

# Fighting for your life

**Patrick D.A. Shearer**  
(University of Glasgow, UK)

This is the ninth year the Biochemical Society has run the Science Communication Competition. The competition aims to give talented young science communicators the opportunity to have their work published in *The Biochemist*. This year's competition attracted entries from around the world covering a wide variety of topics, in both the written and video categories. The entries were judged by our expert panel of judges. In this issue we are proud to present the second place entry from the written category by Patrick D.A. Shearer.

DON'T. MOVE. The tone was serious, but the voice deadly silent. I froze. Silence for a second. I was about to keep moving until I heard it. A dragging sound, off in the distance. It slowly came into view. A massive, bulging monster with small tendrils projecting from its surface. Stopping every now and then to gobble something up or to investigate something with its tentacles—a macrophage. My partner looks at me and smiles: jackpot!

They call me the Human Immunodeficiency Virus—HIV for short. Virus means poison and I got that name because I go after the immune system and because I infect humans. It's just propaganda, and typical human arrogance. I was infecting chimpanzees long before I ended up in humans! I'm the most feared of my kind because I'm hard to detect and even harder to kill. My biggest threat are T-cells. They're the snipers of the immune system, they can detect me and hunt me down

and if they do, I'm in big trouble. My way around them is to sneak inside them and hide—talk about hiding in plain sight! What's even better is that the human I'm attacking won't know I'm here until it's too late. Sympathy? No, I don't feel any of that. After all this is war. We build our weapons and they build theirs. They have this awful thing called a vaccine. It trains the immune system and tells it what to look for so it's ready when we attack. They got it because some other viruses like smallpox were being reckless. They go in all guns blazing and are surprised when they get caught. It was this recklessness that led to the vaccine. They don't have a vaccine for me though. I'm too sneaky for that. Me and my partner are both HIV, but we wear different disguises. We're always changing the way we look so that the immune system doesn't know what to look for. It also means if one of us gets caught, we don't blow the other's cover. My job is to get inside and break down their defences. After that they

**Main image:** 3D rendered HIV in the blood stream.



won't be able to defend against the others, even if they have the vaccine. Clever right? That's why we're so happy. That thing lumbering towards us is a macrophage; it's a clumsy cell of the immune system that wanders around looking for troublemakers like us. We're going to grab onto it and sneak inside. Once we're in we'll start building our numbers for our next attack.

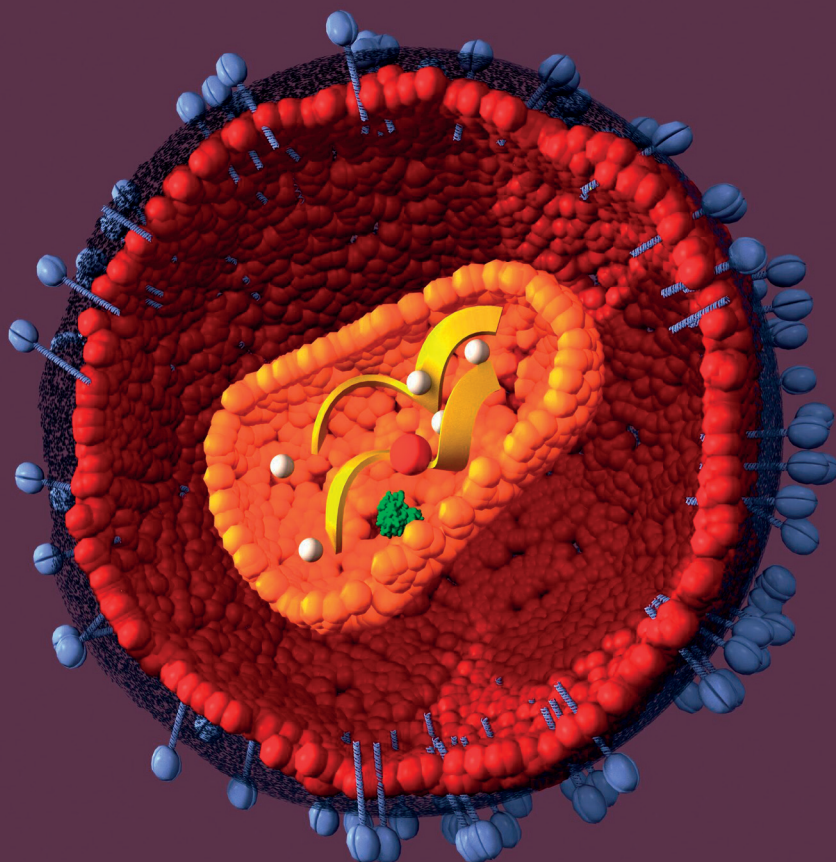
We watch carefully as the macrophage slowly passes, we're looking for something. A protein called CD4. The macrophage uses it to talk to other cells and to call for reinforcements. See, CD4 is like a lock and although I don't have the key, I know how to break in. We make a run for it. This is our big moment, this is the last place we can get caught. Once we're inside we can't be stopped. We're almost there. I look over to congratulate my partner but he's celebrating too early. He hasn't noticed, but there's something on his back. It's another weapon called complement. It's sticky and makes you look tasty to macrophages. Suddenly one of the tentacles shoots out from the cell and swallows my partner whole. A horrible fate awaits him inside. He'll be taken deep inside and destroyed. What's worse is that because he's been caught, the immune system will be on the lookout for us. The mission won't die with him though, because I've made it to the door. My first goal is complete, but now I'm alone. That's alright though because I'm going to use

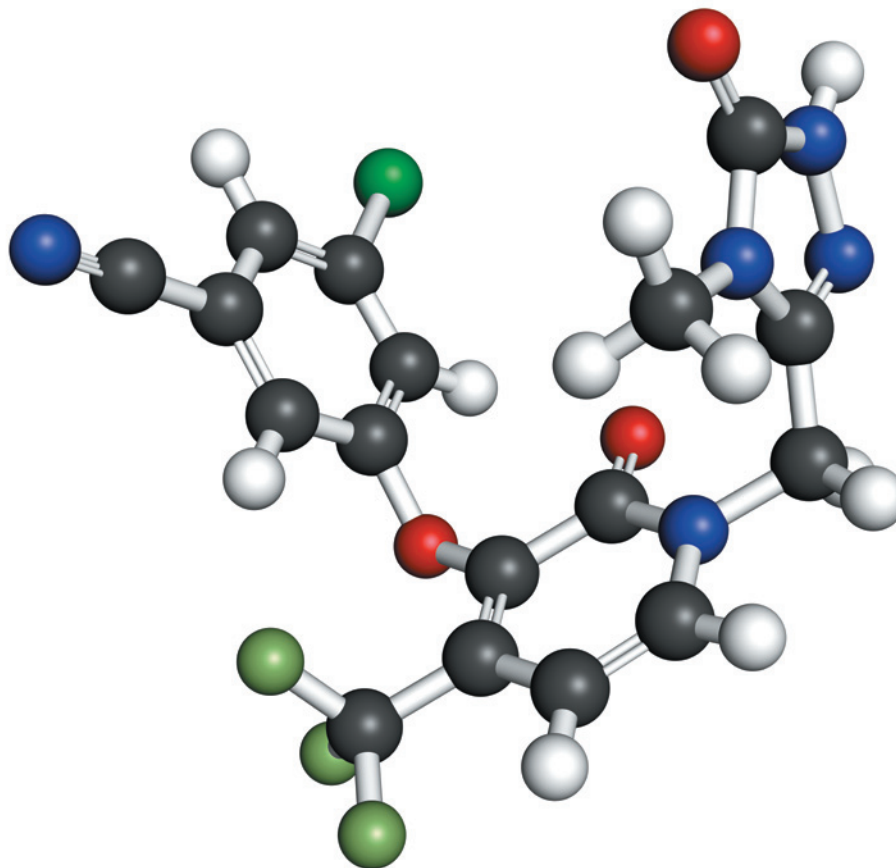
the resources in the cell to make lots of copies of myself. I ditched my disguise when I entered the cell, so I must work fast. What makes me different from other viruses is my toolkit. I have this enzyme called reverse transcriptase (RT). It's a mouthful I know, and it's heavy, but it's vital to my mission. The problem is I'm made of RNA. RNA is similar to DNA, but it's only made of one strand and isn't as stable, so I have to use it quickly. I need to take advantage of a machine in the cell called a ribosome. If I give it DNA, it will build my reinforcements for me. Problem is that the ribosomes don't understand RNA, so I have to turn my RNA into DNA using my RT. It's perfect because the cell does all the hard work for me, and they have no way of telling what's theirs and what's mine! I've been doing this for generations, I'm a total pro and to tell the truth it's easy. All I have to do is... wait. Where's the...? Something's wrong.

## Two weeks earlier...

Fluorescent lights, phones screeching, coughing, wheezing, screaming kids. I can barely breathe through the smell of disinfectant. It feels like hours pass before my name is called. I walk down the hall like a zombie, the same way I've been for the past month. The doctor's words echo in my ears: "HIV isn't a death sentence anymore, there are things we can try". The past few weeks had been excruciating. Sleepless nights, reading newspaper articles and journals trying to make sense of the mountains of jargon. I take a seat in the doctor's office, the bags under his eyes suggest he's getting less sleep than me. "How are you feeling?" I don't know why he's asking, I look like death warmed up. "I've been looking into this new drug on the market, called doravirine" he explains dryly. I think through the hundreds of papers I read the past week, I don't think I know this one. All the drugs sound the same and have lists of side effects the length of my arm. Without checking to see if I'm following, he continues: "It's a reverse transcriptase inhibitor, I think we should add it to your treatment regimen.". Another drug. I already spend half my day taking my current cocktail of pills, what's one more? Reverse transcriptase, I think I remember reading something about that. It messes with the virus making copies of itself, or something like that. I think I was on coffee number 10 during that paper. I dread to think about taking another pill, but everything online says that combination therapy is the best way to beat HIV. What I hadn't realised was that some of the viruses had picked up resistance to some of the drugs, so using a variety gives you the best chance of winning. I don't see how it could make me feel much worse, so I take the prescription and try to ignore the doctor's empty sympathy. After an evening of scouring the internet for miracle cures, I take my mountain of pills and try to catch some sleep.

**Main image:**  
AIDS (acquired immunodeficiency syndrome) virus.





**Main image:** Doravirine HIV drug molecule (non-nucleoside reverse transcriptase inhibitor), 3D render.

### Meanwhile, in a cell not so far away...

I don't understand. This always works. I unpack, and the enzyme starts copying. This is a problem. The cell is full of nasty enzymes called nucleases. They patrol the cell and chew up any DNA or RNA that is out of place, and right now I'm seriously out of place. I don't have my protective coat anymore and there's no going back now that I'm inside, I'm a sitting duck here. I seriously need my RT to start working before... oh no, not like this. Right on schedule, a nuclease is heading for me. I give up on the RT, turn tail and run—but it's no use. It's faster and I have nowhere to run. It grabs on to the end of my RNA and starts tearing it apart piece by piece. I've failed. It's over.

Today the lights make everything brighter. I don't mind the crying kids or the sneezing pensioners. This time the doctor doesn't have to ask how I feel, I'm a changed person and we both know it. "Your viral load is down which means you're fighting off the virus. It's not a cure, but you're on the right track." He says smiling. I think this might be the first time I've seen him smile. I know I'm not cured. I still feel sick; the drugs make sure of that. But for the first time in months I can eat and sleep. I can go to work, see my friends, do my hobbies. I'm still fighting, but it's different now. I have my life back. ■

### Further reading

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