy to get a feel for differences in performance; for what percentage points higher or lower actually mean; what the user gains or loses by them. And where medical equipment is concerned, not

increase to approximately 7%.

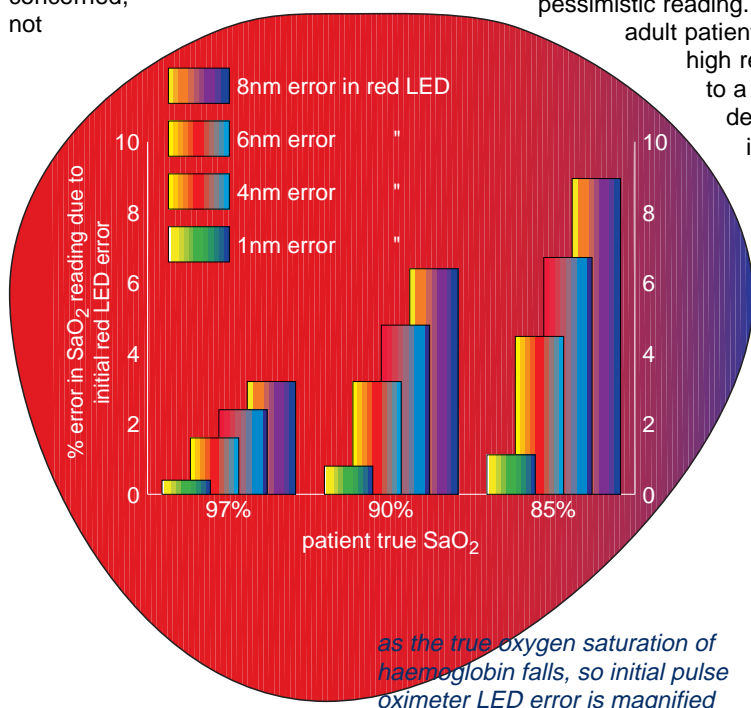
In other words, the sicker the patient, the more crucial it is to use the most accurate equipment possible; anything with a greater error range could tip the balance between a critical situation and a dangerous one.

### a fine line to tread

This phenomenon of an increasing error range has dangers irrespective of whether the probe gives an optimistic or a pessimistic reading. In a child or an adult patient, an erroneously high reading could lead to a delay in the decision to give or increase oxygen.

This in turn could mean the difference between brain damage or total recovery.

However, where the patient is a premature baby, an even finer line must be trodden. Here, there is the added danger that too much oxygen can interfere with the development



only do the differences between one brand and another have to be considered, but the state of the patient must figure in the equation.

Pulse oximeter probes, for example, are standardised against the 97% arterial oxygen saturation (SaO<sub>2</sub>) of a healthy person. An error range of ±1% or 2% at this level will hardly cause a crisis.

### complicating factors

But it's a very different story when the SaO<sub>2</sub> drops. The complicating factor is that at lower O<sub>2</sub> saturation, the same probe which gave a reading accurate to ±2 or 3% at full O<sub>2</sub> saturation, will now give an error range several times greater. For example, at 85% saturation, the error range will

of the baby's eyes, leaving the child with visual handicap.

### one last twist...

To complicate matters yet further, the oxygen being carried in the bloodstream will not all be released to the cells. Again, this is a percentage game. In a healthy person, obviously the percentage is enough to keep the tissues and brain well supplied. But in someone with an already low O<sub>2</sub> saturation, a smaller percentage of the available O<sub>2</sub> will be released to the cells. Tissue death (necrosis), or brain damage can result. Both are equally undesirable complications. Both may be avoided by using the most accurate pulse oximeter probes available. □

Raglan House - Llantarnam Park - Llantarnam - Gwent - NP44 3AB  
tel/fax: 01633 861 772 e-mail: celtic@electro.co.uk website: www.electro.co.uk

