

Priestley and a sprig of mint

Revererend Priestley was relaxing in his living room one afternoon with his old friend from America Benjamin Franklin. They had just returned from church, and the two were discussing the topic of phlogiston, the substance that was believed to make up fire.

"Fire is not a material if you believe Lavoisier, but a chemical reaction and so is respiration... Remarkable theory, really." Franklin said with a dismissive chuckle.

"Yes, and he also thinks that air is not an element but made up of different gases. One of the gases he calls oxygen. Next thing you know he'll be telling us that we are descended from apes..." Priestley guffawed, imagining his friend Franklin as an ape. Glancing at Franklin a second time, Priestley suddenly found a striking resemblance between Franklin and an ape.

"Here, here," Franklin agreed as he withdrew a pipe and a pouch of tobacco from his coat.

Priestley was in a distracted mood that day and his mind was elsewhere. He was mulling over a question that had been bothering him for some time. It was a beautiful day and admiring it Priestley breathed deeply.

"We are all so focused on the question of what makes up the atmosphere- what is air- that none of us has bothered to ask, why is there air?"

Franklin chuckled at this remark, stuffing a pinch of tobacco into the bowl of his pipe.

"You might as well ask : why is the sky blue?"

Priestley looked at his old friend. Though he did not openly admit it, he felt vaguely superior to Franklin.

"I wonder if..." Priestley paused in mid thought. He heard the crack of a match and looked over at his friend Franklin. Priestley watched as Franklin lit his pipe. The bowl of the pipe repeatedly burst into flame each time Franklin inhaled. Priestley looked on in fascination as plumes of acrid smoke filled the air. Why is there air? He repeated to himself. Franklin was now smoking like a chimney... a chimney, thought Priestley. There are millions and millions of chimneys all over the world, and the new factories were belching out millions of tons of smoke into the air everyday. Priestley became consumed by the question, why is there air? Franklin noticed that Priestley was not paying attention. If there was one thing Franklin could not stand, it was not being at the center of attention. He found it rude.

"I say, Priestley..." Franklin called out to catch his host's attention. "Have I shown you my new invention? Really quite brilliant if I don't say so myself."

Startled from his thoughts at hearing the word 'brilliant', Priestley replied:

"Huh, wha..?"

"My new invention. Didn't I tell you about it?"

"No. I don't think so; but perhaps you were only being modest. What is it?"

" This. " Franklin replied as he withdrew a pair of glasses from his coat pocket and put them on. " Bifocal glasses.... "

Not to be outdone, Priestley showed Franklin his new inventions of the rubber eraser and soda pop. Franklin was green with envy. He considered Priestley to be his intellectual inferior, and he couldn't stand Priestley's irritable knack for getting it right all the time. The invention of soda pop was sure to have unforeseeable consequences for society, while Franklin's bifocals, well, handy as they were, would only make reading a little easier.

As evening fell, Mrs Priestley called the two men in for supper. They repaired to the dining room and sat down at the elegantly arranged table. While in the middle of enjoying the meal, a mouse suddenly appeared on the table, snatched a bit of bread and scurried away. Mrs. Priestley screamed. Franklin stopped short just as he was putting a piece of meat into his mouth. He paused with his mouth open and the fork still in front of it, and then slowly he returned the fork and the meat to his plate. Priestley looked on in discomfort and adjusted his jaw.

" How many times have I told you ? " the mortified Mrs. Priestley cried out.

" It's not one of mine, I assure you, dear. Mine are... well, they're not big and black like that. "

" Not one of yours ? How can you be sure ? Looks like one of yours. Course, they all look the same, " Franklin surmised.

They decided to cut dinner short and returned to the living room to enjoy some of Priestley's soda pop. Mrs. Priestley cleared the table.

Seated in the living room, Franklin again withdrew his pipe, filled it with tobacco and lit it. Priestley watched deep in thought as Franklin chattered along through his pipe.

" Are you listening, Priestley ? "

" Hmm... Oh, yes. "

" What did I say then ? "

Priestley did not reply. Instead, he asked:

"Have you ever noticed when you pull on your pipe it bursts into flames and burns hotter? "

Suddenly, there was a loud bang, a boot went flying through the air and Mrs. Priestley screamed. She appeared from the kitchen with a broom and was frantically beating the floor.

" Must be one of your mice again, " Franklin observed off handedly, puffing on his pipe.

" Must be... but what I mean is that pulling on the pipe draws air through it which makes it burn hotter. Therefore, the air must be causing the pipe to burn... "

" Go on, " Franklin said, suddenly interested.

" Now, we already know if we put a candle in an air tight jar and light it, eventually the flame will go out. Therefore, whatever caused the candle to burn must have been used up or been absorbed from the air... When we repeat the experiment with a mouse, the mouse dies... "

" Which explains why you keep such a large supply of them about the house. "

" So the mouse must be consuming the same thing as the candle. Therefore breathing and burning must be the same thing ! They must be doing the same thing to the air. They consume the good or fresh air- the air that supports fire and life- and they replace it with the bad or used air. This causes the candle to go out and the mouse to suffocate. "

" I did an interesting experiment the other day, Franklin said. "Inspired by your work on mice, I put a bag over my head and continued breathing until I passed out. I concluded that an unbreatheable gas was escaping from my body when I exhaled. That is your bad air, right ? "

The image of Franklin passed out with a bag over his head only confirmed to Priestley that his friend really was quite stupid. Only a fool or an idiot would risk his life trying such a dangerous experiment. Rather than saying anything, Priestley replied :

" Exactly. Now here is the thing. We live in a giant bag, to use your example, namely the earth going around the sun in empty space. So where does the good air come from ; in other words, why is there air ? It can't come from empty space, so it must have come from the earth. But the earth is only so big, as big as it is. And animals and people have been breathing the good air from the beginning of time. So why hasn't it all been used up? "

" You mean we don't have an unlimited supply of good air. "

" Exactly. Over time, the good air should have been replaced by the bad air. "

Franklin smiled slyly.

" Well, sir, if the good air should have been replaced by the bad air, then explain how is it possible for us to go on breathing ? " Franklin nodded, obviously pleased with his own cleverness.

" A fair and cunning question, Franklin. How do we go on breathing, when we should have used up all the good air a long time ago ? "

" Obviously, your theory is wrong. "

" Unless, of course, something is replacing the bad air with good air. "

Franklin looked up as if surprised.

" Yes... quite right... but what could it be ? " Franklin asked excited by this revelation.

" I don't know... " replied Priestley.

Franklin bit his lower lip and thought a bit.

" Did you know that Hale has recently shown that plants breathe too. Add that to all the bad air produced by animals and fires and it's really a wonder that life could exist at all on earth. "

" Did you say plants need air to survive ? Did they die like the mice when placed in the sealed jar? "

" I don't think he checked. "

" He didn't check ? Then I suppose I will. I have a hunch... " Priestley said as he lapsed into deep thought.

" You also have a mouse on your shoulder, " Franklin pointed out.

The next day in the lab, Priestley busily set up the experiment. Priestley used a sprig of mint left over from his morning tea. He put the sprig in the sealed jar with the candle. He then lit the candle with a magnifying glass to focus the sun's rays. The candle lit, burned for a bit and quickly went out. Priestley then left the jar with the candle and the sprig in it for a number of days. When he returned to the lab, he found this time he was able to relight the candle. Something had happened. Something that the sprig of mint did to the air in the jar. He repeated the experiment a number of times and found that mice would not die in an air tight container if there was a plant in it.

He quickly jotted off a note to Franklin and his other colleagues gloating:

"I have accidentally hit upon at least one of the restoratives which nature employs for the purpose of breathing and fire. It is vegetation."

Plants, Priestley discovered, convert the bad air, known today as carbon dioxide, into good air, what we call oxygen. This process is called photosynthesis. Animals, on the other hand, consume oxygen from the air and replace it with carbon dioxide, or bad air. This process is known as respiration. Respiration and photosynthesis work together, which means that plants and animals help each other to live.

So Priestley found the answer to his question : why is there air ? Because photosynthesis restores oxygen to the air, converting it from used air into fresh air for respiration.

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