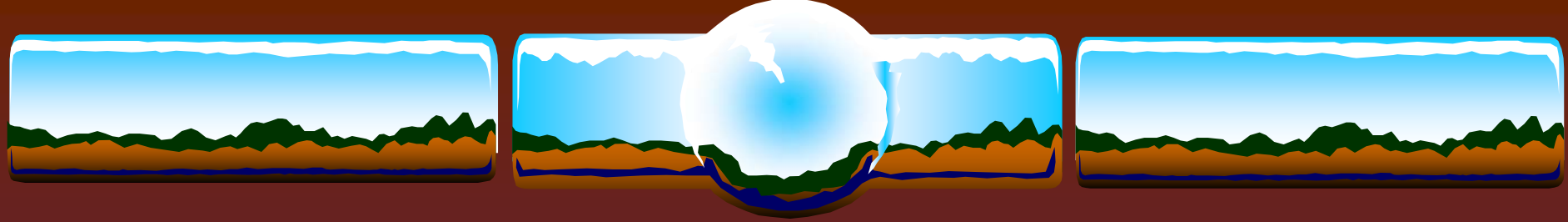
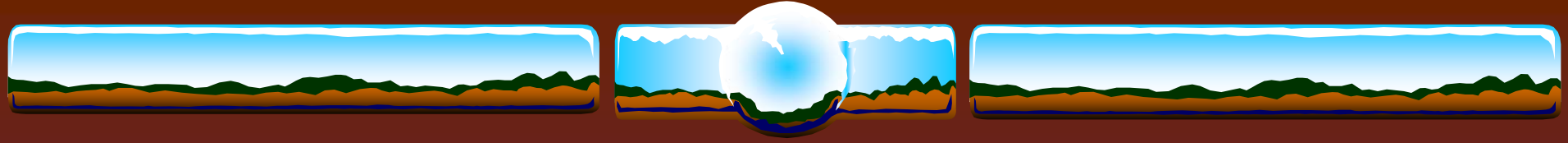


EVIDENCE-BASED MEDICINE AND HYPERBARIC PRACTICE

What is it, is it important, and where do I get it?

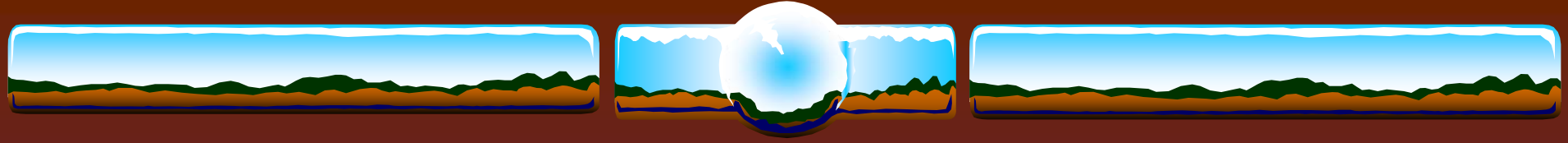
Mike Bennett

POWH 2005



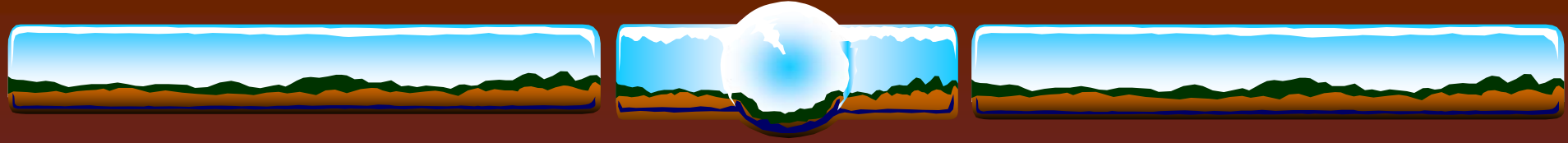
WHAT IS IT?

- “The conscientious, explicit and judicious use of the current best evidence in making decisions about the care of individual patients.”
  - David Sackett 1996



WHAT ISN'T IT?

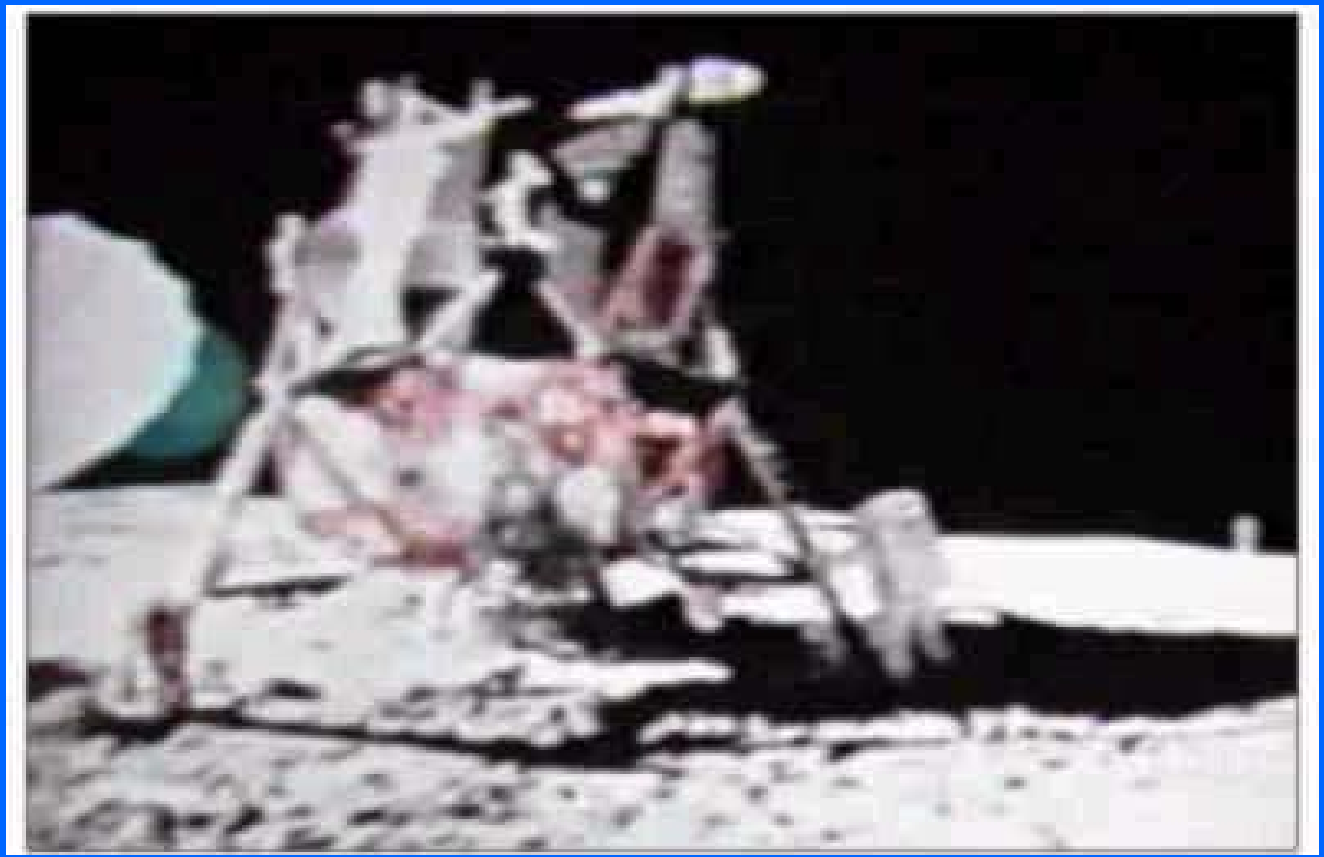
- A cookbook approach to medicine
- An attempt by bean counters to control the practice of medicine
- A threat to the individualisation of patient care by clinicians with therapeutic freedom



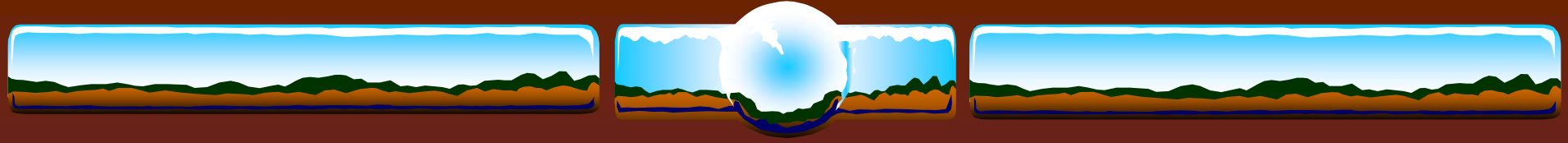
DOES IT WORK?

- A difficult and perhaps largely unanswerable question
- What do you compare it to?
  - Active lack of evidence on which to base decisions?
  - Eminence-based medicine?
  - Vehemence-based medicine?
  - Confidence-based medicine?
- Some evidence from outcomes studies and medical schools.

Illumination in Shadow: FOX narrator: "On the Moon, the astronaut's only source of light was the Sun. ... Here's an astronaut who descends into the huge shadow caste from the lunar module, yet his entire body is still visible. How is it that he is not shrouded in darkness?" Apollo skeptic answers: "It's because there's more than one light source, which means they're not on the Moon."

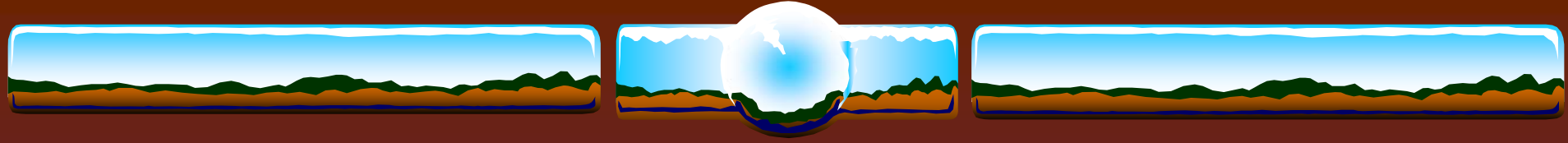


Question: *why is the astronaut in the shadow illuminated?*



SUMMARY OF THE EBM PROCESS

1. Ask a focussed clinical question
    1. Patients of interest
    2. Intervention of interest and comparator
    3. Outcome(s) of interest
2. Search for the evidence
3. Critically appraise the evidence
4. Summarise the results and act on them



Asking good questions

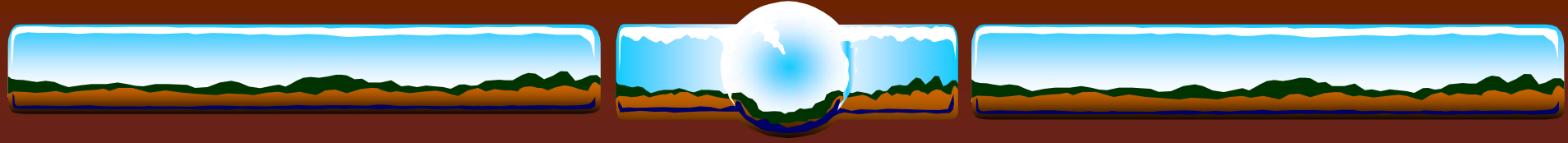
	1. Patient problem	2. The intervention of interest (or cause/prognostic factor etc)	3. Compared to…. (not always required)	4. Outcomes
Tips	Need to define the patient of most interest	Be exact about the intervention	Often simply the main alternative	Focus on important outcomes of interest that seem relevant to the intervention
Example	'In adult patients with moderate to severe carbon monoxide poisoning…	....does the administration of hyperbaric oxygen (>1.5ATA for at least 1hr)…	…compared to a regimen of normobaric oxygen for at least 2 hours…	...result in any demonstrable reduction in neurological or cardiovascular mortality or morbidity?'

Searching

- Guidelines
- Cochrane DSR

- Cochrane CCTR
- DORCTIHM
- Medline
- Other databases
- Pearling, citation registers

- Uncommon in DHM
- Building. Current reviews in COP, MS, ISSNHL, TBI, Chronic wounds, Burns
- Good coverage
- All RCTs in the field
- Gold standard
- May be helpful
- Invaluable

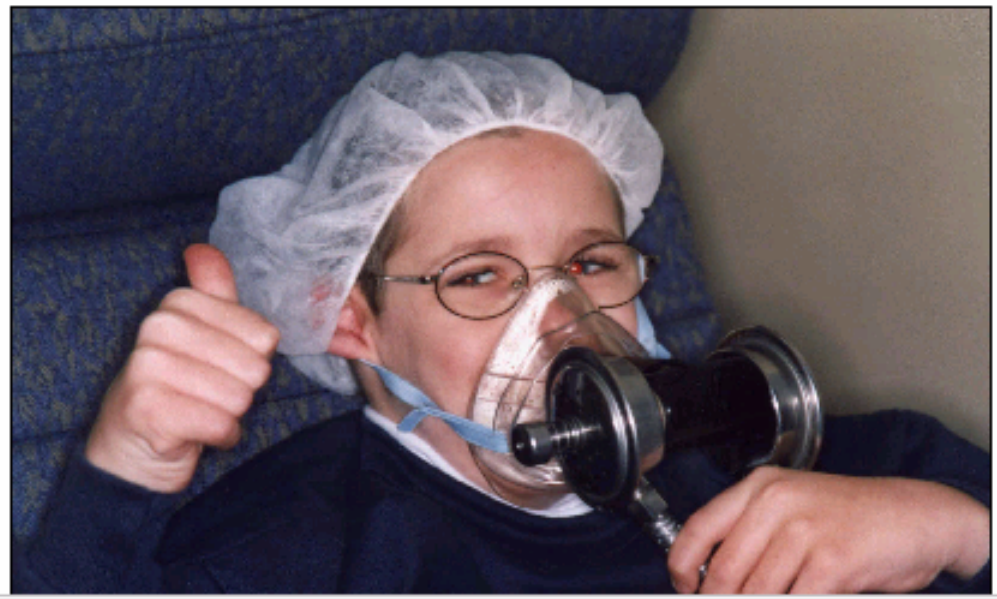


A Clinical Question

- A patient presents with a sheaf of notes off the internet [MUMS Network, Chico Hyperbaric Center] and wants to know about treatment of CP with HBOT.

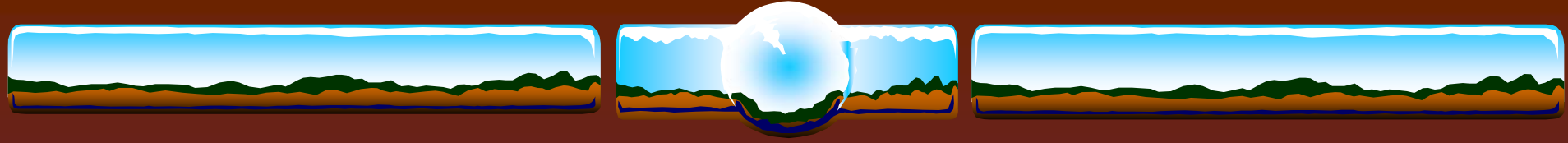
SPINAL REHABILITATION GROUP *Hyperbaric Medicine*

Cerebral Palsy



A Clinical Question

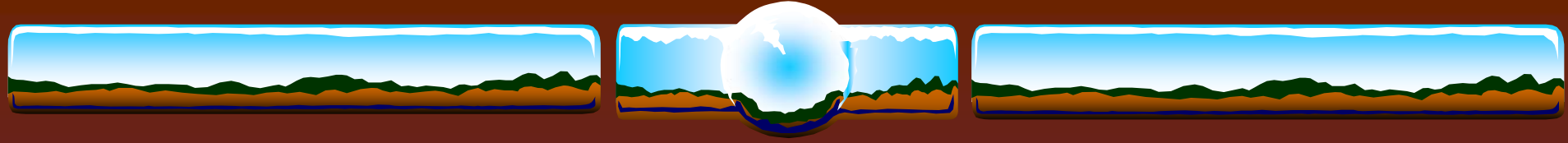
- A patient presents with a sheaf of notes off the internet [MUMS Network, Chico Hyperbaric Center] and wants to know about treatment of CP with HBOT.
- QUESTION: "*For children aged 3 to 7 years with cerebral palsy, does the application of HBO, in addition to standard treatments, result in any important improvement in physical or intellectual ability*?"



Searching

- Guidelines
- Cochrane DSR
- Cochrane CCTR
- DORCTIHM
- Medline
- Other databases
- Pearling, citation registers

- Nothing
- Nothing
- 1 RCT
- 4 RCT citations
- 1 RCT, 1 CCTs
- Nil extra
- Not helpful, some case reports and small series

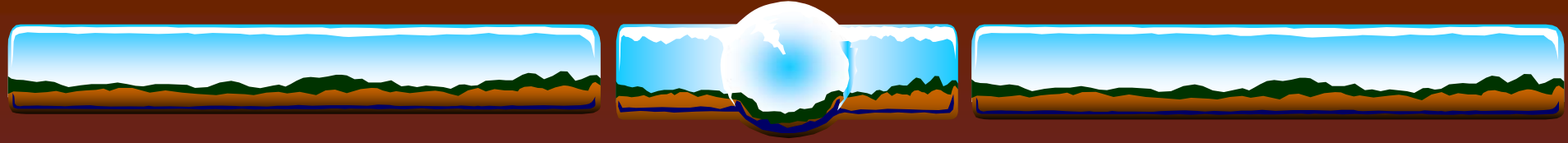


CRITICAL APPRAISAL

- Choose papers to review based on your needs
- Individual patient treatment
  - Use best evidence you can find
- To make a review
  - Need to exhaustively search and review

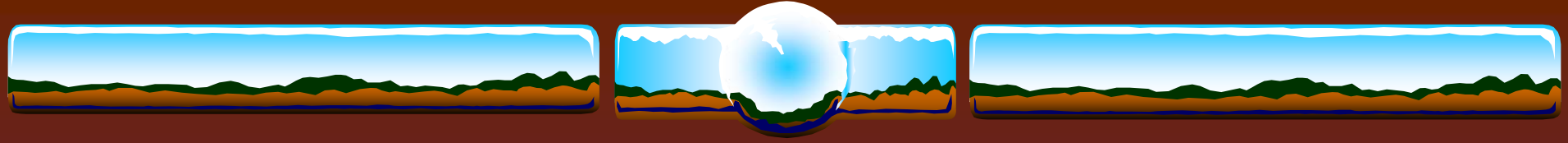
Levels of Evidence (NHMRC)

Level of Evidence	Description
I	Evidence obtained from a systematic review of all relevant randomised controlled trials
II	Evidence obtained from at least one properly designed randomised controlled trial.
III-1	Evidence obtained from well-designed pseudo-randomised controlled trials (alternate allocation or some other method).
III-2	Evidence obtained from comparative studies with concurrent controls and allocation not randomised (cohort studies), case-control studies or interrupted time series with control group.
III-3	Evidence obtained from comparative studies with historical control, two or more single-arm studies or interrupted time series without a parallel contol group.
IV	Evidence obtained from case series, either post-treatment or pre- and post-treatment.
V	Evidence obtained from a single case report.



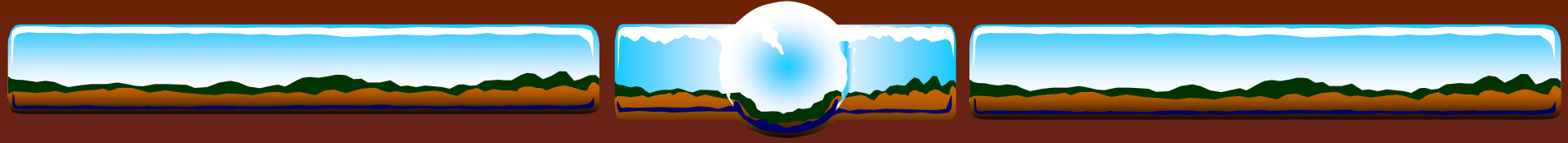
Why are RCTs regarded as high level evidence?

- THE ELIMINATION OF BIAS
- Other methods of investigation do not *systematically* control for potential factors that may alter the outcome of a trial
- We can control for those factors we know, but we cannot control for those factors unknown to us.
- Blinding ensures that allocation and evaluation in the trial are not corrupted



What is the problem with RCTs?

- They are costly, time-consuming and difficult to do well
- They require a suspension of belief
- They only answer the specific question(s) posed
- There are many questions we cannot expect to answer with this approach

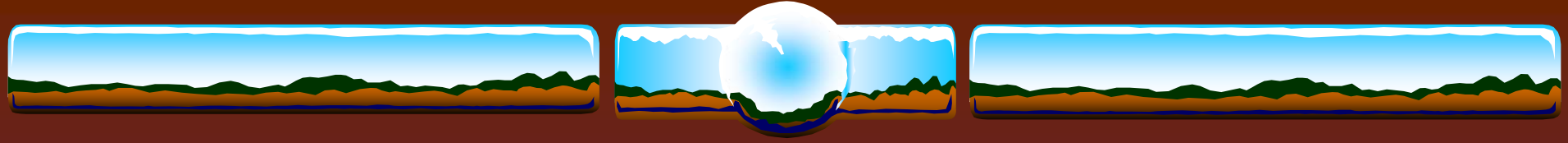


Homeopathy

- What causes an ailment can also cure that ailment
- Extreme dilutions with physical agitation to alter the nature of the water molecules
- “The memory of water”
- Obviously no scientific basis

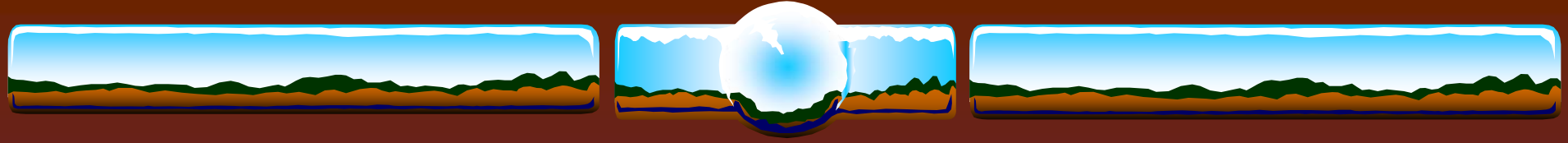
Homeopathy

- Enter Dr. Benveniste, immunologist
- Lab tech noted activation of basophils with a very dilute solution of anti-IgE
- Further testing suggested an effect of ímpossibly' dilute solutions
- Ran a series of formal comparisons between sterile water and a homeopathic dilution of anti-IgE



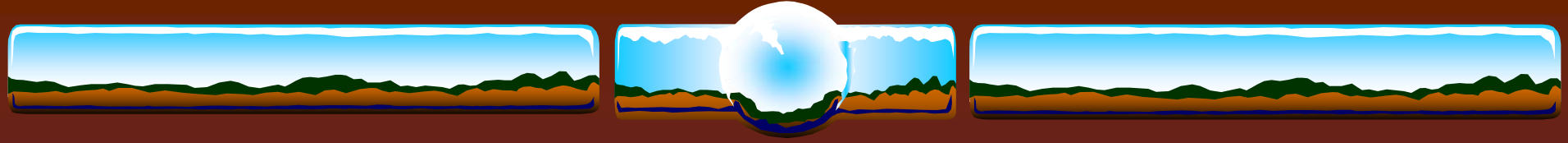
Homeopathy

- Submitted to Nature and accepted after multiple reviews
- An editorial reservation was published with it. This expressed scepticism and the intention to verify the findings in Prof Beneviste's lab
- Nature chose a team including James Randi – a magician and well-known skeptic.



Homeopathy

- Two runs confirmed the positive findings
- Randi noted that there was no observer blinding, but was reassured that the changes were clear and not subject to bias by the counter.
- Nevertheless, a blind run was conducted at the insistence of Randi.
- No difference and much wailing and gnashing of teeth



Lesson!

- THE ELIMINATION OF BIAS
- Other methods of investigation do not *systematically* control for potential factors that may alter the outcome of a trial
- We can control for those factors we know, but we cannot control for those factors unknown to us.
- Blinding ensures that allocation and evaluation in the trial are not corrupted

NHMRC Evidence Table

Level of Evidence*	Authors	Methodology	Result
Level I		NIL	
Level II	Collet 2001	RCT, multicentre. 114 cases. 2ATA HBO versus 1.3 ATA Air, 90 minutes daily x 20	No difference
Level III		NIL	
Level IV	Montgomery 1999	Case series. 25 cases. 1.75ATA on Fi2 0.95 60 minutes x 20	Improved gross and fine motor, spasticity.
	Nuthall 2000	2 cases, both with complications	No benefit
	Machado 1989	case series	Benefit
	Chavdarov 1997	?	?
Level V		NIL	
Level VI	Bischof 2001	Expert opinion.	Favours HBO
	Van Bever Donker		Favours HBO
	Venter 1998		Favours HBO
	Cronje 1999		Sceptical
	Kent 1999		Sceptical
	Neubauer 2001		Favours HBO
	James 2001		Favours HBO
	Bateman 2001		Against

HBO Evidence

The Database of Randomised Controlled Trials In Hyperbaric Medicine

Dr Mike Bennett

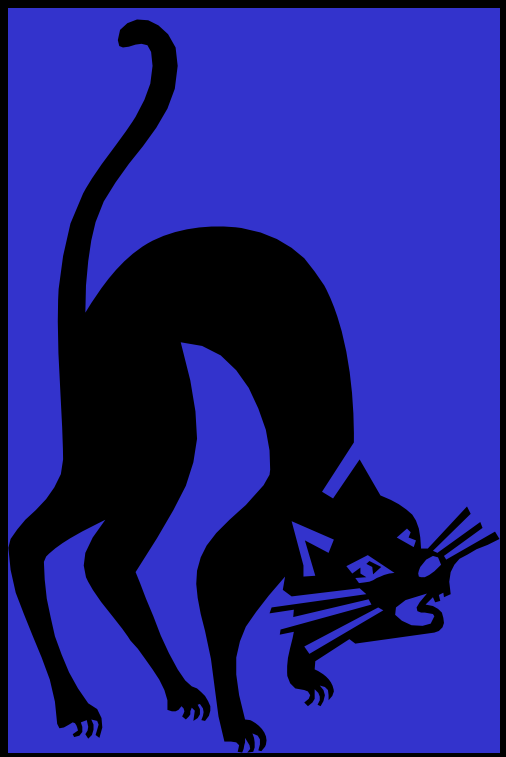
Hyperbaric Unit Director

Sydney

Australia

Tremblay S	Vanasse M	Amar M	A double-blind, randomised, placebo controlled, multicentric clinical trial assessing the effects of hyperbaric oxygen therapy on cerebral palsy.	Undersea and Hyperbaric Medicine 2000; 27 (Suppl):64.	2000	Cerebral Palsy	Encephal
Collet J-P	Vannasse M	Marois P	Hyperbaric oxygen for children with cerebral palsy: a randomised multicentre trial.	Lancet 2001; 357:582-586.	2001	Cerebral palsy	Encephal
Hardy P	Collet JP	Goldberg J	Neuropsychological effects of hyperbaric oxygen therapy in cerebral palsy.	Developmental Medicine and Child Neurology 2002; 44:436-446.	2002	Cerebral palsy	Encephal
Packard M			The Cornell study	http://www.netnet.net/mums/	2002	Cerebral palsy	Encephal

CAT Maker (Badenoch 1997)



- Evidence-based
- Standardised
- Absolute and relative risk
- Numbers needed to treat

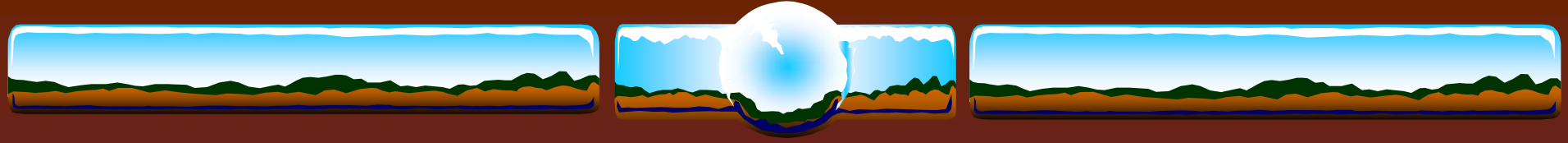
Collet et al

The Study:
Double-blinded concealed randomised controlled trial with intention-to-treat.

Children aged 3-12 years with cerebral palsy of neonatal origin where symptoms are stable. Motor age 6 months to 4 years, psychological age more than 2 years.

Control group (N = 54; 53 analysed): Physical therapy and antispastic medication ceased 6 weeks prior to trial. 40 treatments over two months at 1.3ATA on air for 60 minutes.

Experimental group (N = 57; 54 analysed): As above but 100% oxygen at 1.75ATA for 60 minutes.



Collet et al

GMFS improv. (3 months) %	Air 1.3ATA	HBOT 1.75ATA	P-value
	3.1	3.4	0.97
95% CI	2.2 - 4.1	2.2 - 4.5	

Collet et al

Ear barotrauma (treatment)	Air	HBOT	RRI	ARI	NNH
	23%	50%	121%	27%	4
95% CI				10-45	2 - 10

Conclusions

- No advantage of HBOT on this regimen compared to a sham treatment
- Both groups improved significantly from baseline
  - ?placebo or participation effect
- Further consideration merited BUT no obvious benefit from HBOT *per se*

What does a completed CAT look like?

(about 200 of them at hboevidence.com)

Hyperbaric oxygen administration did not improve subjective or objective assessment of symptoms and signs in multiple sclerosis.

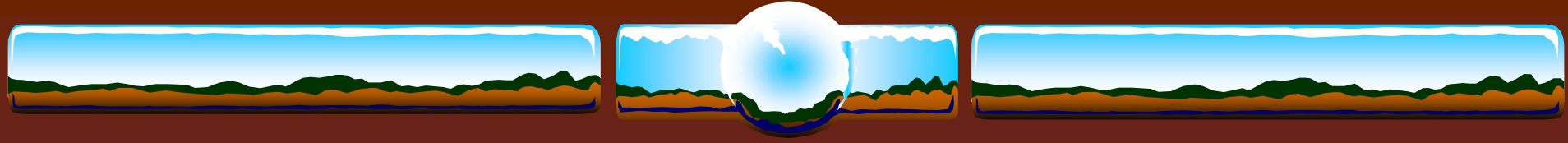
Clinical Bottom Line:
1. No evidence that hyperbaric oxygen is of benefit in multiple sclerosis.

Appraised by: Mike Bennett
Dept of Diving and Hyperbaric Medicine
Prince of Wales Hospital
Sydney; Tuesday, 12 January, 1999

Clinical Scenario: A patient with an established diagnosis of multiple sclerosis of a relapsing and remitting character.

Three-part Question: In the treatment of multiple sclerosis, does the application of hyperbaric oxygen in addition to usual care, result in any resolution of symptoms and signs or reduction in timing and severity of relapse?

Search Terms: Hyperbaric oxygenation, multiple sclerosis.



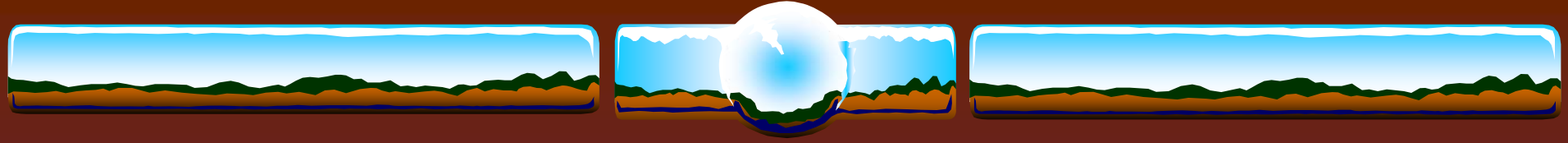
The Study:

Double-blinded concealed randomised controlled trial with intention-to-treat.

Established MS with slow deterioration over six months or a relapsing and remitting nature and documented neurological signs.

Control group (N = 23; 20 analysed): Usual self and nursing care, but no specific regime. Placebo administration of 10% oxygen at 2ATA on same timing as active group.

Experimental group (N = 21; 21 analysed): 100% oxygen at 2ATA for 90 minutes to a total of 20 treatments over 28 days.



The Evidence:

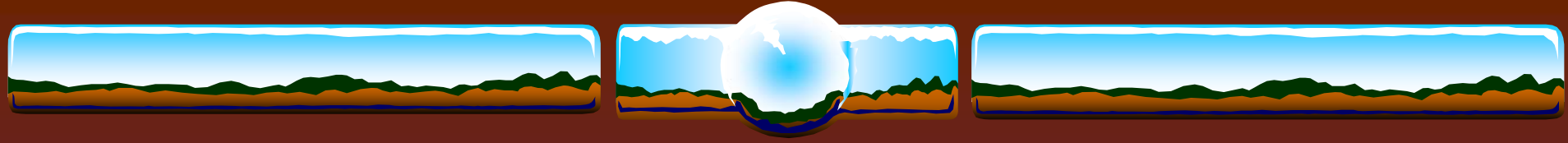
Outcome	Time to Outcome	Control rate	HBO rate	Relative risk reduction	Absolute risk reduction	NNT
Reported improvement	28 days	0.350	0.38	-9%	-0.03	-32
95% CI:				-93% to 75%	-0.33 to 0.26	NNT=4 to INF NNH=3 to INF
Objective improvement	28 days	0.2	0.09	53%	0.11	10
95% CI:				-55% to 100%	-0.11 to 0.32	NNT=3 to INF NNH=9 to INF

Comments:
1. Well-conducted study.
2. Small study with low power to detect a clinically significant improvement.
3. Three placebo group patients withdrawn with aural barotrauma, demonstrating that hyperbaric oxygen is not without complications.

Expiry date: March 2007

References:

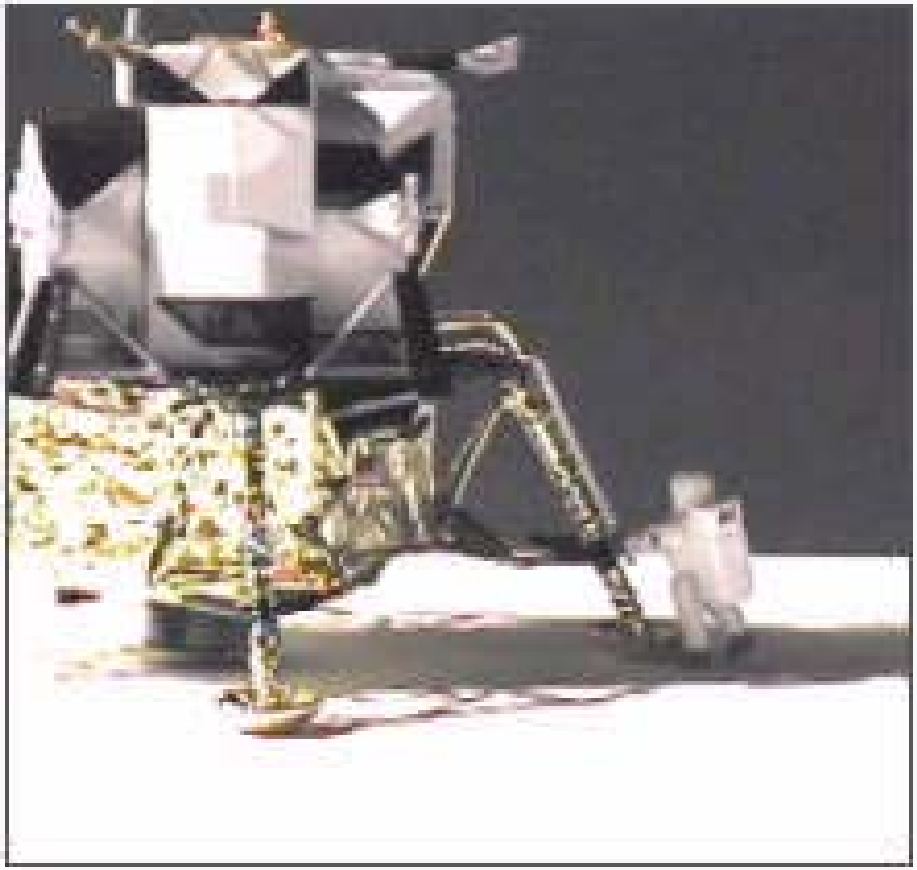
1. Wood J, Stell R, Unsworth I, Lance J, Skuse N. A double-blind trial of hyperbaric oxygen in the treatment of multiple sclerosis. Medical Journal of Australia 1985; 143:238-241.

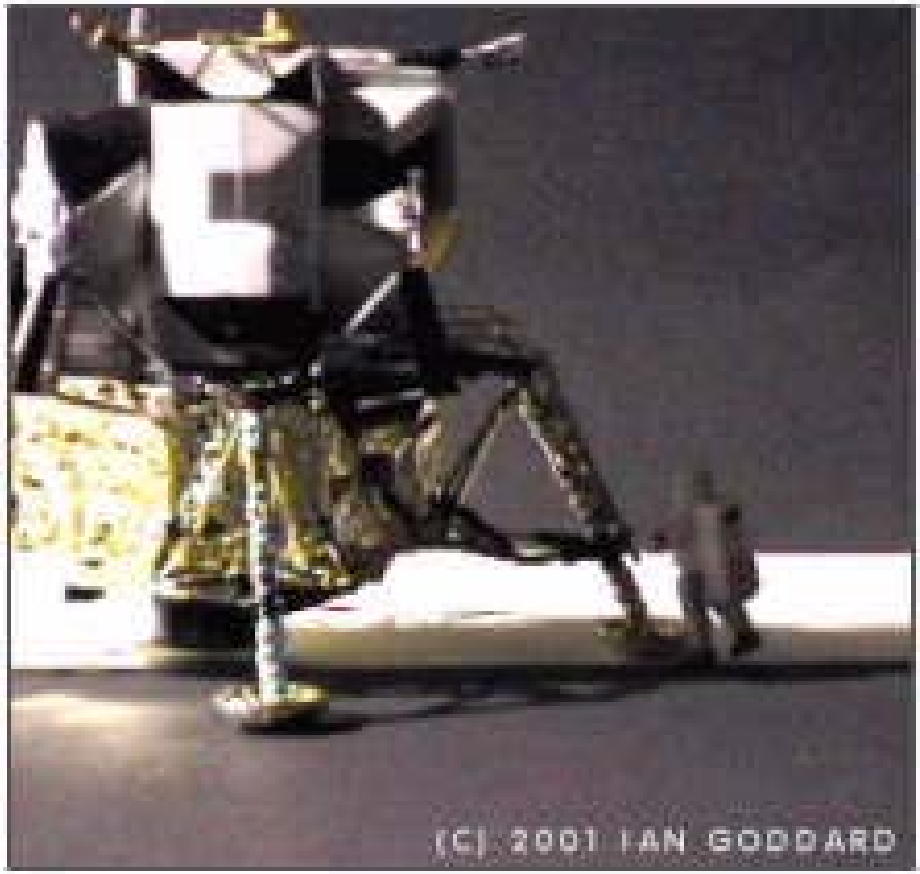


BOUACHOUR ET AL – Crush Injuries

Outcome	Time to Outcome	Air group	HBO group	Relative risk reduction	Absolute risk reduction	NNT
Wound not healed	60 days	0.444	0.06	86%	0.384	3
95% CI:				29% to 100%	0.130 to 0.638	2 to 8
Repeat surgical procedure	60 days	0.333	0.06	82%	0.273	4
95% CI:				9% to 100%	0.029 to 0.517	2 to 34

Answer: *surface reflection of light:*





Test: *surface reflection illuminates toy astronaut in shadow.*
In second image, foreground reflection is reduced with black paper.