The monitoring of physiological functions in acute or chronic conditions is one of the pillars of patient care. This information is essential to correct deviations of the homeostasis, which could compromise survival or the long-term quality of life.

Continuous monitoring is a priority in neonatal medicine since the homeostatic equilibrium is unstable; it can change very suddenly and present large changes. Compensatory mechanisms are still developing and physiological reserves are limited. These big swings in physiological parameters, such as blood pressure and organ perfusion, can induce hemorrhages or hypoperfusion that may compromise vital areas like the central nervous system. Moreover the neonate lacks the ability to verbalize early signs of organ dysfunction.

When monitoring physiological function is important to consider: what do we want to monitor? How to monitor them? How relevant is the monitoring and what actions will be taken in response to the data obtained?

What do we want to monitor?
Ideally we would like to monitor continuously the state of the cells, whether they are receiving the right amount of oxygen to meet the demands, whether they are receiving the right information that will allow them to perform the original genetic and epigenetic code for normal development.

Technology is advancing at high speed, as presented in this book, but at this time it does not deliver the specific information at cellular level. Most of the parameters that we can obtain from our patients nowadays are surrogate or indirect parameters that not necessarily represent the end point physiology that we need to manage these patients properly.

How to monitor these parameters?
Neonates are small, they can be extremely small, they have a very sensitive and fragile skin, they are susceptible to nosocomial infections, and they need a microenvironment to maintain normal temperature. Minimal handling and maximal information are the conditions to meet before thinking on continuously monitoring neonates. Technology is offering new possibilities, new materials to provide this demand as we can see in this book.

How relevant is the present monitoring?
For me this is the most important question to answer if we wish to offer our patients correct adjustment in their physiology to achieve intact survival.

At the moment we monitor different parameters that provide information for short and long term management.

Most commonly used parameters that we monitor in current practice are: Intermittent or continuous information on peripheral or central temperature; continuous monitoring of heart rate and ECG; respiration; continuous invasive (intra-arterial catheters) or intermittent noninvasive (e.g., cuff oscilometry
method) systemic blood pressure; continuous pulse oxymetry; continuous transcutaneous PO2 and PCO2; intermittent or continuous EEG monitoring; intermittent or continuous (during ECMO runs) blood gases status; less often applied we have Near infrared spectroscopy (NIRS) to measure oxygenation of the brain and other organs.

These monitoring efforts are informing us that the patient is alive, most of the time breathing continuously, having a normal range of respiratory and heart rate, some information on the pattern of heart activity, the influence of its main regulatory mechanisms. Moreover we can see values of systemic blood pressure varying from high to low values and often we react to these numbers without a proper understanding of what they represent. Most probably they do not represent tissue perfusion, as we would expect. Pulse oxymetry is perhaps the best and more constant measurement which gives useful information; when comparing different areas of the body or when looking at individual values, still this is a surrogate parameter which only informs us of the saturation state of the hemoglobin but not over oxygenation of the cell.

We are able nowadays to monitor continuously brain activity, this sound like a very broad area and in reality it is, but it provides information on two areas: generates general patterns of activity which can correlate with long term neurological damage and provides information on the level of excitability of the neurons. Further developments and simplification of equipment allowed the NIRS to be used in the NICU. This technology offers some approximation to the state of oxygenation of the brain tissue and other organs, but again, a very general impression.

This book offers an extensive up to date on technological developments that allow or will allow more adequate and friendly ways of acquiring data from patients, measuring new parameters, new techniques for extracting and analyzing information from basic parameters like heart rate, providing information on neuronal electrical activity, observing techniques to analyze behavior and quantify comfort and pain in the newborn.

Furthermore this book handles areas like the microenvironment in the NICU, communication techniques to facilitate and enhance bonds between parents and newborns.

This book is an example of good compilation of information useful for many different professional dealing day after day with this special group of patients. Moreover it presents new directions and possibilities that I am sure will result in sound and relevant monitoring techniques yielding helpful information to neonatologists, nurses and other professionals involved their everyday care and may well extend for home care needs. The cutting edge technologies and approaches for system integration presented in this book will inspire medical professionals, industrial designers, engineers and manufacturers to generate user-friendly neonatal monitoring solutions.

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Carlos Blanco has been appointed Director of Research at The Children’s Research Centre, Our Lady’s Children’s Hospital, Crumlin. Of Dutch and Argentinean nationality, Professor Blanco has spent most of his career in the Netherlands (Director of Neonatology, Division leader of perinatal medicine, Chairman Department of Paediatrics) at University Hospital, University Maastricht. He has been a visiting researcher at Oxford Department of Physiology, University of Cambridge. Professor Blanco will retain some clinical sessions in The National Maternity Hospital, Holles Street where he is a Consultant Neonatologist. Professor Blanco is widely published. His research interests lie in the area of Foetal and Neonatal Physiology and early origins of adult disease in respect of the cardiovascular system.