```
From: sbharris@ix.netcom.com(Steven B. Harris)
Subject: Re: oxygen emulsion
Date: 01 Sep 1996
Newsgroups: alt.tv.seaquest

In <kibo-0109960642280001@news.std.com> kibo@world.std.com (James
"Kibo" Parry) writes:

>In alt.tv.seaquest, *The Purplelicious One* <trickett@nmsu.edu> wrote:
>
>>The breatheable liquid is now being used by military units all over the
>>world. It's effiecent because like you saw in the Abyss, it doesn't
>>cause the pressure vs. depth problems that straight air uses. It's
>>similar to ambeonic fluid (fluid that a fetus/child lives in in the
>>womb) and is thicker than water...Kind of inbetween a milky substance
>>and a pure hydo one.  It is supposedly able to 'carry' up to over 25% of
>>the oxygen needed to breathe above water..So your lungs we be working
>>twice as hard for basically 2/3 the air...Enough to keep you alive, but
>>I'd say you wouldn't feel all that great after having breathed that
>>stuff for an extended priod of time.
>>
>>Cracker
>
>Ah, alt.tv.seaquest, the font of misspelled inaccuracies.
>
>Good evening, ladies and gentlemen. I'm Truman Bradley Junior, and
>welcome to
>
>             S C I E N C E   M A D E   F U N - L I K E !
>
>(slow, pompous trumpet fanfare as an oscilloscope shows a sine wave)


(Headers trimmed)


   And the truth is that liquid fluorocarbons are indeed being
evaluated for all kinds of liquid breathing uses.  Those with the
proper weight and range of boiling points look like water (no
opalescense) and are used as the pure stuff.  They are about twice as
dense as water, and do not mix with anything.  In clinical trials with
people on ventilators, these fluorocarbons are poured directly down the
ventilator tube.  The patient's lungs are not filled entirely up,
ordinarily, but it would be perfectly possible to do this without harm
(we at our lab have done this many times with dogs, which have survived
without problem when this was the only procedure).  In the future, you
will indeed see these things for diving applications, because with
liquid it's possible to control the partial pressure of *all* gases, so
that *none* is high, even at huge total pressures.  At great depth,
even high pressure helium causes embolus problems when pressures are
changed rapidly, and with liquid breathing some of these can be
avoided.  I'm not aware that liquid-breathing has ever been tried on a
human free-dive, but it's only a matter of time until somebody does it.
As we speak, there are dozens of people breathing liquid on ventilators
in phase III trials, in ICUs.

                                          Steve Harris, M.D.
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From: sbharris@ix.netcom.com(Steven B. Harris)
Subject: Re: Cleaning the lungs with breathable liquid (Liquivent)
Date: Sun, 05 Oct 1997
Newsgroups: sci.med

In <3437E33B.407FE34@home.com> Michael T Kennedy <mtkennedy1@home.com> writes:

>A similar fluid is the source of the work on fluid respiration in lung
>disease. Rats and mice have survived such experiments nicely . Partial
>liquid ventilation has been used in infants and adults with severe lung
>injury or distress from prematurity. In these cases the fluorocarbon
>solution is instilled via the trachea while the lung is being ventilated
>by gas. I'm not aware of total liquid ventilation in humans but it is
>coming. The human cases have shown considerable improvement while under
>partial liquid ventilation and have been weaned back onto total gas
>ventilation without trouble. The research is conducted by the Liquivent
>Study Group and can be found extensively in the National Library of
>Medicine Medline search engine.
>
>Michael Kennedy MD FACS

There's really not much point in filling the entire lung up with fluid, although it can be done.   You need some fluid/air surface across which gas exchange can take place, after all (if you leave any airspace in the lung this happens automatically). I've used fluorocarbon fluids in dog resuscitation work extensively, and most fluorocarbons with the correct boiling point and vapor pressure work fine for this You just add them into the lung (pour them right down the ET tube). When you get tired of them, you let them boil off.

The fluids are about twice as dense as water, and do not mix with water or oil. In medicine they are useful for getting to the bottom of an edematous lung and displacing the fluid, allowing it to be removed.

The major commercial product being tested this way is Liquivent (perflubron), which is basically a perfluorocarbon (8 or 9 carbons) with a bromine added to decrease the vapor pressure.   The stuff should be very nasty to the ozone layer because of the bromine, but I suppose systems in the future will have a lot of recirculation features.

Steve Harris, M.D.

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From: sbharris@ix.netcom.com(Steven B. Harris)
Subject: Re: The Bad Science in Science Fiction
Date: Sun, 07 Dec 1997
Newsgroups: sci.physics

In <3489AD72.8F075878@no.spam.worldaccess.nl> "P. Schmitz" <schmitzp@no.spam.worldaccess.nl> writes:

>Michael J. Ramsey wrote:
>
>> You are assuming that the lungs are full of air. What if they were
>> filled with a highly oxygenated fluid? Fluids don't compress.
>
>By the way, didn't I see on TV that they can already submerge rats in
>some oxygenated fluid (don't remember which) and have it breathe normally

>for long periods of time?

Yes, many fluorocarbons are capable of sustaining life this way. Once oxygenated, they can be breathed. In fact, you can pour them right down the tube of a person connected to a ventilator, until the lungs are essentially filled up. This has been done now to many people. The procedure does lots of interesting things-- one is that water in the lungs floats on top of the heavy fluorocarbon, and can be sucked out. Another is that heavy fluorocarbon goes to the bottom of waterlogged lung and opens up alveoli by filling them with fluorocarbon. The stuff boils off after a while if you don't replace it, so it's no problem to get out. Just do nothing, and after a while it's gone. Neat stuff.

The leading commercial product does have one problem-- it has a bromine atom and will be hell on the ozone layer (unlike pure fluorocarbons, which are not an ozone problem). So the company's going to have a lot of EPA hassles, and have to have collections systems-rebreathers, etc, etc.

Steve Harris, M.D.

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From: sbharris@ix.netcom.com(Steven B. Harris)
Newsgroups: sci.med
Subject: Re: Liquid Oxygen to breathe? Help please.
Date: 23 Jan 1998 21:27:34 GMT

In <34C84A6A.1131502F@ttuhsc.edu> Mike Mikulecky <medsmsm@ttuhsc.edu> writes:

>I think your student meant perflurocarbon instead of liquid oxygen. It is a
>pink liquid that is supersaturated with oxygen.

It's not pink-- it's clear. Looks like water. The major liquid being tested commercially is perflubron, a perflorinated hydrocarbon with a bromine. It doesn't need to be supersaturated with oxygen. Normal saturation works fine.

>If you watched the movie "THE ABYSS" you probably saw it and thought that the
>stuff was a joke. They used the liquid to do a VERY deep dive.

This is fiction, of course. Nobody has ever really tried this.

>Anyway perflurocarbon is real. A few years ago there were some tests run
>to see if there is any application for the stuff in the medical
>profession. It was used in a few trials with premature babies (the
>thought was that you would not have to worry about a deficit of
>surfactant because the perflurocarbon would keep the lungs from
>collapsing). Great idea but it didn't seem to pan out.

Too early to say. The company that makes the stuff, Alliance Pharmaceuticals, stupidly ran the trials testing perfluorocarbon with regular ventilators, against no perfluorcarbon and high frequency ventilators. There wasn't any difference in efficacy (which is remarkable, since high frequency is the high tech of the future option for ARDS). But with all that money spent, now they don't know anything, because they have an experiment with TWO variables. Duh. Would perflurocarbon do any better if they used it with the new high frequency ventilators? That's the zillion dollar question that Alliance now has to spend even MORE money to find out. People recommended that they look at that from the beginning, but they weren't listening. Arrogance.

Steve Harris, M.D.

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From: sbharris@ix.netcom.com(Steven B. Harris)
Newsgroups: sci.physics
Subject: Re: Would a physicist please check this fiction fragment for errors?
Date: 13 Nov 1998 06:45:48 GMT

In <72gi3v$70f$1@news1.sirius.com> cpwUhUH@Spamrahul.net writes:

> That may be, but, the idea was that he needs to withstand a lot
>of acceleration. Would half inflated lungs help with that? And, he's
>not necessarily breathing.

Comment:

A LOT of acceleration (typically transient VERY high G) rips the fluid filled (therefore heavy) aorta off the top of your heart. Being immersed in liquid doesn't help with that problem. For really heavy continuous acceleration the problem is the strain on the heart in trying to pump blood at those pressures. Immersion in liquid doesn't help that much, either. Stop the heart and metabolism and you are limited by the aorta weight problem again.

I don't really know where people got the idea that breathing liquid helps you with acceleration. I think it's an incredibly dumb idea, as the lungs are mounted in such a way to support them as air-filled (therefore light) structures, not liquid filled (heavy) structures. Fill them up with liquid and accelerate a person, and my guess is the lungs will rip off some supporting structure long before the aorta does. Or simply rupture from internal pressure = rho*g*h. Nobody's ever tried this, but that's my guess as to what would happen. Hell, when we try to do simple CPR on dogs with lungs full of fluid we get all kinds of tears for just these related reasons. Lungs just aren't MEANT to put up with being manhandled like sausages. You don't take something that is engineered to stand up to 1 g when air filled, and fill it with heavy fluid and shake it at high g and get away with it. That's madness. You'll get about the same result as tossing a water balloon between persons, vs. batting around an air-filled one.

Liquid breathing with no gas at all may be helpful for divers who have to work at very high pressures, and need to control partial pressures and total gas utilization. For acceleration, by contrast, while you may want somebody floating in liquid to distribute body surface pressures, you definately want their lungs full of gas. And not just the lungs-- maybe their large blood vessels and heart also (so long as you're going to suspend their breathing, you might as well cool them and suspend metabolism also.). Remember those water balloons.

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From: sbharris@ix.netcom.com(Steven B. Harris)
Newsgroups: sci.physics
Subject: Re: Would a physicist please check this fiction fragment for errors?
Date: 14 Nov 1998 08:14:51 GMT

In <72hvlrbot1@news1.sirius.com> cpwUhUH@Spamrahul.net writes:
>But it looks like I made a more writerly error in not fully communicating
>a description of his condition, that he is really shut down except for
>his consciousness, not breathing, or anything, his entire body cavity is
>completely filled with liquid, including his blood vessels. His heart
>doesn't need to pump or his lungs breath because all the the cells are
>not even doing their own metabolic processes in his body, all is being
>sustained by external support (nanotechnology is very advanced for the
>builders of this transport system). Of course, if his brain cells aren't
>metabolizing, then how does he have any consciousness? I was thinking, in
>my own mind, that maybe some other process isomorphic to the triggerings
>of axons was tracking changes of states in his neurological system so
>that when he woke up, his brain would be in the same state AS IF he'd
>thought those thoughts under normal circumstances all along. Well, I
>didn't say all this in the story because I didn't want to get that bogged
>down in those details, and if I did I might lose the 'average' reader.
>But maybe I should accept the challenge and try to spell it all out more.
>Have I made myself clear to you now and do I satisfy your objections
>Steven?
>
>-Carl

No. He still has lungs full of heavy fluid (heavier still at high g) which are meant to be mounted and supported as light spongy air filled structures. They're going to rip and rupture. Ditto with blood vessels if you apply even more g. Fill em with gas. Why not? With no cellular metabolism you can do anything you want. With nanotech I suppose you can also do any supporting job you want, also, but in that case why bother with the liquid bath at all?

BTW, fluorocarbon liquids are typically twice as dense as water. That makes the problems of all this even worse.

Steve Harris, M.D.

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From: sbharris@ix.netcom.com(Steven B. Harris)
Newsgroups: misc.health.alternative
Subject: Re: Super-Oxygenated water?
Date: 2 Feb 1999 06:42:35 GMT

In <36B68A97.58F5@erols.com> "physical (Droll Troll)"
<physical@erols.com> writes:

> Further research showed that individuals who respond to oxygenated
>water have little gills in their stomach and intestines. These were
>once thought to be mere polyps, but now they are regarded as remarkable
>adaptation. Some, however, fear that such individuals, if allowed to
>procreate for several generations, will de-evolve to full-fledged fish.
>further research is required...

ROFL. Seriously, you can actually improve a patient's oxygenation by putting a tube into their peritoneum and ventilating that space with 100% stuff. That's actually being contemplated as an ICU measure as an alternative to extracorporeal membrane oxygenation, in those on the edge of hypoxic death from ARDS. And (of course) it's particularly nice for people with anaerobic peritonitis.

Needless to say, far more oxygen is available by this route than you can disolve in a liter of water. A liter of water gives you 20 cc's of O2, and that's a one-shot thing. If you ventilate somebody's peritoneum with pure O2, that's hundreds of cc's available, many times a minute. Enough to make a difference by diffusion if you're lying in bed, next to death. Don't bet on it, of course, if you're using 10 or 20 times the normal amount, running a race <g>.

Steve Harris, M.D.

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From: sbharris@ix.netcom.com(Steven B. Harris)
Newsgroups: misc.health.alternative,sci.med
Subject: Re: Super-Oxygenated water?
Date: 3 Feb 1999 23:12:33 GMT

In <36B82D61.6AF3@mcmail.com> Nick <hero.uk@mcmail.com> writes:

>No no, you're all wrong!
>
>It's that pink liquid that filmstars fill up diving suits with - neatly
>overcoming the dry-drowning reflex - and thereby sink to the bottom of
>the Marianas Trench in order to meet up with aliens.
>
>It's brilliant, I'm going to try it.

Good luck. Interestingly the first liquid breathing experiments by Golan and Clarke in the 1950's were indeed done with superoxygenated saline (done under higher pressure than you can get in a bottle, of course). They caused lung damage, but were enough to sustain a anaesthetized animal for awhile, if the saline was infused and removed in "slow" breathing. The stuff disolves lung surfactant, though, so it's not practical.

These days, liquid breathing is being contemplated using fluorocarbons, which are totally inert, and do not mix with water, oils, or surfactant. To my knowledge, total liquid fluorcarbon breathing (of the kind that would have to be used in deep sea dives-- as in the movie Abyss) has only been used in a couple of humans for a couple of hours, all on the edge or repiratory death anyway. None were awake, and none survived (not the fault of the chemical). Partial liquid fluorocarbon breathing, where the fluorocarbon fills about 1/3rd of the max capacity of the lung, has been used in humans extensively, however, in research. It avoids the problems of total flurocarbon breathing, which involve problems with CO2 diffusion in the liquid, and the viscosity of the liquid. It's very hard work for a human to move the 4 liters a minute of liquid he would have to move, just to get rid of all of this carbon dioxide, even at rest (and it would have to be much more if he was doing any work). Personally, I don't think we'll ever see this applied in humans for any application.

The mix of fluorocarbon and gas ventilation, however, has may possible clinical uses, and I think we'll see it routinely used for many people in a decade. I'm co-author of a pending patent on its use for rapid cooling, in fact, and presented an abstract about this work it at the last Society for Critical Care Conference in San Francisco two weeks ago. It's a very interesting field.

Steve Harris, M.D.

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From: sbharris@ix.netcom.com(Steven B. Harris)
Newsgroups: misc.health.alternative,sci.med
Subject: Re: Super-Oxygenated water?
Date: 4 Feb 1999 08:21:32 GMT

In <36ba0ac8.355292894@news2.ziplink.net> cgregory@gw-tech.com (Carey Gregory) writes:

>sbharris@ix.netcom.com(Steven B. Harris) wrote:
>
>>It's very hard work for a human to move
>>the 4 liters a minute of liquid he would have to move, just to get rid
>>of all of this carbon dioxide, even at rest (and it would have to be
>>much more if he was doing any work). Personally, I don't think we'll
>>ever see this applied in humans for any application.
>
>Granted the work effort would be overwhelming, but why is it not
>practical (potentially anyway) via mechanical ventilation in a
>critical care setting?

Cause it takes PRESSURE to move a lot of viscous liquid. Pressure you don't have to spare, cause you're working on poor guys with ARDS anyway, and worrying about baro and volutrauma (the proximal airways see a lot of the head-to-end pressure differential needed to move liquid all the way to the proximal airways). Heck, there're starting to experiment on ventilating asthmatics and others with bad airway disease with heliox to decrease the viscosity of the GAS. You can imagine what the problems are like with a fluorocarbon which is hundreds of times more viscous than a gas.

The other thing is pure fluorocarbon breathing just won't work in any hypermetabolic state, like fever, etc. You're already at the max for a normal anaestetized large creature, and past it for many small ones. Unlike the case with a gas, there's a max minute ventilation with pure liquid, and beyond that, even if you can put in the pressure to move it, you don't get any more alveolar ventilation, because all your extra ventilation is taken up by increasing dead space. In this case, a special kind of dead space due to CO2 diffusion in liquid problems (diffusion dead space). There's a great experiment in dogs (Undersea biomedical Research, Matthews WH et al, 1978, 5, 341-354) where they found out that increasing minute ventilation of fluorocarbon in dogs made no difference at all-- in fact their CO2 removal was actually worse.

I've discovered the problem, I think, which is that in smaller airways, fluorocarbon flow is so laminar that diffusion is all you have. To get good CO2 or heat transfer you cannot rely on diffusion (or heat conduction) but need some bulk convection. That's the OTHER reason why mixed gas/ fluorocarbon liquid ventilation works-- gas bubble induced fluorocarbon liquid convection in small airways. And it's the key to fluorocarbon heat transfer in the lungs. That's the point of the patent. A simple idea, but the guys doing it up till now just missed it. They got lousy heat transfer doing full liquid breathing (and didn't know why), and the people using partial liquid breathing weren't interested in heat transfer, and never did understand the gas transfer. They just knew it worked. The full liquid people understood very well why their gas transfer wasn't working, but they

never came up with the gas mix solution--- possibly because they were
thinking of exotic diving conditions, and not medical applications.

Steve Harris, M.D.

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From: sbharris@ix.netcom.com(Steven B. Harris)
Newsgroups: misc.health.alternative,sci.med
Subject: Re: Super-Oxygenated water?
Date: 4 Feb 1999 10:01:40 GMT

In <79bnqk$3925@news.okstate> gcouger@tacoma.ceatlabs.okstate.edu
(COUGER GORDON) writes:

>In article <79blac$9c1@dfw-ixnews11.ix.netcom.com>,
>Steven B. Harris <sbharris@ix.netcom.com> wrote:
>>
>> Cause it takes PRESSURE to move a lot of viscous liquid. Pressure
>>you don't have to spare, cause you're working on poor guys with ARDS
>>anyway, and worrying about baro and volutrauma (the proximal airways
>>see a lot of the head-to-end pressure differential needed to move
>>liquid all the way to the proximal airways). Heck, there're starting
>>to experiment on ventilating asthmatics and others with bad airway
>>disease with heliox to decrease the viscosity of the GAS. You can
>>imagine what the problems are like with a fluorocarbon which is
>>hundreds of times more viscous than a gas.
>
>Steve,
>
>How well does the heli-ox mix work on asmatics. I have developed
>a late in life cronic asthma and combined with MS is not a good
>thing. Fortuantly my airways are pretty big but I get real short
>of breath sometimes. Do you need a streight mix or doe He-Os and
>air work?
>
>
>Gordon
>
>Gordon Couger
>624 Cheyenne
>Stillwater, OK 74075
>405 624 2855

The more helium the better, but unless you're richer than sin, you
can't afford it all the time. Best get thee to a pulmonologist
specializing in asthma, and get on the leukotriene blockers, steroids,
anticholinergics, beta antagonists, and so forth used to dilate airways
these days.

And, if it's late in life, do be sure it's asthma and not heart
failure. See the cardiologist for an echo, too.

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From: sbharris@ix.netcom.com(Steven B. Harris)
Newsgroups: misc.health.alternative,sci.med
Subject: Re: Super-Oxygenated water?
Date: 5 Feb 1999 08:11:18 GMT

In <36B99C3D.309F@mcmail.com> Nick <hero.uk@mcmail.com> writes:

>Steven B. Harris wrote:
>>
>> Personally, I don't think we'll
>> ever see this applied in humans for any application.
>>
>>   The mix of fluorocarbon and gas ventilation, however, has may
>> possible clinical uses, and I think we'll see it routinely used for
>> many people in a decade. I'm co-author of a pending patent on its use
>> for rapid cooling, in fact, and presented an abstract about this work
>> it at the last Society for Critical Care Conference in San Francisco
>> two weeks ago. It's a very interesting field.
>>
>>   Steve Harris, M.D.
>
>
>Didn't I see something about research on this liquid for very premature
>babies, to avoid damage to the lungs on exposure to the air? Or was
>this in fact the mix you describe...

This is the very mix. The weight of dense fluorocarbon can open
alveoli which otherwise are held closed by lack of surfactant. But
it's not used clinically for cooling. Yet.

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From: sbharris@ix.netcom.com(Steven B. Harris)
Newsgroups: sci.physics
Subject: Re: Why don't whales get the bends?
Date: 18 Sep 1999 01:25:59 GMT

In <7rrdc1imi1@usc.edu> "Dane Myers" <iotarho@yahoo.com> writes:

>> Or just use an inert gas other than nitrogen to dilute your O2,
>> that's doesn't dissolve much in blood. Helium is a pretty good,
>> but I think it eventually reaches a viscosity limit when the
>> pressure gets too high so it's too hard to breath.
>>
>> Whatever happened to breathing that oxygenated liquid hydrocarbon
>> stuff? With that you could go to nearly any depth since besides
>> the lungs the whole body is mostly liquid and incompressible?
>> (I know it was in Abyss the Movie but it is a real technology)
>>
>> Mark
>
>
>Actually your viscosity answer applies here too, at leat as the limitation
>on the original medium (hyperoxygenated saline). The problem with the
>fluorocarbon related compounds that are the subject of recent research
>(though it was a few years ago that I read up) , and I think are what were
>represented in The Abyss, had to do with their poor ability to flush
>CO2 out of the lungs. Which as a free diver might tell you is also
>bad :).

  Absolutely correct. The problem with fluorocarbons is that although
they have twice the solubility for CO2 with pressure as they do for
oxygen, during a dive the oxygen gradient between fluorocarbon and blood
can be adjusted upward almost without limit (anything between almost
ambient partial pressure at that depth, and the 80-100 mmHg the blood
needs to stay more or less saturated).   By contrast, the gradient of

CO2 can't ever get over 40-45 mmHg (between your blood and new fluorocarbon without CO2). That's a problem, because you rely on that gradient and simple diffusion-- no convection-- for gas transport from alveoli to small airways under normal breathing conditions, whether your lungs are full of gas or liquid. And CO2 does not DIFFUSE as fast in liquid as it does in gas. So there's an artificial CO2 "diffusion A-a gradient," which has to be overcome by moving a lot of liquid. At least 5 L a minute for a resting man, and much more than that for a man doing any real work. That's hard, even for a non-viscous liquid. If you can't breathe more than 6 times a minute due to viscosity problems, it's pretty tough having to move more than a liter of liquid per breath.

The CO2 diffusion barrier doesn't exist in standard partial liquid ventilation (being tested now in medicine), where both fluid and gas is used (lungs are filled about 1/3rd up with fluid, and standard gas ventilation then used). I've seen this under fluoro with a non-radio-opaque fluorocarbon (not one used clinically), and hypothesize that this is not all due to normal CO2 removal in the remaining gas filled lung. The lung, in such conditions, is coated with fluorocarbon everywhere and bubbles shoot out in to the periphery quite dramatically. I suspect that the improvement in CO2 "diffusion" gradient is not due to shorter liquid columns, or none, but rather due to gas-bubble induced liquid *convection* in small airways, which moves a lot of gas by liquid convection movement of disolved gas, in mostly liquid-filled airways. One of the insights recently gained in my own lab is that there's a heat transfer "diffusion limit" in the lungs, just as there is for CO2, and this also can be more or less taken out by introducing mixed liquid and gas, to allow for liquid convection in small airways. Heat transfer is then humungous. It's a feature of our patent.

Gas-driven small airway liquid convection won't help deep divers who want to breath only liquid, however, obviously. There may yet be a way, though. In theory, small airway convection can be induced in flurocarbons by other means. One guy has even invented a double lumen lung cannula to stir the stuff. That's not going to work for divers, but some other stuff in our patent, like ultrasonic stirring of the liquid to get microconvection in small airways (something like what high frequency ventilation does now) should work even with no gas-phase gas. Remains to be proven.

Steve

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From: sbharris@ix.netcom.com(Steven B. Harris)
Newsgroups: sci.med.nutrition,sci.med
Subject: Re: Enteral oxygen absorption?
Date: 11 Jan 2000 08:36:25 GMT

In <jaimiep.947474525@cortex.physiol.usyd.edu.au>
jaimiep@cortex.physiol.usyd.edu.au (Jaimie Polson) writes:

>In <85b2bs$2bn$1@cubacola.tninet.se> "Fredrik Alvelöv" <alven@algonet.se>
>writes:
>
>>Hi!
>
>>I've come across a few companies, that sell oxygen caps and oxygen
>>drinks. Are there any proof that oxygen can diffuse or be transported
>>from the colon into the blood and increase the amount of oxygen on the
>>hemoglobin molecule? I've been looking all over the Internet and MedLine

```
>>for information, but nothing this far!
>
>>/ Fredrik Alvelöv
>
>
>First thing to understand is that under normal circumstances (healthy
>lungs), the heamoglobin in arterial blood is almost 100% (over 95%)
>saturated when breathing normal room air.  So such oxygen caps etc are
>not going to do anything to the oxygen levels in your blood.  If you
>wanted to increase the oxygen carrying capacity of your body, you really
>would need to increase the amount of haemaglobin (i.e through a blood
>transfusion).
>
>One interesting thing I can remember is about certain synthetic fluids
>that dissolve large amounts of oxygen.  Rats/mice were placed in these
>solutions and could "breathe" them, and live fine.  The fluids
>transferred the oxygen to the blood via the lungs, as air normally does.
>Of course, the animals were not drinking the fluid, they were breathing
>it.
```

The amount of oxygen per volume in such pure perfluorochemical fluids is indeed roughly two and a half times that of blood or air, IF the fluids are saturated with 100% oxygen. The problem, of course, is that it's easier to breath 2.5 times as much air as it is to inhale and exhale the given amount of heavy liquid. Also, carbon dioxide solubility is a real problem, so those animals have to work pretty hard. For this reason, you won't see total liquid ventilation any time soon in medicine, even though they've been fooling around with it since 1965.

Around the corner, however, is partial liquid ventilation, where the lungs are filled only 1/3rd to a 1/6th of the way "up" with liquid, and gas ventilation with a standard gas ventilator gets rid of the CO2. Two co-inventors and I have recently applied on a patent to cool or warm patients this way, using cooled or warmed perfluorocarbon. These chemicals are indeed odd stuff.

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