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RESEARCH ARTICLE

The hospital as a laboratory: Population studies at Tel-Hashomer hospital in Israel (1950s-1960s)

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Argument
In this article we examine how a leading Israeli hospital gradually became a large biomedical research facility, resembling a huge laboratory. For Chaim Sheba (1908-1971), the founder and first director of Tel-Hashomer Hospital, the massive immigration to Israel in the 1950s was a unique opportunity for research of diverse human populations, especially Jews who had arrived to Israel from Asia and Africa. The paper focuses on the way research and medical practices were integrated and their boundaries blurred, and studies the conditions under which an entire hospital became a research field. Using the case of one of Israel's prominent medical institutes, we explore and expand upon the idea of "the hospital as a laboratory," arguing that, for Sheba, it was not only the hospital but the *entire country* that functioned as a great research site—a vast laboratory that "had no walls."

Keywords: Israel; hospital; population studies; biomedical research; Chaim Sheba; G6PD; laboratory

1. Introduction

> Israel had a living laboratory like no other nation. Thanks to the strict observance of tradition, prayer customs and folklore, it was possible to trace the members of the various ethnic communities and easily determine to which community a patient belongs. And through heredity, it was possible not only to solve the mystery of an illness, but also to take preventive steps among family members with the same mutation. (Bondy 1981, 300)

Tel-Hashomer Hospital, today the largest hospital in Israel, is located in the city of Ramat Gan next to Tel Aviv. The hospital began as an American medical facility, "U.S. Hospital No. 24," established in 1941 during the Second World War. In 1944, after the American facility closed, the British Army reopened it as "Royal Air Force Hospital No. 26." In 1948, during Israel's War of Independence, the British facility was converted into an Israeli military hospital called "Military Hospital Number 5," before being ultimately repurposed for civilian use in 1953. In this article, we examine how, shortly after its transformation from a military to a civilian hospital, Tel Hashomer gradually became a large biomedical research facility, resembling a huge laboratory. We will focus on the way medical and research practices were integrated into the hospital, and study the conditions under which the entire facility became a research field. Using the case of Tel-Hashomer Hospital in its early years, we will consider the idea of the "hospital as laboratory."

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For Prof. Chaim Sheba (1908-1971), the founder and first director of Tel-Hashomer Hospital, the massive immigration to Israel in the 1950s was a unique opportunity for research on diverse human populations, especially Jews who had arrived in Israel from countries in Asia and Africa. Sheba himself was born in a small village in Bucovina (then part of Romania and earlier of the Austro-Hungarian Empire). He graduated from the Vienna Medical School in 1932 and immigrated to Mandatory Palestine a few months later. Sheba held various medical and administrative roles throughout his career, including Chief Medical Officer of the Israel Defense Forces (1948-1949), Director-General of the Israeli Ministry of Health (1950–1952), and Director of Tel-Hashomer Hospital, which today bears his name.[1]

Sheba believed that all of the Jewish ethnic communities shared a common origin, but that, at the same time, each had its own unique genetic characteristics. Moreover, as our article illustrates, Sheba perceived the 1000-bed hospital he sought to establish in Tel-Hashomer as an ideal site for conducting biomedical research. Such research, he thoughts, would not only directly contribute to both the patients' clinical care and the level and quality of the hospital's physicians, but also provide Tel-Hashomer with a solid economic base. Sheba's quest to encourage extensive research as part of the hospital's activities was also motivated by the fact that, in the mid-twentieth century, many hospitals in the United States and Europe were undertaking extensive research projects alongside medical care (Porter 1999, 525–560; Booth 1993, 205–229).

This article covers several types of research carried out at Tel-Hashomer, but will focus mainly on research of the G6PD hereditary deficiency. The G6PD study is a fascinating example of how the hospital served as both a platform for biomedical research and a starting point for expanding the subject group beyond the patient population. The hospital setting provided access not only to a huge pool of subjects, but also to a diverse and unique population. The G6PD study is also an example of how research undertaken at Tel-Hashomer was marked by a blurring of boundaries between its clinical and research activity. Like a scientific laboratory, the hospital setting allowed researchers to control and manipulate their research subjects—in this case, the patients. This was due in part to the control the hospital staff had over patients' bodies, including where they went and when, and to the access it had to information about patients in their medical files.

Material for the G6PD study was obtained by collecting blood samples from patients at Tel-Hashomer and their families, as well as from patients at other hospitals. Research subjects also included newly arrived immigrants, and different tribes living in Ethiopia, among them the Beta Israel tribe. During the 1960s, Tel-Hashomer expanded its research to include Muslim and Christian Palestinian citizens of Israel, as along with other local minority populations such as Samaritans, Druze, Karaites. After 1967, the study also included Palestinians from Gaza and Rafah, along with early Jewish settlers from the Kibbutzim (rural collective communities).

Sheba perceived himself as head of a huge laboratory that was not limited only to the walls of the hospital itself, but extended across the entire country and even beyond its borders. The government hospital's close cooperation with various state institutions, including the Israeli army (IDF) and organizations responsible for immigration, and its extensive contacts with Israel's political elite, and with Jewish organizations such as the Joint Distribution Committee and donor groups, also contributed significantly to promoting and expanding its research activity.

Access to Chaim Sheba's rich archive at Tel-Hashomer Hospital, which was closed to the public from Sheba's death in 1971 until 2019, has provided an opportunity to draw a broader and more detailed picture than was possible until now. The archive, with tens of thousands of documents in over two hundred files, contains a wealth of material documenting Sheba's extensive activities in and around Tel-Hashomer, and providing extensive information about the Israeli health system in general. The archive's richness is largely due to Sheba's meticulous documentation of both his research activities and his administrative duties as head of the institution.

[1]The hospital was renamed "Sheba Medical Center" shortly after Chaim Sheba's death in 1971. Nevertheless, in this paper it will be referred to as "Tel Hashomer," as it was called in the period we studied and describe in the article. (In fact, the hospital is still commonly referred to as Tel Hashomer Hospital to this day.)

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2. The goal: A thousand-bed research hospital

The transformation of Tel-Hashomer into a research hospital is related to the "large hospital" vision nurtured by Chaim Sheba, and shared—or perhaps inspired—by Dr. Harry Heller (1899–1967). Heller was among the founders and the first director of Beilinson Hospital, located in the city of Petah Tikva and owned by Kupat Holim Clalit (Israel's largest provider of public health services—the name translates loosely as "General Fund for the Sick"). After moving to Tel-Hashomer, Heller headed one of Tel-Hashomer's departments of internal medicine and was the hospital's medical director (Shvarts 2000).

Heller and Sheba strove to establish a large, 1000-bed hospital that would encompass all branches of medicine, and would be both a major medical facility and a research and teaching center. Apparently, as early as 1946–1947, they tried together—unsuccessfully—to persuade Kupat Holim Clalit's administrators to turn Beilinson into a large hospital that would serve as a medical services provider and a center for academic research. They felt that the hospital's size would allow its physicians to treat a wide range of diseases, thereby ensuring the quality of the medical staff and of the institution. They also believed a large hospital should be the center of public health services, in contrast to Kupat Holim Clalit's administrators, who saw their system of regional clinics spread throughout the country as the main provider of health services. For Sheba and Heller, a large hospital was also supposed to serve as a center for extensive biomedical research and clinical teaching, which would be based on the hospital's own large and diverse patient population. As Sheba put it twenty years later: "a combination of healing, education and research all under one roof."[2] Sheba and Heller saw the physician-researcher as a key figure in determining hospital policy and operations, alongside his or her clinical practice (Shvarts 2000, 79–81).

Heller and Sheba's idea of a large hospital in effect represents a profound change in the perception of the hospital's and the physician's role and status, and their power relations with other health institutions and with the medical administrators running them. Israel's War of Independence and the creation of a military medical service—later, the IDF Medical Corps—enabled Sheba and Heller to establish the large medical center they had dreamed of without having to be dependent on Kupat Holim Clalit. It began with the mid-war conversion of the British military hospital in Tel-Hashomer into an Israeli military hospital (Hospital No. 5) in June 1948. During the war, Sheba, in his role as Chief Medical Officer, recruited Kupat Holim Clalit's physicians, including Beilinson's physicians, to IDF's Medical Corps, and especially to Hospital No. 5. He was helped in this by Baruch Pedersky (later Padeh), the Medical Corps Operations Officer who, with Sheba, effectively diverted Kupat Holim Clalit's physicians to the military medical system, which grew dramatically over the course of the war. By late 1948, it encompassed about 3000 beds, divided between eighteen hospitals and rest homes and a rehabilitation center (Nadav 1997).

A few years after the end of the war, in 1953, shortly after Sheba resigned his post as director-general of the Ministry of Health, he worked with Harry Heller to transform Hospital No. 5 into a civilian public hospital. Sheba became the hospital's director, and many Kupat Holim Clalit doctors who had served there as military physicians were integrated into the civilian format of the nascent Tel-Hashomer Hospital (Shvarts 2000, 56–94). Thus, the Israeli War of Independence, and the ensuing state of emergency, facilitated Sheba, Heller and Padeh in laying the foundation for the large hospital they had envisioned,[3] in the form of a military

[2]Introduction to annual report, 1966–1967 (draft), by Chaim Sheba, no date, Studies Reports Tel-Hashomer 1967, Sheba Archive, the Sheba Medical Center at Tel-Hashomer, Israel (Henceforth: Sheba Archive).

[3]Tel-Hashomer quickly became the largest hospital in the State of Israel, but the coveted 1000 beds were not gained overnight. In 1967, for example, Tel-Hashomer had 935 beds. See Introduction to annual report, 1966–1967 (draft) by Chaim Sheba, no date, Studies and Reports Tel-Hashomer 1967; Hospitals in Israel 1963 by the Israeli Ministry of Health, Dr. Heller—miscellaneous (2) 1946–1965, Sheba Archive.

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medical facility (Hospital No. 5) and Kupat Holim Clalit's medical staff, both diverted into a state-owned medical institution—Tel-Hashomer Hospital. The war, in fact, had helped to erode the pre-state medical order and set the stage for a new order, at least in part, in the Israeli medical field, of which Tel-Hashomer Hospital was a prominent manifestation.

3. Research at Tel-Hashomer Hospital

Not long after Hospital No. 5 was converted into a government hospital, it also began its transformation into a large biomedical research facility, a vast laboratory. One of the interesting features of the research at the hospital, as will be shown below, was the blurring of boundaries between its clinical and research activities (Eyal 2017, 90–91). Developments in biomedical research in the west spurred Chaim Sheba and other physicians at Tel-Hashomer to undertake large-scale research as part of the hospital's mission. By the middle of the twentieth century, many hospitals in the United States and Europe were conducting research alongside their clinical activities. In many cases, research was carried out jointly with universities and their medical schools.

Biomedical research conducted in hospitals is a relatively new phenomenon—the culmination of a process begun in the nineteenth century by the coming together of universities, medical schools, hospitals and laboratories. In *The Birth of the Clinic* (1963), Michel Foucault argued that in the years after the French Revolution, an upheaval in medical practice in France led to what he described as an epistemological rift, producing a new kind of medical gaze. As part of this shift, a new approach to diseases emerged, based on knowledge of anatomy and pathology, observation of patients and the signs of their disease, and the quest to better understand and explain the nature of diseases. In other words, this was an etiologically oriented approach. It stood in contrast to the traditional theoretical-analytical and less empirical medical approach— a taxonomic approach that sought to understand diseases through their classification into groups of similar diseases, and almost never dealt with patient observation.[4] The beginning of the twentieth century thus witnessed an increasing connection between universities and medical research, especially around medical schools, with the United States taking the lead.[5] This trend cemented the connection between universities, medical schools and hospitals around the practice of medical research (Porter 1999, 525–560; Booth 1993, 205–229).

A similar model, combining a university's medical school with a hospital, also emerged in Israel at the Faculty of Medicine of the Hebrew University of Jerusalem, which was closely connected with Hadassah Hospital. The founders of the Microbiological Institute, established in 1924 as one of the first of three institutes inaugurated at the Hebrew University,[6] saw it as part of a broader plan to establish a faculty of medicine. In 1936, Hadassah and the Hebrew University signed an agreement to establish a medical school, and two years later Hadassah opened its hospital on Mount Scopus, near the Hebrew University campus. Though the Hebrew University School of Medicine did not officially open its doors until 1949, Hadassah was already conducting research alongside clinical treatment in its Mt. Scopus Hospital by the end of 1930s (Dudai 1974, 158; Becker 2009, 188; Prywes 1960, 19–20).

The emergence of biomedical research at Tel-Hashomer Hospital (and earlier at Hadassa hospital) can also be seen from a regional perspective. During the first half of the twentieth century

[4]Despite Foucault's focus on France, it is important to remember that clinical research emerged in those years not only in France but also in Germany and England. Toward the middle of the nineteenth century, German universities and independent research institutes became the prominent site for medical research. Later, with the "discovery" of bacteria, medical research received a significant boost. Pasteur's and Koch's bacterial institutes marked the culmination of a process known as the "laboratory revolution" in medicine (Cunningham and Williams 1998).

[5]The establishment of Rockefeller Institute in 1901 and the 1910 Flexner Report on medical education were important milestones in the development of medical research in the United States.

[6]The other two institutions were the Institute of Chemistry and the Institute of Jewish Studies.

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medical research emerged in other medical institutions in the Middle East, most of them, like Hadassah in Jerusalem, were American-oriented. The most prominent of these were the medical schools at the American Universities in Beirut and Cairo (Penrose 1970, 224–226). Although, as far as we can tell, these biomedical research sites did not have direct influence on the emergence of biomedical research at Tel-Hashomer hospital, the institutes do share several interesting similarities. For example, the rise of research infrastructure in all was intertwined with national ideologies, and all shared similar funding patterns, which included, among other things, reliance on foreign funding sources like the Blood Research Foundation, the Rockefeller Foundation and the NIH. In addition, disease-related studies, including on the G6PD deficiency, were also conducted in other countries in the Middle East. At some point, there were certain contacts between the Tel Hashomer group and other Middle Eastern research groups, though not, apparently, during the first years of research at Tel-Hashomer hospital.[7]

In the early years of Israel's statehood, biomedical research was also undertaken at Beilinson Hospital, but on a relatively smaller scale than at Hadassah. In 1955, the Rogoff Institute was established at Beilinson Hospital as Kupat Holim Clalit's medical research institute. It was run by Andre de Vries, who had moved to Beilinson from Hadassah in 1955 (Prywes 1960, 18–55; Tidhar 1966, 4781–4782). Extensive biomedical research was also taking place outside the hospital setting at the Weizmann Institute, and at the nearby Israel Institute for Biological Research, Israel's biological and chemical weapons development facility.

Some of the studies conducted in Tel-Hashomer were at the forefront of global medical research. In 1962, Prof. Bruno Lunenfeld and his team were the first in the world to achieve a full-term pregnancy and live birth through hormonal fertility treatments. Lunenfeld's endocrine studies included a variety of clinical and chemical tests of the gonadotropin hormones affecting the testicles and ovaries. The group developed methods for measuring reproductive hormone values in the urine and blood, and examined their effect on men and women in cases of infertility. The Pergonal injection developed by Lunenfeld's research group was approved for use in 1963 as a medication for stimulating ovulation.[8] A related study, conducted in Tel-Hashomer's gynecology department, examined the effect of chemical treatment on fallopian tube obstruction. These studies were consistent with the nascent State of Israel's ideology of encouraging childbirth.

In addition to the value placed on human reproduction, Tel-Hashomer also conducted research related to another of the young state's core principles—human productivity. The cardiology institute, for example, organized a study of patients returning to work following myocardial infarction. The Climate Research Unit examined the effects of Israel's hot climate on workers and the work and rest routine in the country's hotter regions. This unit, headed by Dr. Ezra Sohar, studied the effects of "heatwaves" on the human population, and was even responsible for defining the Hebrew (originally Arabic) term "*hamsin,*" which is used to describe this meteorological phenomenon. The unit's researchers also studied clinical aspects and treatment for heat stroke, as well as mapping and developing a method for measuring the heat index in different regions of the country.[9] Their studies were a joint effort of the Medical Corps and Tel-Hashomer Hospital, and funded by the Ford Foundation, the National Research and Development Council of Israel and the IDF.

The heart institute, headed by Dr. Kariv and Dr. Neufeld, conducted cardiology-related clinical as well as epidemiological research. This included conducting histological research on the Jewish

[7]We would like to thank one of the article's anonymous referees for drawing our attention to this important aspect. This topic deserves a separate and an in-depth study that will allow us to map these connections and similarities and consider their broader implications.

[8]Interview with prof. Bruno Lunenfeld, July 27, 2020. On the continuities between Israel's pronatalist approach in the late 1950s and its current flourishing reproductive industry, see, among others: Birenbaum-Carmeli and Carmeli (2010) Vertommen (2017).

[9]Review of medical research efforts in Tel-Hashomer Hospital by Chaim Sheba, no date, *Studies 1963-1964*, p.4, Sheba Archive.

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Yemenite community, examining morphological changes from infancy, through childhood and adolescence until the age of forty in comparison with other ethnic communities and nations.[10] Tel-Hashomer's audiology institute monitored 500 deaf and hard of hearing children. The dermatology department studied the treatment of ringworm, and the internal medicine-epidemiology department examined the carcinogenic effect of radiation on children with ringworm. Many other studies were conducted in the radiology department, the department of nuclear medicine and the isotope institute, the department of pathology and the department of experimental surgery.

The studies mentioned here, and those we will focus on later, were part of the "living laboratory" within the various pavilions that made up the Tel-Hashomer campus. In addition, research autopsies were performed at the pathology institute, headed by Prof. Moshe Wellman, in the building next to the emergency room.[11] In the early 1950s, pathology research in Israel was based in a research and teaching tradition imported from Europe, mainly from Germany, and led by pathologists at Hadassah, Beilinson, Rambam Hospital (in Haifa) and Tel-Hashomer. Israeli pathology also benefited from the fact that there was still no legislation curtailing it. With the rise of opposition led by family members of the deceased and religious groups, and after some exceptional events, such as the theft of organs from Tel-Hashomer's pathology institute,[12] the hospital's physicians mobilized to defend the practice.[13] They argued that without autopsy it would be impossible to determine with certainty the cause of a patient's death or to fully understand the disease they had suffered from (Eyal 2017; Nuriely and Kozma 2024).[14]

Though the above suggests that research at Tel-Hashomer covered a wide range of areas, Chaim Sheba claimed, in a document reviewing Tel-Hashomer's medical research in 1965, that almost all the hospital's research efforts since its inception were devoted "to the study of differences between the various ethnic communities who have returned to their homeland."[15] This statement is more reflective of Sheba's perception than it is of the diversity of research actually undertaken at the hospital. Nevertheless, it reveals the importance of the comparative study, particularly the genetic study, of the country's ethnic communities to the hospital's research agenda. By the mid-1960s, Tel-Hashomer had become *the* major site for the study of hereditary diseases among Israel's diverse immigrant society. Among the diseases studied were deficiency in the G6PD enzyme, upon which we will expand below, Familial Mediterranean Fever (FMF), color blindness, Dubin-Johnson syndrome, thalassemia and phenylketanuria.

4. Chaim Sheba and the G6PD hereditary deficiency study

4.1 Genetic study of ethnic Jewish communities

The genetic studies undertaken by Sheba and his team were part of a broader research trend in Israel. In the 1950s and 1960s, the genetic study of ethnic Jewish communities was a thriving field, involving geneticists, biochemists and medical professionals. Studies examined the prevalence of common genetic traits such as blood groups, fingerprints, color blindness and PTC tasting as well as rare genetic deficiencies such as thalassemia and FMF. Many of the studies were comparative, examining genetic similarities and differences among Jews of different ethnicities and between specific Jewish populations and the local non-Jewish populations in their countries of origin.

[10]Ibid, p.9

[11]Email correspondence with Prof. Eran Dolev, July 2, 2020.

[12]M. Volman to Y. Fridhi 16.2.1967, *Pictures Personal Letters from Collogues from abroad and More 1940-1960*, Sheba Archive.

[13]Statement by Tel-Hashomer physicians, no date, Ibid.

[14]Despite its importance, we will not deal in this article with postmortem autopsy. An extensive discussion of the subject can be found in Eyal (2017) and in Nuriely and Kozma (2024).

[15]Introduction to a review of medical research efforts at Tel-Hashomer Hospital 1957–1965 by Chaim Sheba, no date, *Studies 1963–1964*, Sheba Archive.

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The research was part of a post-war, worldwide interest in blood collection and human population heredity. From the 1950s onwards, human populations became objects of scientific research, and their blood served as a significant means for bio-medical, historical and anthropological studies. These studies were influenced by geopolitical contexts, such as Cold War agendas, colonial and post-colonial circumstances, and nationalist values (Bangham and De Chadarevian, 2014; Lindee, 2016; Radin 2018; Suárez Díaz, 2019; Bangham 2020). In Israel, founded in 1948, this field held special interest in light of the large waves of immigration, which offered researchers a convenient opportunity for comparative genetic research of Jewish immigrant populations from different parts of the world. During the state's first decade, its Jewish population increased 2.3-fold, mainly due to this mass immigration. Immigrants came from Europe, Asia and Africa in such numbers that, during the fifties, about 70% of Israel's Jewish population was composed of citizens born outside of the country.[16]

As Kirsh has shown elsewhere, genetic studies of Jewish communities undertaken by Israeli researchers in the 1950s and 1960s shared several distinctive characteristics (Kirsh 2004). First, most of the researchers were of European descent (Ashkenazi Jews) while the study subjects belonged mostly to North African or Asian communities (Oriental or *Mizrahi* Jews). As a result, in most studies, Ashkenazi Jews appeared as a single homogeneous category. There was no division into countries of origin, nor any attempt to explain or justify this categorization. All the other ethnic communities were listed by country of origin, under the general category "non-Ashkenazi." Such a division of the Jewish population into two groups, where one group's identity is based on negation, clearly reflects an ethnocentric viewpoint.

Another feature of most of these studies is their reflection of the national Zionist narrative, according to which Jews in the distant past were a single, cohesive collective concentrated in a particular geographical place (the ancient Land of Israel), from which they then scattered throughout the world. During the period of dispersal (the "exile"), the narrative assumes, the Jews split into ethnic communities around the world but maintained their religious, cultural and genetic identity. From the end of the nineteenth century, with the emergence of the Zionist movement, Jews began returning to their ancient homeland, where they met other Jews ("their brothers"), who had also returned to their homeland from other places.

In other words, these studies reflected three main components of the Zionist ethos. The first is *historical continuity*—the Jewish people were a biologically-racially cohesive group that for two thousand years nearly succeeded in completely separating itself from the surrounding non-Jewish populations. The Jews of the twentieth century were thus the direct descendants of the Jews of the First and Second Temple periods, who had lived in ancient Israel. The second ideological component is the belief in *the unity of the Jewish people*—despite geographical, cultural and physical differences, genetic studies were used to provide an image of the Jewish people as a homogeneous entity. Third is the *Jewish people's ties to the Land of Israel*—these genetic studies included descriptions of the Jewish people returning to their "ancient homeland." The researchers' presumptions, rhetoric, presentation and interpretation of the research results reflect this Zionist view about the origin and history of the Jews.

Two seemingly contradictory trends emerge from the population genetics studies conducted in Israel in the 1950s and 1960s. The first is the effort to distinguish among the different Jewish ethnic groups by providing a genetic basis for the (phenotypic) variances. In other words, the studies reflect an attempt to create boundaries and distinctions between the different Jewish ethnic groups. This trend, however, coexists with another and more dominant trend, which is to identify similarities among the different Jewish ethnic groups, thereby genetically validating the claim of an original-homogeneous Jewish collective. This second trend is a bid to blur the boundaries between the various ethnic communities and fuse them into a single Jewish-Israeli national body. The

[16]The different ethnic communities came from: Poland (21-23%), North Africa (7-15%), Romania (13-15%), Iraq (12-13%), USSR (5-6%), Germany (5-6%), Yemen (5%) [*Israel Statistical Yearbook, 1958: table no. 16*].

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process of merging the various Jewish ethnic groups was conducted through the effort to identify a common genetic basis that would distinguish all Jews from other national collectives, especially collectives among whom Jews had lived before immigrating to Israel. Put another way, population genetics research in Israel simultaneously adopted two competing perspectives: the colonial view, where researchers of European descent examined non-European populations which they perceived as "primitive," and the national view, which saw non-European populations as long-lost brothers. The researchers seem to have operated concurrently within these two competing orders—the colonial and the national—although the latter predominated in the studies.

4.2 The G6PD hereditary deficiency study

This article focuses on the studies of Chaim Sheba and his group on the genetic disorders caused by a deficiency in the enzyme G6PD. As we have seen above, previous literature on the history of population genetics research in Israel, including the G6PD deficiency, has concentrated on its content, and the researchers' ideological, national and social biases or on the scientific validity imparted by genetic research to the category "ethnic community" (*edah* in Hebrew) (Kirsh 2003; Abu-El Haj 2012; Falk 2017). In this article, we turn the spotlight on the research practices themselves, and especially the integration of clinical and research practices at Tel-Hashomer Hospital shortly after it became a civilian hospital. More specifically, we examine what happens when an entire hospital becomes a research site.

As noted, the study of G6PD was not the only research undertaken at Tel-Hashomer in those years. It is, nevertheless, a fascinating example of how the hospital served as both a platform for biomedical research and a starting point for expanding the test population beyond its own patients. Through this case study, we will attempt to show how research activity was carried out alongside and parallel to clinical practices in a large hospital in Israel. We will look at how Tel-Hashomer functioned as a laboratory or large research field for Sheba and the group of physicians and scientists working with him.

Deficiency of the enzyme glucose-6-phosphate dehydrogenase, G6PD, is a recessive inherited disease. One of the more common manifestations of the deficiency is sensitivity to fava beans (favism).[17] This disorder is the most prevalent enzymatic mutation among the human population and currently affects 400 million individuals (Burton 2019, 1). G6PD deficiency is X chromosome-linked, and is therefore much more common in men, who have only one X chromosome. It is rarer to find the condition in women, where the defective gene would have to be present on both X chromosomes. Among Jews, it is common in certain ethnic communities, affecting mainly men of Kurdish and Iraqi descent.

Chaim Sheba first encountered favism in 1938, before it was identified as caused by the G6PD genetic deficiency, while working as a physician at Beilinson Hospital. Searching the professional medical literature, he came across nine similar cases among Jews of Yemenite, Iraqi or Kurdish descent. In 1942, while serving as a military doctor in the British Army, Sheba noticed that soldiers who developed hemolytic anemia following exposure to sulfonamide-based drugs were all of Mediterranean descent. This led him to suspect that this phenomenon had a genetic basis. In those years, however, there was still no biochemical explanation for these symptoms. Only in the mid-1950s did a group of researchers from Chicago, led by Ernest Beutler, identify the cause of those symptoms as a lack of the G6PD enzyme located in red blood cells (Beutler et al. 1955).

The G6PD enzyme is found in all the body's cells, where it protects against oxidative damage caused during metabolism. Deficiency in this enzyme is expressed by a low amount of the

[17]Elise Burton (2021) has conducted a detailed study of the history of research on 6GPD deficiency in the Middle East. See Chapter 5 "genes against beans" which also includes a valuable comparative aspect of the Middle East context. Edna Suárez Díaz (2017, 2019), who studied the history of research on 6GPD deficiency conducted in Mexico, claimed that G6PD surveys had greater importance in developing countries since the deficiency was thought to be efficacious as immunity against malaria.

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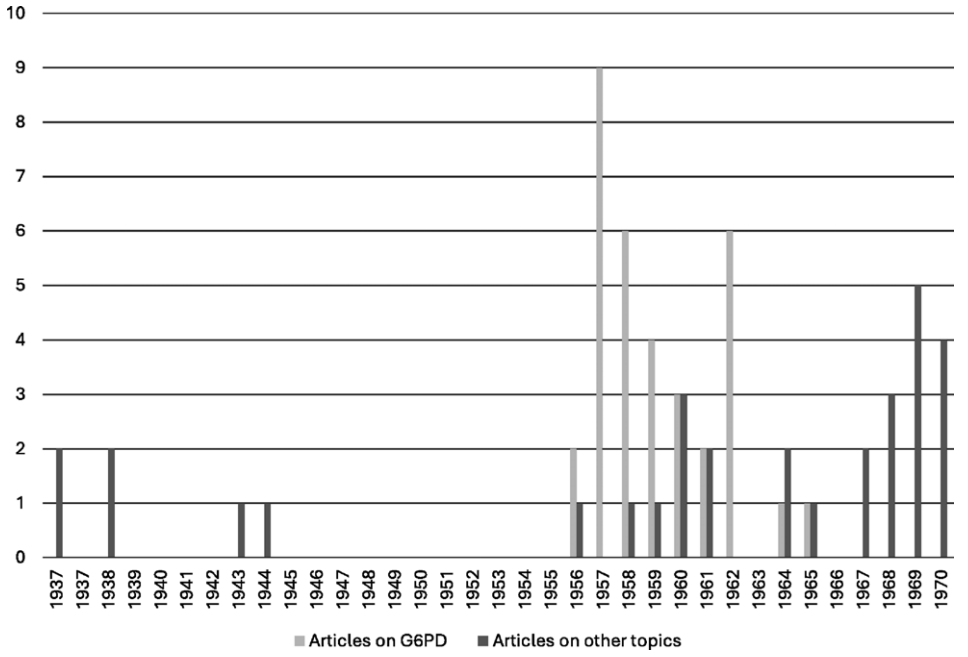

Figure 1. Chaim Sheba's scientific publications on the G6PD deficiency compared to his publications in all other fields (1937–1970).

glutathione molecule. This condition leads to rapid breakdown of red blood cells (hemolytic anemia), following either exposure to aspirin and other sulfa drugs, or exposure to antigens and foods that raise the level of free radicals (Beutler et al. 1955).[18] An outbreak of such anemia is dangerous and can even lead to death. The Chicago research team, and subsequent researchers, made it possible to identify populations with the deficiency through a blood test. The Tel-Hashomer Hospital staff quickly adopted this simple test, which provided the hospital's physician-researchers with both an effective research and a preventive clinical tool.

After learning about the Chicago group's biochemical explanation of the deficiency, Sheba and his group sought to examine all patients suffering from hemolytic anemia, whether caused by sulfa drugs or eating fava beans, as well as the patients' families. The test results were consistent with the American group's findings: a lower-than-normal concentration of glutathione was found among people with a history of the disease, and some of their family members. This was the beginning of a series of biochemical, genetic and clinical studies, as well as population genetics research, conducted at Tel-Hashomer Hospital and focusing on G6PD deficiency. The G6PD study was, in fact, the culmination of Sheba's research activities and one of Tel-Hashomer's first major studies.

In these studies, Sheba's group mapped the prevalence of G6PD deficiency among the various ethnic communities in Israel. They found, among other things, that it exists in 58% of Jewish men of Kurdish descent and in 25% of Iraqi-origin men. At a later stage, Sheba tried to draw a historical description of the movements of Jewish communities throughout Asia and Europe in light of the genetic findings, and based on similarities in the prevalence of G6PD deficiency among non-Jewish communities in those areas.

Figure 1 shows a numerical comparison between Chaim Sheba's scientific publications on the G6PD deficiency and his publications in all other fields. It shows that, of the forty-five articles Sheba published between 1956 and 1965, thirty-four were on G6PD, constituting the vast majority

[18]See also the undated and untitled lecture by Chaim Sheba in which he describes the genetic research he is undertaking, attached to a letter from Mr. Shidursky to Chaim Sheba, April 20, 1960, *Studies Sheba 60*, Sheba Archive.

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of his publications during that ten-year period. Due to intensive research activity and the large immigration waves the research group was able to study, Tel-Hashomer became a prominent world center for G6PD research (Burton 2021, 154–167; Padeh 1968, 53). This study gained recognition within the Israeli scientific community toward the end of the 1950s and early 1960s, earning Sheba and several of his colleagues a number of awards, such as the Szold Prize (1958) and the Israel Prize (1968) (Padeh 1968, 54).

5. The hospital as laboratory

During the late 1970s and early 1980s, various researchers, especially anthropologists and sociologists of science, began looking at the scientific laboratory as an object of serious research. They entered laboratories and made anthropological observations of the routine scientific work that took place within their walls (Latour & Woolgar 1979; Knorr-Cetina 1981; Lynch 1985). The first wave of "laboratory studies" researchers focused on the processes of creating and validating knowledge within the laboratory. The main question asked by them was: How are facts made? Or, in other words, how the work done in the laboratory gives knowledge claims stability and power so that they are considered valid knowledge (Sismondo 2010, 106–119). Laboratories have been increasingly recognized as key sites for the creation of scientific knowledge, for the development of technologies, and as one of the significant sites for the development of modern science. At the same time, laboratories were also recognized as an important site in shaping the modern world, the world "outside" the laboratory. As the name of Bruno Latour's well-known article suggests: "*Give me a Laboratory and I will raise the world*"(Latour 1983, 141–170).

These studies paved the way for a deeper understanding of the activity taking place in laboratories, expanded the original meaning of the concept and opened new ways to understand what a laboratory is. In later studies, the concept of laboratory was also applied to field studies and agricultural research (Hence 2000; Latour 1999), artificial intelligence research (Forsythe 2001), research in the field of economics and sociology (Breslau & Yonay 1999), research activity done in colonial and post-colonial contexts (Tilley 2011; Bonneuil 2000), and more. One notable example of these studies is Helen Tilley's book *Africa as a Living Laboratory* (2011), which explores how the British colonial African Research Survey regarded the entire African continent as a "living laboratory" for the study of medicine, anthropology, agriculture, models of development, racial science, paleontology and the study of human origins, and more.

Tilly's notion of "Africa as a living laboratory" incorporates two elements that we also develop in the current article. The first of these elements is scale. Similar to the way Tilly shows how the entire African continent (or at least the areas controlled by the British Empire) was perceived by the British colonialists as a huge laboratory—so too do we try to show how, for Chaim Sheba and the researchers of Tel-Hashomer, the hospital itself was perceived as a huge laboratory (or as a collection of laboratories) for various biomedical studies. For Sheba in particular, not only the hospital but the entire State of Israel was perceived as a giant and unique laboratory. Like the British colonial scientists and experts, Tel-Hashomer researchers also went to various sites in the country to collect blood samples and to advance their research. The second element concerns the notion of a "**living** laboratory," which is more elusive and suggests access to living (human) populations, to dynamic processes, and to the ability to perform experiments and laboratory practices on them in real time. This element too is also widely present in the case of Tel-Hashomer hospital's research activity.

Sheba recognized the scientific potential of G6PD deficiency research and other population genetics studies conducted within the walls of a government hospital and in an immigration country like Israel. He argued that a hospital is the only place that allows for conducting observations of diseases in a way that meets scientific criteria of comparison between an experimental and a control

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group. Sheba cited the Rockefeller Institute as an example of an institute that had been unable to conduct medical research without first establishing an affiliated hospital:

> Medical research is inevitably tied to observation of the healthy or sick; such observation, in order to meet the requirements of completeness and control, must be conducted within a hospital setting. Evidence of this is those institutes established for the sole purpose of research, and not for the sake of providing medical services to the population, only to discover later that they must also open a hospital within the institute in order to be able to fulfil their role as a research institute. Consider for example Rockefeller Institute in New York.[19]

5.1 A short administrative history of research

The extensive array of research within Tel-Hashomer was dependent on access to the hospital's various medical equipment and laboratories, and required a significant budget and workforce. In 1958, the hospital had only two research units, and two designated non-medical staff. Within a few years, the volume of research activity had increased a thousand-fold, and as early as 1965, Tel-Hashomer boasted fifteen research groups employing between ninety to one hundred employees.[20] A meteoric rise by all accounts.

One of the new research units, the Institute of Human Genetics established in 1962, combined under a single umbrella all the research groups dealing with hereditary diseases—G6PD, Dubin-Johnson syndrome, thalassemia, Familial Mediterranean fever (FMF) and phenyl-ketanuria.[21] Researchers at Tel-Hashomer were, for the most part, experienced professionals. It is also worth noting that the genetic research team working with Sheba comprised a broad range of professional researchers. It included biochemist Arie Sheinberg, geneticist Avinoam Adam and hematologist Bracha Ramot, who, like Sheba, was also a physician. Indeed, their published G6PD studies, as well as other genetic studies on color blindness, FMF or thalassemia, indicate a multidisciplinary approach—biochemical, genetic, clinical and population genetics.

In the first years after assuming the position of hospital director, Sheba promoted research in Tel-Hashomer without an allocated budget and, as we have seen, without dedicated research posts. Sheba reduced staff in regular departments to funnel personnel to research. The first published research papers paved the way for grants from research funds abroad (Bondy 1981, 235). To manage the research activity, a special administrative mechanism was created to oversee research funds and hospital staff. This mechanism was responsible, among other things, for aligning the conditions of research staff with the hospital's clinical staff. In 1969, the Research Fund, in Conjunction with Tel-Hashomer, became the financial arm of the hospital's expanding research activities. In the first decade, the majority of funding came from foreign, mainly American, research funds,[22] among them the NIH, the Blood Research Foundation and the Rockefeller Foundation. The latter provided a significant boost to genetic research by awarding a $50,000 five-year grant to develop this field.[23]

The Health Ministry's "marginal but not negligible contribution,"[24] according to Sheba, amounted to funding the extension of hospitalization for patients whose cases were of interest for research purposes—even if there was no real medical need. Sheba was not content with this,

[19]"Why Should the Government be a Factor in Research" by Chaim Sheba, no date, *Press Releases Various Correspondence, IDF Disability Committees and Widows 1951-1955*, Sheba Archive.

[20]Introduction to a review of medical research efforts at Tel Hashomer Hospital 1957–1965 by Chaim Sheba, no date, *Studies 1963–1964*, Sheba Archive.

[21]Ibid.

[22]Chaim Sheba to the Minister of Health, June 12, 1966, *File 37 April–July 1966*, Sheba Archive.

[23]Introduction to a review of medical research efforts, no date, *Press Releases Various Correspondence, IDF Disability Committees and Widows 1951–1955*, Sheba Archive.

[24]Chaim Sheba to the Minister of Health, June 12, 1966, *File 37 April–July 1966*, Sheba Archive.

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believing that the government must also contribute to funding hospital research. Since the government has so many large medical institutions, he argued, research should be undertaken in them, "and for that purpose [the government should] allocate funds and people 'dedicated to research.'"[25]

5.2 Patients as research subjects

Conducting a study with an entire hospital as a laboratory had three major advantages for Tel-Hashomer's physician-researchers. First, and most importantly, it provided control over the subjects' body, time and space regimes and the ability to manipulate the research population. Second, it offered researchers a huge sample group. Lastly, the hospital afforded access to diverse and unique populations.

5.2.1 Control over subjects' bodies, time and space

The hospital, with its twin functions as medical facility and research center, offered researchers a dual advantage: a readily available research population and easy access to their medical files and blood samples. During the mid 1950s, Leslie Dunn, one of the heads of the Institute for the Study of Human Variation at Columbia University, conducted a serological-genetic study of the Jewish community in Rome. Describing the experience, Dunn noted that his team was "dealing with animals over which we have no control," likely referring to such obstacles as false information and ambiguous historical records (Lipphardt 2010, 315). At the same time, the team at Tel-Hashomer had access to a wealth of information from their patient's official files. Moreover, the hospital's patients had their blood taken regularly as part of treatment, which meant blood samples were readily available. Researchers did not need to expend any extra efforts to procure them, and could use them for medical research purposes. As Sheba described:

> I thought about what we, in Tel-Hashomer, could do with our limited means and no budget; research that others do not have the opportunity to undertake . . . . Red blood cells were an easily examined tissue. *We were drawing patients' blood for various tests in any case.* We began with the question of why Ashkenazi patients' red blood cells are more resistant than blood cells of Iraqis or Yemenites or North Africans. (Bondy 1981, 300–301. Emphasis ours)

Sheba's discourse and his group's working practices show that their research was limited to blood samples as the sole source of the desired information. The rest of the human body was of lesser, even irrelevant concern for research purposes. As we will see, when researchers collected blood from the residents of Kibbutz and Moshav rural communities, or from factory workers or new immigrants arriving at the airport, they treated the samples as a raw material—collected at one location, bundled together and transferred to another for testing. Usually, the only details attached to the samples were the donor's age, gender and country of origin.

In his article, "Give Me a Laboratory and I Will Raise the World," Latour analyzes Pasteur's work in developing an anthrax vaccine. He discusses the phenomenon of the transformation in scale, from large to small and vice versa, that occurs in a laboratory. Pasteur introduced into the laboratory only the anthrax bacteria, which he had isolated from the bodies of infected cows, and then grew on solid media into visible colonies. Thus, in the laboratory he produced visible clusters of bacteria colonies from something that on the farm had been invisible. On the other hand, the huge phenomenon of anthrax disease, which had spread uncontrolled among herds of cattle

[25]"Why Should the Government be a Factor in Research" by Chaim Sheba, no date, *Press Releases Various Correspondence, IDF Disability Committees and Widows 1951–1955*, Sheba Archive.

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across extensive geographical areas, had become controlled in the laboratory by reducing it to its components in the blood of the small experimental animals.

Playing with size and moving between the macro and micro level also characterized the work of Tel-Hashomer's researchers. In their work on the G6PD deficiency, they were interested, as noted above, only in the subjects' most basic personal information and blood. In fact, their blood research focused on a single aspect—the presence or absence of the glutathione molecule indicating either normal or deficient activity of the enzyme. Focusing on a specific aspect, effectively "reducing" the patient to a blood sample and an enzymatic deficiency, allowed researchers to compile a large database. Another transformation in scale, but from micro to macro, occurred when Sheba used the information about the deficient gene in order to describe the entire history and wanderings of Jewish ethnic groups. Sheba sought to expand laboratory findings concerning the enzyme and molecule to a panoramic view encompassing events that had been going on for more than a thousand years and across three separate continents.

Controlling the research subjects' regimes of space, having information about their medical condition, direct access to their bodies and blood samples, and the ability to perform further tests gave Tel-Hashomer researchers excellent research conditions. But this was not all. They also had control over their research subjects' time.[26] Thus, to advance a particular study, Sheba, with the consent and funding of the Health Ministry, would approve extending a patient's hospitalization even when there was no real medical need. He even searched for creative ways to find extra funding to cover additional hospitalization costs. We have no way of knowing whether patients were informed that their hospitalization was being extended for research purposes. At one point, this procedure became so common that Sheba, concerned about the growing expense, felt the need to intervene. In a letter to "department directors with hospitalized research subjects," he requested that any hospitalization for research purposes be referred to him for approval, and that such hospital stays be kept as brief as possible. Sheba stressed that in special cases where prolonged hospitalization is required, he himself would seek approval from the Ministry of Health. He also confronted his colleague and chief physician, Harry Heller, with data according to which, in 1960, hospitalization for research purposes of patients with the FMF genetic disease Heller was studying amounted to 5000 Israeli lira.[27] In response to Sheba's letter to department heads, Heller referred to two other cases in which prolonged hospitalization was required:

> Both of these cases involve very rare diseases, making them scientifically important. If it turns out we cannot keep them for the purpose of research, scientific ethics will likely require us to offer them to other institutions if they can bear the costs of hospitalization for research. I refer to Beilinson, and Jerusalem, I imagine they will both jump at such an opportunity.[28]

Heller and Sheba's correspondence mentioned other cases of genetic diseases, such as a Turkish tourist suffering from Adult Fanconi Syndrome who required a lengthy hospitalization. Sheba, who may have taken seriously Heller's implicit threat to hand over interesting research cases to Tel-Hashomer's competing research-hospitals—Beilinson and Hadassah in Jerusalem—suggested a number of possible solutions to the budget problem. He raised the possibility that funding for the hospitalization of patients for research purposes, in the cases Heller mentioned and others, be based on referral from the welfare bureau or Kupat Holim Clalit clinics, or by registering patients under a mental illness or infectious disease, for which hospitalization was free or paid for by other institutions. Also, in some cases, he ordered patients transferred to outpatient care. Though

[26]For further reading on these theoretical terms, see Knor-Cetina's (1999, 43) discussion on the way laboratories reconfigure their objects of study by inserting them into new temporal and territorial regimes.

[27]Chaim Sheba to Harry Heller, Dr. Ziperkovsky and Dr. Cohen 8.12.1961; Chaim Sheba to Harry Heller, Dr. Cohen and Mr. Zalman Weinberg 24.12.1961, *State of Israel-General File*, Sheba Archive.

[28]Harry Heller to Chaim Sheba 13.12.1961, *State of Israel-General File*, Sheba Archive.

funding hospitalization for research purposes was still viewed as a challenge requiring creative solutions in the early 1960s, by 1965 Sheba could already claim that, "we were able to hospitalize patients without financial coverage, if it was a problem that warranted medical research."[29]

5.2.2 Access to thousands of research subjects

In early October 1956, Sheba received a letter from Dr. Joseph Feldman of the Pathology Department of University of Pittsburgh Medical School in the United States declining Sheba's invitation to join the staff of Tel-Hashomer Hospital as a pathologist. He justified his refusal on the grounds of his current focus on basic research and experimental pathology, which requires a laboratory, research budget, free time for research and the institutional support of a university. Feldman added that to his knowledge, these conditions were not yet available at Tel-Hashomer Government Hospital and existed in Israel only at Hebrew University's Hadassah Medical School and at the Weizmann Institute. He concluded his letter by saying that if such laboratory research will be possible in the near future at Tel-Hashomer Hospital, he would be happy to accept the position.[30]

In a belated response to Feldman's claim that suitable conditions for research were available at the Weizmann Institute but not at Tel-Hashomer, Sheba stated, ten years later, that, "even Weizmann Institute is limited in human biological research because it does not have thousands of patients passing through its doors and halls."[31] The team studying G6PD deficiency had access to an entire hospital as an experimental field. The juxtaposition of research and clinical benefits afforded them access to an available, extensive research population. Researchers at the Weizmann Institute, and other significantly smaller hospitals in Israel that also sought to conduct research, could not lay claim to such a valuable resource.

In addition to hospital patients' regular blood tests, samples were often collected from patients' families, especially when the tests focused on hereditary deficiencies. Thus, for example, Sheba wrote personally to R.Z., a relative of a patient from the Bukharan Jewish community,[32] asking him to come to the hospital for an examination. Sheba noted that the test was "a new, very simple method requiring only a tiny drop of blood."[33] Sheba also showed great curiosity in an unusual and very rare case of favism in an Ashkenazi Jew. In a letter to the man's brother, he asked for a blood sample, even offering to send one of his assistants to collect it, and stressed his interest in examining the rest of the family.[34] Indeed, Sheba's interest extended beyond patients to include Tel-Hashomer employees as well. As he wrote to a training candidate at Tel-Hashomer: "We are very interested for purposes of a research study in testing the blood of all your immediate blood relatives for a tendency to blood deficiencies from drugs, which can be diagnosed before they fall ill in a way similar to how you did."[35]

The collection of blood specimens was not limited only to those who crossed the threshold of the hospital and their families. In fact, from the end of the 1950s, Tel-Hashomer researchers conducted an enthusiastic "blood race" to collect blood samples from various populations around the country for research purposes. "We are very interested in blood," Sheba began his letter to

[29]Introduction to a review of medical research efforts at Tel Hashomer Hospital 1957–1965 by Chaim Sheba, no date, *Studies 1963-1964*, Sheba Archive.

[30]Joseph D. Feldman to Chaim Sheba, 2.10.1956, *Audiology Institute 1956-1960*, Sheba Archive.

[31]Chaim Sheba to the Minister of Health, June 12, 1966, *File 37 April–July 1966*, Sheba Archive.

[32]A Jewish community originating in Central Asia, mainly in modern Uzbekistan and Tajikistan. The origin of the name is in the city of Bukhara in Uzbekistan, the former capital of the Bukhara emirate, where a large Jewish community existed.

[33]Chaim Sheba to R. Z., August 15, 1963, *File 28 Correspondence with physicians, patients, visitors from abroad and people related to day-to-day work 1963*, Sheba Archive.

[34]Chaim Sheba to Yehoshua Lahavi, October 19, 1958, *file 19 Research 1 1954.* Sheba Archive.

[35]Chaim Sheba to Hana Aylon, May 20, 1957, Ibid.

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Dr. Shimon Winter from the Department of Pediatrics at Rothschild Hospital in Haifa, followed by a detailed list of requests:

> A. Of cases of favism or any other hemolysis ... also in the blood of family members as much as possible.
>
> B. We are interested in the blood of various ethnic groups, mainly Kurds, Baha'is, Druze, Falashas, Cochin, Saloniki, etc.
>
> We have an arrangement with Dr. Barzilai from Rambam Hospital, whose chief of medicine, Dr. Tatarsky, clarified with us the technical side. In the coming days we will come to Haifa and Acre on blood matters and will contact you then ...[36]

In 1958, Sheba and his group performed blood tests on workers at the Argaman and Keshet textile factories in the city of Ramat Gan, located in proximity to Tel-Hashomer hospital. Sheba also asked permission to test for G6PD enzyme deficiency at military industrial plants. In letters to the factory heads, Sheba explained that contact with chemicals at the factory by workers having the defect could lead to the destruction of their red blood cells. The tests, presented as aimed at locating those workers sensitive to the chemicals, were even partially subsidized by Israel's national labor union—the Histadrut.[37]

In the early 1960s, a Tel-Hashomer medical team was regularly stationed at Lod Airport to examine newly arriving immigrants to Israel on behalf of the state.[38] At the same time, they "took blood samples for research purposes (Adam 1963),[39] in order to try and sketch what Sheba described as the immigrants' "genetic profile."[40]

An example of the close eye Sheba kept on immigration to Israel is a letter from May 1962 about a study of Jews from the Indian port city of Cochin (today known as Kochi), in which he reports that "only three days ago another 100 or so [Cochin Jews] had arrived."[41] His deep involvement in the absorption process of new immigrants was possible in large part because Tel-Hashomer was a government hospital and thus part of the state apparatus. Sheba at one point raised the possibility of collaborative research with the nearby Bar-Ilan University. He suggested that university researchers from the fields of psychology, sociology or history join the Tel-Hashomer doctors at Lod Airport in the initial screening of immigrants and follow-up research. The intention was for Bar-Ilan researchers to focus on social and cultural aspects of the various communities.[42] In addition, Sheba tried to promote similar testing among immigrants arriving by sea at Haifa port, and contacted the staff of Rambam Hospital for this purpose.[43]

The fact that the research team belonged to a state hospital, with close ties to surrounding communities, contributed not only to the dramatic increase in the size of the population examined, but also, as will be seen below, to the degree of subject groups' heterogeneity. This serves as a good illustration of Bruno Latour's claim that a laboratory has no walls (Latour, 1983). Latour and other science studies scholars, as well as anthropologists and sociologists of science, saw laboratories as key sites for creating scientific knowledge and the development of modern science. They argued that laboratories did not exist in isolation from the world "outside" the laboratory (Knorr-Cetina 1999;

[36]Chaim Sheba to Winter, April 7, 1958, Ibid.

[37]Chaim Sheba to Mr. A. Klear from the Argaman factory (Bnei Brak road) October 5 1958 and to Zvi Dar General Manager of Israel Military Industries December 29 1958, Ibid.

[38]Much has been written about the medical treatment of immigrants upon entering the receiving state, including the medical treatment of Jewish immigrants. See, for example, Seidelman (2020); Davidovitch and Zalashik (2006).

[39]Report for December 1962, *Medical Examinations November-December 1962*, Sheba Archive.

[40]Chaim Sheba to David Barzillai Rambam Hospital April 26 1964, *File 30 1964*, Sheba Archive.

[41]Gilbert Kushner to Chaim Sheba May 10 1962 and from Chaim Sheba to Gilbert Kushner May 14 1962, *File 9 Various correspondences 1962*, Sheba Archive.

[42]Chaim Sheba to Prof T. Bar-Ilan May 3 1962, Ibid.

[43]Chaim Sheba to Dr. David Barzilai from the Rambam Hospital April 26 1964, *File 30 1964*, Sheba Archive.

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Latour and Woolgar 1979; Lynch 1985). According to Latour (1983), shattering the dichotomous distinction between inside and outside is another transformation carried out in laboratories, alongside their ability to induce changes of scale, as discussed earlier. These transformative abilities enable laboratories to generate new and original knowledge unlike any other institution. They thus gain a unique advantage in knowledge production, while also generating interest among social groups otherwise indifferent to what goes on inside a laboratory.

To illustrate this point, Latour evoked the double move by Louis Pasteur to shatter the internal/external dichotomy during his research on anthrax. First, Pasteur brought material from the farm into the laboratory, and later, after producing the anthrax vaccine, moved the laboratory outside, to farms across France through vaccination of herds and collection of statistical data (Latour, 1983). Tel-Hashomer's researchers, in contrast, benefitted from an even better starting point: a significant proportion of their research subjects—the hospital patients—were already inside the laboratory/hospital. There was no need to go outside to look for them. The hospital's dual clinical and research role thus shattered, ipso facto, the inside/outside dichotomy by eliminating the need for actively having to "bring inside" the laboratory research subjects. From those initial subjects-patients, Tel-Hashomer researchers expanded their research beyond the hospital to encompass family members and additional communities, thereby significantly increasing the number and diversity of individuals included in the study.

5.2.3 Diversity of the research population

In addition to their collecting of blood samples from new immigrants at the country's gateways, Tel-Hashomer researchers also aggressively pursued the collection of blood samples of immigrant populations in various localities—even those at great distance from the hospital (Padeh 1968; Bondy 1981, 300–312). In such cases, they sometimes worked in cooperation with district health bureaus, which were apparently interested in early detection of the hereditary deficiency in order to preclude hemolysis. Thus, for example, in September 1958, Sheba sent the Sharon sub-district physician a report of glutathione tests taken several months before. These tests encompassed the following villages and ethnic groups:

> Haʻogen and Givat Haim: 30 blood samples of Indian Jews (Bnei Yisrael and Cochin)—all normal
>
> Tnuvot: 48 samples from a large Yemenite family. [To this record, and to later ones, Sheba appended the names of the subjects who showed sensitivity]
>
> Shvut Am: 8 samples from Iran
>
> Hadid: 23 samples from Cochin Jews—all normal
>
> Burgata: 34 samples from Turkish Jews—all normal
>
> Ahituv: 65 samples from Persia, Iraq, Kurdistan.[44]

In conducting large-scale blood surveys, Sheba consulted community leaders in a bid to reach all members of a community.[45] For example, he turned to B.A., from the Caucasus Jewish community[46] for help in examining "some if not many of the members of the Mountain Jews

[44]Dr. Y. Lifschitz (District Physician from the Sharon Natanya District Health Bureau) to Chaim Sheba August 29 1958; Chaim Sheba to Dr. Y. Lifschitz September 4 1958, including a report of Glutathione tests in the Sharon district that were taken in June–July 1958, *file 19 Research 1 1954,* Sheba Archive.

[45]Chaim Sheba to Mr. A. B. from Tel Aviv, September 21 1958, Ibid; Chaim Sheba without a specified recipient, February 3 1963, *File 29 Correspondence with various people, a number of letters relating to the use of thalidomide 1963,* Sheba Archive.

[46]Caucasus Jews, also known as mountain Jews, come from the eastern and northern Caucasus, mainly Azerbaijan, and various republics in the Russian Federation: Chechnya, Dagestan and Kabardino-Balkaria.

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community." In his letter, Sheba stated that he and his staff were willing to accept any proposal to perform the test: home or hospital visits. In the latter case, emphasized Sheba, it would be possible to perform a general examination or any examination the subject needed—free of charge. "Any way that helps us to reach the goal of covering a significant portion of his community and which his Honor is willing to help us achieve will be agreed upon," Sheba wrote.[47]

The ability to explore a hereditary trait among entire communities and families allowed Sheba and his team to test how the trait was passed down from one generation to the next. This was a significant advantage in comparison to other research teams, who conducted their studies on conventional, available subject populations such as soldiers and prisoners. When comparing genetic research done in Israel to research done elsewhere in the world, Sheba remarked:

> While we were still working on this, a study was published on the same subject by a group of researchers from Chicago who saw a similar phenomenon, the difference of the red cells among blacks and whites. Thus, we, the group in Chicago and a third group in Italy were all working on the same topic. They were ahead of us in the biochemical aspect. We had the advantage on the hereditary side, how it passes down through families. In Chicago, they could only examine individual soldiers or prisoners, whereas researchers in Israel had at their disposal entire families, the entire clan, including grandmothers, aunts and nephews. (quoted in Bondy 1981, 300)

Another noteworthy point is that the groups tested in the Chicago study were mostly men, whereas Tel-Hashomer also had access to female patients,[48] as well as female family members, as noted earlier.

The G6PD study, and other research conducted at Tel-Hashomer Hospital in those years, raises some ethical questions. We will not address this issue in depth here, but confine ourselves instead to a few brief remarks. Concerning the extent to which patients/subjects knew that some of the blood and other tests performed on them were for research purposes (similar to the previously mentioned issue of whether patients were informed of extended hospitalization for research ends), we do not have a definitive answer. The impression is that, at very least, the hospital patients and new immigrants at the airport were unaware that their blood was going to be used for research purposes. Regarding the second tier of blood collection—from patients' families, immigrant communities and agricultural settlements, at least in some cases the subjects knew the purpose of the testing, because Sheba and his colleagues expended considerable efforts in getting their consent. Among the various inducements and strategies were free comprehensive testing at the hospital, and appeals to the sentiments or pride of community leaders.

Tel-Hashomer's researchers were working at a time when rules for medical ethics were being formulated and an international legal infrastructure established for the regulation of human clinical trials. The Nuremberg Code was published in 1947, in the wake of the Nuremberg trial, in which Nazi physicians were prosecuted for conducting medical experiments on humans during World War II. In 1964, the Helsinki Declaration redefined some of the principles outlined in the Nuremberg Code. Both documents required, among other things, the informed consent of a participant in a study. The Helsinki Declaration also addressed the need to reduce a participant's exposure to risk as a result of a research study.

[47]Chaim Sheba to Mr. A. B. from Tel Aviv, September 21 1958, Ibid; Chaim Sheba without a specified recipient, February 3 1963, *File 29 Correspondence with various people, a number of letters relating to the use of thalidomide 1963,* Sheba Archive.

[48]For example: Semi-Annual Report, July–December 1956, on the movement of female patients and diseases in the internal medicine department, Pavilion 38 Tel-Hashomer Government Hospital, *Semi-Annual Report 1956 Internal ward Pavilion 38*, Sheba Archive.

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Presumably, Tel-Hashomer's researchers were aware of both the Nuremberg Code and the later Helsinki Declaration. However, like many other medical establishments around the world in those years, they ignored these ethical guidelines or at least were selective with regard to them, especially when it came to vulnerable populations.[49] The ethical aspects of the way Sheba and his research team thought and behaved were part of a larger historical context. After World War II, the blood of indigenous peoples was frequently used as a vehicle for studying human evolution. Kowal et al. (2013) discussed in-depth the ethical questions raised by this kind of research. A controversial case that has recently been thoroughly investigated is the reuse of the Pima Indian blood samples. Radin (2017) studied and analyzed how the Pima Diabetes Dataset, previously collected for a certain purpose, was eventually reused for the purposes of tracking the emergence of HIV, in a way that raised difficult ethical questions.

5.3 Benefits of research for the hospital

In addition to the advantages that research projects gained from being conducted within a hospital, Sheba also recognized the derivative benefits that in-house research offered to the hospital itself. First, he argued that the language of modern medicine was becoming increasingly scientific and foreign to those he called "the old-school physicians."[50] Conducting research within a hospital would address the growing need for proficiency in the language of scientific research, which is also required of physicians not engaged in research but interested in enjoying the fruits of research conducted by others.[51] Second, Sheba claimed that incorporating research into the hospital's clinical routine would attract talented physicians and may even be one of the ways to keep young, ambitious and talented physicians in Israel and prevent them from taking advantage of research opportunities abroad. In a letter to the Minister of Health in 1966, he remarked:

> . . . but research is also needed to motivate the younger generation of physicians for whom the United States beckons with vast research possibilities, virtually with no financial constraints. And the Jewish mind of the young physician is drawn to this possibility more than is his heart to the greed for greater wages. And if we cannot offer them a higher salary, at least we should maintain a research budget that will prevent emigration of young doctors.[52]

Sheba added that undertaking research in the hospital would attract not only talented physicians but also generous donors. "Science and research," he wrote, "have become the common coin in the fundraising industry."[53] Indeed, in 1969, Sheba established the Research Fund in Conjunction with Tel-Hashomer Hospital, which was intended, among other things, to facilitate the flow of donations to fund medical research. While all government hospitals had research funds (which were in fact a branch of a government research fund established by

[49]There are many instances of the medical establishment (and many other scientific establishments) ignoring the ethical codes mentioned above in the second half of the twentieth century. One of the most famous and scandalous of these is the case of the syphilis experiment in city of Tuskegee, Alabama. The trial was performed on a population of 400 African-American syphilis patients and a control group of 200 healthy African-Americans between 1932 and 1972 (Brandt 1978; Reverby 2009). Another example is the HeLa cancer cells from the patient Henrietta Lacks, which were obtained without her consent in Johns Hopkins Hospital in 1951. The HeLa cell line is used worldwide in research laboratories until this day (Coppola et al. 2019).

[50]"Why Should the Government be a Factor in Research" by Chaim Sheba, no date, *Press Releases Various Correspondence, IDF Disability Committees and Widows 1951–1955*, Sheba Archive.

[51]Ibid.

[52]Chaim Sheba to the Minister of Health, June 12, 1966, *File 37 April–July 1966*, Sheba Archive.

[53]"Why Should the Government be a Factor in Research" by Chaim Sheba, no date, *Press Releases Various Correspondence, IDF Disability Committees and Widows 1951–1955*, Sheba Archive.

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the Ministry of Health in 1966), the Sheba Research Fund surpassed them all, by a huge margin (Bettelheim 2018, 102–103).

5.4 Research networks

A prominent factor in Sheba's study of G6PD was the broad use he made of his well-established network of connections. First were connections with both the Ministry of Health and colleagues from other hospitals across the country. Additionally, as Tel-Hashomer was part of the state apparatus, Sheba was able to count on the cooperation of district health bureaus and physicians, and of authorities in charge of immigration to Israel. Sheba also relied on his connections with the Histadrut labor union, and with factories willing to allow him to carry out testing among their workers. When necessary, he turned for help to the academic staff at the Hebrew University and the newly founded Bar-Ilan University. In the mid-1960s, Sheba was one of the founders of the School of Medicine at Tel Aviv University. One of the first departments he established within the School of Medicine was the Department of Human Genetics. Thanks to this department and its faculty—Batsheva Boneh-Tamir, Avinoam Adam, Israel Ashkenazi and others—the Tel Aviv School of Medicine became a center for research in the field of human genetics.

Sheba also called upon his close connections with the Israeli labor movement members and specifically *kibbutz* members. Thus, for example, for a study on malaria resistance, conducted in 1961–1962 in collaboration with the Ministry of Health, he approached twenty rural settlements (*kibbutzim* and *moshavim*) in Hefer Valley, Jezreel Valley and Beit She'an Valley.[54] As part of the study on malaria resistance, Sheba conducted an extensive survey, with the aim of collecting blood for testing from those having a "natural immunity against malaria."[55] He sought out members of *kibbutzim* and *moshavim* who had been exposed to malaria patients between 1930–1936, but had not fallen sick themselves. The degree of response can be gleaned from the many notes Sheba received. For example, N. B. from Kibbutz Maoz Haim wrote to Sheba: "If their blood suits your study—I will immediately prepare a list [of kibbutz members]" (September 9, 1961), and the administrative secretary of another kibbutz wrote: "Please let us know the date you plan to arrive to take blood from the above members" (October 10, 1961).

The research project on malaria resistance shows just how broad Sheba's research options were. These included not only hospital patients and their families, immigrant communities from Asia and Africa, but also members of the early Jewish settlers of Palestine/Israel who were mostly of European (Ashkenazi) descent. Tel-Hashomer Hospital served its researchers as a huge laboratory, but it can also be argued that its researchers viewed the entire State of Israel as a vast laboratory.

6. Conclusions: The state as laboratory

Within a few years of its establishment, Tel-Hashomer Hospital, under the leadership of its director Chaim Sheba, became a huge laboratory. The large, 1000-bed hospital envisioned by those few physicians in the pre-state period had become a near reality within just a few short years of the founding of the State of Israel. As we have tried to show, clinical and research activities at the hospital evolved simultaneously—supporting each other, or, using Sheila Jasanoff's term, co-producing each other (Jasanoff 2004). Medical care provided a rich source of research opportunities, and research activity strengthened the hospital's clinical endeavors. Thus, for

[54]*Examination of people with native immunity to malaria, Kibbutzim 1961-1962*, Sheba Archive. It is worth noting that one of the explanations for the high frequency of G6PD deficiency in various populations suggested that this deficiency gave one an advantage in resistance to malaria. It is very possible that this aspect aroused Sheba's curiosity and led him to undertake a malaria study, even though, by the early 1960s, malaria no longer posed a health hazard in the State of Israel.

[55]Apparently the material collected was not used for further research (Zvi Saliternik to Sheba January 4 1962, Ibid).

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example, the great interest of Tel-Hashomer's researchers in Jewish (and to a lesser extent also non-Jewish) genetic diseases laid the foundation for the establishment of the hospital's genetic counseling system in the late 1960s.

For Sheba, the hospital was the ideal site for medical research. Investing in research was an opportunity for Tel-Hashomer to not only compete locally with Hadassah and Beilinson hospitals, but to be on a par with institutions such as the University of Chicago, Johns Hopkins, Columbia and Stanford. As we have seen, in order to compete with these institutions, Sheba made the most of what he perceived as the State of Israel's great advantage—the fact that it was, for him, a living laboratory.[56]

It is worth noting that, in Sheba's case, this was a laboratory largely organized around the idea of population—describing it and constructing it at the same time. The starting point of this laboratory was the assumption regarding the ontological validity of a Jewish national category, which encompasses different Jewish ethnic communities as subcategories of one nation, and can be clearly distinguished from an Arab national category. This assumption led Israeli researchers to suggest creative interpretations for genetic differences between different ethnic communities of Jews and while ignoring genetic similarities that were found between Arab and Jewish populations (Kirsh 2003).

The development of biomedical research at Tel-Hashomer Hospital is not a unique phenomenon. It fits into the overall picture of the interrelationship between science and politics around the establishment of the State of Israel, and the great waves of immigration it absorbed in its early years. This is not the only instance where Israel's creation and the large waves of immigration following it generated favorable conditions for promoting scientific research and gave the country's researchers an unprecedented opportunity to establish an experimental field on a large scale. Anat Leibler has described a similar situation in the field of statistics, with the establishment of the Central Bureau of Statistics and the first census the bureau conducted in November 1948. The first census under Israeli rule actually enabled statisticians to produce an unprecedented body of demographic knowledge unique in its scope and accuracy compared to the previous attempts during the periods of Ottoman and British rule. A perfect laboratory of the Israeli population (Leibler 2004). The same occurred, apparently, in the fields of architecture and regional planning (Sharon 2017; Efrat 2004) and, to a degree, in archeology (Feige and Shiloni 2008) and sociology (Ram 1995).

We therefore contend this was a widespread phenomenon. The emergence of the new "state order" occurred in parallel to (enabling and at the same time being made possible by) the emergence of various laboratories. These laboratories counted, sorted, cataloged and characterized population and space under the rule of the new state, simultaneously studying and defining various aspects of the population and space of the new state. In a sense, the State of Israel functioned as an incubator for a collection of laboratories that together created a huge research field—a kind of laboratory state. Tel-Hashomer Hospital, under the leadership of Chaim Sheba, as we have attempted to show, was one such laboratory.

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[56]See quotation in our introduction (Bondy 1981).

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