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Opening extract from

Will Farts Destroy the Planet ?

Written by

Glenn Murphy

Published by

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Glenn Murphy received his master's degree in science communication from London's Imperial College of Science, Technology and Medicine. He wrote his first popular science book, *Why Is Snot Green?*, while managing the Explainer team at the Science Museum in London. In 2007 he moved to the United States. He now lives and works in Raleigh, North Carolina, with his wife, Heather, and two unusually large and ill-tempered cats.

Favourite science fact: the eye of a colossal squid measures 27 cm (almost a foot) across. It has the largest eyes of any animal in the world.

Glenn is currently writing his ninth book.

Also by Glenn Murphy and published in association with the Science Museum

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Will farts DESTROY the planet?

and other extremely important questions
(and answers) about climate change
from the Science Museum

Glenn Murphy

Illustrated by Mike Phillips

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Contents

Foreword: how this book works 1

Introduction to Climate Science 3

1. Transport and Travel 7

The Age of the Rechargeable Car 20

Biofuels: Plant Power and Grassoline 25

Crowded Planes or Flying Trains? 30

Up in the Air 35

Greener Paths and Smarter Traffic 41

Future Transport – Wordsearch 48

2. Future Energy 49

A Solar-powered Planet 61

Hot Rocks and Poo Power 67

The Wind and the Waves 73

Energy from Fossils and Atoms 79
Smart Grids and PowerNets 86
Power and Energy – Quiz 92

3. Food and Water 94
Hot, Crowded, and Hungry for Beetles! 103
Insect Recipes 108
Cow Farts and Future Farming 109
Saving Our Clear Blue Treasure 114
Drinking from Drains 120
Sponge-crops and Smart-crops 126
H_20 – Quiz 132

4. Plants, Animals and Human Adaptation 134
Living with Less Water 146
World Population – Puzzle 152
Rising Tides 154

Glaciers – Anagrams 159
Vital Forests and Vertical Farming 160
Shifting Species 167
Looking After Life 172
Endangered Animals – Wordsearch 177

5. The Future History of Climate Change 178
Getting Serious 190
New Rules for a New World 195
Shoving the World Towards Cleaner Energy 199
The World Works Together 205
History of Climate Change – Quiz 210
Jake's Story: the Quiz 212

Answers 215
Index 221

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Foreword: how this book works

This is not a textbook. You don't need to study it, memorize it, or answer its questions for homework. Unless, of course, you really *want* to . . .

This is a book that tells two stories.

The first is an imaginary tale about a boy named Jake, set around the year 2050. The story follows Jake as he explores the history of climate change for a school project.

Sound like fun to you?

No?

But remember this – Jake's history is our future. So along the way he'll be whizzing through our future traffic, exploring our future cities, talking to our future computers and eating our future foods. And while the story is fictional, everything in it is based on what scientists and engineers say *could* happen in the not-so-distant future.

The second tale is not imaginary.

It's the real story of climate change on planet Earth. It explains what's happening to the planet *right now*. It tells us all about climate science, and what we do and don't know about our environment, and why it's changing. And it looks at how we might adapt our lives and technologies to survive in a changing world.

We'll meet robot cars and high-speed supertrains, solar houses and drinkable toilets, future farms and farting cows, and, by the end of it, you'll know so much about climate change and future technology, you'll be able to do

Jake's homework for him! But happily, you won't have to. No tests, no essays – just read, enjoy and learn.

Also, you can read this book however you like.

Each section begins with part of Jake's fictional future story and then goes on to explore the real ideas and technologies Jake discovers along the way. But you don't have to read it all start-to-finish. You might prefer to skip between the chapters and read all the story bits first, then go back and read the 'real' stuff later. Or you might want to browse the chapters like web pages, dipping in and out wherever you feel like it. It's up to you.

But before you get stuck in, here's a quick introduction to climate science – just so you know where to start . . .

Introduction to Climate Science

Climate change isn't easy to get your head around. While the basic idea is pretty simple, the science can be complicated and confusing. What's more, people always seem to be arguing about how it works, how to tackle it, and whether it needs worrying about at all.

In the scientific world, pretty much everyone agrees that climate change is real, that it's happening right now and that it's definitely worth worrying about. But there are still questions about how quickly it's happening, how to stop it or slow it down, what problems it will lead to, how it will affect our future world and who will be affected.

The truth is, there is still a great deal we don't know about climate change. Predicting how it will affect the planet is a bit like predicting the weather – the further ahead you try to look, the harder it gets.

You might have noticed that weather forecasters on different channels on TV sometimes come up with different forecasts for the weather a week from now. But they almost always agree on what will happen tomorrow. Climate scientists are a bit like that, only they work on much longer timescales.

Just like weather forecasters, they measure temperatures, gas pressures and other features of the atmosphere and oceans, and use them to build computer models of how the climate is likely to change in the future. And while two different scientists might come up with

different ideas of what will happen 500 years from now, they almost always agree on what will happen in fifty.

This book, then, is based on what the majority of climate scientists say is likely to happen to the world within the next few decades.

The good news is that we're not talking about global disasters just yet. The oceans are not going to flood the entire planet. Ice caps and glaciers will (mostly) still be around, and most of the world's plants and animals – including us – will happily survive to see the next century.

The bad news is, there will be changes. Ice will melt, waters will rise, temperatures will rise, and people, plants and animals worldwide will be affected in a whole host of different ways.

So what do scientists think is happening? Well, here's the short version:

1) The atmosphere on our planet is already warmer than it should be, thanks to the greenhouse effect.
As you might already know, water vapour, carbon dioxide, methane and other gases in the Earth's atmosphere trap heat and keep the planet warmer than they should be, given that it's quite a long way from the Sun. Without the greenhouse effect, the Earth would be a much, much colder place, and most living things (including us) simply could not survive on it.

2) Our climate can change naturally over very long periods of time.
Global temperatures go up and down naturally over periods ranging from centuries to millions of years. This can happen after large asteroid impacts and volcanic

eruptions, or as the Earth's orbit of the Sun shifts or due to changes in the Sun's brightness or interactions between oceans, atmosphere and ice.

3) But the world now seems to be warming much faster than it should.
During the last fifty years especially, the warming of the atmosphere and oceans has sped up. A lot. And neither volcanoes nor asteroids, changes in the Sun or changes in our orbit around it can explain how quickly and by how much these temperatures are rising.

4) This recent warming seems to be man-made – caused by our burning massive amounts of fossil fuels for power and energy.
We've been burning coal, oil and gas for heat, light and energy to power machines for centuries. But it's only in the last hundred years or so that we've started burning HUGE amounts of them. Since 1900 the world's population has exploded, and with it the number of farms, factories and vehicles needed to support all those billions of people. Every new machine burns more fossil fuels and adds more greenhouse gases (like methane and carbon dioxide) to the atmosphere. Over time this has built up, changing our atmosphere and warming our planet in new and unusual ways.

So now we know all this, what are we going to do about it?

Well, that's what the rest of this book is all about. How *much* the world will change – and how much we'll be affected – will partly depend on what we do *now*.

Right now the warming of the atmosphere and oceans

shows no signs of slowing down. And while we have noticed it, and taken some steps to tackle it, we're still burning thousands of tonnes of fossil fuels and releasing thousands of tonnes of methane and carbon dioxide into the atmosphere every year. Even if we stopped burning fossil fuels *right now*, the warming would still continue fifty or one hundred years from now because there's already so much heat-trapping carbon dioxide in the atmosphere from the past 150 years of fossil-fuel use. And it doesn't seem likely that the world is going to stop burning fossil fuels any time soon.

Happily, though, we *are* doing things to try to tackle the problem. We're inventing new energy-saving technologies. We're developing new cleaner fuels and energy sources that might one day help get the atmosphere back to where it was. Now it's just a question of how quickly we can make it all come about.

We can't know for sure what will happen in our world by the year 2050, or what the kids and adults of the future will think about our efforts to deal with climate change today. This book represents one possible vision of how it might turn out.

The best thing you can do for our future world is to be like Jake, the hero of our story. Like Jake, you should ask questions, get answers and find out all you can about climate change and what can be done about it. That way, you'll be ready for the future, no matter what it brings.

OK – are you ready?

Then it's time to go. Off to the year 2050, where the school day is just ending . . .

1. Transport and Travel

Jake left school in a huff. As the bright, cheery digital chimes signalled the end of the school day, he hefted his laptop-backpack and stomped towards the huge solar-glass walls of the entrance lobby.

Frowning hard, he swung an angry foot at the clear exit doors. But of course they slid harmlessly aside with a quiet hiss, well before his foot could make contact. This just made him angrier. It was as if the school itself was mocking him, wasting his time, laughing at him.

This, for Jake, was not an unusual feeling. He had never really liked school and didn't see why he had to go. After all, some kids didn't. More and more kids these days were at Virtual Schools – joining classes via webcam and doing all their work from home. *Those* kids didn't have to deal with

beefy meatheads beating them up in PE classes. *Those* kids didn't have to worry about the 'cool gangs' giggling at them because their clothes and hair weren't trendy enough.

Jake was more short, dark and thoughtful than tall, tough and trendy. He found his daily schoolwork easy, if hardly exciting. He could happily do it all at home, on the screen of his touchscreen computer – one window open for his geography test, and three more for chatting and gaming with his friends.

Besides, going to school was just a waste of time. Jake wanted to be a games designer. What could easy, boring maths and geography classes teach him about that? He was just biding his time until he could leave school for DigiTech College. Then he'd be happy and free – like his big brother. Heath was at university already. No one bothered *him* about getting *his* homework done.

Jake was still frowning and grumbling as he stomped across the wide, flat square in front of the school and into the leafy park that lay beyond. Bike-riders and other walkers wove around him as he strode onward to the meeting place by the fountain.

Jake's dad worked in a small office less than a

mile from the school. So he and Jake would drive into town together each day, park the car, walk together for ten minutes or so until they reached the park, then split up at the fountain to walk the last part of their journeys. At the end of each day they'd meet back at the fountain to make the reverse trip home. Dad said it saved energy, and that the walking did them good. Dad was like that. Always going on about saving water and energy and stuff.

So today – like every day – Jake arrived at the fountain to find his dad there waiting for him.

'Hey, son,' said Dad, 'why the long face?'

'Hrrmph,' offered Jake by way of an answer, not stopping to wait as he strode past the fountain.

'I see,' said Dad, falling into step beside him. For a minute they walked in silence down the long, tree-lined path leading back to the parking centre. But Jake couldn't stand this for long.

'It's this *stupid* homework project,' he blurted. 'I have to do it this week, and email it to Mr Sharp by Friday morning. It'll take *ages* to do. And Dave and I just got to level twelve on *World of Ninja Dragoncraft*! It's such a pain. My whole week is ruined.'

‘OK . . . ’ said Dad warily. ‘So what’s the project about?’

They were walking on over the wide footbridge connecting the park to the parking centre, passing over the buzzing lanes of cars, buses and bikes below.

‘It’s about how the world dealt with climate change, from 2000 to 2050. Like, *ancient* history-of-science stuff. We have to find out all the big changes that happened in those fifty years. Like how they cleaned up transport, how they changed the way they make and use energy, how they dealt with the water crisis back in the twenties, and how plant and animal life has adapted to a warmer planet.’

‘Wow. That’s quite a list.’

‘Exactly! It’s just not fair.’

‘Anything else?’

‘Yeah. We also have to draw up this timeline of big ‘turning points’ in history. Like when the USA, UNASUR*, Russia, China and India signed some big Carbon Treaty or something. Bo-o-o-o-ring.’

They arrived at the bottom deck of the parking centre and hopped into the cylindrical glass-walled

* The Union of South American Nations (Union de NAciones SURamericanas). This is an organization of South and Central American nation-states – including Brazil, Argentina, Columbia, Peru and others. It was founded in 2008, and by 2025 it had become larger and more powerful than the USA

Up-Shuttle that would take them to level five. The doors slid shut, and the shuttle sped smoothly upwards.

'Well, you know,' said Dad a little testily, 'to *some* people that's not such ancient history. And to *some* people those turning points were very important and exciting.' The doors slid open and they emerged right in front of Dad's shiny silver Nissan ElectroRailer.

'Whatever,' said Jake, shrugging off his backpack and slumping into the passenger seat. As the electric motor silently started, and the car began its smooth glide around the spiralling ramp down to ground level, Jake stared huffily out of the window, his arms folded in front of him.

What did *Dad* know? He was *old*. He had a thick quiff of all-grey hair on his head. (Jake couldn't remember a time when it was any other colour, even when he was little.) He had thin, dark eyebrows that pinched together in the middle. And he wore square-edged designer glasses that might have been trendy back in the thirties but certainly weren't any more. Who wore glasses now anyway? Why didn't Dad just get his eyes lasered, like everyone else? He was *so* uncool-and-old-school.

The car glided from the ramp and slipped on to the main road. Dad flicked on the AutoDrive, and it merged seemlessly into the steady stream of traffic that whizzed by all around. Cars, buses and trams flowed smoothly along the wide, flat roads between the buildings. Overhead, long transparent cyclotubes made criss-crossing bridges between the rooftops. Jake squinted to see the bike-riders inside, pedalling from one green, grass-covered rooftop to the next.

Jake sighed dramatically. Then, when he got no response, he did it again more loudly. His dad looked up from the speed and ETA numbers blinking on the navigation screen before him and raised a quizzical eyebrow.

'Okaaay,' said Jake, rolling his eyes. 'You can help me with it. If you like.'

'Wow. What a gracious offer. How could I possibly refuse?'

'Oh, come *on*,' said Jake. 'You want me to beg? Fine. *Pleeeease*, Dad, will you help me with my *stupid* climate-change project?'

'Only if you stop calling it stupid.'

'OK, fine. Deal.'

Jake's dad smirked and chortled lightly to

himself. Then he took a breath, and his face became serious. He pointed a finger past Jake, gesturing towards an old-style engine-car, rolling noisily alongside them.

'You see that?' he said. 'When I was your age that was pretty much all there was to drive. Liquid-fuel cars, with big, noisy engines.'

'So?' said Jake, sounding unimpressed.

'So that was a big part of the problem. Millions of cars like that were releasing thousands of tonnes of carbon dioxide into the air every day – altering the atmosphere and the global climate. And by the time we got round to doing anything about it, the world was already changing around us.'

'But we *did* do something about it,' said Jake. 'We started making electric cars instead, didn't we? And now only old fogeys and poor people drive those noisy junk-heaps.'

'Jake,' said Dad, a warning in his tone, 'that's not very nice.'

'What? I'm right, aren't I?'

'As a matter of fact, no. It's much more complicated than that. Electric cars didn't suddenly arrive all at once. Right through the early twenty-first century we were still making cars with engines

alongside those with electric motors. Some people just didn't *want* plug-in electric cars. In the early days, electric cars were very expensive to recharge. And before the intercity charging stations were built, the fact that you couldn't go more than a couple of hundred miles on one charge was a problem. So most people stuck with what they knew: engines rather than electric motors. And car-builders found new ways to fuel their engines instead.

'Take that one,' said Dad, pointing again at the aging car beside them. 'What do you think it runs on?'

'I dunno,' said Jake. 'Old-school, dirty petrol?'

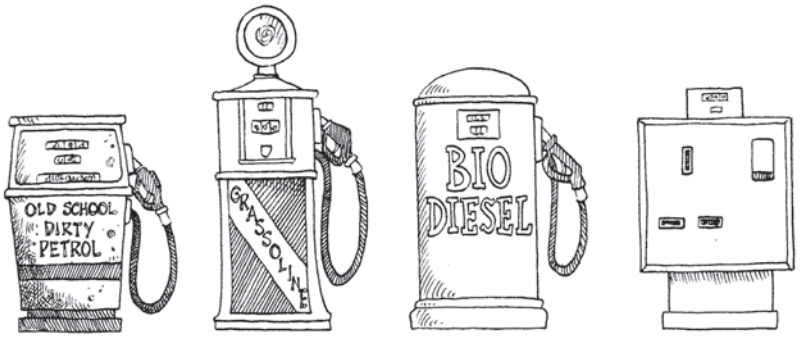
'Grassoline,' replied Dad. 'Cellulosic ethanol, made from recycled plant waste. And that one?' he said, pointing to the car in front.

'I give up.'

'Biodiesel. An older form of eco-fuel, which that guy probably makes at home by fermenting his food scraps and garden waste in a backyard bioreactor.'

'Whoopee,' said Jake. 'Good for him.'

'It *is* good for him,' Dad continued, ignoring Jake's less-than-enthusiastic response, 'and it's



good for us too. It was low-carbon fuels like those that helped to wean us off petrol and clean up our cars.

'Plus, nowadays, lots of people choose not to drive cars at all. They just take the tram, or the bus.' He pointed to a speedy electric tram on their left side, fully loaded with passengers and zipping past the car traffic in its own BAT* lane.

'But wasn't it always like that?' asked Jake.

'No.' Dad laughed. 'It really wasn't. Trams only ran in a few big cities, and even then, you couldn't go very far on one. And buses and trams were so *slow* that you had to allow nearly an hour to get to work or school. And cars took even longer.'

'What?!' Jake spluttered. 'That's crazy! How could they be so slow?'

* Bus-and-Tram

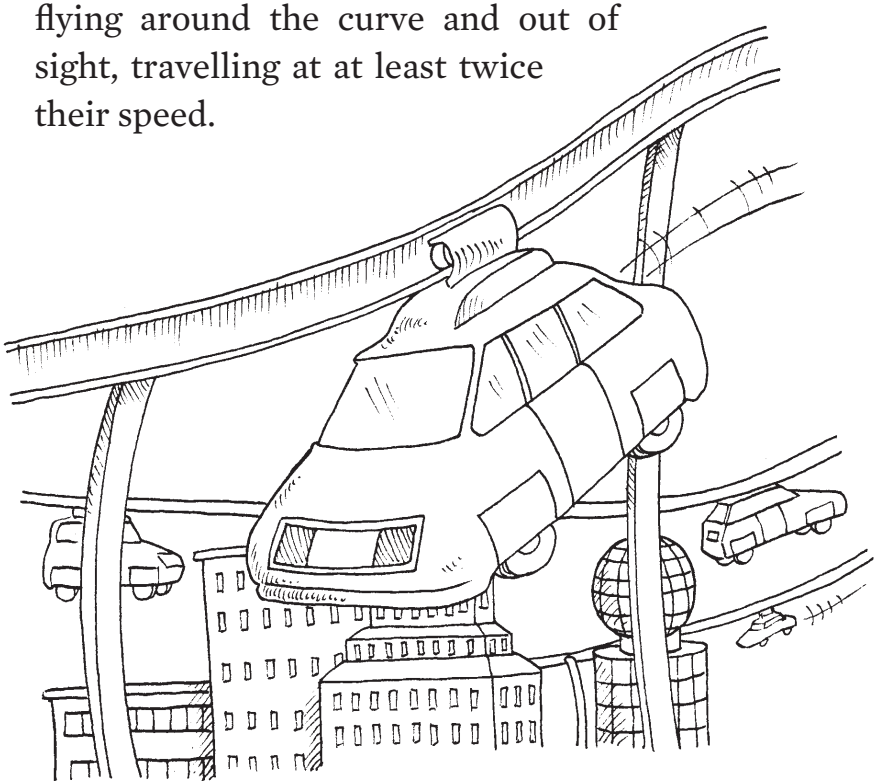
‘Because back then,’ said Dad, ‘we didn’t have computer-controlled traffic. Drivers had to judge it, and weave in and out for themselves. And anywhere two fast roads crossed, the traffic going one way had to stop – at a big red light – so that traffic going across it could keep moving. As you can imagine, that meant lots of stopping, starting and jamming. On average, cars rarely made it above 30 miles an hour in big cities. And buses rarely got above twenty.’

As their car wove its way through another junction, Jake looked at the other vehicles as they slipped in and out of side roads. The cars, buses and trams flowed smoothly around each other like flocking birds. He tried to imagine it as his dad had described it – with stop lights and queuing at every junction. He couldn’t. He gave up.

The car slid off the main road and up a long ramp to the railing station. There the AutoDrive guided it into position beneath the monorail, which stretched out across the city to the distant suburbs beyond. With a brief *whirr* and a sharp *thunk*, the roof-mounted drive wheels rose up to meet the rail and snapped firmly into position.

Within seconds, the car was cruising high over

roads and buildings, whizzing towards their destination at over 150mph. A little way off to the side, Jake could see a second elevated monorail, which ran parallel to theirs for a while, before curving off to the right. As he watched, a hovering Intercity MagLev* train suddenly appeared atop the rail. Within three seconds it was gone again – flying around the curve and out of sight, travelling at at least twice their speed.



* MAGnetic LEVitation

‘What about the railways?’ Jake wondered aloud. ‘You had *those*, right?’

‘Yes, we had railways,’ replied his dad, already programming the AutoDrive to detach and rejoin the road at the next RADE* station. ‘But believe me – they weren’t *at all* like this.’ Jake could see the station just up ahead.

The ElectroRailer slowed and the monorail dipped down as it approached the junction. (This was always Jake’s favourite part of the journey – the sudden drop lifted his lunch into his chest, reminding him of the high-speed terror coasters at Chessington.) At the bottom of the dip, the roof wheels derailed in one swift movement, and the car dropped lightly on to the road, still rolling.

Before long they were home. As they turned into the driveway the garage door slid open to swallow the car. Jake picked up his pack and jumped out. Jake’s dad emerged from the driver’s side, leaned across to the wall, flicked the switch to activate the charging plate and closed the door. In the floor beneath the car, the plate buzzed and hummed as it recharged the battery.

‘This is even bigger than I thought,’ sighed Jake.

* RAiling-DErailing station. Where convertible car-trains attach and detach themselves from high-speed monorails.

‘I’ll never get this stup—’ His dad frowned. Jake paused. ‘. . . this *project* done by Friday.’

‘Well, you’ve made a start,’ said Dad. ‘Perhaps your mum can help you with the next bit.’

‘Great,’ said Jake, and stalked sulkily into the house.