



Invited lecture/Reflection

Interdisciplinary Cooperation and Education at Charité Universitätsmedizin Berlin

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Abstract

This report includes the written experience and reflection of a physician and two students from different faculties of the University of Ljubljana. Within the observatorship programme, we took part at the renowned medical clinic Charité Universitätsmedizin Berlin (Charité). Our stay has familiarised us with several campuses of hospitals and institutions, all taking part of Charité. Within the scope of the observatorship, we got to know several medical professionals from different fields, we were able to observe their work, ethics and their approach to treating patients in outpatient clinics and in intensive care units. Additionally, we were presented with the clinical research conducted by many researchers in Charité's laboratories. The experience of observing work and research at Charité has thus helped broaden our horizons, make new long-lasting international connections and introduced us to a new, different world of knowledge previously unfamiliar to us.

Keywords: Observatorship; Interdisciplinary cooperation; Research; Student; Charité.



1. Introduction

The article is organized in four parts: the first part reports the experiences of the authors in organizing and staying at Charité Universitätsmedizin Berlin (Charité). The second part includes a report of the first author (E.K.), a 1st year student of general medicine at University of Ljubljana, Faculty of Medicine and observations of the third author (B.K.), an orthopaedic surgeon. The third part includes a report of the second author (T.T.), a 2nd year student of biology at University of Ljubljana, Biotechnical Faculty. The fourth part includes data on the organization of Charité and on its history.

2. A Visit to Charité

The visit to Charité took place due to the contact of the authors with professor Andrej Trampuž, the Head of the Musculoskeletal Infections and Research Department at the Charité. Professor Trampuž started his medical career at the Faculty of Medicine of the University of Ljubljana, continued his medical career at the Mayo Clinic in the United States, later moved to Switzerland, and since 2013, he has been employed in Berlin. The first discussions about a visit to Charité for professional training of B.K., so called observatorship, started over two years before the visit. At that time, E.K. and T.T. have already chosen their studies and future professions and were delighted to be included in the visit to this distinguished institution. The most intensive discussions and the planning of the three-month observatorship started roughly a year before we left for Berlin. There, professor Trampuž invited us to visit him and observe his infectious diseases research department in Charité to get an impression on the work and ethical conduct taking place in Charité.

Prior to our departure, we were informed by the Charité officers that E.K. and T.T. would be observing and shadowing the work of the medical staff and Professor Trampuž. B.K. would be able to participate in consultations, however, he could not have his own patients there due to the lack of B2 or C1 level German language certificates.

After securing the opportunity for an educational visit to the Charité, our next big step was finding an apartment, which proved to be a major undertaking. There was already a significant housing shortage in Germany's capital under normal circumstances, and after two years of the COVID-19 pandemic and its corresponding lockdowns, the influx of tourists and seasonal workers was even greater.

Berlin's residents and political leadership were facing soaring rents, which have risen by up to 200% since 2006 (Perković, 2022), making finding affordable housing a very difficult task. The war that has been going on in Ukraine since February of 2022 has also contributed significantly to the occupation of housing throughout Germany. According to a BBC report, in the first four months of the war until July 2022, about one million Ukrainians have fled to Germany and were seeking refugee facilities and temporary housing (BBC, 2022). After months of searching for housing, we found a large semi-basement apartment in the Westend part of Berlin, just outside the ring road in the western part of the city, through a local German agency called Wunderflats.

We were very pleasantly surprised upon our arrival at Westend in Berlin. The neighbourhood was very quiet, the properties there were spacious and dominated by old villas with large gardens full of greenery. In addition, there were many embassies in Westend, which means that there was additional security, rendering the staying in that area even safer and more pleasant. Upon our arrival, we asked the landlords about public transportation in Berlin, which turned out to be one of the most efficient passenger transport systems we have ever used. We bought a monthly pass valid for all forms of Berlin public transportation (including bus, tram, overground, underground and commuter train) via the official BVG app (BVG, 2023). Fortunately, we found that Berlin's political leaders had reduced the price of the monthly public transportation pass from over €100 to just €9 per person for the summer of 2022 (June, July and August) in order to promote the public to use the public transportation instead of private cars, and thus helped to reduce harmful emissions.

As a result, over the course of the summer, roughly 52 million people bought the reduced public transport ticket to decrease CO₂ emissions by around 1.8 million tonnes (Feingold, 2022). On the first day of the observatorship in Berlin, we met professor Trampuž at the Charité Virchow clinic located in the Northern part of Berlin. We found security guards stationed at all entrances to the campus, requiring a negative COVID-19 test or a certificate of employment from each person entering the clinic. Thus, before entering, we had to show



the invitation to the clinic. Professor Trampuž then showed us around the clinic's campus and took us to the infection department, to which he is the head. We discussed the possibilities of observation and training in several different departments in regard to B.K.'s preferred specialty, that is orthopaedic surgery, and interests of E.K. and T.T.

3. Professional Education at Charité University Medical centre Berlin (E.K. and B.K.)

E.K. and B.K. have acknowledged during their stay, that in the Berlin's world of medicine, the Virchow-Klinikum Campus is considered the centre for emergency cases and septic surgery cases, especially musculoskeletal infections. On this campus, professor Trampuž runs his own research department regarding infections within the Musculoskeletal Surgery Clinic, and thus works closely with main surgeons. On the other hand, one of Charité's other campuses, Charité Mitte is considered to be the centre for primary surgery and revision surgery, and is home to some of the world's leading specialists in orthopaedic surgery. The Virchow-Klinikum and the Charité Mitte Campus have an intensive collaboration, with vans constantly running between them to transport health professionals for consultations and rounds. The other two Charité campuses, Benjamin Franklin and Berlin Buch, were not visited from a medical perspective but only from a tourist perspective, due to their geographical distance and limited collaboration of Professor Trampuž with colleagues from other campuses.

From a clinical perspective, B.K. found the work similar to the one experienced to that in Ljubljana: Patients obtain the appropriate referral from the doctor or specialist of their choice, who requires a consultation or an opinion from a specialist in Charité. Most physicians work in outpatient clinics at least once a week, but usually more often. What stands out in their work at the outpatient clinics is the excellent cooperation between experts from different specialties, which allows for a thorough and time-efficient approach to the patient care and treatment. It is therefore quite common for several different specialists to see and consult on a patient at the same time. Additional imaging diagnostics are also available within very short time limits.

Access to surgical or internal medicine services was primarily faster than B.K. has observed in Ljubljana but not many other major differences were envisaged. The drugs available were mostly the same or similar to those prescribed in Ljubljana, the treatment methods seemed similar, as did the protocols. Orthopaedic services and procedures seemed similar or the same as in Ljubljana. The use of newer instruments and devices stood out, but the methods of treatment and surgery seemed generally similar or the same as those administered in Ljubljana. B.K. and E.K. have observed that treatment of difficult pathology was concentrated in Charité, as the most challenging cases from all over Germany, sometimes even the world, were transferred there. Also, they had the opportunity to observe the treatment of a number of patients from Ukraine who had been injured in the current war.

Regarding the workload, the contractual work in Charité is generally 48 hours per week, but physicians are mostly present for longer than their regular work commitment. There is little time for additional, off-duty and after work activities. B.K. observed that annual leave is comparable, or slightly less than in Slovenia. Physicians' salaries are higher in Germany - about double the average physician's salary in Slovenia.

4. A University of Ljubljana Student Researcher's perspective (T.T.)

For the second author (T.T.), staying at the Charité Virchow-Klinikum was undeniably an unrivalled experience, which rooted her passion for scientific research and piqued her interest in renaissance-like thinking about contemporary medical issues.

During the first year of her Biology undergraduate studies at the Biotechnical faculty of the University of Ljubljana, T.T. decided that she wanted to spend her summer enhancing the knowledge and skills needed to become a successful researcher. She found professor Trampuž incredibly kind and fulfilled these desires, regardless of T.T. being at the beginning of her university journey. With immense gratitude, T.T. spent six weeks as an intern with his team. It was lovely to experience being a part of a very diverse group of interns, each of whom came from all over the world, including Turkey, France, Austria and Egypt.

The first part of the internship took place at the clinic, where B.K. was performing observation while E.K. and T.T. shadowed Professor Trampuž and his residents. Despite not being a medical student, a unique opportunity of T.T. to observe his approach to treating



the patients, hear the questions asked by physicians, following the discussions regarding optimal treatments - was invaluable because it demonstrated how research translates into treatments. As a Biology student, this opened the eyes of T.T. to the real-world problems healthcare is facing today in a very tangible manner. Consequently, it inspired her to ask herself wider research questions from a top to bottom perspective, seeking the big unanswered questions of physicians. T.T. believes that laboratory researchers, who do not have and insight into the experience of patients might not think of delving into these problems. The second part of the internship took place in the laboratories, where T.T. had the opportunity to observe the ongoing work of Ph.D researchers mentored by Professor Trampuž. These bright minds were likewise of international origin, working on research involving bacteriophages and antibiotics. T.T. was able to ask many questions, discuss and observe the methodologies applied, read and interpret the findings and analyses, as well as simply see what the life of a Ph.D. is like.

Wanting to demonstrate her capabilities, which had been enriched by the experiences from the past few weeks and the available literature, T.T. created a presentation about the novel cephalosporin antibiotic - Cefiderocol. This antibiotic had only been approved by the FDA in 2019 and is supposed to function as a Trojan horse, mimicking a structure inherent to bacteria to enter their cell wall without the fear of being rejected by bacterial resistance mechanisms (Fetroja, 2022). This structure is called a siderophore; it is secreted by bacteria to sequester iron from the environment and bring it back into their cytoplasm (Fetroja, 2022). Cefiderocol's molecular structure includes a siderophore-like component, which enables the antibiotic to penetrate the bacterium through a special iron-transport system (Fetroja, 2022). This renders the antibiotic immune to bacterial resistance mechanisms such as porin-channel changes, efflux pumps and different classes of beta-lactamases (Fetroja, 2022). Being able to override these three key resistance mechanisms (at least to a certain degree), makes this drug advertised as a game-changer in the fight against antibiotic-resistant Gram-negative bacterial strains (Fetroja, 2022).

Through the use of an array of scientific literature and discussions with colleagues, T.T. conducted a systematic review on the drug, including its biochemical and cellular mechanisms, *in vitro* and *in vivo* outcomes, as well as clinical trials and usage in Charité hospital itself. The conclusion was rooted in the argument that every merit of this antibiotic holds its value only to a certain extent, which opened up many more inquiries and possible improvements. The opportunity to discuss these findings with leading physicians and scientists in this field gave T.T. the confidence to question what else could be researched on the topic and from which angle to begin.

Charité allowed T.T. to think outside the box and be excited about all the knowledge that scientific research has yet to uncover.

5. Charité Universitätsmedizin Berlin

Charité is the largest university hospital in Europe and it is the oldest hospital in Berlin. The hospital was founded over 300 years ago, in 1710, just north of the wall that surrounded Berlin at the time. Frederick I of Prussia had the hospital built in order to provide quarantine facilities to isolate patients suffering from bubonic plague (World Health Summit, 2022). As the plague outbreak across Europe drew to a close, the building was used as a hospice for the elderly, homeless and poor, and as a shelter for unwed mothers. After 17 years, the King Frederick I of Prussia had the building renovated, adding additional floors and rooms, and expanding the building's purpose; in addition to being a shelter for the poor, it also became a hospital for the care of those injured in the war. Since then, it has also served as a place for the training of future war doctors. At that time, the hospital was renamed Charité (Charité, History of Campus Charité Mitte, 2022), that is French for charity (Pons, 2023), as it is known today.

Today's Charité University Clinic consists of 4 campuses; the Charité Mitte Campus, the Virchow-Klinikum Campus, the Benjamin Franklin Campus and the Berlin Buch Campus.

5.1 Campus Charité Mitte

The Charité Mitte Campus is located in the central Mitte area of Berlin. The campus is considered as an original part of the Charité hospital complex, consisting of buildings that were built as early as the time of King Frederick I and were only renovated or newly built at the turn of the 19th and 20th centuries. This was also the time of building of the famous red brick building (**Figure 1**), which is today one of the most recognisable parts of Charité (Charité, History of Campus Charité Mitte, 2022).

During the World War II, much of the Charité Mitte campus was destroyed by shelling and bombing. During the subsequent Cold War and the division of Germany into the east and west sectors, the campus belonged to the eastern part of Berlin and thus to the German Democratic Republic, which extensively renovated the hospital and added new, specialised facilities meant to promote the government's policy. Nowadays, the 22-storey tower block, around which several smaller buildings or structures are located, stands out as a particular Berlin landmark (Charité, History of Campus Charité Mitte, 2022).



Figure 1: Red brick building of Charite Mitte (Dreamstime, 2022).

4.2 Campus Virchow-Klinikum

The Virchow-Klinikum campus was built at the beginning of the 20th century on the initiative of Rudolf Virchow, one of the most prominent physicians and pathologists of the 19th century. His most famous work includes cell theory and the origins of disease. Virchow explained that disease does not begin spontaneously in organs or tissues in the body, but in individual cells, from which it then progresses through tissues and organs (Underwood and Ashworth, 2022). The Virchow-Klinikum campus consists of a main green avenue, which is almost 500 metres long, and divides the campus in two sides of hospital buildings (**Figure 2**).



Figure 2: The Virchow-Klinikum campus (Belin Health Excellence, Campus Virchow-Klinikum, 2022).

As foreseen in the original design of the campus, the left side of the avenue mainly hospitalises surgical patients, while the right side is used for patients with non-surgical or internal problems. The Virchow-Klinikum Campus was rebuilt after the World War II (Charité, History of Campus Virchow-Klinikum (CVK), 2022). The many benches, the boardwalk and the fountain at the end of the avenue make the campus feel very open and welcoming for both patients and medical staff. Unlike the Charité Mitte Campus, the Virchow-Klinikum Campus belonged to West Berlin during the Cold War, and only joined the Charité University Clinic complex at the end of the 20th century (Charité, History of Campus Virchow-Klinikum (CVK), 2022).

4.3 *Campus Benjamin Franklin*

The Benjamin Franklin Campus was built in the second half of the 20th century during the Cold War, when the western sector of Berlin was left without a university. A new one was thus founded in 1948, followed by the construction of a new university hospital in the South of the city. About one-fifth of the hospital's construction costs were covered by the US, which led to the campus being named after the famous United States presidents, Benjamin Franklin. The campus is built as a large building with several wings and a large park in front of it where patients and medical staff can take walks and get a taste of nature (**Figure 3**). The Benjamin Franklin Campus joined the Charité University Clinic complex at the beginning of the 21st century (Charité, History of the Campus Benjamin Franklin, 2022).



Figure 3: Campus Benjamin Franklin (Berlin Health Excellence, Campus Benjamin Franklin, 2022).

4.4 Campus Berlin Buch

The last of Charité's four campuses, Berlin Buch is located in the North-Eastern part of Berlin. For more than 100 years, it has played a leading role in German medical, clinical and laboratory research. Biomedicine is very important in the research work conducted at Berlin Buch, but interdisciplinary collaboration is also crucial and is further facilitated by the physical proximity of the buildings on the campus (**Figure 4**). The campus also includes the BiotechPark Berlin-Buch, the largest biotechnology park in Germany with offers space for laboratories and research facilities (Campus Berlin-Buch GmbH, 2022).



Figure 4: Campus Berlin Buch (Helios, 2022).

5. Conclusion

The visit at Charité Universitätsmedizin Berlin was interesting, but organisationally challenging. The professional environment there was very stimulating, with all the latest technologies and knowledge available to use, and the ease and speed of the interdisciplinary approach and treatment was gratifying. Treatment of the patients seemed advanced, developing as an evolution and not a revolution. For a student or researcher, a visit to Charité



and Berlin was an opportunity to broaden horizons for the future work, both in terms of research and potentials of modern laboratories, as well as in terms of the transfer of this experience and knowledge into everyday (clinical) practice.

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