Malcolm Hooper is passionate about hyperbaric oxygen and how it can help people all over the world suffering from pain and illness. Hyperbaric oxygen has helped me. I commend his book ‘The Life is in the Blood.’

Tony Robbins
Praise for Malcolm Hooper and *The Life is in the Blood*

'I have had the pleasure of reviewing *The Life is in the Blood* and as a clinician I appreciate its coverage of a broad spectrum of medical conditions and the inclusion of exemplary case studies. It is very important that Malcolm Hooper has referenced information about the use of adjunctive therapies to achieve the best possible clinical outcomes. He has done an outstanding job, and his approach to treating spinal cord injury conditions is unparalleled in the field of healing medicine. When I do presentations to groups of medical professionals, I always mention Malcolm’s work because of his efforts to connect the global community of hyperbaric practitioners. Malcolm is right—the life is in the blood, and Hyperbaric Oxygen Therapy will play an important part in the future of healing medicine.'

Carol L Henricks, MD,
NorthStar Neurology PC and NorthStar Hyperbaric

'What if there were a medical therapy that could treat many problems for which there was no better alternative, and when used correctly often has life enhancing results so profound as to improve the function of those it is used on and change their lives for the better... forever? What if there was such a therapy but it was not connected to special interest groups that could handsomely profit from it? Hyperbaric oxygen is just such a therapy. It is not a miracle, but it is one of the most benign medical procedures in the armamentarium of modern medicine, an orphan therapy because it is not a patented drug and there is no corporation profiting from its use. Wouldn’t Hyperbaric Oxygen Therapy pose a significant risk to corporate controlled medicine if it were appropriately utilized for the betterment of the whole of society? Malcolm Hooper’s book gives a great overview of how, when and why hyperbaric oxygen should be an indispensable tool in modern medicine. Yet most people have never heard about it. If this is your first exposure to the subject, you will be pleased at what you find in the pages of this book. If you are familiar with hyperbaric oxygen as a therapy, you will enjoy being reminded of all the benefits that could be had if only it were readily recommended and made available.'

K. Paul Stoller, MD, FACHM,
Hyperbaric Oxygen Therapy San Francisco, Chief of Hyperbaric Medicine at Azzolino Neurology Group and the editor of Medical Gas Research

'I often strongly recommend Malcolm Hooper’s work, books, thinking and his treatments to a wide range of my networks. Why? Because Malcolm knows what he is doing, he is scrupulously honest, he is passionate about bringing improved health to everyone with whom he interacts, and he cares about people. In this early part of the 21st century, such willingness to care for others is a remarkable and crucial quality. If Malcolm tells you he believes he can help you, you can believe him. If he cannot help you, he will have no hesitation in honestly telling you so, and then direct you to someone who may be able to help. Read this book. Listen to Malcolm. Learn from Malcolm. And invest your time and energy into your health. After all, what else on earth is more important than your health? In my view, whoever follows Malcolm’s advice will make the world a better place.'

Charles B. Kovess, LL.B. (Hons), LL.M., CSP, MAICD,
Professional speaker, author, executive coach and industrial hemp expert
‘You have to admire a pioneer in any field. Malcolm Hooper is a true pioneer in Hyperbaric Oxygen Therapy in Australia and across the world. I have known him for well over a decade—professionally, as a patient, and as a friend. As a medical practitioner, whenever possible, I have always preferred to use physical therapies rather than pharmaceutical products. Working in a medical centre directly opposite Malcolm’s clinic, it wasn’t long before I crossed the road to discover the world of Hyperbaric Oxygen Therapy. Walking through the door, I was immediately made very welcome and then given a guided tour of his excellent facility. His equipment is very impressive. Apart from the hyperbaric chambers, he has invested in several state-of-the-art mobility devices. His passion and enthusiasm for Hyperbaric Oxygen Therapy is infectious. He is quite confident that it will eventually become a mainstream therapy for a wide range of hypoxic inflammatory conditions. He is always ready to produce and discuss the latest journal article relating to Hyperbaric Oxygen Therapy. His expertise has been acknowledged internationally and is often invited as a keynote speaker at world conferences. With my interest in sports medicine, concussion is becoming a big issue in contact sports like Gridiron in the US and Aussie Rules in Australia. Sports medicine practitioners are very limited in treating these patients. They can monitor their progress with cognitive testing, but there is currently no specific treatment. Unlike an ankle sprain, you can’t compress the brain with a bandage. Hyperbaric Oxygen Therapy, however, does compress the brain and it also floods the injured area with oxygen. Malcolm always attempts to quantify improvement, using very specific inflammatory markers and brain SPECT scans. His first edition, published in 2005, was already an excellent and complete overview of Hyperbaric Oxygen Therapy. In this second edition, which together over 20 years of clinical experience, features several improved changes.’

Dr. John Marx, MB BS, BSc. (Hons)

Forthcoming in October 2018, Malcolm Hooper’s new book
## Contents

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forewords</td>
<td></td>
<td>viii</td>
</tr>
<tr>
<td>Preface</td>
<td></td>
<td>xxii</td>
</tr>
<tr>
<td>Faith in Your Values</td>
<td></td>
<td>xxiv</td>
</tr>
<tr>
<td>Chapter 1.</td>
<td>Introduction</td>
<td>25</td>
</tr>
<tr>
<td>Chapter 2.</td>
<td>Why Hyperbaric Medicine?</td>
<td>29</td>
</tr>
<tr>
<td>Chapter 3.</td>
<td>HyperMed Australia</td>
<td>33</td>
</tr>
<tr>
<td>Chapter 4.</td>
<td>Typical Program</td>
<td>35</td>
</tr>
<tr>
<td>Chapter 5.</td>
<td>A Short History of Hyperbaric Medicine</td>
<td>39</td>
</tr>
<tr>
<td>Chapter 6.</td>
<td>Back Facts and Impacts of Arthritis</td>
<td>43</td>
</tr>
<tr>
<td>Chapter 7.</td>
<td>Failed Back Surgical Syndrome</td>
<td>53</td>
</tr>
<tr>
<td>Chapter 8.</td>
<td>Delayed and Non-Healing Bone</td>
<td>61</td>
</tr>
<tr>
<td>Chapter 9.</td>
<td>Advantages of Spinal Hyperbaric</td>
<td>67</td>
</tr>
<tr>
<td>Chapter 10.</td>
<td>Spinal Cord Injury</td>
<td>73</td>
</tr>
<tr>
<td>Chapter 11.</td>
<td>Functional Gait Retraining</td>
<td>95</td>
</tr>
<tr>
<td>Chapter 12.</td>
<td>Stroke</td>
<td>101</td>
</tr>
<tr>
<td>Chapter 13.</td>
<td>Heart Disease</td>
<td>117</td>
</tr>
<tr>
<td>Chapter 14.</td>
<td>Brain Injury</td>
<td>125</td>
</tr>
<tr>
<td>Chapter 15.</td>
<td>Cerebral Palsy and Related Disorders</td>
<td>139</td>
</tr>
<tr>
<td>Chapter 16.</td>
<td>Multiple Sclerosis</td>
<td>157</td>
</tr>
<tr>
<td>Chapter 17.</td>
<td>Chronic Illness: Chronic Fatigue Syndrome, Degenerative Motor Neuron Disorders</td>
<td>171</td>
</tr>
<tr>
<td>Chapter 18.</td>
<td>Chronic Non-Healing Wounds</td>
<td>185</td>
</tr>
<tr>
<td>Chapter 19.</td>
<td>Cancer</td>
<td>193</td>
</tr>
<tr>
<td>Chapter 20.</td>
<td>Brain Radiation Necrosis</td>
<td>209</td>
</tr>
<tr>
<td>Chapter 21.</td>
<td>Burns</td>
<td>213</td>
</tr>
<tr>
<td>Chapter 22.</td>
<td>AIDS</td>
<td>219</td>
</tr>
<tr>
<td>Chapter 23.</td>
<td>Stem Cells</td>
<td>223</td>
</tr>
<tr>
<td>Chapter 24.</td>
<td>Hyperbaric Foundation: Sponsor a ‘Mate’</td>
<td>233</td>
</tr>
<tr>
<td>Chapter 25.</td>
<td>OXY-Sports Health</td>
<td>235</td>
</tr>
<tr>
<td>Chapter 26.</td>
<td>A Final Word</td>
<td>249</td>
</tr>
<tr>
<td>Chapter 27.</td>
<td>A Tribute to Leearne Ridge (née Hooper)</td>
<td>251</td>
</tr>
<tr>
<td>Appendix A.</td>
<td>International Indications for Hyperbaric Medicine</td>
<td>253</td>
</tr>
<tr>
<td>Appendix B.</td>
<td>To the Consulting Patient</td>
<td>255</td>
</tr>
<tr>
<td>Appendix C.</td>
<td>Patient Handbook for Chamber Use</td>
<td>259</td>
</tr>
<tr>
<td>Bibliography</td>
<td></td>
<td>265</td>
</tr>
</tbody>
</table>
Foreword by

Dr. Ralph Howard

In Australia, Hyperbaric Oxygen Therapy has tended to be associated with a certain mystique, conjuring up thoughts ranging from deep sea divers in distress to injured football heroes hoping to speed up their return to active duty.

Australian doctors have also been limited in their thinking about Hyperbaric Oxygen Therapy by the cost constrained group of approved indications in the government listing of medical benefits.

Until more recent times the task of following overseas research into wider applications of this treatment has been limited by access to appropriate library facilities and the constraints of time. The burgeoning use of the Internet has changed this forever, and now the question is one of sorting through the bewildering array of information posted, as well as keeping track of the more traditional channels of journals and texts.

In publishing an account of his experience with Hyperbaric Oxygen Therapy in his Spinal Rehabilitation Group clinic, Malcolm Hooper has come to our aid in this regard with a comprehensive listing of publications outlining the experience of many workers in this field.

I have had a keen interest in Dr. Hooper's work for many years. We have shared a common interest in the management of spinal injuries. For the past several years I have had the opportunity to work in his clinic, where I have maintained a medical overview of this work. It is worth pointing out that the treatment starts intensively and then continues at appropriate intervals along the way with blocks of treatment. Some remarkable results have been obtained. Certainly it has been rare for spinal patients presenting with pain not to be relieved of their pain and their condition stabilized. The patients have had concomitant treatment in most cases with medication, acupuncture and tactile therapy including chiropractic and physiotherapy modalities. The results I have seen have been superior to those I have grown to expect where these latter modalities have been used alone.

Certainly Hyperbaric Oxygen Therapy warrants further evaluation in Australia in a great number of fields beyond the narrow constraints currently observed in the majority of treatment units. My feeling is that it is here to stay, and that it will prove to hold up in many fields, even under the rigour of the harshest controlled experimental design.

Dr. Hooper's book will prove a rich source of clinical interest in addition to being a valuable resource of reference material. It will act as a guide for those readers who feel inspired to take charge of their health and well being by following the Internet trails, as well as for those in the health care professions wanting to test the boundaries of Hyperbaric Oxygen Therapy.

Dr Ralph W. Howard, MB BS (Melb), FAIM
Foreword by

Dr. Alan Lee

All things by immortal power
Hidden near or far
To each other link’d are
That thou canst not stir a flower
Without troubling of a star.

Francis Thompson 1845

A frog in a well knows not of the ocean.

Mu Jian 168 A.D.

It ain’t what a man don’t know as makes him a fool, it’s what he does know, as ain’t so.

Mark Twain 1887

Medicine, the sages tell us, is so very old its origins are ‘lost in the limbo of forgotten things’. But the principles of medicine have a way of persisting and insisting on further examination. The current applications of Hyperbaric Oxygen Therapy are relatively new and for many this means it is controversial. In an age of rapid and extraordinary advances in a multitude of therapeutic interventions, newness of application is invariably accompanied by suspicion, cynicism and controversy.

Hyperbaric Medicine is a living and stubborn challenge to established ‘scientific’ knowledge. Its roots are hundreds of years old and it is based on a sound philosophy and its mode of action can be explained if one accepts its conceptual premises. It is into this maelstrom of technology, empiricism and hard scientific fact that Malcolm Hooper has leapt, rather than entered.

I first met Malcolm some six years ago at Royal Melbourne Institute of Technology (Melbourne) where we were both completing Masters Degrees in Applied Science (Acupuncture). I have always considered this an appropriate meeting place in view of the various strands of our relationship that have developed over the ensuing years, embracing scientific and philosophical discussion, and at times hearty debate. I was soon fascinated with Malcolm’s unique contribution to the practice of spinal management and the continued role of chiropractic therapy in Australia – the championing of Hyperbaric Oxygen Therapy. This fascination has continued over the years, as like all emerging concepts challenging traditions, Hyperbaric Oxygen Therapy has provided a living, evolving science, broadened by current knowledge and skills available, and responding to the changing needs of patients.

Malcolm has pursued his passion relentlessly and the many grateful patients echo clinical results. Good medicine is always based on thorough diagnosis, and is then followed by a uniquely devised treatment protocol to provide a remedy and facilitate a return to health.

This text is plainly intended as an introduction to Hyperbaric Oxygen Therapy and for use in teaching the approach. In an age of fast motorcars and industrial deadlines, Hyperbaric Oxygen Therapy offers an enormous
clinical gift. It is a method of treating patients who have suffered accidents and other incidents of trauma, which result in neurological dysfunction. Other branches of medicine often have little to offer in the treatment of such dysfunction.

Malcolm has a dream. It is to bridge the gap between non-clinical researchers, concerned with the ‘how’ in the light of modern science, and clinicians who ‘know’ that this therapy is effective.

Has he been successful in bridging this gap, and fulfilling his dream?

You, the reader, must be the ultimate judge, but I believe the answer will be in the affirmative and Malcolm will never see his dream turn to regret.

Dr. Alan Lee, PhC, MPS, DC, DA, DAc, FACPP, PhD, GradDipAppSc (Acup), MAAppSc (Acup).
Foreword by
Barry Argroves

The greater danger for most of us is not that our aim is too high and we miss it, but that it is too low and we reach it.

Michelangelo

Never worry about numbers. Help one person at a time, and always start with the person nearest you.

Mother Teresa

I thought it appropriate to begin with two of my favourite quotes, and I believe that each has a place in this writing. Anyone who knows Malcolm Hooper can never accuse him of ‘aiming too low,’ which, as Michelangelo reminds us, we are in great danger of doing in our lives. The temptation to settle for the easy way out and rest on our successes is not an option that Mal will ever choose.

I believe Malcolm and I first met in the fall of 2000, at one of Dr. Richard Neubauer’s International Hyperbaric Symposia in Fort Lauderdale, Florida. It seems obvious now, looking back on that time, that Malcolm would one day become a leader in the field of hyperbaric medicine. I have great respect for the field of chiropractic medicine, and Malcolm truly impressed upon me back then that he was a man on a mission. That mission was to incorporate the full scope and practice of medicine to improve the health of his family and patients in real, meaningful and lasting ways.

Malcolm has a keen vision for improving healthcare, which is coupled with a remarkable depth and breadth of knowledge. He also possesses an uncanny ability to understand and assimilate complex and varied ideas to formulate a reasonable, compassionate and holistic plan of care that is appropriate for a wide range of medical needs. He is absolutely passionate to learn about the nuances and minute details of how our bodies respond to accidents, trauma and disease. He is then relentless in his research and efforts to incorporate the most effective, cutting-edge therapies that can be offered to those with whom he works.

As evidenced in The Life is in the Blood, the cases Malcolm presents are very complex, and difficult to manage and treat. But true to his spirit and calling, he is willing to take on any issue and challenge, never backing down from his vision to help bring healing and wellness to those in greatest need. Prepare to be blown away by what you will learn as you read and evidence visual ‘miracles’ of some unprecedented, non-surgical spinal recovery and healing.

When listening to Malcolm’s hopes of and dreams for improving medical care, one is reminded of the challenge of drinking water from a fire hose. Even so, he is always conscious of the individual patient, who is special, unique and in need of specific care, compassion and healing. Malcolm has a long history of ‘helping the person nearest’ him, while simultaneously looking across the globe for efforts and opportunities that need to be put into place to help others in dire circumstances.

I have personally sought out Malcolm’s wisdom and direction for those in my life whose health was compromised, while also accessing the wealth of knowledge from his website, which is a veritable library and database of medical references, studies and information worthy of use by a medical university.
So, enjoy reading *The Life is in the Blood*, and take heart that good things are possible for your health through Hyperbaric Medicine. You will also discover other scientifically documented, valid therapies that you may have never heard of before. Whatever your background, I can assure you that you will learn a great deal through his book. Malcolm clearly understands that Hyperbaric Medicine is part of the medicine of the future. The time is right for us now to work together to bring forward the full potential of this amazing and profound therapy to make it available in the present.

It is an honor and privilege to call Malcolm Hooper my friend. It is a real gift and a blessing in my life to be closely associated with him through the International Hyperbaric Medical Association and the International Hyperbaric Medical Foundation. Our Association and Foundation work tirelessly to move the healthcare needle in the right direction for all who are in need. Through his dedication, expertise and hard work, Malcolm will continue to play a key role in our work to expand the legitimate scope and practice of Hyperbaric Medicine across the globe. Thank you, Mal, we’re all in your debt.

**Barry Argroves**  
**Executive Director, International Hyperbaric Medical Association**
Foreword by

Edward A. Betts

Dr. Malcolm Hooper has given a most wonderful gift to all medical professions—the light of knowledge. *The Life is in the Blood* is a great step forward in the quest to understand Hyperbaric Oxygen Therapy and expand its availability. Dr. Hooper clearly explains why this drug-free tool should be in every physician’s kit, not only as an adjunctive modality but in many cases as a primary course of action.

This text details the basics of Hyperbaric Medicine, its concepts and applications. It will prove a most valuable aid to awakening the medical professions to the fact that they are not treating brain injury, or, in many cases, not treating neurological dysfunction. Hyperbaric Oxygen Therapy is accepted as the best treatment for wound healing, but almost ignored if the it is a ‘brain wound’.

Oxygen is a huge anti-inflammatory but not widely used to treat inflammatory conditions. New drugs are promoted every day but are accompanied by a huge list of negative side effects. Many of these drugs are not approved or indicated for the conditions they treat. Consider Post Traumatic Stress Syndrome (PTSD). Drug therapy for PTSD is ‘off-label’ but widely used. There is no approved drug for this condition and yet the standard of care is mood altering drug therapy... often with fatal contra-indicators. Hyperbaric Oxygen Therapy has had amazing success in the treatment of PTSD and yet is not widely utilized because it is off-label. It is a sad state of affairs that the use of Hyperbaric Oxygen Therapy is so heavily restricted by government guidelines when it is actually one of the safest modalities to be offered.

There are many obstacles to overcome if we are to widen the understanding and uses of Hyperbaric Oxygen Therapy. This text is a thought-provoking nudge for all clinicians, researchers and physicians. It is certainly one more large and important step on the pathway of enlightenment.

I congratulate Malcolm Hooper on a most excellent text, for his desire to share his knowledge with the world, and for his efforts to change the culture of medicine. I know that this book will be a useful reference tool for medical professionals worldwide. I am proud to work with Malcolm as a friend and collaborator in bringing Hyperbaric Oxygen Therapy into the forefront of medical practice.

**Edward A. Betts**

Executive Director of ANDI International, The Patriot Clinics Inc., ANDI Pressure Solutions, Inc., AHA Hyperbarics USA, Inc. Foreword by Robert L. Beckman
Foreword by

Robert L. Beckman

The Down Under Wonders! Many of us admire Australian grit. Malcolm Hooper is from that world that recognizes if you want something done, you better hump your own pack.

He’s in good company with those who precede him in changing the culture and practice of medicine. Consider this short story about the mentality and culture we’re up against, but how the Aussies are leading the charge.

In 1981, two renegade Australian MDs knew that there was a simple treatment for ulcers: an antibiotic to kill Heliobacter pylori bacteria. Conventional medicine already knew that ulcers were caused by stress and yet an entire set of industries grew up around ‘healing’ stress and its aftermath of antacids, stomach surgery for bleeding ulcers, gastritis, stomach cancer and depression. To the ears of gastroenterologists the concept of a germ causing ulcers was like saying that ‘the Earth is flat.’ For them the cause of ulcers was psychosomatic—‘all in the head.’

To cut to the chase, for their relentless scientific persistence to find a simple treatment for H. pylori bacteria, Marshall and Warren shared a 2005 Nobel Prize. Today the standard of care for an ulcer is treatment with an antibiotic, and stomach cancer—once one of the most common forms of malignancy—is almost gone from the Western world.

There is a close parallel between what Drs. Marshall and Warren took 20 plus years to accomplish, and what Drs. Hooper and Harch and Fogarty and Shor and James and Efrati and a myriad of other internationally recognized Hyperbaric Medicine practitioners and researchers are learning daily. Hyperbaric Oxygen Therapy works. And we know more and more about why and how. Yet conventional medicine resists the obvious: traumatic brain injury may be an ‘invisible wound’ but it is nevertheless a wound, and so are a myriad of other neurological diseases.

Here’s another head-banger. Research has just confirmed what any warrior or winger already knows: combat, whether on the pitch or the battlefield, can lead to brain wounds. Simply hoping that ‘rest’ and ‘watchful waiting’ will return the wounded to normalcy is a stunning admission of ignorance in light of what Dr. Hooper and others continue to show us. Take a look at any concussion protocols out there. They border on medical malpractice. A whole industry exists to nurse a brain wounded patient back from injury, all without directly mentioning or even bothering to treat the wound. All this symptom reduction and palliation of pain without confronting the underlying wound reminds us that organizations are ungodly beasts in the face of the need for change. You’d think they’d never read a textbook on inflammation, stem cells or hyperbaric medicine. (Oh, wait, of course they haven’t. Hyperbaric medicine is barely mentioned and certainly not in the context of evidence-based medicine.)

Hyperbaric medicine is winning, just not fast enough. But as Arthur Schopenhauer once wrote, ‘The truth goes through three stages: first, it is ridiculed, then it is violently opposed, and then it is accepted as self-evident.’ We can console ourselves with the inevitability of the truth winning out.

Robert L. Beckman, PhD
Executive Director, TreatNOW Coalition and Knowledge Manager,
Foundation for the Study of Inflammatory Disease
What is the difference between the masters Rembrandt, Michelangelo and Van Gogh and a house painter? All possess the tools to create a masterpiece. But it is passion, unique insight and precision that allow a masterpiece to be revealed.

The use and integration of Hyperbaric Oxygen Therapy in mainstream medicine continues to be surrounded by controversies, misconceptions and assumptions, perpetuated by professionals who have little exposure to this powerful therapeutic option. The reality is that the true advantages of this powerful treatment option will continue to be underestimated if we continue to value procedures over outcomes. Converting truly exceptional patient outcomes into statistical significant results is possible only when professionals are exposed to Hyperbaric Medicine. *The Life is in the Blood* by Malcolm R. Hooper fills a void by proposing that the reader explore what is possible when you think outside the box and approach many difficult conditions by integrating Hyperbaric Oxygen Therapy into a multi-disciplinary approach.

In 1970, Professor Nicolaas Gerardus Meijne, in a text titled *Hyperbaric Oxygen and Its Clinical Value with Special Emphasis on Biochemical and Cardiac Aspects*, expressed the following:

Hyperbaric oxygen therapy should be used early in the course of a disease or a condition involving inflammation or hypoxia, as an adjunct to complement other well-established treatment options. It is not a panacea. It is rarely of value as a last resort. Used in this manner the practitioner is committed to extended courses of treatment and treatment failures.

It is unfortunate that many in hyperbaric today, failing to heed Dr. Meijne's observations from over 50 years, have accepted Hyperbaric Oxygen Therapy as a last resort.

*The Life is in the Blood* is an exceptional contribution to the field of rehabilitation medicine. Through this work, Malcolm reveals his unique insight into multi-disciplinary integrated rehabilitation using Hyperbaric Oxygen Therapy. This coordinated approach capitalizes on the strengths of each treatment, clinical investigations and comprehensive medical strategies to optimize the recovery and stabilization of Malcolm’s patients.

Hyperbaric Oxygen Therapy is a powerful therapeutic option. In the hands of a master like Malcolm—having a significant appreciation of science, knowledge when to employ it and under what circumstances it will be effective—a true masterpiece is revealed. The Life is in the Blood is a window into the passionate insight through which the value of this treatment option is explored.

**Thomas M. Fox, MAS, MS, CHT**

*Research Physiologist for the Hyperbaric Institute for Research and Training*

Foreword by Robin Willcourt
Foreword by
Robin Willcourt

Over the last half century medicine has evolved from a tightly personal relationship between patient and physician into a global business that now serves multiple masters, unrecognizable from the patient-physician relationship that existed for many centuries.

Today, impersonal, even indifferent, might be how many patients would describe the relationships they have with their doctors. Accountants, lawyers, legislators, insurance brokers have all been injected into the mix, and with it comes fragmentation of care, and with that comes the loss of focus on the patient. The end result is often many broken links in the chain of care, and sub-optimal delivery of that care.

It has been my privilege to work with a man who understands better than most how critical it is to integrate all aspects of healthcare in our medical system, using as many relevant resources as possible to make sure that people are not lost in the cracks as they traverse the landscape of fragmented medicine.

Malcolm Hooper is a pioneer in Australia and indeed, one could say, the world in helping to establish the science of Hyperbaric Oxygen Therapy to treat a wide spectrum of disorders. The science behind the use of hyperbaric oxygen has been well-established for decades, but only recently have scientists uncovered the many intricate pathways by which this therapy enables cellular repair to take place and in what circumstances it provides optimal recovery. Malcolm has brought this knowledge into his practice. Based on solid science and evidence, he has brought extraordinary care to Australians with his state of the art facilities in Melbourne.

In The Life is in the Blood, Malcolm Hooper gives the reader not only factual information about Hyperbaric Oxygen Therapy and its role in healing, he also offers his experience and insights into how the physiology of the human body can be treated effectively without using harmful and often ineffective drugs.

I have worked with Mal for the better part of six years, treating patients who, because of their difficult-to-treat disorders, were long since abandoned by their GPs and specialists. Why? For decades medical knowledge has for the most part been given to the pharmaceutical industry to disseminate, which has led to non-pharmaceutical solutions being ignored in the medical school curricula.

Such has been the case with Hyperbaric Oxygen Therapy. But it is with people like Malcolm Hooper and other leaders in the world of Hyperbaric Oxygen Therapy that this modality is gaining recognition and will become an integral part of patient care for hundreds of disorders.

Robin Willcourt, MB.BS. MD FACOG FRANZCOG, author of Chasing Antelopes and The Last Custodian.

Willcourt has been on the faculties of the University of Hawai‘i, University of Louisville, Georgetown University, University of Nevada-Reno, and the University of Adelaide.
Foreword by

Dr. Steven Skaggs

I learned early in my career as a chiropractic physician that chiropractors are not always well received in some spheres of the medical field. However, in 2016, I had something happen that changed my opinion and attitude forever. I was in the audience of the International Hyperbaric Medical Association Annual Conference in New Orleans attempting to listen to the deluge of information that was being presented. Suddenly, like a bolt of lightning, it struck me that Dr. Malcolm Hooper was lecturing to an auditorium filled with physicians from all over the world, physicians from every field imaginable are listening intently to Dr. Hooper and he’s a chiropractor.

Dr. Hooper has managed to accumulate a vast wealth of medical knowledge and experience and has here assembled a concise edition as a premier contribution to Hyperbaric Medicine. This book encompasses information for the novice, a family member searching for a last hope solution for a loved one, and even works well as an introduction for health practitioners.

I once heard Dr. Hooper described as one who possesses great wealth, but that it is wealth measured by his friends and his knowledge. To ask Dr. Hooper a question is like ‘attempting to drink from a fire hose’ because so much knowledge gushes out with inestimable volume and immense force. There is always so much to take in. Stead fast, anchored in his faith and armed with his knowledge, Dr. Hooper is a formidable foe and an incredible physician. Leading the way forward, he is one of the foremost researchers in the world of hyperbaric treatment, from failed back syndrome to chronic inflammation, closed head injury to stroke. This edition covers the disease processes that today cost our society dearly while costing the quality of life of so many.

Dr. Hooper is an articulate author, a compelling lecturer, capable of conveying his knowledge to all who will listen. I recall a moment from 2017 watching Dr. Hooper standing toe to toe with Dr. Paul Harch in the early morning hours in a hotel lobby, exchanging concepts, hypothesis and dosages. There was no indication that either one of these great minds would quiet down anytime soon. Just to be there and be able to listen to the scope of the conversation was motivating and simply inspiring.

Convening an assembly of experts, clinical advisors and physicians, Dr. Hooper has managed to become a successful entrepreneur constructing OXYMED International. From that vantage point, he can provide hyperbaric for some of the world’s elite athletes. He is a visionary, a pioneer in his field, celebrating his successes in quite a manner becoming of his stature.

I remember my younger years being glued to the television watching Jacques Cousteau globetrotting around the world, riding atop the waves aboard the Calypso, and discovering the lay beneath the water. A reporter one day asked Cousteau why his expeditions were so important. Cousteau’s response resonates with me to this day, ‘Someday we might just find the cure for many of the disease processes that robs humans of our lives.’ Today, I find it rather peculiar that our Divine Creator hid the cure not in our vast depths of oceans but all around us. It has been here all this time, it surrounds us everywhere go, we can’t live without it, we breathe it, and now we are able to use it to heal humankind.

So, if you are a health professional and this is your first encounter with hyperbaric, may you become obsessed with it, may you share the experiences of those of us who advocate oxygen therapy, may you find that treatment that saves a family member, and may you shed tears of joy everyday in your practice.
I was taught many of life’s lessons growing up in the Texas Panhandle in the 1960s. Some I have had to visit repeatedly before I learned the lesson. But my most profound lesson is that ‘a man should not be judged or remembered for his accolades, accomplishments or accumulation of wealth. But should be remembered for what he did for his fellow mankind.’ Dr. Mal Hooper, please continue to lead the way.

Dr. Steven Skaggs, DC, C.C.I.C.
Clinical Director of Skaggs Chiropractic
Foreword by
Edward F. Fogarty

This is not so much a foreword as a celebration of the life and body electric as powered by the gases we breathe. It is also a celebration of the movement that has taken hold around the world for educating our fellow beings on the simplest body repair techniques in history. The best part of this history is how Hyperbaric Oxygen Therapy has renewed the lives of many people. It has brought speech to the mute—whether the mutism was a result of autism, anoxia, trauma or stroke—and helped the lame to walk again.

Fellow board member of the International Hyperbaric Medical Foundation (IHMF) and author of the book you are about to read, Malcolm Hooper, has revolutionized the care of his fellow citizens in many creative ways. By combining robotic assisted walking therapy with hyperbaric oxygen therapy, for instance, quite a few Australian children are now walking when this was not expected in their development or progress by traditional physiatry care. One day soon there will be super-chambers with Lokomat devices putting into overdrive neuroplasticity improvements for the ambulation of our most vulnerable.

Just after Malcolm’s presentations at the International Hyperbaric Medical Association Annual Conference in 2016, Dr. Paul Harch, the past president and founder of the IHMF, remarked that we should expect to see continued progress in Hooper’s ‘multi-modality ground breaking achievements in orthopedics, neurology and sports medicine.’ Down Under, Hooper’s work continues under a microscope because his pioneering approach clearly threatens markets and upsets a paradigm of entrenched thought in medicine and healthcare. He is not of the ‘guild class’ of physicians, but he has innovated ‘physical therapies’ by using a device that pushes our reparative and regenerative capabilities by the simplest manner.

My role in medicine is primarily that of an observer. I am a clinical radiologist, a sort of photojournalist in medicine. We radiologists get to see the hand of our colleagues in clinical medicine from a distance. I have been privileged to help in the publication of scientific imaging with two of the world’s leaders in hyperbaric-cellular resuscitative medicine, Drs. Paul Harch and Keith Van Meter from the Louisiana State University in New Orleans. The breadth of my professional practice over the last 15 years includes the interpretation of over 100,000 medical imaging exams, as well a variety of other image-based interventional procedures in medicine. From the lens of my career on the upper Missouri River, I can say without a doubt that there are things that happen in hyperbaric chambers that just do not happen anywhere else in the halls of medicine.

Hyperbaric Oxygen Therapy is bigger than any discovery in medical history because its regenerative capabilities, so simply administered, are directly applicable to everyone on earth. The air surrounds us and is a medium that touches all of us. We are gas-powered consciousness, and the same little subatomic particles that power the most advanced computers also power God’s best quantum computer system, the human mind. We are carbon based air-powered computers with cells that are semi-conductors in a network so vast that it is an embarrassment of human hubris to think a silicon based system could ever create an artificial intelligence as grand as the human brain. Revelations and observations are not programmable; inspiration is both a physical act and a metaphysical concept.

In the hands of my physician colleagues at Louisiana State University in New Orleans, who are the world’s leading clinicians, a person like Robert Parrish, who in 1983 drowned at a depth of 110 feet in the Mississippi River, is still walking the earth. In 1998, a young man with anoxic brain injury from a near-drowning incident recovered with hyperbaric oxygen applied in the Intensive Care Unit of a New Orleans area hospital. He was not expected to recover due to
the severity of the injury, but simple hyperbaric oxygen applied for three days in short sessions brought his brain back to full working order. And when school started in August, this student was back with his fellow classmates.

Perhaps these were miracles, but it seems that the real miracle would be getting this information out into the world.

The ghost in our machines is air and under pressure our DNA writes faster. Even just a little loss of pressure is a familiar exercise for many of us in how our cells slow down the writing of the biological code. Given that parents have a role in the stewardship of creation and the electric sparks of oxygenated life move through us from generation to generation, it seems no accident that the calling of Malcolm Hooper’s father was that of a preacher. My father and grandfather were attorneys with storied careers on the Nebraska bar, saving the Niobrara River and writing the Omaha City Charter among their accomplishments. So, as the Devil’s advocate in the establishment of academic medicine for the hyperbaric community, I can think of no other maverick more in line with the cowboys at the end of the Chisholm Trail than my brother in arms, Malcolm Hooper. He has challenged the priesthood of medicine.

Like a preacher, Malcolm has found his calling in converting as many of our fellow beings to understanding the prana of oxygen and pressure in the battle against entropy in biological systems. Entropy is just a term for what physicians might call disease, a state of disorder and chaos that reverses with the input of energy and intelligence. In advocating for this chiropractor, who astutely employs thermodynamically-accelerated healing to some of the world’s elite athletes and many fellow countrymen, I would guess the Australian medical authorities might consider this foreword problematic for the full exercise of my free speech rights under the US Constitution. The muzzling of free speech in the area of science and medicine is becoming a fad in western ‘democracies’. Malcolm’s greatest impact on our global movement has been to remind us all that hyperbaric medicine is humanitarian medicine. We live in a marketplace of ideas upside down from humanitarian goals, where greed and downright censorship is the norm for the protection of corrupt proprietary markets. The Wizards of Oz are now upon us with their global bandwidth curtains in media, distracting us from the obvious, cheapest, safest and most profound medical advance, one that is older than all pharmaceutical companies, older even than all the nation-states of our planet.

In an ‘open secrets’ moment of truth, one of the world’s leading athletes of the last 20 years, Novak Djokovic, told the world he was aided in his professional career by using Hyperbaric Oxygen Therapy with Malcolm Hooper as his molecular-biophysics coach. This created a stir and hyperbaric as a recovery system was investigated under the suspicion that it could be a version of blood doping. It was ruled legal and a tennis star and his molecular trainer trail-blazed a path through the medical-legal morass of restrictions against this simple process.

The lack of basic awareness of oxygen saturation technology in modern medicine is one of the strangest things I have ever witnessed. That is, until I started to see the claws come out in the turf battles for patients and the various silos of specialties or systems of thought in healthcare. We of the sacred Hippocratic oath have orphaned our best friends from an amazing medical specialty. What is worse is the short sightedness of the MBA class in healthcare administration and insurance companies ignoring the obvious economic gains that come from the input of oxygen under pressure into our fellow beings. Physics amplifies and attenuates biological processes through gases in ways we should be harnessing all over the world. All people should have easy access to some version of barometric pressure medicine as an auspicious right in health care. Why should we not have the right to the simplest, cheapest and safest version of health care?
To my brother of healing pressure Down Under, please forgive me for writing a foreword that only obliquely hints at the great work you have accomplished. I am honored to have the opportunity to write this in the spirit of Cowboy Ethics with a modern bullhorn in hand and the Badlands of the Dakotas on the horizon. Mine is a discourse for the square deal that all of God’s air breathing creatures should be afforded. Speech being the translation of thought and oxygen being the energy currency of our human experience makes this our sacred communication, my friend. The air-powered vibratory tones of humanity that distinguish our consciousness as a more enriched biological quantum computer than our mammalian cousins, is a resonance of sound that connects us all and has kept us gathered in community for eons. We are all atmospherically connected, with nitrogen and argon as ballast for our lungs and oxygen as our cellular currency. We must continue as pressured noble warriors driving oxygen powered molecular translations of a code that we humans only a century ago never knew existed. To borrow from our dear friend, Dr. Paul Harch, ‘it’s OxyGene therapy’. Thank you mate, for sharing some of the most astounding cases I have ever read. Let’s heal the poorest of the poor in the cheapest of ways. The resonance of molecules under pressure is a chorus heard in every corner of the planet for all of the mavericks you have assembled.

Edward F. Fogarty, MD  
President, International Hyperbaric Medical Foundation Chair,  
Department of Radiology, School of Medicine and Health Sciences, University of North Dakota
‘People are unreasonable, illogical and self-centred. Love them anyway.

If you do good people will accuse you of being selfish or having ulterior motives. Do good anyway.

If you are successful you will win false friends and true enemies. Succeed anyway.

Honesty and frankness make you vulnerable. Be honest anyway.

The good you do today will be forgotten tomorrow. Do it anyway.

The smallest people with the smallest brains will shoot down the biggest people with the biggest ideas. Think big anyway.

People favor underdogs but follow only top dogs. Fight for some underdogs anyway.

What you spend years building may be destroyed overnight. Build anyway.

Give the world the best you’ve got and you will probably get kicked in the teeth. Give the world your best anyway.

You see, it’s not the score that somebody else keeps on your life that counts in the end, it’s the score you keep on your life that makes the difference. Have faith in your values!’

Author unknown
Chapter 1. Introduction

The purpose of this book is to facilitate the dynamic and developing application of Hyperbaric Medicine, also known as Hyperbaric Oxygen Therapy (or HBOT). When combined with appropriate medical investigations and other treatment protocols, HBOT is part of a multi-disciplinary treatment program specialising in chronic illness and disease, including brain and spinal cord injuries and related neuro-vascular infectious disorders.

HBOT is a method of safely delivering high doses of oxygen to the body by breathing 100 per cent oxygen through a mask or hood while inside a pressurized air chamber. The pressure inside the chamber causes the oxygen breathed to be dissolved at greater levels in the blood. This provides a fifteen to twenty fold (or 2000 per cent) increase in tissue oxygenation (although some publications have stated that HBOT increases wound healing up to 30 fold). Increased tissue oxygenation significantly accelerates the rate of healing, stabilisation and repair.

At Melbourne Hyperbaric and Spinal Rehabilitation Group, orthopaedic and neurological disorders are what we focus on primarily given that approximately 20 to 30 per cent of the body’s consumption of oxygen occurs within three to five per cent of the body mass—the brain and spinal cord. These structures are extremely sensitive to oxygen deficiency and the use of HBOT can produce dramatic rehabilitative results.

Conditions Treated
The following is a current list of conditions and disorders treatable with Hyperbaric Oxygen Therapy. I recommend the reader also consult ‘Appendix A: International Indications for Hyperbaric Medicine’.

Traumatology
- Crush injuries
- Compartment syndrome
- Soft tissue musculoskeletal injuries
- Closed and open head injury

Orthopedic Disorders
- Fracture repair (all stages), delayed and non-union
- Bone grafts
- Aid to prosthesis rehabilitative care
- Acute and chronic spinal instability
- Sacroiliac syndrome
- Osteoporosis
- Facet dysfunction
• Disc protrusion (single, multi-level)
• Canal stenosis (central, foraminal)
• Post-surgical instability
• Degenerative joint disease (single, multi-level)
• Inflammatory arthritides

**Neurological Disorders**
• Spinal cord neuropathy due to crush and neurovascular degeneration
• Paraplegia, quadriplegia due to incomplete neurovascular compression
• Peripheral nerve injury and neuropathies (crush, demyelination)
• Closed head impact injury (brain damage)
• Cerebral edema
• Migraine
• Vegetative coma
• Brain abscess
• Cerebrovascular stroke (acute and chronic stages)
• Multiple sclerosis
• Multi infarct dementia
• Cerebral palsy, epilepsy due to hypoxia
• Near hanging
• Near drowning

**Cardiac Disorders**
• Aid to cardiac surgery and rehabilitation
• Coronary heart disease (angina pectoris, myocardial ischemia)
• Heart insufficiency (post surgical)
• Heart contractile dysfunction

**Plastic and Reconstructive surgery**
• Non healing, delayed wounds
• Aid to survival skin flaps with marginal circulation
• Aid to reimplantation surgery
• Aid to burns treatment
Peripheral Vascular Disorders
• Delayed wounds, recurrent ulcers, infection
• Gangrene
• Acute and chronic arterial insufficiency

Haematology
• Sickle cell crisis
• Acute and chronic blood loss anemia

Radiosensitivity
• Enhancement of radiosensitivity of malignant tumours

Ophthalmology
• Central retinal artery occlusion

Otorhinolaryngology
• Sudden deafness
• Acute acoustic trauma
• Labyrinthitis
• Meniere’s disease
• Malignant otitis externa (chronic infection)

Gastrointestinal
• Gastric and duodenal ulcers
• Necrotising enterocolitis
• Paralytic ileus
• Pneumotoides cystoides intestinalis
• Hepatitis

Endocrine Disorders
• All stages of diabetes

Lung Disorders
• Lung abscess
• Pulmonary embolism (as an adjunct to surgery)
Obstetrics
Complications of pregnancy, including

- Diabetes
- Eclampsia
- Heart disease
- Placental hypoxia
- Foetal hypoxia
- Congenital heart disease of the neonate

It would seem to be an absolute basic medical consideration that by simply elevating the amount of dissolved oxygen into compromised (hypoxic) tissue enhances the rehabilitative and salvage effects of brain and spinal cord injured patients. Why is it not more commonly recommended is the million dollar question?

Many patients recognize their lack of improvement and are often referred to us as ‘the last hope’. Due to the severity of their disability and their failure to improve with conventional therapies, most patients and their families hope that the use of hyperbaric oxygenation together with assertive physical therapy will produce better results.

Hyperbaric Medicine is used as ‘adjunctive’ therapy. To promote stabilization and repair, HBOT can be administered in conjunction with other forms of aggressive treatment recommended by a patient’s doctor. The purpose of HBOT is to repair tissue that is severely damaged because of inadequate blood supply.

- HBOT improves the immune system mechanisms with an increase in lymphocyte (white blood cell) production, promoting fibroblast replication and collagen production, repairing disc and supporting ligaments.
- HBOT accelerates body defence mechanisms enabling the patient to overcome chronic infections and viral conditions inhibiting immune system function. This is extremely important in spinal surgery patients where delayed wound healing due to poor vascular compliance leads to further serious complications. The incidence of post surgical scarring, adhesions and predisposition to infection is dramatically reduced with HBOT.

In the US, England, Europe and Asia, HBOT is used routinely to promote accelerated healing, including pre- and post-operative procedures. It is used to reduce secondary complications of infections and to promote functional rehabilitation. HBOT significantly reduces the length of post-surgical rehabilitation care and hospitalisation.

And there are a number of other benefits. HBOT is non-intrusive because it is not a surgical procedure. Unlike many other treatments and procedures, HBOT is safe because it has few side effects and almost none of any lasting nature. It also works well with other traditional and complimentary forms of physical therapies or requisite medications, enhancing their effectiveness.

Hyperbaric Medicine is not a ‘cure all’ but it demonstrates dramatic immune responses that assist patients with problems ranging from simple delayed wound healing to complex disabilities and impairment.
Chapter 2.

Why Hyperbaric Medicine?

I am the Director OXYMED (formerly Hyper-Med Australia), which incorporates Melbourne Hyperbaric and the Spinal Rehabilitation Group. I have been solely responsible for both the development and clinical application of Hyperbaric Oxygenation Therapy (HBOT) in the treatment and management of chronic spinal and related neurovascular disorders at Hyper-Med Australia. My initial introduction to Hyperbaric Medicine was in 1994 but it was not until 1995 that I took the plunge and integrated pressure chambers into the facility to commence patient treatments.

Background

I had become increasingly aware of the multitude of problems in attempting to manage patients with complex back pain subsequent to the limitations of back surgery. In 1986, the Spinal Rehabilitation Group emerged as a multi-disciplinary practitioner group intently focused on dealing with the exact causes and effects of spinal and related problems. The clinical focus of the Spinal Rehabilitation Group between 1986 and 1995 was medico-legal. The vast majority of our consulting patients were medically referred to us because they suffered complex pain syndromes due to industrial and accident related injury.

Soon after introducing our initial pressure chambers, Melbourne Hyperbaric emerged out of a necessity to accommodate the ever-increasing referrals and inquiries of patients suffering other medical related conditions that could also benefit from hyperbaric. The fact that we were heavily involved in medico-legal consultancy required that we make a commitment to clinical investigation and comprehensive medical strategies designed to optimize the recovery and stabilization of our patients. This commitment reflected my quest for clinical knowledge, which has always been the driving influence in my professional development.

Rachael’s Story: Why I Took the Plunge?

In 1994, my fourth child, Rachael (my wife Cathryn and I have six children) at the age of 18 months fell into a fire and suffered extensive burns to her hands, arms, stomach and knees. This was a devastating period and it challenged and ultimately changed my professional career.

Rachael was rushed to the emergency department of the Children’s Hospital and she received excellent care and attention for the next six weeks. But the inevitable emerged when her specialist recommended extensive skin grafts and plastic surgery. Both my wife and I were overwhelmed with a sense of hopelessness. As would any parent, I responded with absolute resolution to provide the best for our child. The fact that I am also a practitioner simply compelled me to research as much information as I could find on clinical advances or alternative treatments for burn victims.

It was during this initial process of review that I came across a treatment referred to as Hyperbaric Oxygen Therapy. It was encouraging to discover that it was widely used for a range of conditions including the treatment of complex burn victims. It was and still is an established protocol for the treatment of burn victims in Russia and in a number of European countries.

Although I was armed with new information that could enhance my daughter’s recovery, my enthusiasm was quickly deflated when I attempted to discuss this other avenue of care with her specialist. It was like I hit...
a brick wall. My wife and I were informed that if hyperbaric therapy were an acceptable form of treatment for burns then it would already be available and Medicare funded. I found this very difficult to comprehend given that the Children's Hospital did not even have a hyperbaric department for conditions that were considered 'accepted' and covered under Medicare.

The issue of using 'laser' also attracted another big negative. Again, we were informed that there was 'no evidence' laser would enhance tissue repair. Obviously laser techniques have emerged significantly over the years and are now commonplace in cosmetic care and plastic surgery. But back then the specialist cautioned me in no uncertain terms that increasing blood flow would accelerate scar formation.

My 'gut' feeling was that the process of vascularization was the answer given that we were repeatedly told that Rachael's hands were 'ischemic' and the issue of diminished blood meant that no new adequate skin could form. We were told that unless surgery was performed Rachael would suffer terrible scars that would eventually contract and cause severe disfigurement to her hands and forearms.

I was overwhelmed by my daughter's dilemma. I felt damned if I did and damned if I didn't. Was I to follow the specialist's advice or trust my instinct and use these newly discovered techniques to increase my daughter's vascular response? Unfortunately, Rachael was unable to gain entrance into a hyperbaric facility, but we did use laser directly onto the burns area and almost instantly we saw a noticeable difference. We saw a bright reddening of the skin surface including the area immediate to the 'whitened' spots that covered most of her forearms and the palms of her hands.

After several weeks of laser and an enormous amount of 'prayer', we were finally relieved when the specialist remarked, 'This is unusual, the scarred areas have reduced, look at all of the new tissue growth'. This was all we needed to know. My wife and I were absolutely overjoyed and thanked God for our daughter's improvement. Rachael has not looked back since this ordeal. She has not required surgery and over the years we continued to apply topical dimethyl sulfoxide (DMSO), which has significantly softened her scars and maintained her flexibility. Rachael emerged from this ordeal as an extremely energetic and determined young lady. Her ability to overcome obstacles is one of her greatest asset.

During my review of the literature, it was evident that HBOT was used throughout Europe and America with incredible success in treating what appeared to be an ever growing range of conditions, including burns, chronic infections, multiple sclerosis, closed head injury, stroke, fracture repairs, and more.

I discovered that there were even several limited studies on spinal cord injury, including an Australian study back in the 1970s. This study identified the merits of hyperbaric oxygenation and recommended a national study for its application as an early intervention for spinal cord injury. This recommendation was never followed up, and so there has been no further Australian initiative for treating spinal and related conditions with HBOT.

My initial thought was that perhaps the 'mechanisms' associated with the clinical effects of HBOT might have a role in the clinical management of patients with acute and chronic pain due to disc prolapse, failed back surgery and spinal cord dysfunction. Little did I realise that the inclusion of HBOT would completely revolutionize the way in which spinal and related disorders would be clinically assessed and treated.

Melbourne Hyperbaric and Spinal Rehabilitation Group is the first facility within Australia to offer comprehensive Hyperbaric Medicine as an adjunctive measure in the management and treatment of degenerative spinal, neurological and vascular related disorders.

Hyperbaric Oxygen Therapy was implemented in 1996. Since its introduction, we have now performed in excess of 60,000 separate chamber treatments. The impact of HBOT coupled with assertive physical therapy has clearly demonstrated that complex illness including spinal and related neurovascular disorders can significantly influence greater success outcomes.
Phillip, a patient with advanced diabetic gangrene of the foot, was recommended to our HBOT services.
I had previously treated this patient for diabetic related gangrene of his ‘other’ leg some three years earlier.
With aggressive HBOT combined with appropriate medical management his condition resolved without loss
of limb or any surgical intervention. His ‘bad’ leg and foot have remained stable for this entire period. Phillip’s
story is unfortunately typical of many diabetic individuals who fail to maintain adequate management of their
condition. Eventually there is another episodic break down. In Phillip’s case it was the other foot, or the ‘good
side’.

Now an important event in Phillip’s story and my own occurred at the time that I first treated Phillip—Medicare
in Australia changed its funding policy interpretation. And I do mean policy interpretation given that even
to this day the established 1996 Federal policy under Medicare states that if the HBOT facility is a non-hospital
based facility, then reimbursement is based on HBOT being provided by a registered doctor. This means that
the patient receives entitlement under the billing of a GP for an extended or prolonged consultation. If the
patient requires several hours of HBOT each day, then the consultation is reimbursed as repeat consultation
with appropriate documentation and referrals sent to Medicare.

The requirement that a doctor be in attendance at each HBOT consultation for a patient to attract some form
of Medicare reimbursement differs from every other country world-wide. It is not the recommendation as set
out in the guidelines of the International Standard for Hyperbaric Medicine. The International recommendation
for HBOT is that any approved condition should receive full reimbursement under medical referral.
Furthermore, it recommends reimbursement for the provision of HBOT requires no greater than a registered
nurse or HBOT technician.

When the ‘policy interpretation’ changed in late 1999, our five attending and fully-supervising HBOT GPs were
suddenly and without notification reimbursed for the lowest possible consultation—that is, Level A which is
a short five to eight minute medical consultation.

We have a multitude of evidence where Medicare offices under the direction of the Health Insurance
Commission (HIC), the judicial body of Medicare, changed the level of professional service provided by
the medical doctor and changed the charge code to the lowest possible charge, reimbursing the patient
the lower consultation fee. This constitutes fraud! When our consulting patients confronted the offending
Medicare offices, Medicare representatives denied changing patients Medicare slips. And when a formal
complaint was made, the HIC quickly stepped in and attempted to bully us into a position of only accepting
the lower Medicare consultation rate.

This meant that regardless of the doctor being in attendance with the patient for the entire period of the
HBOT (that is, three to fours hours of each day a patient attends), the patient would only be reimbursed a
short five to eight minute consultation. This was untenable for both our patients and our ability to sustain the
high cost associated with employing medical doctors to provide the HBOT service. Doctors were dismissed
and patient attendance was severely disrupted, a recipe for disaster but a desired outcome for Medicare and
the HIC.

To this day Australia differs from the rest of the world. As mentioned, any approved condition is entitled to
receive Medicare funded HBOT. Australian legislation continues to state that reimbursement for a non-hospital
facility requires a medical doctor’s full attendance, but Medicare will only reimburse for a short consultation.
Formal complaints and appeals to the appropriate government regulatory bodies, even the Australian
Competition and Consumer Commission, fell on ‘deaf ears’ and there is absolutely no support for our patients
or the plight of HBOT service availability throughout Australia. We finally had to give up on the idea of having
doctors perform the HBOT service.

For another slap in the face, the Medicare Services Advisory Committee (MSAC) has recommended cutting
back the conditions approved under Medicare reimbursement. I have no doubt that the HIC was fuelled by
self serving bodies interested in limiting the expansion of private non-hospital based HBOT facilities.

But let’s get back to the story of Phillip, a patient with a history of gangrene and a history of successfully
responding to hyperbaric oxygenation. Given the ‘policy interpretation’ of the HIC, his new gangrene
condition was not entitled to receive any form of Medicare for HBOT by attending our private facility. For convenience, Phillip was admitted to a large public hospital, yet this hospital did not have a HBOT facility. Phillip requested a transfer to a hospital with HBOT as he was very keen to get his condition under control and was confident he would respond quickly under HBOT management, as he had done so previously.

Unfortunately, the issue of transferring the patient to another public hospital with a HBOT facility was met with ‘policy’ objection because the public HBOT hospital did not have an available bed. The ‘current’ funding position in Australia is that if the HBOT hospital does not have an available bed then the patient must be transferred as a ‘day patient’ from the non-HBOT hospital to the HBOT hospital. This means that the non-HBOT hospital is billed the expense associated with treating and transporting the patient to the HBOT hospital. The bottom-line is that this represents a considerable loss of funds for the non-HBOT hospital, and yet again a conflict of interest emerges.

This was Phillip’s dilemma precisely: the non-HBOT hospital he was admitted to ‘refused’ to cooperate and refer him as an attending day patient stating every possible reason for the lack of referral including the standard line that the process was under ‘review with the hospital board’. Phillip remained without appropriate HBOT for an additional ten days. He continued to meet medical objection even though the HBOT physician from the public HBOT hospital visited Phillip and maintained that his condition could be appropriately treated given his past success with HBOT.

The medical politics that emerged and the opinions by all were simply overwhelming for Philip and his family. His condition continued to deteriorate and he did not receive HBOT. Two weeks later, under considerable objection by the hospital medical staff, Phillip got out of bed, hobbled around to the hospital reception and discharged himself as a public patient. He got into a taxi and went to a private non-public hospital with a HBOT facility and admitted himself as a private patient.

Phillip’s condition was again successfully treated with HBOT combined with appropriate surgical intervention. Unfortunately he lost a significantly greater region of his foot as a result of not having had an opportunity to have the medically referred implementation of HBOT at an earlier date.

The plot of medical reimbursement thickened because the other interesting issue that emerged from Phillip’s ordeal was that the private non-public HBOT hospital was reimbursed at a considerably lower rate than the public HBOT hospital. Phillip was requested to contribute to the additional costs associated with HBOT beyond his Medicare reimbursement.

Phillip is my father-in-law. Hospitals generally maintain that they have lengthy waiting lists and it often takes months before a new patient can be accepted for appropriate HBOT. But if the patient’s condition is like my father-in-law’s (peripheral vascular disease with associated gangrene complications), the patient does not have several months to wait before commencing HBOT. The patient will probably lose his or her leg, and possibly life, due to systemic poisoning.

It is bizarre to consider that if a patient attends a fully private, non-hospital based facility, receives HBOT and appropriate care, stabilizes the condition without the loss of limb or life, this same patient is not at all entitled to receive funding for HBOT.

The view of Melbourne Hyperbaric and the Spinal Rehabilitation Group remains that the health of the patient cannot wait for the decisions of bureaucrats and politicians. We remain focused on the individual needs of each consulting patient and will continue to offer the best and most affordable treatments, including Hyperbaric Medicine.
Chapter 10.
Spinal Cord Injury

The final frontier in the treatment of complex spinal cord and neurovascular injury is focused on ‘repair and functional restoration’. This involves the use of growth factors to promote axonal sprouting, activation of idling and non-functional neurons whilst promoting new capillary formation (or neovascularization) of damaged areas. Research efforts to bridge spinal cord and brain cell lesions are also underway experimentally, using transplanted tissues and bridging devices.

Developing biotechnology and DNA restructuring show incredible promise, but the exquisite topographic organisation of the ascending and descending nervous system pathways, including the brain and spinal cord, provide an extremely difficult hurdle to be overcome. Success in these reconstructive efforts will overlap, and the best outcome for the patient will be the capability to improve ‘neurovascular’ support into the damaged scarred regions.

The extent of neurovascular deterioration (or scarring) can be significantly diminished with early and continued implementation of Hyperbaric Oxygenation Therapy (HBOT). HBOT will provide a fertile neurovascular platform for emerging stem cell implant procedures and techniques using DNA restructuring. The dynamic impact of these and future procedures depend upon the integrity of the underlying supporting neurovascular bed.

HBOT is not promoted as a ‘cure’ or recommended as a stand alone treatment, and it is not the ‘missing link’ in spinal cord injury. But it certainly has a major role in developing treatments for spinal cord and brain injury. HBOT combined with appropriate physical therapy and the emerging frontier of biotechnology restorative medicine will radically alleviate the plight of those suffering from spinal injury and numerous other forms of crippling neurological and vascular disorders.

The Story of Peter, 39 years old
C6/7 Quadriplegic

Peter suffered a C6/7 dislocation during a car accident in 1994. Surgical reduction and fixation of the dislocation immediately after the accident provided limited return of function. He has made partial recovery to his upper arms and hands enabling him to operate a wheel chair, but with difficulty.

MRI investigation before commencing treatment with HBOT confirmed severe spinal cord injury at the level of C6/7. A large atrophic T1 hypo and T2 hyper intense lesion in the cervical cord consistent with post traumatic ‘syrinx formation’ extending from the level of C6 to T1.

Accompanying medico-legal reports supplied by Peter confirmed that ‘syrinx formation associated with post traumatic cord injury, is a common cause for further deterioration in the neurological status of a quadriplegic’. Continuing neurological deterioration warrants further invasive surgery.

Peter commenced daily HBOT and physical therapy in July 1999. Change in his condition was extremely slow but consistent given that his injury occurred in 1994 with fixed deficit for many years after.
Peter states:

The first thing both my wife and I noticed was that my energy levels had gone up enormously. Before I started treatment I had extremely limited ability to get myself around in my wheelchair. I could only go so far and then needed a rest. I had always tried to push a little bit further, but I could never break through that barrier. Usually I would require at least three five-minute breaks to complete a two kilometre block. This has now steadily improved and now I can cover the same distance in a shorter time and without even a break.

Also my skin has improved a lot, it doesn’t feel as dry and looks more natural. When I get my daily stretch exercises done I now know where my legs are with my eyes closed. Before treatment I had absolutely no idea where any part of my body was below the middle of my chest. You could place my foot up over my head and I wouldn’t even know! I can also now feel my muscles stretch and now have some sensation in my legs, stomach and back region. My back has become a lot stronger and I can now pull my stomach in and upwards towards my ribcage. I can also contract my buttocks. I couldn’t even feel these areas let alone move before starting treatment. I can now sit and manage myself in my wheelchair and transfer a lot better because of improved pelvic and abdominal control.

During January 2000 my reflexes in my knees came back. This has been confirmed with a number of the insurance doctors evaluating my progress. About 18 months after of my accident I was required to be assessed by independent medical doctors for the insurance company. One of the tests during this insurance assessment identified which reflexes were present and which were completely gone. The reflexes in my knee were one of the groups that were completely absent. Now they have returned.

The other major improvement that I have had is that I can now tolerate the hot temperature a lot better. With my sort of injury there is difficulty in my body adjusting to temperature changes. In the summer of 1998/99 I would have to go inside an air-conditioned room when the temperature got to about 25 degrees Celsius. This past summer in Melbourne with temperature up around 37 degrees, I have been able to cope without difficulty. This has given me a lot more quality of life because now I can go out with my family a lot more than before without having to worry about getting overheated.

The latest improvement is that I am getting some more feeling in my big toe and the lower part of my right leg. I can feel the muscle tighten in my right calf when I try to contract it. A lot of people comment that I look really well and healthy.

Comparison MRIs of Peter were performed at different facilities and each MRI confirmed traumatic cervical spinal cord involvement including mild atrophy of the mid and upper cervical cord, focal expansion spanning from C6 to T1 levels due to bilocular T1 hypo and T2 hyper intense lesion in keeping with hydromyelia. T2 hyper intense signal extends into the proximal thoracic cord centrally in keeping with myelomalacia/gliosis, down to the T2 level. Peter has continued to experience dynamic clinical changes and his medicolegal reports, including comparison MRI reports, indicate that his condition remains ‘stable’.

The Story of Julie, 20 years old

C5/6 Quadriplegia

Julie is another spinal cord injured patient attending hyperbaric therapy and spinal management. She suffered C5/6 dislocation that resulted in quadriplegia. Julie’s injuries were caused by a severe motorcar accident that occurred in April 1998. She received intensive care for multiply injuries for an eight-week period. C5/6 spinal fusion was performed with an anterior spinal fusion supported by a three screw-fixing device.

MRI investigation when Julie commenced treatment revealed realignment and fusion at the C5/6 level. Screws placed in situ at the C5 and C6 were observed extending from the posterior aspect of the vertebral body into the central canal at both levels, resulting in significant central canal compromise and causing obstruction of the cerebral spinal fluid with imposed cord rotation. The cord adjacent to the C5/6 fusion had deteriorated with T2 hyper intensity changes (compressive myelomalacia) of the normal cord signal.
Julie’s progress prior to commencing HBOT was minimal and with residual ‘fixed neurological deficit’. She suffered significant sensory loss from the neck down with extremely limited and minimal motor ability of her upper arms, and minimal response and movement to both her thumb and forefingers. Her legs suffered complete loss of motor function and normal sensory response. She complained of a burning sensation across her hands, groin, upper posterior thighs and calf regions.

Treatment included HBOT coupled with assertive physical therapy and high frequency electro-acupuncture directed to the injured site and distal affected areas, including both upper and lower extremities.

Julie began to experience improvement with both bladder and bowel function within six chamber sessions. She reported movement of the toes in her right foot, and the reduction of a pressure sore that had been of concern to her for several months. After her eighth session, Julie reported that she could feel her stomach muscles contracting and began experiencing sensation under her rib cage and was able to ‘breathe more easily’. She also recorded some improvement with movement of both her fingers and thumb.

By the tenth session she reported improved circulation to her legs and feet, her skin was no longer not as ‘blotchy’ as before treatment, and her wound had begun to disappear. She also stated that her pressure sore no longer required constant attention and dressing.

By the twelfth session, improvement to her stomach muscles enabled her to breathe easier still and her pressure sore was half the size it was before commencing treatment. She also reported that her legs and feet were not as purple or as cold before.

Further improvement of her stomach muscles and in her bowel and bladder function was noticed by the fifteenth session. Not only had her breathing improved considerably, she was also able to exert some force with a cough. She experienced enhanced extremity circulation, and her pressure sore had almost completely gone. She reported improved fine motor capability of her thumbs and forefinger, and is better able to support herself with her upper arms. Her spasms, which were previously uncontrolled and uncoordinated, now mimic movement. She reported that her foot moves upwards and her leg follows as if attempting to perform the movement voluntarily, where previously the spasms would result in her leg going straight and shaking violently.

By session 25, Julie reported continued progress with extremity limb function. She could slightly tense her left calf muscle and contract her right thigh, calf and buttock muscles. She could feel her lower spine muscles contract slightly and experienced improved sensations throughout her body. By session 29, her ability to cough was 10 times stronger than when she exerted a cough in her fifteenth session.

The following is extracted from Julie’s 1999 and 2000 diaries in which she noted observations and impressions of HBOT between her thirty-fifth and seventieth chamber sessions. Each session lasted for 90 minutes

**Sessions 35 to 40**

*Back muscles feel stronger. My stomach muscles and toes are showing slight improvements. Sensations are beginning to change. My legs feel the urge to move. When I was doing my bed transfer this morning, my leg felt as though it was ready to move. This doesn’t happen all the time.*

*I can begin to clinch a fist with my left hand. Movements in my little finger, thumb, pointer and middle fingers have improved slightly. People around me are beginning to notice changes. They are telling me I look healthier, and are beginning to notice the improvement in my hand function. I have more control. My wrists are stronger and movements are gradually coming back. My right leg is showing greater improvements than the left. The circulation has increased. The right leg tends to be warmer.*

*All my toes on my right foot moved. This is not consistent. My big toe and second toe move consistently. Thigh and calf muscle flicker consistently on my right leg. On my left leg my big toe and little toe are beginning to move more. I’ve been feeling tired when I come out of the chamber. I’ve noticed an increase in neurogenic pain, this mainly occurs in my feet at night- time. Foot rotations seem to help. Spasms have decreased. When I bypass the catheter the sensation beforehand is stronger.*
**Sessions 41 to 46**

Last night all my toes on my right foot moved, the muscle underneath moved also. It was a strong movement it happened consistently until I fell asleep. When they moved up I could feel an upward pull in my ankle and lower leg muscles. My toes on my left leg all moved, they had a strong movement. Bev woke Michael up she was excited.

I can feel my pelvic floor muscles. I can squeeze them the tiniest bit. Stomach muscles are becoming stronger. Movement was consistent up until yesterday. My big toe and little toe move and the two toes next to my little toe twitch. I can control the twitch. On my right foot my big toe, second toe and little toe move. The third and fourth toes move also, not as much as the others. My right leg muscles tense consistently but the strength to which they tense varies. My left hand can squeeze more. The warmth in my legs is the significant change. Carers have noticed they aren’t as cold anymore. This shows an increase in circulation.

This morning I went to the toilet myself! I took senokot and coloxyl last night the same as I do every night before a bowel morning. When I woke this morning I could feel I needed to go to the toilet. It’s being so long since I felt that sensation that I ignored it and still had my carer use a suppository. Five minutes later I felt a strong urge to go to the toilet. The suppository didn’t contribute to this; there wasn’t enough time for it to take effect. It came away separately. Wrist flexion has come back on my right hand. It has been getting stronger. After spasms in my feet, I can move my foot down slightly. This isn’t consistent, however it is happening more frequently.

**Sessions 47 to 54**

Calf and thigh muscle still tense slightly. Spasms are now becoming a partial movement, this happens frequently. Mum noticed the tone in my legs, when she did my exercises. She noticed they are beginning to become firm and they have weight in them now. Pelvic floor muscles are still returning slightly. Stomach muscles have improved. I can breath in easier.

Circulation is continually improving. Finger movements on my right hand have improved, they all move except for my pointer finger, which the tip of it moves slightly, this is not consistent. The movements on my left hand are not as strong but I can begin to clinch a fist. I have noticed an improvement in stomach muscles. I am now able to do twenty sit-ups opposed to ten. Wrist flexion on my right hand is improving.

This morning I woke whilst I was still in bed, my bowel was ready to go off. This was about five six o’clock and everybody was still in bed asleep. I tried to wake Mum, but couldn’t. I was able to stop my bowel from going off. I don’t know how I was able to do this, I just was. I’m not sure if it was controlled or not. My pelvic floor muscles are very weak and not consistent.

My muscles are slowly returning e.g. stomach, calf and thigh muscles. My legs are gradually regaining tone and my right leg muscles are still tensing slightly. All in all I am noticing slow gradual changes. My toes move continuously on my right foot. My skin has improved dramatically, it isn’t blotchy and I have not any problems with pressure sores. This is a significant indication that circulation is continually improving. Central abdominal muscle is returning slightly. Pelvic floor muscles are more noticeable in my buttocks.

**Session 55**

I have increased abdominal sensation. I have noticed more sensitivity. I can feel menstrual cramping. I felt as the sensation of needing to empty my bladder. This was strong and was not a spasm. Sensation is becoming stronger when I by-pass the catheter. The tone in my legs is beginning to become more defined. Right leg muscles are tensing slightly stronger and my legs have the urge to move they don’t feel as heavy. Wrist flexion in my right hand is consistent.

**Sessions 56 to 66**

Spasm is more a movement and after the spasm I was able to move my foot twice. The spasm was a quick, swift movement. My foot lifted up followed by my ankle then calf, next my knee and then my thigh. The sensation in my left leg and right foot has changed to slight tingling.
Increased sensation in bowels, I can now feel a push. Tingles in my feet. I have had more of an appetite over the past few weeks. My legs have been feeling heavy and tired. Circulation is continually improving. There has been an increase in spasms. Hands have neurological pain through the fingers and wrists. Pelvic floor muscles are still slight. Hand function is continually improving. I am able to use more hands rather than the tendisis grip. I can pick objects up easier. My shoulder and upper arms move more easily.

I have had the sensation that my bladder is full. This has happened twice. It is a strong sensation.

Sphincter muscles are becoming stronger. Bladder and bowel sensation is more sensitive. Calf muscle on my left leg has began to tense more firmly and when I tense this muscle I can feel the muscle at the base of my foot and ankle tense also. When I do this the top of my foot tenses. Tone in my legs is becoming more apparent. Circulation has improved and continues to improve. I have not had any problems with my skin, e.g. pressure sores and blotchiness.

Sessions 67 to 70

I have noticed an increase in spasm. Spasm is particular in the morning and in my legs rather than my upper body. Toe movement continues to improve. My legs have a heavy sensation and my ankles have a burning sensation.

I can control spasms at night more easily. My legs are starting to become restless. Bladder and bowel continue to improve. My hands have still being getting neurogenic pain in them. Finger movement on my right hand is consistent and gradually becoming stronger. I am able to tense my calf muscle in my left leg slightly more. I have not noticed a dramatic difference. My abdominal muscles are slightly noticeable; they are gradually becoming stronger. I am not noticing new improvements, however I have noticed that those already achieved are consistent and stronger.

Julie is still in the early stages of HBOT treatment. But the changes experienced to date are promising. They include the ability to ‘hold a pen and sign her name’. She also reports, ‘sensation to hot and cold water on her lower extremities’. These small but consistent changes have improved her quality of life, and it is reasonable to expect that she will make further gains with ongoing treatment.

The Story of Jason, 31 years old

L1/2 Paraplegia

On 9 June 2001, I injured my back in a motorbike accident when I hit a tree. I was diagnosed as ‘complete paraplegia’ due to a compression fracture and dislocation of my L1 vertebra, which is located in my lower back region.

I was told I would never walk again.

I also injured my right forearm with a compound and ‘non-healing’ fracture. I was told that I had ‘delayed union’ of the bone causing significant swelling of the arm and elbow, resulting in me being unable to place any weight on my arm because of the major pain.

Since starting Hyperbaric Therapy my arm has improved dramatically, both the swelling and pain have virtually disappeared.

I had my accident in country Victoria and was taken to a local country hospital where I was told that my spine had been severely damaged. I was told that I would have to be transferred to a larger spinal facility in Melbourne where I was examined and the grim news confirmed to my family and me was that I would ‘never walk again!’

I was immediately scheduled for spinal surgery on my back, with rods and screws to stabilise my spine. The doctors told me they were very happy with the surgery; however, my spinal cord had been significantly damaged and again I was told I would never be able to walk again.
I was paralysed from the waist down: no feeling or movement, no bladder or bowel control. The day after my back operation, I had a haemorrhage and needed a blood transfusion; the doctors also found that I had two large blood clots in my stomach. Over several days following I needed more surgery on my forearm, and eventually I was told that my arm was not healing correctly. I was told I had ‘delayed non-union’ of the bone. This was a very difficult time for my family and me. The following day my lungs collapsed requiring more medical attention. I felt that this was the last straw!

I had been unable to see my kids because of all of the tubes and wires hanging from me. I knew they were very upset about their dad being busted-up in the accident, but they would have become even more upset to see their dad in this initial state. Eventually, under a lot of persuasion from my wife and my parents, the hospital staff removed the tubes from my nose and stomach and finally, one week after my accident, I was able to embrace my kids.

After five weeks, I was transferred to another hospital where I commenced supervised rehab. Whilst at rehab I was able to visit my business, which gave me the opportunity to try some acupuncture, which was suggested might benefit. In fact, I began to get some feeling back into my stomach and into the middle and inside aspect of my thigh. My rehab doctors told me that this sensation was ‘coming from my abdominal muscles and not at or below my injury level’.

Whilst at work I read about Hyperbaric Medicine and the Spinal Rehabilitation Group and their work with other complicated orthopaedic and neurological conditions including spinal cord injury. In fact I read about one of the quadriplegic patients who after six years of no sensation or movement began to get a return after starting Hyperbaric. I didn’t know what to expect but I needed a miracle!

I was recommended a complete reassessment of my spine that included new MRIs of my full spine and brain (I hit my head during the injury and suffered memory loss). This was the first time my brain and the rest of my spine had been MRI-ed. Blood tests were ordered to rule in or rule out the possibility of underlying infections that could affect my recovery process. Blood tests included Chlamydia, Epstein Barr virus, Cytomegalovirus, Mycoplasmas, Rickettsia and others. I tested positive for several, for which I received appropriate treatments.

Perhaps the most shocking news was the fact that the new MRIs revealed that the surgery performed had ‘fixed’ my T11, T12 and L2 and L3 vertebra but not the collapsed L1 vertebra, which now had two fragments that had apparently fused but were visibly compressing into my spinal canal!

The MRIs showed that I had also developed a large ‘hydromyelia’, often called a syrinx, which means I had spinal fluid accumulation into my spinal cord that was extending from the T11 level down. Apparently, the syrinx can further deteriorate and cause more spinal cord deterioration and problems. They are mostly surgically drained but apparently they usually reappear.

I must admit I was very upset by this news given that I was told by the surgeons that they had ‘stabilised my L1 vertebra’ and were ‘very happy’ with the outcome of the surgery. Obviously I am not!

Dr Hooper explained in detail the possible mechanisms of how the Hyperbaric Therapy coupled with medication and physical therapy could influence my spinal condition. He stated that I was still in the early stages of my injury and classified me as a ‘fresh injury’. I had nothing to lose and everything to gain!

I have had about 20 hours of chamber sessions so far. I can now move the muscles in my thighs and calves. I have good feeling down to my knees, although below my knees the feeling remains numb.

I can now lift my knees to my chest whilst I am sitting in the spa. When I started HBOT, initially I was able to manage about six knee lifts and I would be exhausted. Now I can lift them between 70 and 80 times each!

My toes are moving slightly but are definitely moving. I can also now move my legs when I am lying down and the best thing is that I can slowly ride my exercise bike with my feet strapped to the pedals. The exercise bike is one that I drive by turning the pedals with my arms, but I am now able to push with my legs. My legs feel very strong and I know I will continue to improve.

I believe this treatment has given me hope. I am convinced this treatment will benefit many other spinal cord victims. My family and I are convinced that I will continue to improve; and obviously to walk is my ultimate goal.
After each chamber session I receive acupuncture needling with electrical stimulation, along with B6/12 injections, and I am taking a high potency amino acid antioxidant preparation. My legs are becoming stronger each day, and my muscles in my thighs and calves have become more defined and finally I see hope of a better future.’

Jason now has limited walking ability with the use of calipers.

The Story of Anita, 30 years old
C5/6 Quadriplegic

Even though a horse riding accident left her paralysed, Anita believes miracles can still happen.

Anita has made incredible progress from her injuries. She has worked extremely hard undergoing daily intensive physiotherapy and massage. She also maintains an amazing sense of purpose and is a tower of emotional strength and mental determination: ‘No one ever thinks it’s going to happen to them. It’s an accident and you have to get on with life.’

Anita has minimal financial support and is cared for by her parents and friends. Despite the difficulties, financial and medical, Anita does not give up hope. It is hope that propels her to believe she will continue to improve regardless of conservative medical opinion constantly telling her that there is no hope or grounds for improvement.

Comparison MRIs taken prior to commencing hyperbaric revealed a reduction in the extent of cord edema (swelling) when compared to the MRIs taken immediately after surgical reduction and fusion. This was enormously encouraging to Anita and her family, and was testimony to all of the good work and discipline that she had undertaken.

Anita lives in Perth on the west coast of Australia. The Melbourne Hyperbaric and Spinal Rehabilitation Group is located in Melbourne on the east coast. Hyperbaric funding is limited in Australia with no immediate provision for spinal cord injury. Anita had to make the journey to Melbourne to get this treatment.

Anita attended for a month and received four hours of HBOT daily combined with direct acupuncture needling (whilst in the chamber), and injections. She reported:

**Week 1 (Initial 20 hours)**
- Initially very tiring, slight ear problems and slight headaches.
- Improved lung and diaphragm control (interesting given the fact that I was told I had lost diaphragm function!).
- Changes in movement pattern and control in my fingers and wrists.
- Acupuncture into the hands produced slight movement in the fingers and when concentrating my range of movement increased.
- Body temperature irregularity. Increased tone in both legs; and feet are more responsive to touch. Body undergoing many changes and reactions to treatment.

**Week 2 (20-40 hours)**
- Feeling more body changes in regards to position, movement and comfort. Sleeping position has changed.
- Sessions in the chamber no longer as tiring, not feeling as cold as before.
- Energy levels has improved dramatically, not as tired, going out after treatment sessions.
• Morning spasms (dysreflexia) have diminished and do not last as long.
• Feeling tingling sensations throughout entire body, intense feeling of discomfort in my bum bones and down into my legs.
• Past two weeks noticed increased sensation on both forearms and into hands, which have become extremely sensitive to touch; finger dexterity is more defined and has become more supple with different fingers activating at different times; right thumb activity is more pronounced and twitching in the left thumb has increased.
• Both legs and feet have been feeling hot internally; sitting in the wheelchair has become uncomfortable even across my whole back as my body feels like it should be standing.
• Trunk control has improved making transferring easier; I am now able to pull my stomach muscles in.

Week 3 (40-60 hours)

• Morning spasms have diminished dramatically.
• Improved control and movement of hands, wrists and fingers.
• Strange body sensations, feeling buttock and leg bone pain.
• Arms and legs feeling warmer internally.
• During morning shower, legs have straightened from a slight flexed position
• More aware of body position whilst in bed; able to sense when leg position is being altered and moved back to its original position!
• Energy levels continue to improve, not as tired with chamber sessions becoming easier and easier.
• Body temperature has improved and regulating a lot better; not feeling always cold.
• Episodes of feeling stabbing pains down into the right forearm and then later feeling all tendons in my forearm twitching down into the fingers.
• Experiencing a dull sensation in my legs; and my left foot reacts with direct acupuncture needling.

Overall

• Higher energy levels, better temperature control, and able to breathe deeper.
• Transfers are easier as I am able to assist with the transfer; trunk control has improved and overall body has become more supple.
• Fingers are definitely more active, supple and responsive.
• Arms are stronger and have greater directional control; sensation and feeling in my arms and hands have improved dramatically.
• Muscle tone in the legs has increased.
• Posture in the chair is better; more awareness of body position and comfort whilst in the chair or bed.
• Increased all over body sensation especially along my lower back and buttock regions,
• Able to fully stretch fingers straight; when relaxed fingers are now in a more neutral position and definitely not as clawed.
What happens to the damaged cord?

The illustration below is of an injured spinal cord and shows:

1. Vascular hemorrhage represented by large fluid filled vacuoles.
2. Bright signal indicative of swelling and edema obstructing vital oxygen efficiency and promotion of scar tissue.
3. Intact portion of the damaged cord with significant non-functional neurons and neurovascular compression.

Hyperbaric Medicine has gained considerable acceptance and respect in the management of brain and related injuries. The application of hyperbaric oxygenation in spinal cord injury is similar to its role in treating stroke and brain injury. Reducing edema and correcting cellular ischemia are key factors in the application HBOT in the treatment of spinal cord injury.

Neurosurgeon Kewal K. Jain, in his *Textbook of Hyperbaric Medicine* (1995) provides a detailed explanation of the effectiveness of Hyperbaric Oxygenation in treating traumatic spinal cord injury, which vary from partial cord compression to complete severance of the cord, partial obstruction of the supporting neurovascular mechanisms to complete neurovascular compression.

Traumatic myelopathies (abnormalities of cord function) are characterized by ischemia and edema, which may lead to a cascade of degenerative effects. Vasoparalysis of the cord means abnormality with constriction of the blood vessels supplying vital blood flow through the cord. Compromise of the microvasculature of the cord results in decreased blood flow and oxygen supply to the gray matter (deeper structure) of the cord, with surrounding hyperemia (increased blood flow) of the white matter, and associated swelling and edema.

For HBOT to have the most dramatic effect on spinal cord injury, Jain states it is best applied within two to four hours and no more than 12 hours after direct injury. He refers to this period as the ‘Golden Hour’, a period that relates to the transitory phase in the progression of the pathophysiological sequence of events in spinal cord injury resulting in permanent anatomical disruption.

Jain further states that Hyperbaric Oxygenation within this initial period, even before surgical fixation, will have a significant impact on both the short and long term outcome for the injured patient.
There are two major effects of spinal cord injury:

- Anatomical disruption of the cord with immediate secondary vascular compromise following venous stasis (slow blood flow), edema (excess fluid in the tissues or cavities of the body) and hypoxia (oxygen starvation). These result in a cascade of inflammatory degenerative effects, which occur at the site of the injury and usually spreads down the cord.

- Functional loss and paralysis below the level of the cord injury.

Surgery is usually performed in an attempt to reduce the displaced vertebral segment. Often, with severe impact trauma, the vertebral body may fracture with bone fragments displacing into the spinal cord canal and contributing to compressive changes of the cord. Most surgery involves reduction of the displacement followed by fixing and/or fusing the bone structure using bone grafts, screws, rods and other metallic fixing devices.

Surgical stabilization is generally performed within hours of the trauma. CT Scan and, more recently, Magnetic Resonance Imaging (MRI) investigations are performed as a post-operative measure to ensure reduction of the displaced segment. However, surgical reduction may contribute to long-term compressive effects of the already damaged cord.

This following statement may rock the boat of established medical convention. When many spinal cord injured patients, including para and quadriplegics, are reassessed with additional MRI investigations, a high percentage of patients have contributory cord compression due to the fixing devices. Screws that have been inappropriately placed, or have moved over time, can project through the vertebral bone, causing further canal compromise and stenosis resulting in laceration, cavitation and other cystic changes of the cord.

Bone grafts, used as a fixing measure, are often placed within the central canal and may reduce displacement of the offending vertebra, but may also contribute to compression of the cord and exiting nerve root structures. Forced removal of displaced screws may cause further spinal cord rupture because cord material may be extracted along with the screw.

Spinal cord neurovascular compression differs from actual and total severance in that many cellular structures remain intact but are non-functional. The degree of cellular damage varies within the damaged zone, where many neuronal cells continue to survive. This is reinforced by the progressive return of certain functions of spinal cord injury patients. Many patients who have felt as though their spine was completely disconnected, in time have stated that there is some element of sensory and functional return.

Progressive improvement of the patient is likely due to ‘idling or inactivated’ nerve cells eventually responding as the degree of cord edema and ischemia resolves. Other patients are not so fortunate. Spinal cord degenerative changes progress and compound further deterioration. This usually results in atrophy of the limbs, cold extremities, and a predisposition to multi-level circulatory problems, including ulcers and local and systemic infections.

**Spinal Cord Injury and Dimethyl sulfoxide**

In the *Annuals of the New York Academy of Sciences*, J. B. Geldert and others published the results of an animal study conducted to determine the therapeutic effects of dimethyl sulfoxide (DMSO) and hyperbaric oxygen therapy (HBOT). Geldert et al performed spinal cord transection in two groups of animals: one group was exposed to HBOT and treated topically with DMSO; while the second or control group did not receive either HBOT or DMSO. The animals were then examined at autopsy between 60 and 120 days after treatments, with investigations including transmission electron microscopy.

The study demonstrated that the treated group had ‘significantly less degeneration’ and post-lesion naked axons. Normally the growth of axons is completely retarded within several days of being severed. Geldert reported benefits of DMSO and HBOT, as evidenced by markedly less cavitation and degeneration of the cord when compared to the control group.

Geldert identified that the ‘reduction of microcirculation decrease oxygen and cellular ATP levels result in massive platelet aggregation within the microvasculature’, which further compromises the blood supply to adjacent neural tissue and causes eventual cell death. Geldert demonstrated that the inclusion of HBOT and DMSO protected
axons and their myelin sheaths, reduced edema, increased blood flow, and showed reduced cavitation and scar formation and enhanced return of function.

As free radicals are produced by all aerobic tissue and highly toxic to living cells they are rapidly eliminated by normal enzymatic activity. Following spinal cord injury, altered metabolic activity may increase free radical production resulting in cell death and release of lysosomal enzymes. DMSO has been shown to stabilize lysosomal membranes and scavenge free radicals; it may function in these capacities to reduce neural tissue destruction following injury.

Studies indicate a positive synergistic effect in combined HBO / DMSO treatments. Geldert demonstrated 60 per cent effectiveness in acute transected animal spinal studies.

To summarise:

- For axons to grow through an injured area they must be provided with a compatible biological environment as found in viable neuropil, which is the network of nerve fibres along with synapses and glial filaments.

- Cavitation formation seems to be a result of the destruction of microcirculation, which results in ischemia, hypoxia, and eventual cell death with subsequent release and / or production of substances that accelerate the demise of surrounding neural tissue in the spinal cord.

**Advances in the Treatment of Spinal Cord Injury**

Omentum transposition is one of many new advances giving doctors additional measures to close the gap between incomplete and partial recovery of spinal cord injury. In the abdominal cavity, there is a membrane called the omentum, which hangs in front of the abdominal organs and acts as a protective buffer. The omentum is extremely rich in the supply of neurotransmitters, the chemicals that carry nerve impulses between nerve cells. It is also rich in the supply of neurovascular factors that foster both blood vessel and nerve growth.

Surgeons have developed techniques to modify and lay this membrane directly over the damaged cord structure while still attached in the abdomen. The benefit of this procedure is that blood vessels from the omentum will grow directly into the spinal cord, supplying a potentially rich source of neurotransmitters and growth factors. This bridging technique has also been adapted for embryonic stem cell transfers for stroke and brain injured and degenerative upper motor neuron patients.

Hyperbaric oxygenation has been piloted with omentum transposition. Rainer Neubauer, in a paper titled ‘Cerebral Oxygenation and the recoverable brain’ (1998), states that HBOT provides an excellent screening technique, since those patients who improve after receiving HBOT are likely to improve after this and related cell transplant surgical procedures.

**Embryonic Fetal Cells**

Another medical advance is the technique of grafting embryonic fetal cells into the damaged regions of the spinal cord and brain. In 1992, Florida scientist Dr Douglas Anderson and his colleagues at the University of Florida, repaired damaged spinal cords in cats by implanting neurons from cat fetuses. Forty per cent of the graft recipients regained some walking ability; the cats that received grafting within a short period after the spinal cord injury responded the most favorably.

Anderson reported that the implanted cells may restore essential myelin insulation around the axons and provide essential neurochemical growth factors to assist with reproduction and growth. He also stated that this technique may one day replace ‘screw and plate’ grafting techniques.

Dr. Paul Reier, also from the University of Florida, asserts that many spinal cord injured patients suffer cord trauma but unless the injury is extremely severe, many fibers are spared. For Reier, gaining many ‘little victories’ with new techniques are not only possible, they are preferred. ‘If you can restore bladder or bowel function, relieve spasticity, restore sex,’ Reier says, ‘those gains can bring huge improvements in the quality of life.’

Although the human spinal cord has an estimated 20 million axons, only a fraction is necessary to restore significant function. Dr. Wise Young, neuroscientist at New York University, has said that surgeons sometimes ‘remove a tumor from the spinal cord that destroyed 90 per cent of the axons, and the patient walks out of the
hospital.’ But Anderson believes that smaller functional improvements are realistic rather than dramatic ‘rising from the wheel chair’ recoveries. The good news, as stated by Reier, is that ‘human embryo cell transplantation will happen and it will occur sooner than you think.’

**Stem Cell Transplant**

According to data presented at the 68th Annual Meeting of the American Association of Neurological Surgeons in San Francisco, California, studies involving laboratory rats injected with embryonic stem cells as a treatment for spinal cord injuries showed improved lower extremity function than control animals.

Dr. Todd J. Stewart, from Washington University School of Medicine in St. Louis, Missouri, reported at the meeting that he and colleagues delivered controlled contusion injuries to the spinal cords of 40 rats, causing complete initial flaccidity followed by some recovery at three weeks.

In this randomized control trial, researchers allocated one group of injured rats to receive approximately 1 million embryonic stem cells by injection into the spinal cord at nine days post-injury, and the other group to receive standard or no treatment. The team compared the expected return of function in the control group with that seen in the treated rats. At two weeks post-transplant the treatment group showed improvement in lower extremity function. Dr. Stewart told Reuters Health in an interview during the meeting, that ‘this improvement continued and at six weeks the rats were able to walk but displayed much spasticity. Conversely, functional improvement in the control group maximized at three weeks post-injury and did not improve beyond expectations for this type of spinal injury.’

Additional analysis of the treatment group indicated that the embryonic stem cells differentiated into oligodendrocytes or glial cells that wrap around and support axons in the spinal cord. According to Dr. Stewart, this caused myelination, which may be a partial cause of improvement. Still at the infancy of this research, Stewart and his colleagues are now researching the underlying mechanisms that may have caused the functional improvements in the treated rats.

**Inosine Stimulates Axon Growth After Injury**

Reuters Health reported research that involved treating rats with the purine nucleoside inosine after spinal cord injury caused uninjured nerve cells to sprout axons across the injury, according to a study published in the November issue of the ‘Proceedings of the National Academy of Sciences’ (1999).

After a study conducted by Dr. Larry Benowitz from Harvard Medical School in Boston, Massachusetts, and colleagues from Boston’s Children’s Hospital, Benowitz, in an interview with Reuters Health, explained:

> The cellular terrain of the spinal cord and particularly the white matter tract are generally seen as being highly inhibitory to growth. We thought the corticospinal tract would be particularly interesting... because in humans it’s the major pathway for controlling body movement, and it’s the loss of that pathway that has such devastating consequences.

His team made a lesion in the left side of the corticospinal tract of rats in the rostral medulla. A day later they equipped the rats with a mini-pump that continuously delivered either inosine or a control solution to the right side of the motor cortex. Fifteen days later, axons were labeled in the rats and the rats were then euthanased. In eight rats treated with inosine, hundreds of axons crossed from the uninjured side of the lesion to the denervated area. But in six rats treated with a control solution, axon crossing was limited, on average only 10 per cent of the number of axons in the inosine-treated animals.

‘We were delighted and frankly very surprised to see the amount of axon growth that we got,’ said Dr. Benowitz. Although they do not know how inosine works, studies in cell culture suggest that inosine may travel into the cell and stimulate the protein kinase, turning on a whole subset of genes required by the nerve cell to extend an axon.

The group saw an unprecedented amount of axon growth, but its functional significance is still an open question. Because the corticospinal tract in rats differs from humans in that it mainly controls only fine movements, Benowitz noted that, ‘we have to start doing some more behavioural work now to see how this will translate functionally.’
Injured Spinal Neurons Reach Out to Each Other

A paper published in *The Journal of Neuroscience* and posted on Medscape Wire (in January 2000) reported findings by researchers at the University of Pennsylvania Medical Center that injured spinal neurons establish specialised bridges to connect with other injured neurons.

Interestingly, the injured cells reach out only to each other and exclude healthy neighboring cells from the process. The bridges, called gap junctions, are commonly found among neurons during development but are rarely seen in the adult mammalian nervous system. The results suggest how connectivity between neurons in the spinal cord, and between neurons and muscle, might be re-established after peripheral nerve damage or spinal cord injury, areas for which current treatments are inadequate.

The re-coupling of injured spinal neurons by gap junctions is similar to the coupling normally seen among neurons in developing animals. Finding ways to recapitulate this developmental phenomenon is therefore an important part of future therapeutic efforts to rewire neurons and their targets after injury.

‘Our study shows that neurons establish connection with other neurons after injury by creating bridges called gap junctions,’ said Rita J. Balice-Gordon, PhD assistant professor of neuroscience and senior author on the study.

Gap junctions are induced after nerve damage and may mediate electrical and/or biochemical communication between injured neurons. The presence of gap junctions could affect either neuronal activity or the exchange of second messengers and other small molecules that in turn, could encourage neuronal survival and promote re-wiring after nerve injury.

The researchers investigated the motor neurons in the spinal cord, the cells that control the movement of skeletal muscles. Scientists know that motor neurons change their function or stop functioning and die after spinal cord injury, or during the progression of motor neuron diseases. Very little is known, however, about how motor neurons change after injury or whether and how normal function might be restored.

Hoping to gain insight into how spinal motor neurons change or cope after injury, the scientists severed the axons of these neurons in animal models. They then used glass needles connected to electronic recording equipment to listen to the injured neurons talking to each other. They also injected dyes into single injured motor neurons and looked for dye passing to other motor neurons. The researchers found that gap junction bridges connected the injured cells and that they established the bridges only among themselves, failing to connect with nearby healthy cells.

The scientists also examined the proteins used to build these bridges, called connexins. They found that the amount and types of connexin proteins present in the neurons did not change after nerve injury. This suggests that gap junction bridges may be present among normal motor neurons but are perhaps inactive under normal circumstances.

This is an important identification in the potential treatment of spinal cord injured patients. The ability of the body to reactivate dormant cells and innate processes is possible with success dependent upon firing these responses. We are convinced Hyperbaric Medicine has an essential role in the collective treatment and management of spinal cord injury.

Expectations of Treatment with Hyperbaric Oxygenation

The rationale and clinical usage of hyperbaric oxygenation has been detailed previously. HBOT used in the early stages of spinal cord injury is a proven rehabilitative measure, minimizing edema and the progressive ischemic changes associated with contusion.

But before embarking on a course of HBOT it is essential to establish the exact position and integrity of the spinal cord and surrounding structures. This usually means that current MRIs and possibly CT Scan investigation are performed to determine the structural relationship between the surgical fixing devises and the cord. Enhanced MRI also enables an accurate determination of secondary myelopathy degenerative changes of the cord.

Continuing compressive changes of the cord results in cord cavitation and a range of significant degenerative effects (myelomalacia) due to progressive ischemic effects and swelling. Deformity of the cord above the lesion can lead to upper spinal cord pressure, resulting in headaches and upper motor neuron signs due to obstructive
cerebral spinal fluid dynamics. Cerebral spinal fluid obstruction at the lesion site can occur due to the nature of the injury, and as a consequence of poor surgical fixation.

Destructive changes associated with bone and spinal cord injury accelerate apoptosis, which is the programmed cellular degeneration and cell death of an organism. Apoptotic bodies and DNA fragmentations are observed in virtually all avascular-ischemic cellular structures including brain and spinal cord. The presence of inadequate underlying neurovascular support and capillary dynamics, vascular compromise due to heavy steroid medication, fatty emboli due to elevated lipids presence of opportunistic antigen-antibody deposited in the vascular walls adjacent to the necrotic lesion enhance the rate of continued deterioration and prohibit cellular repair.

Hyperbaric oxygenation however raises the levels of oxygen saturation into hypoxic and ischemic tissue directly impacting the cellular apoptosis of the region. HBOT corrects the ischemia state and boosts fibroblastic, angioblastic, osteoblastic, and osteoclastic activities inhibiting osteonecrosis.

The benefit of HBOT in the long-term injured patient is an increased capacity for exercise. Established spinal cord injured patients suffer significant biochemical limitations including excess concentrations of lactate, and pyruvate and ammonia prohibit exercise and promote fatigue. Metabolic complications associated with vascular insufficiency of the extremities lead to progressive degenerative problems, further complicating the long-term prognosis of the spinal cord injured patient.

Two other benefits of HBOT should be pointed. The first is that quadriplegics and many paraplegics have a reduced vital lung capacity. HBOT improves vital lung capacity whilst improving tissue Oxygenation. The second is that spasticity is also a major problem for the spinal injured patient, diminishing the impact of physical therapy and exercise capability. HBOT has been demonstrated to reduce extremity spasticity by improving metabolic circulatory function.

**Spinal Case Studies**

**Mr. SM**

A series of MRIs revealed structural instability and progressive neurological symptoms for Mr. SM. He had exhausted every possible treatment approach and was eventually recommended a spinal fusion given the continued deterioration evidenced on his MRIs. As a last attempt to avoid surgery he decided on HBOT combined with physical therapy and direct electrical stimulated acupuncture. His condition remains stable.

Before HBOT
Mr. CD

Mr. CD is a 34 year old with a long history of chronic lower back and leg pains. He has complained of constant back stiffness with episodes of acute debilitating back and sciatic pains. Condition had been progressively deteriorating over many years with Mr. CD complaining of incredible back stiffness and aching legs. During initial consultation, he complained of severe lower back pain with sharp shooting pains extending down from his right thigh to his leg and foot. He described a heavy numbness sensation of his lower leg and foot. He complained of constant pins and needles down his legs and across his toes. He reported weakness of his right leg and when walking found that he often missed a rising step with his right foot.

Review and treatment by his doctor, extensive physical therapies, including chiropractic and physiotherapy, failed to improve his condition. Review by an orthopedic surgeon recommended decompressive surgery and possible fusion. MRI confirmed L5/S1 herniation with sequestrated fragment and possible thrombosis involving the arteriovenous plexus.

Mr. JB 1

This 28 year-old male has a history of chronic back pain with periodic episodes of acute back and right-sided sciatica. Original injury occurred while lifting a desk at work. Initially he experienced a ‘tearing’ sensation, which resulted in severe pain and stiffness the following day. Eventually his condition settled with a residual dull ache. He maintains a high level of fitness that includes skiing, snow boarding, and surfing. Over the 12 months prior to attending this clinic his condition continued to deteriorate with increasing episodes of acute pain.

Day to day living became severely restricted and required assistance to perform simple basic functions including getting in and out of bed and attending the shower or toilet. Unable to sit or stand, he had become stooped as an attempt to find relief. Extensive forms of treatments including physiotherapy, chiropractic, traction and hydrotherapy, all failed to alleviate his symptoms. His local doctor recommended a surgical opinion including discectomy and possible fusion. MRI confirmed a L5/S1 herniation large sequestrated fragment.
Mr. AH
AH has suffered chronic back pain as a direct consequence of working as a boiler-maker over the past 15 years. His condition has endured the usual stable and unstable periods and he has generally been able to control his condition with appropriate medication, treatment and rest.

His condition suddenly deteriorated and after exhausting numerous forms of treatments, his doctors recommended surgery (spinal fusion) given the extremely large ‘sequestrated’ disc fragment compressing the lower portions of his spinal cord and exiting nerve. Pain was intense and extremely disabling. Clinical investigations revealed the presence of underlying ‘opportunistic infections’ requiring specific medication. Hyperbaric oxygenation combined with medication and physical therapy was commenced daily. MRI investigation reveals clinical structural stabilisation and reduction of both spinal cord and exit nerve root pressure. Patient continues to stabilise.

Ms. GA
Inappropriate manipulation into Ms. GA’s neck resulted in acute neck and arm pain, loss of feeling down her arm and numbness and tingling in her legs. In addition, she often felt an urgency to urinate. Diagnosis determined C6/7 disc protrusion with acute traumatic cord compression (compressive myelomalacia as represented by increased T2 hyperintensity of the cervical cord). Her treatment period was for three months.
Mr. GT

Mr. GT experienced chronic lower back pain compounded by multiple snow boarding falls and accidents. MRI revealed an extremely large L5/S1 disc protrusion. Surgical fusion was recommended. Treatment period with hyperbaric oxygenation was four months. Comparison MRI indicated only an approximate 15 per cent reduction of the overall disc bulk. However, he has remained completely pain free for two years without incidence. He has returned to his active sports but maintains control.

Mr. JB 2

Mr. JB 2 is 29 years old male and has an acute L5/S1 disc prolapse with a large adjacent fragment. He has had a chronic history of low back and leg pain. Increased physical activities resulted in a slow deterioration of his lower back with a gradual increase in leg pains. His condition eventually collapsed with intense crippling pain in his lower back extending into his right thigh and leg with intense pain at his right lower leg and ankle region.

Investigation by MRI showed a one cm circumscribed T1 and T2 intermediate signal intensity lesion extending from the posterior aspect of a L5/S1 disc protrusion / extrusion indenting the right anterolateral aspect of the thecal sac compromising the right S1 nerve root. This is associated with thickening of the posterior longitudinal ligament overlying the disc extrusion.
Mr. GH

Mr. GH is 44 years old with acute L5/S1 disc prolapse and sciatic leg pains. He has suffered chronic pain on and off over many years, with period of acute episodic pain triggered by lifting, bending and twisting. He was recommended surgical disc removal and laminectomy after another acute episode. His treatment period with HBOT was for four months.

Mr. JF

Mr. JF is 23 years old with advanced central canal stenosis due to large L4/5 disc extrusion. He has a long history of chronic low back problems and had described his condition as being ‘on and off’ over the years and directly aggravated by heavy physical work. He reports a number of impact falls, heavy farm related work, including sheep shearing and numerous sporting related injuries. Patient reports acute lower back pains extending down the right thigh into his calf and foot area. Pain is predominately right sided but reports involvement of his entire left leg also. He describes his back as feeling extremely unstable. Mr. JF was a very difficult case, but he had an excellent outcome at a 12 month MRI interval.
Mr. BB

Mr. BB is 34 years old with acute L5/S1 disc prolapse and left sided leg pain and weakness. He described a chronic history of back stiffness and pain associated with many former years of competitive sports. He stated that his overall condition was manageable with general physical treatments without any serious ongoing problems. But a recent lifting injury resulted with immediate acute debilitating pain that continued to deteriorate with pains shooting down his left thigh, leg and into his foot, and with constant pins and needles across his left foot extending to his outer parts of his toes. Coughing, sneezing and straining with bowel action aggravate his condition. He also complains of increased urination frequency and incontinence. He cannot sit, stand or lie down for any length of time without increased pain. He had received numerous forms of physical therapy, medical treatments, and was reviewed by neurosurgeon who recommended surgery including spinal fusion.

Mr. HN

Mr. HN is 29 years old with acute L5/S1 protrusion and right S1 nerve involvement. He has had a chronic history of back related problems over a two year period.
Mrs. VS

Mrs. VS is 65 years old and is suffering L5 spondylolisthesis with secondary post-surgical degeneration causing chronic central canal stenosis. She has a chronic history of back problems extending over 25 years. She had previous lower back surgery approximately 22 years earlier, with double laminectomy decompression at her L5. She has suffered constant back and leg pains, which she has said she has had ‘learnt to live with’. She states that her condition took a terrible turn for the worse when she fell on a slippery floor. Prior to this injury She said that prior to this injury she wore a back brace periodically, but now she is totally dependent on the brace. She presents with acute low back pain with radiation extending down into both legs. She grades her pain as being nine out of a possible 10. She reports cramping pains and pins and needles extending down both the front and backs of both her legs. She also states that both legs are extremely weak, and reports secondary neck and upper back pains. She was recommended for total block spinal fusion after she was reviewed by a number of specialists.

Selected Clinical studies, Research and Publications

- **Multiple hyperbaric oxygenation (HBO) expands the therapeutic window in acute spinal cord injury in rats**


Hyperbaric oxygenation (HBO) therapy has been reported to improve neurological recovery following spinal cord injury (SCI). In the present study, we examined whether multiple HBO expands the therapeutic window for acute SCI. Single HBO (2.8 ATA, 1 hour) treatment was used at 30 minutes, 3 hours, and 6 hours following SCI, and serial HBO treatment (once daily for 1 week) at 6 hours and 24 hours post-injury. The group of animals receiving a single HBO intervention beginning at 30 minutes and 3 hours, or serial HBO treatment starting at 6 hours following the injury had a significantly better neurological recovery than animals with SCI only. The results of this study demonstrate that multiple HBO expands the therapeutic window for acute SCI to 6 hours after injury, further that serial HBO administration is superior to single HBO therapy.

Maeda (1965) published the first documented effects of Hyperbaric Oxygenation with SCI in animal experiments. Maeda suggested that tissue ischemia resulted in hypoxia due to spinal cord injury induced in dogs. **HBOT at 2 ATA resulted in dramatic increases in spinal cord tissue Oxygen (pO2) levels** (Maeda 1965).

Hartzog (1969) demonstrated reversal of cord injured baboons with 100% O2 at 3 ATA absolute within 24 hours of injury. Locke (1971) found that lactic acid accumulates with SCI, as a direct result of restrictive tissue blood flow. **Lactic acid leads to tissue hypoxia** (Oxygen starvation).

Jones (1978) studied the effects of HBOT in seven SCI patients treated within 12 hours of the cord injury. Two of the twelve had functional recovery. Three of the twelve who had suffered complete cord lesions became incomplete (partial recovery). Jones reported one patient who after two HBOT sessions had enough motor and sensory function return to allow the use of calipers.

Kondrashenko (1981) treated patients who had suffered incomplete SCI with Hyperbaric Oxygenation at 2 ATA, and showed that this lead to an earlier return of sphincter function, compared to the control group.

Holbach (1974) demonstrated an increase in CSF (cerebral spinal fluid) Oxygen pressure during HBOT. Linke (1974) used EMG to test the effects of HBOT in muscles corresponding to the level of the spinal cord lesion. He found increased muscular reaction potentials after each HBOT session. Linke reports on the cumulative effects of HBOT on muscular action potentials.
Yeo (1976) observed significant improvement of acute SCI induced in sheep. HBOT was performed at 3 ATA absolute within several hours of induced injury. Improved motor recovery was observed over the following eight weeks.

Yeo (1977) further demonstrated the benefits of improved blood supply with HBOT evidenced by significant reduction of cystic cord tissue necrosis and degeneration of the surrounding white matter (myelopathy) when compared to the control study group. In summary, Yeo demonstrated improved motor function and reduction of secondary cord degeneration.

Higgins (1981) studied spinal cord electro-potentials in subjects with cord damage due to impact injuries. The HBOT treated group demonstrated beneficial effects on long tract neuronal function. Higgins concluded that HBOT might afford protection against progressive degeneration of post-traumatic spinal cord injury if early treatments were applied.

Sukoff (1982) studied the impact of HBOT on experimental compressive spinal cord injury. 17 cats were treated immediately after injury with 100% O2 at various pressures. No animals treated with HBOT remained paralyzed, whereas six of the 13 controls remained paralyzed. Five treated animals recovered fully, and all but one could walk. Only one of the control animals could walk.

De la Torre (1981) initially summarized the effects of HBOT with SCI. Further, Drs Sukoff, Professor of Neurosurgery at the University of California and Jain, Neurosurgeon (1996) assert that HBOT:

- Can reverse neuronal damage that is due to bruising rather than laceration
- Activates recoverable idling and dormant neurons in the penumbra zone (where there is diminished tissue oxygenation) surrounding infarct cells
- Relieves ischemia of the gray matter of the spinal cord
- Reduces edema of the white matter
- Increases po2 levels in the cerebral spinal fluid dynamics
- Corrects biochemical disturbances at the immediate and distal sites of spinal cord injury including metabolic enzymatic disturbance
- Stabilizes the negative impact of metabolic disturbances. This includes the production of free radicals capable of causing vasodilatation and vascular wall damage. Hypoxia (Oxygen starvation) causes a shift in glycolysis with the production of lactic acid and lowered pH levels. An imbalance of energy demand and availability results in further ischemic like state with loss of ATP available to the neurons and surrounding tissue. In addition to oxidative free radicals, excitatory amino acids are released as a consequence of vascular injury. The loss of cellular integrity and edema, combined with continuing biochemical toxic effects results in further ischemia, swelling and compression.
- Can minimize and even reverse secondary cascade degenerative spinal cord effects
Hyperbaric Medicine: The Life is in the Blood

- **Spinal Cord 1997 Nov; 35(11): 763-7 (ISSN: 1362-4393)**

  Ishihara H; Matsui H; Kitagawa H; Yonezawa T; Tsuji H Department of Orthopaedic Surgery, Toyama Medical and Pharmaceutical University, Japan.

  The effectiveness of hyperbaric Oxygen therapy (HBO) in predicting the recovery after surgery in patients with cervical compression myelopathy was evaluated.

  The study group consisted of 41 cervical myelopathy patients aged 32-78 years. Before surgery, the effect of HBO was evaluated and was categorized as four grades. The severity of the myelopathy and the recovery after surgery were evaluated by the score proposed by the Japanese Orthopaedic Association (JOA score). The correlation between many clinical parameters including the HBO effect and the recovery rate of JOA score was evaluated. The recovery rate of JOA score was found to be 75.2 +/- 20.8% in the excellent group, 78.1 +/- 17.0% in the good group, 66.7 +/- 21.9% in the fair group and 31.7 +/- 16.4% in the poor group.

  There was a statistically significant correlation between the HBO effect and the recovery rate of the JOA score after surgery (r = 0.641, P < 0.0001). The effect of HBO showed a high correlation with the recovery rate after surgery as compared to the other investigated parameters. HBO can be employed to assess the chance of recovery of spinal cord function after surgical decompression.

- **Hyperbaric Oxygen and acute spinal cord injuries in humans**


  Clinical assessment of a regime of hyperbaric Oxygen within 12 hours of acute spinal injury in humans suggests that further study of this method of treatment is indicated. For statistical proof of the efficacy of this form of treatment study of a large number of patients is necessary and an Australian-wide study is suggested. A recommendation is made for an early referral to the spinal unit.

  Note: Unfortunately this recommendation was never implemented.

- **Hyperbaric Oxygenation in the treatment of spinal cord lesions**


  In 13 patients with compressive spinal cord lesions we performed a trial of treatment with HBOT. This therapy was post-operatively administered when neurological deficit persisted. In order to assess the effect of each individual HBOT (given daily at an inspiratory Oxygen pressure (PO2) of 1.5 ATA for 40-minutes) as well as of the entire HBOT (consisting of 10-15 single sessions in each case) neurological and electromyographical follow-up examinations were regularly performed. In 6 of the 13 patients we found a marked improvement, particularly in motor functions. The other patients only showed little change in neurological status. Arterial and cerebrospinal fluid (CSF) PO2 were concurrently measured in 8 patients during HBOT. The values of both showed a considerable increase. The rise in CSF PO2 may be regarded as indicative for an improved Oxygenation of the spinal cord tissue during HBOT. On the basis of these findings we may assume that repetitive HBOT can be helpful in the management of compressive spinal cord lesions.

- **Hyperbaric Oxygenation (HBOT) for acute traumatic cervical spinal cord injury**


  A retrospective study of spinal cord injury (SCI) treated with and without HBOT. 34 cases of hyper extensive spinal cord injury without bone damage and previous history of surgical intervention were divided into two groups, with HBOT or without HBOT. The neurological findings at admission and their outcomes were evaluated by means of Neurological Cervical Spine Scale (NCSS) and the average improvements rates in individual groups were compared. Results: the improvement rate ranged from 100% to 27.3% with the mean value of 75.2% in the HBOT group, while these values were 100%, 25.0% and 65.1% respectively in the non HBOT group. Conclusion: in the HBOT group, the improvement rate indicated effectiveness in acute traumatic cervical spinal cord injury.
More Praise for Malcolm Hooper
and *The Life is in the Blood*

‘Malcolm Hooper is one of those rare breeds of health practitioner who combines his spiritual, intellectual, clinical and philanthropic backgrounds into a unique knowledge and foresight capable of providing health solutions and benefits to advantage particularly the disabled. Seeking even one per cent difference for the disabled, whose lives diminish by the day as a result of their unique deck of cards, makes a positive impact on their quality of life. Like all pioneers, mainstream medical resistance has provided inevitable business and regulatory obstacles in Malcolm’s path. Yet his unyielding belief in Hyperbaric Oxygen Theory and robotic rehabilitation protocols has necessitated putting his career, family and financial position constantly on the line to protect the future of his patients, both disabled and elite sportspeople alike. He is the ultimate survivor, visionary, and uniter, demanding of recognition and support to accelerate the development and the implementation of his health science, clinical experience, and vision for how the human brain and body can overcome and prosper from its unique setbacks and circumstances in life. I thank Malcolm for saving my life and redefining my purpose and the impact I can have on others.’

Graeme Little Né Peter Pope
Health Politics Advocate

‘Malcolm Hooper and I were university classmates in Melbourne, Australia. It gives me great pleasure to write about the use of Hyperbaric Oxygen Therapy in his new book. I was introduced to the use of Hyperbaric Oxygen Therapy in China for the treatment of a number of health conditions. But Malcolm is the person responsible for bringing me to the realization that Hyperbaric Oxygen Therapy may be the solution for many chronic diseases. I have practiced in China for the past 15 years and have personal encounters with many doctors who use Hyperbaric Oxygen Therapy routinely. Some of them have more than thirty years of experience and they tell me that Hyperbaric Oxygen Therapy can reduce chronic inflammation, inhibit cell apoptosis, balance oxygen free radicals, and activate neural stem cells. They have proved the efficacy of Hyperbaric Oxygen Therapy in their daily practice and I have been privileged to share some of the cases with them. I have no doubt in my mind that Hyperbaric Oxygen Therapy will become even bigger in China once standardization is achieved. There are over 5000 hyperbaric oxygen chambers in China and that number is likely to rise substantially in the next decade. The use of Hyperbaric Oxygen Therapy in China differs from the western world and we need the guidance of experts like Malcolm to bring some form of standard to a largely unregulated market. I have had the privilege to preview The Life is in the Blood. Malcolm’s book is well researched and clinically relevant, which is a welcome combination. I cannot wait to share it with my Chinese colleagues.’

Visiting Prof. Henry Chen  B.Sc.(Hon), DC., MD., PhD

‘The short journey of life presents many challenges along its path. How humanity deals with the myriad of obstructions, crossroads and roadblocks defines a person’s character and their contribution to humankind. You can just stay in cruise control, enjoy your pension, grandchildren and ride into the sunset, or you can take a leaf out of Dr. Malcolm Hooper’s book. Malcolm is a true visionary not fazed by the obstructions and roadblocks that come his way because he believes in the greater good. His vision of how Hyperbaric Medicine can evolve to treat numerous conditions and improve patient wellbeing is testimony of his character. As an event planner having to organize Hyperbaric Oxygen Therapy conferences for over a decade, I have come to know Malcolm
well and understand the unique qualities that define him as a special person. He is modest and humble when
talking about his wife Kate and their six children, who have all achieved some amazing standards in sport and
commercial enterprise. Yet when he talks about Hyperbarics and the role he and others can play on a global
level, it’s as if a light bulb has intensified significantly. His enthusiasm for making things happen is contagious,
and his knowledge and professional acumen enables him to plan and deliver things in a dynamic and controlled
way. Malcolm is realistic enough to know that his vision of Hyperbaric Medicine cannot be a single crusade and
that he’s reliant on other expert visionaries passionate to make a change for the better. I commend my friend
Dr. Malcolm Hooper on this book. It provides such a good insight into his vision and the desires of others strivng
to make Hyperbaric Oxygen Therapy far more recognized as a therapy that works in many modalities.
So, as Mal would so eloquently say to me, Good on ya mate. You’re fair dinkum!’

Jeremy Phillips President & CEO, FMI Event Management
Co-Founder and Joint Owner, Advanced Applications in Medical Practice

‘I have been a hyperbaric physician in Romania since 1992. Hyperbaric Medicine in northern European countries
has a long history. Back in the 1970s, surgery was often performed with remarkable results whilst inside
a theatre-dedicated hyperbaric chamber. Hyperbaric Oxygen is the application of oxygen at increased pressures
to expand the oxygen capacity of the blood, which significantly increases the partial pressure of oxygen in
biological tissue. The partial pressure of oxygen becomes higher than when breathing pure oxygen under normal
atmospheric pressure. When breathing oxygen at atmospheric pressure, oxygen transport is limited and only
a small part of oxygen is transferred by plasma. With hyperbaric oxygenation, oxygen transport by plasma
increases significantly. Since most pathological conditions occur in condition of hypoxia (oxygen deficiency),
the application of Hyperbaric Oxygen Therapy accelerates the healing processes. It is absolutely indispensable
in treating anaerobic infection, air embolism and carbon monoxide poisoning. In Romania and Russia as well as
in other European countries Hyperbaric Oxygen is commonly used before and after surgery to provide better
outcomes for both patient and hospital. I commend Malcolm Hooper’s Hyperbaric Medicine – The Life is in the
Blood. It is very informative and instructive.’

Dr. Serge Taracila, Surgeon, Oncologist, Certified Hyperbaric Oxygen
Therapy Specialist and Specialist in Hyperbaric Oxygen Apparatus
"Talk about getting punched in the gut when you’re not ready. First up I was told I had spinal stenosis, and then I tore my rotator cuff while snowboarding for which I thought I was going to get some PRP injections to heal my shoulder. Instead, I was told that I’m not ever going to be functional again. I called four of the best doctors I knew and they all said there was no solution. But I had made a promise to myself that I wasn’t going to suffer, so I kept searching and found a man in Melbourne Australia, Malcolm Hooper, who sent me before-and-after MRIs to show me how 100 hours of hyperbaric oxygen caused the body to release 800 percent more stem cells than your body would ever get from any drug or other approach. So I went to his clinic and he wanted to test my cytokines, as well as my inflammation and heavy metal markers, and all of a sudden I was thinking, ‘What am I doing here?’ And yet my markers were extreme! I still have challenges with my spine, but on a zero-to-ten scale I would say I’m a nine.”

Tony Robbins

"Our medical system so often focuses on treating symptoms at an enormous cost to the community. The same medical system “plays down” the importance of healthy natural alternatives such as nutritious and anti-inflammatory diets, yoga and meditation. This failure particularly impacts disadvantaged people because of the information asymmetry that we see in our society. Hyperbaric oxygen uses oxygen at pressure to help revive and fuel the body. As a therapy, it can be immensely helpful in improving health in our society. Used properly, it can also significantly reduce the cost pressure that we are seeing in our health system. This is particularly important given our aging population. It’s therefore a pleasure to see Malcolm Hooper’s book, which explains how hyperbaric oxygen can and should be used by modern medicine to improve health and reduce dependence on long-term pharmaceutical solutions. Malcolm is a leading expert in this area and has many years of practical ‘hands on’ experience with using hyperbaric oxygen to deal with a whole range of maladies.”

Peter Hunt AM, Investor and Philanthropist
Chairman of Greenhill Australia, Grameen Australia, So They Can and Founder and Director of Women’s Community Shelters

"Dr. Malcolm Hooper is a true pioneer. He understood before most of us in the field the true power of Hyperbaric Oxygen Therapy to synergize with other treatment strategies to accelerate patient outcomes, especially in orthopedic injury. The Life is in the Blood is a comprehensive overview of Hyperbaric Medicine and its indications. His passion is palpable, his command of the information unquestionable, and his internal drive to bring Hyperbaric Oxygen Therapy to the world is, as an Australian would say, ‘just awesome’. I owe a huge debt of gratitude to Dr. Hooper and his contemporaries Dr. Paul Harch and Dr. Shai Efrati, giants in the field, with whom I have the privilege of calling friends and mentor. It is easy to stand on the shoulders of giants when those shoulders are sturdy, strong, and compassionate all at the same time.”

Dr. Scott Sherr, Board-Certified Internal Medicine Physician
Founder of IntegrativeHBOT.com and Director of Integrative Hyperbaric Medicine and Health Optimization at Hyperbaric Medical Solutions in New York

"Malcolm Hooper is passionate about hyperbaric oxygen and how it can help people all over the world suffering from pain and illness. Hyperbaric oxygen has helped me. I commend his book ‘The Life is in the Blood.’

Tony Robbins"