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Tiny Specks of Misery, Both Vile and Useful

By NATALIE ANGIER

I spent New Year's Eve with friends and family. A couple of days later, my pathologically healthy mother called to say she'd gotten very sick after the party, like nothing she'd experienced before. She thought it had been a stomach bug. Hey, it's just like in "The Devil Wears Prada," I said lightly, the perfect way to jump-start your new diet!

Hardy har. By that afternoon, my husband and I had been drafted into the same violent weight-loss program, and for the next 18 hours would treat the mucosal lining of our stomachs like so much pulp in a pumpkin, while our poor daughter ran around scrubbing her hands and every surface in sight as she sought to stay healthy. I am relieved to report that she succeeded, and that her parents lost 10 pounds between them.

The agent of our misery was a virus, very likely a type of norovirus. Named for Norwalk, Ohio, the site of a severe outbreak of vomiting, nausea and diarrhea among schoolchildren in the late 1960s, the norovirus is a small, spherical, highly contagious virus that targets the digestive system. Its sour suite of symptoms is often referred to as "stomach flu," but norovirus infection is distinct from the flu, which is caused by the influenza virus and targets not the gut but the lungs.

Well, not that distinct. Noroviruses, flu viruses, the rhino and corona viruses that cause the common cold, the herpes virus that causes the cold sore, all are active players in the wheezing ambient pleurisy of January.

As viruses, all of them are, by definition, infectious parasitic agents tiny enough to pass through a microfilter that would trap bacteria and other microbes, tiny enough to fit millions on board a single fleck of spit. All viruses have at their core compact genetic instructions for making more viruses, some of the booklets written in DNA, others in the related nucleic language of RNA. Our cells have the means to read either code, whether they ought to or not. Encasing the terse viral genomes are capsids, protective coats constructed of interlocking protein modules and decorated with some sort of docking device, a pleat of just the right shape to infiltrate a particular cell. Rhinoviruses dock onto receptors projecting from the cells of our nasal passages, while hepatitis viruses are shaped to exploit portholes on liver cells.

Their ergonomic specificity stems from the competition for a niche in a virus-packed world. Viruses very likely arose along with or possibly just before the appearance of the first living cells, nearly four billion years ago, and they have been jimmying cellular locks ever since. "Viruses are found everywhere, in every tree of life," said Phillip A. Sharp of the Center for Cancer Research at M.I.T., "and every virus has to have a scheme."

It's easy to hate viruses for those freeloading schemes: nice trick, forcing me to throw up just so you can get out and mingle. How about if I name an entire class of computer problems after you? Yet viruses can seem almost tragic. Many strains, it turns out, are surprisingly delicate.

“Microbes like the anthrax bacterium can remain dormant in the soil for years” and still retain their power to kill, said Marlene Zuk, author of “Riddled With Life” and a professor of biology at the University of California, Riverside. “But viruses are really fragile, and they can’t survive outside their host for very long.” A few hours, maybe a couple of days left unclaimed on a cup or keyboard, and the average viral spore falls apart.

And they are so nakedly needy. They depend on our cells to manufacture every detail of their offspring, to print up new copies of the core instruction booklets, to fabricate the capsid jackets and to deliver those geometrically tidy newborn virions to fresh host shores. Through us, viruses can transcend mere chemistry and lay claim to biology. Many scientists view viruses, with their lack of autonomous means of metabolism or reproduction, as straddling the border between life and nonlife. But if there is ever a case to be made for the liveliness of viruses, it is when they are replicating and mutating and evolving inside us.

Yet viruses have not only taken; they have also repaid us in ways we are just beginning to tally. “Viral elements are a large part of the genetic material of almost all organisms,” said Dr. Sharp, who won a Nobel Prize for elucidating details of our genetic code. Base for nucleic base, he said, “we humans are well over 50 percent viral.”

Scientists initially dismissed the viral elements in our chromosomes as so much tagalong “junk DNA.” But more recently some researchers have proposed that higher organisms have in fact co-opted viral genes and reworked them into the source code for major biological innovations, according to Luis P. Villarreal, director of the Center for Virus Research at the University of California, Irvine.

Some genes involved in the growth of the mammalian placenta, for example, have a distinctly viral character, as do genes underlying the recombinant powers of our adaptive immune system — precisely the part that helps us fight off viruses.

In fact, it may well have been through taking genomic tips from our viral tormentors that we became so adept at keeping them at bay.

“Our bodies spontaneously recover from viruses more so than overwhelming bacterial infections,” said Anthony S. Fauci, director of the National Institute of Allergy and Infectious Diseases. “Viral infections have shaped the nature of the human immune system, and we have adapted to mount a very effective response against most of the viruses that we confront.” Vaccines accentuate this facility, he added, which is why vaccination programs have been most successful in preventing viral diseases.

Should prevention elude you, well, you may at least lose some weight.