

Chapter 1
A PUZZLE TO SOLVE

*“Yeah, it’s true we’re all dealt a set of cards.
But it’s also true that it’s up to us to figure out how to play the hand.”*
— Francis S. Collins

My heart was beating faster than normal as I scrolled through the data on the screen in wonder. So this is what everyone was waiting for I thought, and I was the first see it. It was 2:25am, April 12, 2003 and the complete genome sequence appeared on my screen. These many letters, the DNA sequence, has being scaring the world. I got up in elation leaving my chair for the first time in hours. But there was no one around to share the excitement with; my colleagues had left hours before on that Friday night. I sat back down to examine in more detail and verify that what I saw was indeed correct.



The sample that would lead to world-wide headlines arrived from Winnipeg early April of 2003, ready for analysis. At the time, the GSC (Genome Sciences Centre) at the BC Cancer Agency in Vancouver was the only major DNA sequencing centre in Canada. Even though this was not a cancer project, many were depending on our facility to produce the complete sequence of the SARS coronavirus (SARS-

CoV) genome, and urgently. People were dying. Knowing the DNA would lead to drugs to combat the virus. We were aware that the CDC (Center for Disease Control) in Atlanta was doing the same and we hoped to report our findings before them.

During the week of April 7th, the lab prepared the sample for the DNA sequence machines. The DNA, composed of bases, was broken in pieces several hundred bases and converted to data called sequence “reads” which we then had to overlap like a puzzle to get the complete genome sequence of the coronavirus. The machines pumped out that data which we were waiting to analyze. To put it simply, we had to overlap reads and align them to put together the full genome sequence using various software packages and the code we developed.

On Friday, April 11, 2003, the first set of data from the lab became available and a few of us researchers got to work to analyze it. With each batch that became available, we transferred the data immediately to our computers for analysis. A couple of other brilliant colleagues who reported to me, Obi and Anca, designed a data pipeline for putting together the puzzle—the complete sequence. Like me, Obi was dark haired and a twin. Ironically, like our sample we were working with, he was also from Winnipeg. He was easy to communicate with as was Anca, a good looking and smart woman with a slight accent of which language I couldn't figure out.

Because the staff in the lab worked hard to the late hours during the week, it made sense for us analysing the data to do the same. It was hard to go home at the end of the day knowing we could be the first in the world to contribute to the efforts of dealing with the virus using knowledge based on the DNA. Around ten o'clock, a few from the lab joined others in bioinformatics to go out to eat. I remained at my desk with no interest in taking a break. Some came back after to check on things and then left. Soon I was the only one at the genome centre.

After a few hours of analysis putting the puzzle of DNA sequences together, my heart was beating fast and at 2:25 am, the complete genome sequence appeared on my screen. I was in awe that this was what was causing such a scare around the world. Little did I know that 17 years later, there would be a rush to analyze another coronavirus—Covid-19 (SARS-CoV-2). After looking at the data, confirming that there was enough evidence at each of the 30K bases, I knew we had the complete genome sequence.

I typed out a quick email. “Mom, we did it!”

I then sent a short message to inform staff of where we were in the analysis. I spent the next hour and a half scrolling on my screen. Thousands of letters; As, Ts, Gs, and Cs denoting the 4 bases of DNA of the genome we put together. Seeing this made it real what I had studied back in university. For the first

time, reads were overlapping (coverage) with no gaps from the start of the virus's genome to the end. I sent an image to the laser printer—a complete picture of DNA coverage for the full SARS coronavirus genome. It was 4 am and I danced around my desk holding the paper in the air as if it was the Stanley Cup. I had just scored the winning goal but there was no one around cheering. I emailed the image of the viruses genome and I decided that it was time to head home and catch a few hours of sleep. No doubt my email would cause a flurry of interest. I was the first in the world to hold the full genome sequence of the coronavirus in my hands.

I made my way out from the 3rd floor of the cancer clinic into the dark that was slightly transitioning to light. As I walked up the street which was just was silent as the computer room, to my apartment, I sensed a bitter-sweetness in the fresh air. There was no one to share my excitement with other than the moon above me. I got to the street light, the only one on the way home, and pondered. I would have liked to have arrived home, crawl into bed, and whisper to my girlfriend that we did it. Alas, we had split the previous year. With no traffic, I crossed the empty street reviewing the evening in my head. I wondered who would be the first to see my email.

My eyes opened slowly and I saw that it was 10 am. I felt a small headache but rushed out without a bite to eat. As I walked briskly, I thought of my twin brother, Noam, mentioning that over the previous few months he noticed I was having a lot of headaches. My excuse was the extra time I spent doing exciting cancer research. I think this affected the relationship with my girlfriend who prepared dinners and waited for me to come home from working more than normal hours. I had a gut feeling my headaches were a result of my lingering sadness losing her, something of which I kept to myself.

Thus grief had made space in my brain and grew as I believe I had not properly released it. I didn't have time to; there were too many exciting things going on in my life. yoga, taekwondo and hockey every week. I crossed the intersection again, waiting for the light to turn green, this time with many cars on the road.

I walked into the office that Saturday morning suddenly seeing a super busy room that was empty the previous nice. Clearly my email was caught by many. There were staff everywhere and it felt like it was a normal workday but this time there was extra excitement in there air. Anca and Obi were at their desks along with my supervisors Marco and Steve. The lab was busy also and more sequence was to be coming in which we would use to further analyze the genome and confirm the quality of the DNA. The more reads, "puzzle pieces," that overlapped and connected at a certain location, the more confident we were with the quality and accuracy of the final result. We continued to work throughout the

day as more and more data became available knowing the full genome sequence could potentially allow researchers throughout the world to come up with effective forms of treatment. Someone brought in donuts from Tim Horton's along with Egg McMuffins and a full selection of Safeway orange juice—pulp, no pulp, and low acid. The local media showed up and were at my desk while Marco and I examined the sequence. Later that day we held a press conference.

After reviewing and confirming the results in Marco's office that night, April 12, 2003, we felt we were ready to report our findings. Steve would be uploading the complete sequence to a known public database and informing the media that we had made the sequence public. I decided to take Obi and Anca out for a late celebratory bite to eat at the Cactus Club. We pondered if we should get paid for all the extra hours. It was worth it we thought whether we did or not. My headache was gone and on Sunday, we were the lead headline of city newspaper.

“Scientists at the BC Cancer Agency have made a major breakthrough in solving the puzzle of the killer virus known as SARS. The Vancouver scientists are the first to crack the genetic code of the Severe Acute Respiratory Syndrome virus—which will speed the diagnosing of victims of the often-fatal disease and help with the work of finding a vaccine. The group, working out of the Michael Smith Genome Sciences Centre, made the discovery at 4 am yesterday”

— [*The Province, April 13, 2003*](#)

We announced our findings before the CDC which I think made many Canadians proud. Our work traveled quickly not just in Vancouver but throughout the world from articles in the NY Times to cover stories in a few other magazines such as Newsweek and BC Business. We published in [Science](#) back to back with the CDC's publication in May.

I was proud of our accomplishment and knew that we would do many more great things at the genome centre, and my career took a giant leap forward.