



King's Research Portal

Document Version
Peer reviewed version

[Link to publication record in King's Research Portal](#)

Citation for published version (APA):

Vertommen, S. (2017). From the personal project to Kadimastem: A genealogy of Israel's reproductive-industrial complex. *Biosocieties*, 12(2), 282-306.

Citing this paper

Please note that where the full-text provided on King's Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher's website for any subsequent corrections.

General rights

Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the Research Portal

Take down policy

If you believe that this document breaches copyright please contact librarypure@kcl.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.

From the Pergonal Project to Kadimastem

A genealogy of Israel's reproductive-industrial complex

Abstract

In the Israeli “start-up nation” biotechnology has emerged as one of the most thriving knowledge-intensive industries. Particularly the med-tech and repro-tech sector are widely regarded as world-class in their ability to develop experimental therapies and medicines based on topnotch “pioneering” biomedical research. These developments have rightly been attributed to the neoliberal turn of the late seventies when Israel started to position itself as significant player in the global health and research market. By exploring the (dis)continuities between Pergonal, a fertility drug developed in the late 1950s by the Israeli scientist Bruno Lunenfeld and the Swiss-Italian pharmaceutical company Serono, and the experimental stem cell therapies that are currently being developed by the Israeli biotech company Kadimastem, this paper argues however that a much older, but still ongoing history of Zionist settler colonial warfare in Palestine/Israel also lies behind the emergence of Israel's flourishing reproductive-embryonic industry. A Zionist demographic logic that aims to consolidate a Jewish majority in a Jewish state has created fertile conditions for the emergence of a reproductive-industrial complex in which the interests of a pronatalist Jewish state and a biomedical establishment - consisting of academic entrepreneurs, venture capitalists, biotech companies and pharmaceutical giants - have coalesced. The bodies of Israeli women play a pivotal role in this process, not only as reproducers of the settler nation but also as providers of the raw biological materials that are needed to produce experimental research results and to generate surplus bio-value.

Keywords: Palestine/Israel, reproductive-industrial complex, bio-capitalism, Zionism, settler colonialism, demography, stem cell technologies, Pergonal

Israel's start up nation: The Promised Land of Science and Technology

"Falafel, high-tech and biomed may be the three best things to come out of Israel."

Promotion for Israel's annual Innovation Conference

It is a widely accepted fact that Israel has one of the most innovative high-tech and biotech sectors in the world. Israel houses the world's highest density of start-up companies. With half of its exports stemming from high-tech products such as military equipments, (bio)pharmaceuticals, medical devices and information technology, Israel's industries in computer science, life science and military and defense have become crucial engines of economic growth (Bichler and Nitzan, 2002). Moreover, Israel's high-tech and biotech sector absorbs huge amounts of surplus capital, mostly stemming from investments from venture capital funds (Rosenberg, Haaretz, 2015) ⁱ. Particularly Israel's med-tech sector is widely regarded as world-class in its ability to develop innovative therapies and medicines based on experimental biomedical research. Israel is number one for patents in medical devices per capita and ranks second in bio-pharma patents per capita worldwide (USPTO, 2013). Blockbuster drugs such as Rebif, Gonal-F, Copaxone and Azilect were developed in Israel. This bio-boom has been made possible through generous government funding. At a record rate 4.4% of its gross domestic product, Israel leads the world in expenditures on civilian research and development with biomedical research being a central sphere of investment (OECD, 2011; Messer Yaron, 2011) ⁱⁱ. The percentage of the budget of the Office of Chief Science allocated to the life sciences doubled from 14% in 2000 to 28.5% in 2013 (OCS,

2014). Israel's techno-scientific success is reflected in society's overall positive and fearless attitude towards science and technology. A national survey of the public's perception of professions in 2014 indicated doctors, engineers and scientists as the three most prestigious professions in Israel ⁱⁱⁱ. Moreover, as Prainsack and Firestine (2006: 33) have observed, there is a remarkable absence of public controversies on scientific practices such as therapeutic cloning, genetic engineering and sex selection, resulting in a very lenient regulatory S&T framework regarding.

In spite of being so fundamental to its national prosperity, Israel's intimate relation with science and technology has attracted relatively little research attention with only a few notable exceptions (Golan, 2004). In their patriotic bestseller "The start-up nation: The story of Israel's economic miracle" Dan Senor and Saul Singer (2011:15) addressed the question why Israel - a young country of 7.1 million people, with no natural resources, surrounded by enemies and in a perpetual state of war since its creation – has succeeded in emerging as the high tech miracle of the world. Unfortunately, in their explanatory answers they strongly emphasize the uniqueness of Jewish-Israeli character idiosyncrasies, epitomized in concepts such as *chutzpah* or *bitzu'ism* which can be explained as "*a kind of audacity and pragmatism at the heart of the pioneering ethos and Israel's entrepreneurial drive*" (Id: 106). Similarly, Noah Efron (2011) points out to the historic achievements of generations of Jewish scientists with their *Yiddischer Kupf* or Jewish genius. Other, more critical scholars have understood Israel's techno-scientific strengths to be co-produced by the political and socio-economic circumstances in which they were anchored. Prainsack and Firestine (2006) argued, for instance, that Israel has always emphasized the role of research and technology as an indispensable tool for national survival in a hostile environment. Dani Filc (2005) has attributed the astronomic growth of Israel's life science industry to the post-Fordist/neoliberal

turn of the late seventies when Israel started to position itself as significant player in the global health and research market. Indeed, since the transition from a Fordist to a neoliberal world economy, the capitalization of bare biological life has become a very lucrative globalized business (Waldby, 2002, 2006, 2008; Rose, 2007; Cooper, 2006, 2008). This paper argues however that, although the neoliberal turn certainly has intensified the growth of Israel's bio-economy, there is a much older, yet still ongoing history of Zionist settler colonialism and bio-capitalism in Palestine/Israel that has enabled the emergence of Israel's innovation-based biotech industry, particularly its reproductive-embryonic industry which will be the subject of this paper (Rajan, 2006; Nahman, 2013). From a gendered political economy' perspective, I will contend that from the early 20th century onwards a Zionist demographic logic aiming to consolidate a Jewish majority in a Jewish state has created favourable conditions for the development of an experimental reproductive industry (Nahman, 2013; Prainsack 2006; Prainsack & Wahlberg, 2013). Before moving into the actual analysis, a short note is at place on how the proposed gendered political economy framework will be conceptualized and operationalized.

Accumulation and elimination: a fertile double logic in the political economy of Zionism

Drawing on the work of Helmreich (2007) and Goven and Pavone (2014), I will not conceptualize Israel's reproductive-industrial complex as a mere techno-scientific or economic formation, but rather as a political project driven by state –and global market-making practices and shaped by histories of settler colonialism and bio-capitalism. Both settler colonialism and bio-capitalism are socio-historical systems that - despite their local particularities – are governed by a certain structural logic. In the case of settler colonialism Patrick Wolfe (1999, 2006, 2007) refers to a demographic logic of elimination of the

indigenous population as a way to repopulate the country with the newly arrived settler population. Wolfe conceptualizes Zionist settler invasion not so much as an event that ended in 1948 with the creation of the State of Israel or that started in 1967 with the military occupation of the West Bank, Gaza and East-Jerusalem, but rather as a demographic structure that has not ceased, but has taken many new shapes since it moved on from the era of frontier homicide and mass expulsion. Indeed, since the early beginnings the Zionist movement understood that in order for Israel to become a Jewish state, at least the majority of the population should be Jewish. As such, the presence of Palestinians, within and outside the borders of what became Israel in 1948, has always posed an existential threat to the Jewish collective body. Israel has attempted to establish and consolidate a Jewish majority in the Holy Land in two significant ways. First and foremost, by installing a strong migration policy to attract Jews from the Diaspora, crystallized in the Law of Return of 1952 which gives every Jew in the world the right to “ascend” to Israel (aliyah) and become an Israeli citizen, and by simultaneously denying Palestinian refugees their Right to Return. Secondly, by issuing pronatalist reproductive health policies that would stimulate an “internal aliyah”. Israel’s pronatalist regime has been institutionalized through multiple funds and committees that provided monetary incentives and social benefits for (re)producing large families, such as the 1949 Heroine Award for mothers with at least ten children, the 1962 Committee for Natality Problems, the 1968 Demographic Centre with its Fund for Encouraging Birth and the 2002 Israel Council on Demography (Yuval-Davis, 1993, 1995; Birenbaum-Carmeli 2007, 2010). The same pronatalism has been detected in Israel’s assisted reproductive policies. Reproductive technologies such as in vitro fertilisation (IVF), intracytoplasmic sperm injection (ICSI), donor insemination (DI), surrogacy, egg donation, egg freezing and prenatal genetic diagnosis (PGD) are not only widely accepted and exceptionally popular in Israel, but most of them are generously state-sponsored^{iv}. In contrast to this remarkable support for

enabling reproductive technologies, treatments that potentially restrict family size, such as family planning services and contraceptives remain largely under subsidized in Israel (Portuguese, 1998; Balabanova and Simonstein, 2009). Moreover, abortion is still illegal, except for therapeutic reasons ^v.

Next to being a settler colonial project, Zionism was (and still is) also a capitalist enterprise in Palestine/Israel. The underlying structure of capitalism is one of endless capital accumulation and the ongoing commodification of everything (Wallerstein, 2003). Bio-capitalism in particular has been defined as a new economic model built on the speculative promise of creating commodities from existing forms of bare life (Rajan, 2007). Scholars as Cooper (2008) and Benner and Löfgren (2007) have posited how epistemic turns in the field of molecular biology, have coincided with global macro-economic transitions to neoliberal modes of accumulation that attempted to resolve the Fordist-Keynesian crisis of the seventies through the creation of competitive workfare states ^{vi}. These mutually constitutive transitions have transformed biomedical research into a profitable area of investment for the volatile forms of financial capital that have dominated the global economy since the 1970's (Harvey, 2005; Cooper, 2008).

Israel's financial crisis of the late 1970's paved the way for the introduction of the New Economic Policy (NEP) as a way to radically break with Zionist Fordism-Keynesianism, by encouraging the privatisation of state-led industries and services, the deregulation of financial markets and the export of high tech commodities, with a strong emphasis on military and biotechnological products. There is no question that Israel's neoliberal turn of the late seventies has indeed bolstered the growth of a bio-economy. I argue, however, that a much older (yet still ongoing) history of Zionist settler colonialism lies behind the emergence of Israel's biotech industry. In their "Global Political Economy of Israel" (2002, p.17) Nitzan

and Bichler rightly pointed out that “*Israel’s recent neoliberal phase was not at all a structural break, but rather the latest step in the long process of Israeli capitalist development which began not in the 1990s, but almost a century earlier, the initial Jewish colonization of Palestine.*” I argue, in similar fashion, that concordant with the Zionist endeavor to create a Jewish state in Palestine, a (bio)capitalist logic of accumulation and a demographic logic of elimination have converged in the emergence of a *reproductive-embryonic industrial complex* in which the interests of a pronatalist Jewish state and a biomedical establishment - consisting of academic entrepreneurs, venture capitalists, biotech companies and pharmaceutical giants - have coalesced. This argument will be gradually developed throughout this paper. First, by elaborating on the quintessential historical role of science and technology in the creation of a Jewish nation-state, and by focusing on the therapeutic importance of reproductive health technologies for the Zionist demographic enterprise in Palestine/Israel. Then, I will trace the genealogy of Israel’s reproductive-embryonic industry from a gendered political economy perspective by exploring two of its techno-scientific apparatuses (Barad 2003), both situated in a particular time-space frame in Israeli history. The first case study is Pergonal, a fertility drug developed in the late 1950s by the Israeli scientist Bruno Lunenfeld and the Swiss-Italian pharmaceutical company Serono. The second case study concerns Kadimastem, an Israeli biotech company founded by the Israeli scientist and bio-entrepreneur Michel Revel that is currently developing stem cell technologies dedicated to regenerative health therapies and drug screening. Apart from unraveling the historical context in which these scientific developments emerged, particular attention will be paid to three key themes that I consider to be fundamental in a political economy analysis of reproductive medicine in Palestine/Israel. First of all, I will focus on the impact of a settler colonial demographic arithmetic on the emergence of certain experimental reproductive-embryonic technologies in Palestine/Israel. Secondly, attention will be paid to the modes of accumulation in which these technologies

have been produced, with a strong emphasis on the underpinning property and labour regimes and to the intimate collaborations that were forged between the Jewish state, Israeli academia and industry in the production of these technologies. Thirdly, I will focus on the essential role that gender hierarchies have played in this process. Even though political economy analyses often tend to overlook issues of gender, I argue that Israel's bio-economy is particularly gendered, and that its reproductive-industrial complex could have never been produced without the crucial contribution of Israeli women, as both reproducers of the settler nation and producers of what Catherine Waldby (2001) has termed bio-value, i.e. the production of a surplus out of socially constructed biological vitality which was obtained through the biotechnical reconfiguration of living processes^{vii}. In the final section, I will explore the discursive-material (dis)continuities between Serono's fertility drug and Kadimastem's stem cell therapy in the emergence of a reproductive-embryonic complex in Israel, taking into account the aforementioned key notions.

This paper proposes a genealogical method as a way to re-evaluate the existing discourses on the emergence of Israel's bio-economy. It is based on fieldwork conducted in Palestine/Israel from 2012 until 2014, which largely consisted of 1) archival work on the Pergonal Project in the Israeli State Archive in West-Jerusalem and in the personal archive of Bruno Lunenfeld, 2) a close reading of Israeli policy documents and the websites and promotional material of technology transfer companies, stem cell companies 3) participatory observations during biomedical conferences and fairs in Israel and 4) more than 70 semi-structured interviews with fertility researchers/doctors, stem cell researchers, officials from the Ministry of Health, representatives of feminist organizations, CEO's from biotech companies, technology transfer companies and venture capital funds. The two interviews with the protagonists of this paper, Bruno Lunenfeld and Michel Revel, take a central position.

1. Zionism's techno-scientific history: a discursive-material love story

"We are in a desert, we are fighting against Nature, we don't have resources, so what is left? Science and technology."

Michel Revel, founder and chief scientist of Kadimastem (interview Nes Ziona, 16/07/2012)

Science and technology have always been of vital importance for Zionism, both in the development of Zionist thought and ideology as in the practical materialization of the Zionist project in Palestine from the end of the 19th century onwards (Golan, 2004; Efron, 2007). In his utopic novel *Altneueland* (1904) Theodor Herzl, the founding father of political Zionism put forward a blueprint for the New Jewish Society, in which he explicitly linked Western ideas of progress and modernism to the advancement of a techno-scientific culture in Eretz Israel (Davidovitch and Seidelman, 2004; Efron, 2007). Noah Efron (2007: 421) rightly argued that Zionism's intimate relation with science has always served the idea that "*Jewish settlement of Palestine was a Western project flush with Western ideals and committed to advancing those ideals in the East*". As such, the discourse of science and technology was cleverly deployed to legitimize the Jewish colonization of Palestine, which most Zionists erroneously described as 'terra nullius', an empty, barren and primitive land, in dire need of an enlightened intervention. Universities and research institutions, such as the Weizmann Institute of Science in Rehovot, the Hebrew University and Hadassah Medical Centre in Jerusalem and the Technion in Haifa - all established during the first half of the 20th century - served as the cornerstones of this scientific colonialism. Through many of its different disciplines these scientific institutions assisted in producing the necessary knowledge for the consolidation of Zionist title to the land. Cartographers who began to explore and map the country, started replacing the Arabic names of Palestinian villages, mountains and rivers with Hebrew names. New agricultural techniques were introduced, encouraging the *kibbutzniks* to redeem the Land of Israel and *to make the desert bloom* (Efron, 2007).

Besides offering a justifying narrative for the ongoing colonization of Palestine, scientism also had an important internal function within Zionist ideology and practice. Science and technology were of crucial therapeutic and diagnostic importance in the creation of the so called New Jew or Sabra, referring to a healthy, masculine and strong Israeli-born Jew who symbolized the collective rebirth of the Jews after centuries of “diasporic” degeneration (Almog, 2000; Weiss, 2002) Analyzing the relation between Zionism and health, Davidovitch (2004) concluded that Zionism’s remedy for the psychopathology of the diasporic Jew was the return to Palestine, where a healthy Jewish national homeland could be created. Consequently, medicine and public health, and particularly reproductive health and fertility, were of immense importance for the successful realization of the Zionist undertaking in Palestine. In the early 20th century, Zionist health missions founded mother and child clinics to provide basic reproductive health services in newly established settlements (Shvarts, 2008; Filc, 2009). In her historical overview of Israeli researchers’ contribution to the field of reproductive medicine, Daphna Birenbaum-Carmeli (2010:57-59) aptly described how fertility emerged as an important field of research in Israel. Particularly in the 1940s and 1960s Israeli researchers emerged as distinguished figures in the field of reproductive medicine, contributing significantly to global fertility research, which “*has generated a generalized feeling of national pride in Israel*”. Bernhard Zondek, for instance, has been called the greatest gynaecologist of his times (Birenbaum-Carmeli, 2010; Lunenfeld, 2013). Zondek, one of the thousands of German Jewish physicians and scientists who reached Palestine in the 1930s, has been celebrated for his discovery of gonadotropins, protein hormones that stimulate estrogenic hormones and thereby ovulation ^{viii}. As the prototype of the Zionist medical pioneer who combined scientific excellence with settler nation-building, Zondek inspired many generations of Israeli fertility specialists such as David Serr, Rabau,

Halbrecht, Joseph Asherman, Bruno Lunenfeld, Neri Laufer, Shlomo Maschiach and Joshua Dor to follow his revolutionary footsteps.

Israel's scientific pre-eminence in fertility research has often been explained by underlining the central importance of reproduction in Judaism, Jewish culture and tradition. Scholars, often anthropologists or sociologists of science, have referred to the first religious commandment (mitzvah) that prescribes Jews to '*be fruitful and multiply and replenish the earth*' and to the compatibility of Jewish law (Halakha) with the scientific grounds of fertility research. Others pointed out to the violent history of the Jews in Europe and the virulent waves of anti-Semitism they faced culminating in the Shoah, through which individual procreation increasingly became a matter of collective Jewish survival (Kahn, 2000; Weiss, 2002; Gooldin & Shalev, 2006; Hashiloni-Dolev, 2006; Remmenick, 2006, 2011; Shalev, 2010, 2011, 2012; Birenbaum-Carmeli, 2004, 2008, 2010; Balabanova & Simonstein, 2010; Gooldin, 2013). While these cultural narratives are obviously crucial for understanding Israeli pronatalism, they often tend to reproduce hegemonic accounts of reproduction that disregard the Zionist state's inherent stratified and exclusionary reproductive practices, particularly towards Palestinians. This paper proposes a gendered political economy perspective as a way to overcome these sometimes myopic analyses. Building further on the work of Jacqueline Portuguese (1998), Rhoda Kanaaneh (2002), Yali Hashash (2010) and particularly Michal Nahman (2006, 2008a, 2008b, 2013), it focuses on the close entanglements of Zionist settler colonialism and (bio-)capitalism in Palestine/Israel as a way to further understand the emergence of an academic-industrial fertility complex. In what follows, I will trace the lineages of Israel's reproductive-embryonic industry by exploring the (dis)continuities between Serono's Pergonal and Kadimastem's stem cell therapies, with a strong focus on

three key notions, i.e. settler colonial demographics, property –and labour regimes and the (re)productive role of women.

2. The Pergonal Project: turning urine into babies and gold

“We are devoted to the improvement, promotion and nurturing of life”

Merck-Serono.

In the introduction to a Special Issue on “50 years of Gonadotropin Therapy” in the *Journal of Reproductive Medicine and Endocrinology* (2013: 5) dedicated to Bruno Lunenfeld, the editorial board wrote: *“Without the pioneering work of Professor Bruno Lunenfeld the development of the first urinary human menopausal gonadotropins would not have been possible. He gave the impetus for the development of further preparations (...) and procedures in hormonal stimulation treatments such as IVF and ICSP”*. Born in Vienna in 1927 to a wealthy family of Jewish lawyers, Lunenfeld escaped Austria’s surging anti-Semitism in 1938 with the help of the Jewish Agency. In 1940 Lunenfeld first set foot in Mandatory Palestine, but soon after he left to study Medicine in Geneva, where he - together with his supervisor Hubert De Watteville - discovered that menopausal urine contains high amounts of gonadotropins, the ovulation-enabling hormones discovered by Bernhard Zondek. In 1954 Lunenfeld and De Watteville demonstrated that it was possible to isolate the gonadotropins from menopausal urine through the kaolin-acetone method^{ix}, a groundbreaking scientific discovery that could enable infertile women to ovulate. Yet, for this to ever happen, a pharmaceutical partner was needed and this is when – according to Lunenfeld - the first problems occurred (interview Tel Aviv, 27/08/2013):

*“We very quickly published the research results in the Swiss journal *Experientia*, for the simple reason that at that time we believed that medicine should be public for everybody, that it was still something ethical, for humanity and not for profit. Then we discovered that the problem was that no industry was interested in doing this, because the information was public and there was no possibility to have a patent.”*

Moreover, pharmaceutical companies were reluctant to logistically engage in an such an experimental project that depended on enormous amounts of urine donations and thus required safety precautions (Lunenfeld, 2013:2). Serono, an Italian pharmaceutical company founded in 1906 by Cesare Serono, was the third company that was approached by Lunenfeld. In 1958 Lunenfeld was invited by Serono's research director Piero Donini to give a presentation to the board of directors in Italy. Lunenfeld (interview Tel Aviv, 27/08/2014) recalled:

“Everybody applauded after my presentation, but then the director Fabio Bertarelli said that Serono was a pharmaceutical firm and not a pissoir. I'm not sure if I started crying or not, but I knew that my dream was finished”.

Yet, on his way out Lunenfeld was approached by a man who introduced himself as Prince Giulio Pacelli. Prince Pacelli was the nephew of Pope Pius XII whom he represented on Serono's board. Since 1952 the Vatican's Banco de Santo Spirito had been the majority shareholder in Serono. After inviting Lunenfeld for a short stay in Rome to discuss the logistics of the large-scale urine collection, Pacelli gave the same lecture to Serono's board as Lunenfeld, but he added one crucial sentence: *“My uncle, the pope, is ready to collect urine in old age homes of nuns, and will give it to you for free”*. After the continued flow of bio-value in menopausal urine was guaranteed, Serono's board agreed to start the production of what became Pergonal.

The production of Pergonal relied on the donation of millions of liters of urine provided by overall more than 110.000 post-menopausal women who were not only found in Pope Pius XII's old age homes for nuns, but also in Argentina, Brazil and Israel (<http://www.emdserono.com>). Lunenfeld managed to arrange urine collections from three Mal Ben Homes, Jewish nursing homes for the elderly and the disabled in Israel. Even though as primary generators of gonadotropinal bio-value, the elderly women made a crucial contribution to the development of Pergonal, they were not reimbursed for their donation. As Lunenfeld remembered:

“If you pay the women for the urine they may add water to increase the volume and to get more money, so you can't pay for the urine. But the women donated with pleasure, they became very happy while doing this. They were so interested that they could help making babies, that they made clothes for babies and gave presents.”

An Israeli newspaper article on “Pergonal, the magical drug” from 1965 (Weinstock, Maariv, 01/02/1965) mentioned how the old women even asked for a daily portion of watermelon as a way to increase urination. One of the research participants described how they once organized a humoristic theater play on Pergonal, highlighting the fact that – despite their old age- they were still able to increase the size of the population (Weinstock, Maariv, 01/02/1965).

This demographic consideration was precisely the reason why the Pergonal Project was met with such great interest by David Ben-Gurion, then Israel's Prime Minister and a notorious proponent of maintaining a Jewish majority in Israel by encouraging Jewish natality. As he once famously declared (1971: 839): *“Any Jewish women who (...) does not bring into the world at least four healthy children is shirking her duty to the nation, like a soldier who evades military service”*. This settler colonial demographic arithmetic constituted the solid underpinning of the State of Israel's engagement in the development of Pergonal (Birenbaum-

Carmeli, 2010). Ben-Gurion got involved in the Pergonal Project through Carmi, the director of Ikapharm, at that time Israel's second largest drug manufacturer after Teva. Carmi was a mutual friend of both Bruno Lunenfeld and David Ben-Gurion, who became interested in Pergonal as “*a demographic project of national priority*” (interview Lunenfeld, Tel Aviv, 27/08/2013). The proposed deal was that Israel would provide Serono with the post-menopausal urine from female residents of old age homes collected by Ikapharm. In exchange, Israel would receive Pergonal free of charge, a deal which lasted at least until 1966 (Birenbaum-Carmeli, 2010). From then on Pergonal was commercialized and Israel started importing it from Serono through Ikapharm, although at a very low price ^x. In Lunenfeld's (interview, Tel Aviv, 27/08/2013) words:

“The workers of Ikapharm collected the urine from the Mal Ben Homes and we send it to Serono. In return we got free ampules of Pergonal to conduct the clinical trials in Israel. In 1966 Serono started charging Israel for Pergonal. So Carmi went to Ben-Gurion, who was always interested in internal immigration, and Ben-Gurion arranged Pergonal to be free for infertile women and men who wanted to be treated for infertility.”

In 1968 Ben-Gurion promoted the establishment of a Center for Demographic Problems which was funded from the Prime Minister's Office budget. The goal of the Demographic Centre was to “*systematically create a psychologically favorable climate, such that natality will be encouraged and stimulated, seen that an increase in natality in Israel is crucial for the whole future of the Jewish people*” (Portuguese, 1998). Besides designing public education campaigns to promote an increase in Jewish fertility, offering low-interest loan schemes for young couples who planned for another child, the Centre for Demographic Problems was also

charged with the task of distributing Pergonal freely to infertile couples ^{xi}. Lunenfeld (interview, Tel Aviv, 27/08/2013) recalled how this odd arrangement lasted for several years.

“The interesting thing was that until 1970 the money for the Pergonal came from the Prime Minister’s Office. Only after quite a number of years, someone started wondering why a fertility medicine was paid through the Prime Minister’s Office and then they transferred it to the Ministry of Health”.

Advertisements in Israeli newspapers and commercials on the radio promoted Pergonal as a “magic medicine solving all types of fertility problems”, even though it was not yet clinically proven which types of infertility Pergonal actually tackled ^{xii}. Many infertile women presented themselves at Tel Hashomer Hospital in Tel Aviv, where between 1959 and 1963 Lunenfeld had started conducting clinical experiments with Pergonal. Serono had offered and paid him a fully equipped laboratory at Tel Hashomer to perform these clinical trials. As Lunenfeld proudly said: “I never had one single share of Serono, and I never got one cent for Pergonal, but I got my laboratory.” At that time there were no bio-ethics committees to approve the clinical trials of drugs. When Lunenfeld asked Chaim Sheba, then director of Tel Hashomer, how to proceed with Pergonal, he was instructed the following:

“I was told to first inject it to myself, take my temperature, if it rises then it needed further purification. We did this until we got something that was pure enough and didn’t increase my temperature. Then he permitted me to use it on three female patients. The treatment was a success, they all ovulated after stimulation with Pergonal”.

Israeli women did not only contribute to the development of Pergonal by providing post-menopausal urine, but also by serving as experimental trial subjects. The first infertile woman

in the world to become pregnant after being clinically treated with Pergonal was a 27 year old Israeli woman (Lunenfeld, Sulimovici and Rabau, 1962). The media referred to her in heroic terms as “*a brave and courageous Jewish ola*” or migrant from Latin America (Livneh, Haaretz, 2002). Doctor Rabau, Head of Tel Hashomer’s Gynaecology Department that worked closely together with Lunenfeld’s Endocrinology Department, was impressed by the patient’s obedience:

“It took many tests to find the right protocol, but the patient showed a lot of endurance and did everything that she was told to do. Every day for two years she had to bring her urine to Tel Hashomer labs” (Aviam, Maariv 19/3/1963)^{xiii}.

After 12 series of treatments she got pregnant and eventually gave birth to a daughter. However, not all women that participated with the Pergonal experiments were so fortunate. The first woman to die of ovarian hyperstimulation was also an Israeli. After her death it quickly became evident that ovulation induction with gonadotropins has an increased risk of multiple pregnancies and ovarian hyperstimulation syndrome ^{xiv}.

In 1963, after the clinical experiments were concluded in Tel Hashomer Hospital, Pergonal was registered as a certified drug. Initially, the drug was not a big commercial success. Lunenfeld remembered a hysteric telephone call from Serono’s director Fabio Bertarelli asking for his help in boosting the sales. Bertarelli had not sold one gram of Pergonal, so he convinced Lunenfeld to travel to Italy for a promotion tour at Italian universities, which illustrate how crucial the role of research institutions was in the development of Pergonal.

“In ten days we gave 25 lectures at 25 different universities. People became interested in Pergonal based on the lectures we gave. Finally, in Rome I got the honour membership of the Italian Gynaecology Society - I was the youngest ever - and Fabio

Bertarelli made his first million (laughs). Serono made the money, but I made my name and international fame.(...) I remember lively when I told my father that I wanted to become a doctor, he advised me to become a chemist and make gold out of shit. In the end I became a doctor and I extracted gold from urine.”

In 1978 Louise Brown, the world's first test tube baby, was conceived with the help of Pergonal. Because of the introduction of gonadotropin protocols in IVF and ICSI the sales of Pergonal began to skyrocket. This also significantly increased the global demand for menopausal urine, which could never be covered by the existing supplies. However, the development of recombinant DNA technology allowed for the production of pure, synthetically manufactured gonadotropins in unlimited quantities with a reduced risk of disease transmission via biological contamination (Lunenfeld, 2013:16). This genetically engineered gonadotropin, known as Gonal-F, was developed at the Weizmann Institute in Israel and the patent was acquired by Serono (<http://www.bertarelli.com>). This allowed the company to consolidate its position as world-leader in the infertility market with an estimated market share of 60%, making it the third largest biotechnology company in the world (Spar, 2006: 40). Even though Serono has a diverse drug portfolio in the field of reproductive health, multiple sclerosis and oncology, Pergonal and Gonal-F remain their flagship products, accounting for 32% of the company's sales in 2004 (Spar, 2006) ^{xv}.

After the Pergonal Project, Serono continued its cooperation with Israel through research collaborations and drug development projects. As such, it contributed significantly in laying the foundations of Israel's biotech industry. In 1981 Serono created an Israeli daughter company InterPharm as a way to intensify its relations with the Israeli Academia, notably with the Weizmann Institute. This close cooperation between Serono and InterPharm led to the development of several blockbuster drugs such as Gonal-F and Rebif, the latter being

developed by the famous Israeli microbiologist Michel Revel who was the founder and Chief Scientist of InterPharm. For more than a decade Interpharm was, together with BTG, the showpiece of Israel's biotech sector (Prainsack and Firestine, 2006). The expectations were high that these two companies would catalyze the growth and development of biotechnology in Israel, but in 2004 - against all odds and despite the privileged relation between Israel and Serono - InterPharm was transformed into Inter-Lab, a smaller research and development center specializing in cell therapy. The rest of the company was transferred to Geneva where Serono received a tax-free offer the Israeli government was unable to compete with.

Broadly speaking, however, Israel - through the Office of Chief Scientist ^{xvi} of the Ministry of Economy - has provided a broad spectrum of risk-sharing programs to stimulate technological innovation in Israel. These provisions range from generous tax benefits and venture capital government backing ^{xvii} to research grants and the development of technological incubators for the biomed and high tech sector, with a special focus on those dozens of start-ups that mushroomed during the nineties (OCS, 2014; Oliver, 2004). One of these programs was Magnet, which brought together academics with already existing companies to work on experimental research that could lead to eventual commercialization (Prainsack and Firestine, 2006; IATI, 2012; Messer-Yaron, 2011; Walker, 2012). Here as well, Serono – that in 2007 merged together with the German pharma giant Merck – played a crucial role. In 2011 Merck-Serono launched Israel's Bioincubator Fund, an initiative which offers both seed financing and access to Inter-Lab's laboratory facilities to a number of Israeli biotech start-ups that are developing innovative technologies aligned with Merck-Serono's strategic focus (www.merckserono.com). One of the start-ups that Serono selected for its incubator program was Kadimastem, a regenerative medicine company that focuses on the industrial development and commercialization of stem cell-based therapeutics to screen drugs and to

create medical solutions for diabetes and neurodegenerative diseases. In November 2013 Merck-Serono and Kadimastem signed a joint development agreement on the screening and discovery of stem cell-based drugs that “*could lead to the next generation therapeutics for Multiple Sclerosis*” (Kadimastem, 2013).

3. Reproductive-embryonic economies in post-Fordist Israel: the case of Kadimastem

The stem cell industry constitutes a promising sector within Israel's booming bio-economy. Since the late nineties Israeli scientists such as Benjamin Reubinoff, Joseph Itzkovitz-Eldor, Karl Skorecki, Michal Amit and Nissim Benvenisty have done foundational work in the field of stem cell research. Of the first twelve publications on human embryonic stem cells, ten included Israeli authors (Vogel, 2002). Science Magazine described Israel as one of the leading countries in stem cell research (UKSCI, 2006). Israel's pre-eminence in human embryonic stem cell research has partially been explained by Judaism's tolerant stance on techno-scientific interventions in 'God's creation' (Barilan & Siegel, 2004; Prainsack, 2006; Simonstein, 2008; Birenbaum-Carmeli, 2010;). Unlike Christianity, Judaism does not oppose human embryonic stem cell research seen that Talmudic tradition dictates that life begins significantly after conception. Moreover, the Israeli government has assisted in the development of a national stem cell sector by establishing state-of-the-art laboratories and by directing huge research funds to this field, especially oriented towards academic-industrial cooperation. One of these programs was Bereshit, a \$20 million Consortium for Cell Therapy that brought together stem cell researchers from the academic and industrial scene for the development of clinical grade human embryonic stem cell lines that could serve as a base for

the development and commercialization of stem cell therapies. This helped the launch of several startups - mostly university spin off companies - such as Pluristem, Cell Cure, Gamida Cell, BrainStorm and Kamidastem, which are considered to be “*pioneers in the stem cell frontier*” (Vogel, 2002), especially in the area of cell therapy and regenerative medicine. As Charles Irving, CEO of Cell Cure, stated (West-Jerusalem, 20/02/2012): “*Without Bereshit there would be no clinical grade, very high quality human embryonic stem cell lines to form us a basis of a stem cell industry in Israel*”.

Kadimastem was founded by Michel Revel, an internationally acclaimed molecular geneticist from the Weizmann Institute of Science who made his career as Chief Scientist at InterPharm. For many years Revel was also Chairman of the National Biotechnology Committee and the Chairman of the National Bioethics Committee. He was among the first Israeli academics that started commercializing his biological research. He perceived the close interaction between Israeli universities and the industrial world to be a key characteristic of the “Israeli model”. The Israel Tech Transfer Organization (ITTN), which is the umbrella organization for Israel’s twelve technology transfer units owned by universities, research institutes and medical organizations, features nearly 1700 patented projects including 800 projects in biotech and life sciences, pharmaceuticals, medical devices and diagnostics. This intimate relation between Israeli Academy, the state and industry is not new. Israeli research institutions were among the first in the world to commercialize their academic discoveries through the successful creation of technology transfer companies prompting Messer-Yaron (2011:17) to term Israel “– *by all measures - a best practice example*” in matters of technology transfer. In 1959 - 21 years before the legalization of the Bayh-Doyle Act in the United States - the Weizmann Institute of Science had already established its technology transfer unit Yeda. In 2006, Yeda – Hebrew for knowledge - was ranked first in income royalties among world academic

institutes. Together with Yissum, the technology transfer company of the Hebrew University, Yeda is rated among the top ten technology transfer companies worldwide in terms of revenues (AUTM, 2010. Messer-Yaron, 2011)^{xviii}. Kadimastem is a product of this entanglement between academia, industry and the state in Israel. When Michel Revel retired from the Weizmann Institute and founded Kadimastem in 2004, Yeda provided the company with the exclusive licenses on all the intellectual property he gathered over the years. Moreover, Yeda is part of the Board of Directors of Kadimastem. *“And if we have success, of course the universities will have income as well”* (interview Michel Revel, Nes Ziona, 16/07/2013). In contrast to Bruno Lunenfeld’s position towards intellectual property monopolies in medicine, Michel Revel’s (interview Nes Ziona, 16/07/2012) stance is more lenient:

“There is nothing dishonorable in writing patents. One should teach these young students, because if you don’t write your patents before you publish your paper, you might cause your university to lose a lot of opportunities to make money. Money for universities is always good for new research.”

Christian Zeller (2008:101) calculated that between 1990 and 2000 the number of patents granted in biotechnology rose 15 percent a year at the US Patent and Trademark Office and 10.5 percent at the European Patent Office, compared to a five percent a year increase in overall patents. He attributed this astronomic expansion of intellectual property monopolies not so much to technological breakthroughs but rather to neoliberalism’s far-reaching economic and institutional changes^{xix} connected to the rise of a finance-dominated biotechnology innovation system and the corresponding regime of intellectual property monopolies.

As mentioned earlier, the development of experimental health therapies in Israel would not have been possible without the continuous availability of women's biological tissues. Just like post-menopausal women's urine was required for the development of Pergonal, so are many kinds of stem cell therapies derived from female reproductive tissues such as egg cells, embryos, placentas, umbilical cord blood and cadaveric fetuses. Brown and Webster (2004) have noted that these reproductive materials are increasingly harvested by contemporary biomedicine as a generative site for scientific, medical and commercial purposes. In the emergence of a flourishing stem cell sector in Israel these female tissues have been transformed into desirable commodities which has created a close entanglement between the assisted reproductive sector and human embryonic stem cell research. Sarah Franklin (2006) has termed this close entanglement the "IVF-stem cell interface" while Catherine Waldby and Melinda Cooper (2009) refer to it as the "maternal-embryonic nexus". In Israel this nexus is very outspoken. Four of the five first stem cell lines that were developed by James Thomson in 1998 were created with the help of spare IVF embryos from the fertility clinic in Rambam Medical Center in Haifa, where Joseph Itskovitz-Eldor not only leads the Obstetrics and Gynaecology Department, but also the Stem Cell Research Centre. His research assistant, Michal Amit (interview Haifa, 22/02/2012) who carried the frozen embryos on the plane to Thomson's lab to assist in the project, tellingly stated:

"Most of the embryos for the Wisconsin research came from our lab. This is what happens if you do a lot of IVF, you have a lot of surplus embryos that nobody wants."

IVF is indeed omnipresent in Israeli society. Israel has more fertility clinics per capita than any other country in the world and Israelis are by far the biggest consumers of IVF in the world (ICMART, 2004). The Israeli government subsidizes every citizen of the country - irrespective of religion or marital status - for an unlimited number of IVF cycles until the live

births of two children within the current relationship (Birenbaum-Carmeli, 2007; Shalev and Felmayer, 2012).

That ART and stem cell research in Israel are closely intertwined became clear again with the voting of the controversial law on Egg Cell Donations in 2010 (Shalev, 2010; Hashash, 2010, Nahman, 2013; Vertommen 2015a) ^{xx}. This law allows single, healthy Israeli women aged between 21 and 35 who are not undergoing fertility treatment themselves to donate egg cells for reproductive or research purposes and receive a financial compensation of NIS20.000 or approximately €5000. Israeli women between 18 and 54 who suffer from fertility problems can request an egg cell donation, which will be partially covered by the National Health Insurance (Shalev, 2010). The law came about after an intensive ten year deliberation process that took place in the Knesset and in multiple governmental committees. The need for a Law on Egg Cell Donations was framed within a discourse of helping infertile women to reproduce in a way that ethically and culturally corresponded to existential Jewish questions (Vertommen, 2015a). While the primary objective of the law was indeed to regulate egg donations for reproductive purposes, it was vastly overlooked - as Yali Hashash (2010) has convincingly argued - how prominent representatives of Israel's biomedical establishment succeeded in including donations for research purposes. Analyzing the protocols of the governmental committee on egg donations, Hashash concluded that substantial pressure was exerted on politicians to pass the bill in order to establish a legal framework for future scientific development (Hashash, 2010: 288).

At the time when the Egg Donation Bill was first introduced in the early 2000s two Israeli stem cell research teams - one at Rambam Medical Centre in Haifa and the other in Hadassah Hospital in Jerusalem - were experimenting with somatic cell nuclear transfer (SCNT) or therapeutic cloning ^{xxi}, a specific type of stem cell research which required a large amount of

egg cells. Joseph Itzkovitz-Eldor and Benjamin Reubinoff, the directors of the aforementioned research centres, are not only international leaders in the stem cell field, but also successful academic entrepreneurs who recently joined the scientific advisory board of Kadimastem. Reubinoff also started his own stem cell company called Cell Cure, a Hebrew University spin off company that develops cell therapy products based on human embryonic stem cells. At several moments these two physicians/researchers appeared before the governmental committee to lobby for an Egg Donation Bill that would include research donations. In recent years SCNT has been described as an inefficient technique which requires an excessive amount of oocytes (Dennis, 2006). However, at the time when the Egg Donation Law was first discussed in the early 2000s, SCNT still had the potential of developing into a promising technique. Michel Revel, who also appeared for the governmental committee on egg donations, explained afterwards:

“The scientific use of the eggs at that time for SCNT looked very important and we were convinced that it should be included. If not, you make it almost impossible for Israeli scientists to work with those eggs. Today it’s not so important anymore, but maybe tomorrow a discovery will happen that makes the use of unfertilized eggs important again. Without any doubt, there will be some breakthroughs in research that will create a bigger demand for unfertilized eggs again for medical research.”

(Interview Nes Ziona, 16/07/2012).

At present, none of Israel’s stem cell companies are directly depending on the procurement of unfertilized eggs for the development of experimental stem cell therapies; Pluristem is using placental cells, Gamida Cell umbilical cord blood cells while Cell Cure relies on existing stem cell lines developed by Reubinoff under the Bereshit Program. Kadimastem uses the same existing stem cell lines, as well as genetic mutation-carrying embryos from the pre-

implantation genetic diagnosis ^{xxii} (PGD) unit from the Shaare Zedek Hospital in West-Jerusalem. Spare embryos, fetal tissues and cord blood are often discursively constructed as wasted forms of vitality if not donated to stem cell research (Waldby and Cooper, 2014). This is particularly true for PGD/PGS embryos that are not considered suitable for reproductive purposes and are usually discarded if not used for experimental research ^{xxiii}. Similar to the urine donors in the Pergonal Project, the Israeli donors of spare or PGD embryos were not remunerated for their donation. Within the existing legal frameworks women are often confined to donate their reproductive tissues as gifts - for altruistic reasons such as the progress of science and humanity - without receiving any financial compensation. This is justified as a way to avoid the exploitation of underprivileged tissue donors who could otherwise be induced to sell their bodily materials out of financial considerations. For instance, in the aforementioned PGD research project at the Shaare Zedek Hospital the informed consent form explicitly stated that:

“Participation in the study is voluntary and you will not receive any financial benefits or property rights for your consent to participate in it. It is possible that the stem cell lines derived from your donated embryos, the cell derivatives or the results of the research carried on the stem cell lines will have commercial potential. It is possible that such potential will lead to commercial associations. Note that in such a case you will not be eligible for financial or other benefits ^{xxiv}.”

In their analysis of post-Fordist stem cell economies, feminist scholars such as Michal Nahman (2008), Catherine Waldby (2002, 2006, 2008, 2010, 2014), Melinda Cooper (2006, 2008, 2010, 2014) and Donna Dickenson (2002, 2007) have demonstrated how bio-economical regimes of labour and intellectual property are configured through a mind-body split that only recognizes the innovative labor of the scientist who transforms biological

matter –often considered as “res nullius” or nobody’s property - into patentable products while blatantly disregarding the embodied labour (of often female) donors (Dickenson, 2007). As such, Waldby and Mitchell (2006: 76) stated that tissue donors are often treated as “*open sources of biological material which can be readily disentangled in ways that favor the rights and profits of biotechnology companies*”, a trend that can also be discerned in Israel’s bio-economy. Michel Revel (Nes Ziona, 16/07/2012) recalled the case of Interferon-beta, which he developed for the treatment of Multiple Sclerosis and supplies Merck Serono with hundreds of million dollars annually through the sales of Rebif .

“I myself made my career and my money by discovering Interferon for which we needed blood donors. I remember during our research there was a case of blood donors who claimed that they were inventors. They are not inventors, they are just blood donors. The scientists made the invention. So I do not think that it would be wise to extend the intellectual property rights to people who are just donating an organ or tissue.”

As will be discussed further in the concluding part of this paper, the development of Israel’s reproductive-embryonic sector was highly dependent on the unrecognized reproductive labor of women as suppliers of raw reproductive tissues, such as placenta, egg cells and embryos.

4. Israel’s reproductive-industrial complex: fertile grounds of Zionist demographic warfare

We need an army of scientists ^{xxv}

Shimon Peres, former president of Israel

Similar to the emergence of a prosperous military-industrial complex in Israel, Zionism's century old double logic of (bio-)capital accumulation and demographic elimination has created the fertile conditions for the development of a thriving reproductive-embryonic biotech sector in which the interests of a pronatalist Jewish state and a biomedical establishment have conjoined. My genealogy of Israel's reproductive-industrial complex centered around two techno-scientific *apparatuses*, Serono's Pergonal and Kadimastem's stem cell therapies, each situated in a specific time-space frame of Zionist history. Following Goven and Pavone's (2014) conceptualisation of the bio-economy as an exclusionary political project rather than a techno-scientific or economic given, I have argued that it is not possible neither desirable to comprehend the emergence of Israel's reproductive-embryonic sector without analyzing its underlying political-economic power configurations (Jasanoff, 2004; Rajan, 2007). By focusing on a broad variety of issues that characterize such a political economy approach in settler-colonial Palestine/Israel - such as Zionist demographic arithmetic, intellectual property monopolies, academic-industrial cooperation and gendered labour regimes - certain continuities and discontinuities between the Keynesian-Fordist and neoliberal "fix" of Israel's reproductive-embryonic economy were discerned (Harvey, 2005).

First of all, both Pergonal and regenerative stem cell therapies have been co-produced – either directly or indirectly - by Israel's historically pronatalist policies that were oriented towards the fruitful and healthy reproduction of the Jewish settler body. In its ongoing quest for the Judaization of Palestine/Israel, Zionist ideology has materialized through a wide gamut of pronatalist experiments that have catalyzed innovations at the frontier of global health and research markets. From Lunenfeld's discovery of Pergonal in 1961 to Reubinoff and Itskovits-Eldor's contribution in manufacturing the first human embryonic stem cell lines, Israel is celebrated for bringing forth medical pioneers, particularly in the fields of assisted

reproduction, reproductive genetics and stem cell research. In the case of Pergonal the linkage with Jewish pronatalism was direct. Bruno Lunenfeld's switch from menopausal to fertility research in the mid-fifties was strongly inspired by a rabbi who had encouraged him to "*bring back the six million Jews that we lost during the Shoah.*" During our interview (Tel Aviv, 27/08/13) Lunenfeld proudly stated that by now he got 12 million children back, five million from IVF and seven million with ovulation induction. Moreover, the main reason why Prime Minister David Ben Gurion was interested in supporting the Pergonal Project was demography; in order to promote an *internal aliyah* in Israel. This also explains why for a long period Pergonal was freely distributed through the Centre for Demographic Problems and subsidized by the Prime Minister's Office. Similarly, I have analyzed Israel's eminence in stem cell research as an indirect by-product of the country's pronatalist stance on assisted reproductive technologies. It has been widely acknowledged how Israel's decennia long devotion to fertility research which resulted in abundantly present "spare" reproductive tissues has enabled the development of its stem cell sector (Shalev, 2010; Hashash, 2010; Nahman, 2013). As one famous stem cell researcher (interview West-Jerusalem, 17/02/2012) from the Hebrew University aptly summarized it: "*Apart from the fact that Jewish religion poses no objections to stem cell research, I see two main reasons why several Israeli researchers pioneered in stem cell research. Firstly, their personal good ties with people like Thomson and Trounson. The other reason, which was not a coincidence, was the good practice of IVF in Israel.*" One powerful example of Israel's maternal-embryonic nexus can be detected in Israel's recently voted Law on Egg Donations, which included research as a legitimate ground for donation after the successful lobby work of entrepreneurial Israeli researchers who were working on therapeutic cloning^{xxvi}. Today, Israel's stem cell laboratories at universities and biotech companies are working closely together with PGD labs of hospitals for the purpose of research on genetic diseases.

Secondly, from old Italian nuns to young Israeli egg donors, it is clear that women are crucial protagonists in Israel's settler colonial bio-economy, both as reproducers of the nation and as (unrecognized) producers of bio-value ^{xxvii}. In her research on the creation of plentiful environments in the Land of Milk and Honey, Tamar Novick (2014: 37) identified the figure of the "New Jewess" who personified "*bodyscapes of plenty*" in Zionist discourse. This process has intensified with the introduction of and the governmental support for a broad mosaic of new reproductive technologies, such as IVF, egg donation and surrogacy. Motherhood is constructed as the chief ideological identity of Israeli women (Yuval-Davis, 1998; Remennick, 2008) while childlessness is pathologized as "*a deviation from the natural order*" (Donath, 2014:6) and – as I have argued - as an existential threat to the Zionist demographic project, particularly in contrast to the perceived hyper-fertility of Palestinian women. Given that processes of reproduction are located at the heart of capitalized biosciences, as Franklin and Lock (2003) have posited, women have been placed in a central - yet not so privileged - position. Ranging from the post-menopausal urine that was used for the production of Pergonal to the spare IVF/PGD embryos needed for the configuration of stem cell lines, Israeli women's biological tissues have been harvested as "res nullius" for the development of experimental and (potentially) lucrative medical therapies, a process which Marx would term primitive accumulation. Women and their bodies were not only mobilized as the providers of raw biological resources, but also as experimental trial subjects for promissory technologies such as Pergonal, DES and stem cell therapies.

A third point of focus, was the configuration of the regimes of accumulation through intellectual property monopolies. Knowledge and technology have become central axes of what Benner & Löfgren (2007) have termed neoliberalism's financialised rentier-regime seen that it heavily relies on the massive expansion of intellectual property monopolies (Zeller,

2008). While Zeller (2008: 92) explicitly nuances the novelty of the valorization of knowledge in capitalist history, he does insist that “*distinctive for the current finance-dominated accumulation regime is the highly increased importance of monopolized knowledge and information for the extraction of rent.*” While in the early sixties, Bruno Lunenfeld refused to patent his discovery in order to keep medical knowledge accessible for the scientific community, this was not possible anymore for Michel Revel’s generation for whom patenting is seen as a crucial flow of income for university. This entrepreneurialization of Israeli Academia has placed Israel among the world’s top patent holders in the field of medical devices and bio-pharmaceuticals. Through their development into financial and knowledge asset values and - to a lesser extent - into commercial bio-commodities, these enclosed knowledges have constituted the solid base of Israel’s reproductive-embryonic industry (Tyfield & Birch, 2013) ^{xxviii}.

Fourthly and closely connected to the previous point, the contribution of public research centres has been so tremendous that it would be more sensible to opt for the term reproductive-academic-industrial complex. Amalya Oliver (2004: 584) argued that under impulse of neoliberal economic policies, the Israeli government set out three initiatives nineties in order to facilitate the commercialization of academic research, i.e. the creation of incubator units for fledgling companies, the supply of high-tech resources for academic and start-up companies, and the creation of links between academia and industry. Although these interventions have certainly invigorated the commercial importance of academic powerhouses in Israel’s bio-economy, I have emphasized that Israeli universities have always been strongly oriented towards the market (Messer-Yaron, 2011). The first technology transfer companies were created long before the introduction of the Bayh-Doyle Act in 1980 in the United States, which officially heralded the new era of the entrepreneurial university. Neither Pergonal nor

current stem cell therapies could have been developed if it was not without the strong cooperation between companies such as Serono and Kadimastem on the one hand and public research institutions, such as the Weizmann Institute and Tel Hashomer Hospital with its highly skilled academic staff on the other hand. Serono, which played such a constitutive role in Israel's biotech history, decided to invest in Israel after their success story with Lunenfeld. Today, most of Israel's stem cell companies are arising from university spin offs. An important difference with earlier modes of governance lies in Israeli university's current role as indispensable generators of intellectual property monopolies.

Although Israel's reproductive-embryonic sector indeed took a giant leap forward in the late seventies with the introduction of neoliberal economic policies, I have argued that Zionism's century old settler colonial foundations have enabled the emergence of this thriving industry. From its early inceptions the Zionist project necessitated the development of advanced medical knowledge, science and technology to make the so called barren Palestinian desert bloom and to regenerate the weak diaspora Jew into a healthy and fertile New Jew. Instead of fixating on the innovative novelty or the market-drive behind Israel's bio-economy, I have discerned important continuities between Zionism's Keynesian and neoliberal "fix" in the creation of a reproductive-industrial complex in which the state, universities and pharmaceutical companies have been pivotal players. This conceptualization of Israel's bio-economy transcends dichotomies between the state and the market, as already suggested by Benner and Löfgren (2007) and Goven and Pavone (2014).

While Israel has been famous – notably during the first three decades of its existence- for being strongly inspired by Labour Zionist principles such as mutualism, welfarism and kibbutzism, this has been debunked by critical scholars as mostly pseudo-socialist mobilizing myths. Ella Shohat (1988:21) called "*the Zionist manipulation of socialist slogans and*

syndicalist language a smokescreen for the structural ethnical and class contradiction within the Zionist experiment". Ben Gurion, Labour Zionism's symbol *par excellence*, could only pursue his generous reproductive health policies, including the free distribution of Pergonal, thanks to a close cooperation with pharmaceutical companies such as Serono and Ikapharm. Conversely, Israel's neoliberal turn of the late seventies did not imply a complete retreat of the state. On the contrary, Israel's current bio-economy still depends on multifaceted state interventions, not so much on the demand-side as was the case during its Fordist-Keynesian phase through, for instance, the free distribution of Pergonal to infertile Israeli women, but rather on the supply-side, in attempt to make Israeli bio-tech start-ups, pharmaceutical companies and the State as a whole more competitive and innovative (Benner and Löfgren, 2007)^{xxix}. Particularly during the "roll-out neoliberal" nineties, the Israeli government continued to nurture its biomed sector via supply-side measures, such as a permissive regulatory framework on assisted reproduction, therapeutic cloning and stem cell research, tax benefits, government backed venture capital funds, generous research grants and programs such as Magnet and Bereshit, and the provision of technological incubators.

Similar to Rajan's (2006) conclusion that 'new' genres of Indian bio-capital depended on older exclusionary histories of colonialism, this paper argued that processes of settler colonialism and (bio-)capitalism are intricately connected in Palestine/Israel, and that Zionism's double logic of capital accumulation and demographic elimination has furthered the emergence of a thriving reproductive-industrial complex.

Acknowledgements

I would like to thank Hedva Eyal, Sahera Dirbas, Bilal Dirbas, Tamar Novick and Lana Khaskia for helping with the translation of archival and policy documents, and Michal

Nahman, Leila Stockmarr, Adam Hanieh, Koen Bogaert, Annemie Vermaelen, Sami Zemni and the anonymous reviewers for their valuable feedback and comments.

Bibliography

- Almog Oz. 2010. *The Sabra: The Creation of the New Jew*. Berkeley: University of California Press.
- Balabanova, Ekaterina and Frida Simonstein. 2010. "Assisted reproduction: a comparative review of IVF policies in two pronatalist countries." *Health Care Annal* 18: 188-202.
- Barad, Karen. 2007. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Duke University Press.
- Barilan, Y. M., and G. Siegal. 2004. Stem cell research: An Israeli perspective, in W. Bender, C. Hauskeller, and A. Manzei, eds., *Crossing Borders: Cultural, Religious and Political Differences Concerning Stem Cell Research*, 293–324
- Ben-Gurion, David. 1971. *Israel, a personal history*. New York: Funk & Wagnalls.
- Bichler, Shimshon and Jonathan Nitzan. 2002. *The global political economy of Israel*. London: Pluto Press.
- Birche, Kean and Tyfield, David. 2012. "Theorizing the Bioeconomy, Biovalue, Biocapital, Bioeconomics or...What?" *Science, Technology and Human Values*: vol. 38(3): 299-327
- Birenbaum-Carmeli, Daphna. 2004. "Cheaper than a newcomer: on the social production of IVF policy in Israel." *Sociology of Health and Illness* 26(7): 897-924.
- Birenbaum-Carmeli, Daphna and Yoram Carmeli, eds. 2010. *Kin Gene, Community: reproductive technologies among Jewish Israelis*. New York: Berghahn Book.

- Birenbaum-Carmeli, Daphna and Martha Dirnfeld. 2008. "In Vitro Fertilisation policy in Israel and women's perspective: the more the better?" *Reproductive Health Matters* 16(31): 182-191.
- Borth, R., Lunenfeld, B. et Watteville, de, H. 1954. Activite gonadotrope d'un extrait d'urines de femmes en menopause. *Experientia*. 10: 266.
- Brown, Nik and Andrew Webster. 2004. *New Medical Technologies and Society: Reordering life*. Cambridge: Polity Books.
- Cooper, Melinda. 2008. *Life as Surplus: Biotechnology and Capitalism in the Neoliberal Era*. Washington University Press.
- Cooper, Melinda. 2006. "Resuscitations: stem cells and the crisis of old age." *Body and Society* 12(1): 1-23.
- Davidovitch, Nadav and Rona Seidelman. 2004. "Herzl's Altneuland: Zionist Utopia, Medical Science and Public Health." *Korot: The Israel Journal of the History of Medicine and Science* 17:1–20.
- Davidovitch Nadav and Margalit Avital. 2008. Public Health, Racial Tension and body politic: mass ringworm irradiation in Israel, 1949-1960. *Journal of Law, Medicine and Ethics*.36, 522-530.
- Davidovitch, Nadav and Rakefet Zalashik. 2011. The social history of medicine and Israeli history: a potential dialogue. *Journal of Israeli History: Politics, society, culture* 30(1), 83-88.
- Dennis, Carina. 2006. "Mining the secrets of the egg". *Nature* 439:652–655.
- Dichek Bernard. Baby Boomer, 08/02/2011 <http://israel21c.org/people/baby-boomer>
- Dickenson, Donna. 2001. "Property and women's alienation from their own reproductive labour." *Bioethics* 15(3):205-217..

- Dickenson, Donna. 2007. *Property in the body: Feminist perspectives*. Cambridge: Cambridge University Press.
- Eyal, Hedva. 2010. *Egg donation in Israel, action research 2009-2010*. Isha L'Isha, <http://www.isha.org.il/upload/file/EggDonationactionresearchEng2010.pdf>
- Efron, Noah. 2007. *Judaism & Science: An Historical Introduction*. Westport CT and London: Greenwood Press.
- Filc, David. 2005. "The health business under neoliberalism: the Israeli case." *Critical Social Policy* 25: 180-197.
- Filc Dani. 2009. *Circles of Exclusion: the politics of health care in Israel*. Ithaca: Cornell University Press.
- Franklin, Sarah. 2006. "Embryonic economies: the double reproductive value of stem cells." *BioSocieties* 1: 71-90.
- Franklin, Sarah and Margareth Lock. 2003. *Remaking Life & Death: Toward an Anthropology of the Biosciences*. Sante Fé, School of American Research Press
- Golan Tal. 2004. *Introduction Israel Studies, Volume 9(2)*, pp. iv-viii, Indiana University Press.
- Gottweis, Herbert and Catherine Waldby and Brian Salter. 2009. *The global politics of human embryonic stem cell science : regenerative medicine in transition*. Basingstoke: Palgrave Macmillan.
- Goven, Joanna and Pavone Vincenzo. 2014. *The Bioeconomy as a Political Project: A Polanyian Analysis*. *Science, Technology & Human Values* 1-36.
- Harvey, David. 2005. *A brief history of neoliberalism*. Oxford University Press.
- Hashash, Yali. 2010. "Medicine and the State. The Medicalization of Reproduction in Israel", In *Kin, Gene, Community: Reproductive Technologies among Jewish Israelis*,

ed. Daphna Birenbaum-Carmeli and Yoram S. Carmeli, 271-295. New York:
Berghahn Press.

- Hashiloni-Dolev, Yali. 2006. "Between mothers, fetuses and society: reproductive genetics in the Israeli-Jewish context." *Nashim*, 129-150.
- Helmreich, Stefan. 2007. "Blue-green Capital, Biotechnological Circulation and an Oceanic Imaginary: A Critique of Biopolitical Economy". *BioSocieties*: 2, 287–302
- Herzl Theodore. 1988. *The Jewish State*. New York: Dover Publications.
- Ishihara and Adamson (ICMART). 2013. "World report on Assisted Reproductive Technologies 2004" *Human Reproduction*. 28(5): 1375–1390.
- Jasanoff, Sheila. 2004. *States of Knowledge: The Co-Production of Science and the Social Order*. London: Routledge.
- Kadesh, Avigayil. 2014. "IXiii BioMed conference draws thousands". 26/06/2014.
<http://mfa.gov.il/mfa/innovativeisrael/conferences/pages/mixiii-biomed-conference-26-june-2014.aspx#.U6wSQ2pauX.twitter>.
- Kahn, Susan Martha. 2000. *Reproducing Jews : a cultural account of assisted conception in Israel*. Durham, Duke University Press.
- Kanaaneh, Rhoda. 2002. *Birthing the nation: strategies of Palestinian women in Israel*. Berkeley: University of California Press.
- Livneh, Neri. 2002. *The Good Father*, Haaretz, 30/05/2002,
<http://www.haaretz.com/the-good-father-1.43736>
- Löfgren, Hans and Benner, Mats. 2007. "The Bio-economy and the Competition State: Transcending the Dichotomy between Coordinated and Liberal Market Economies." *New Political Science* 29(1):77-95.

- Lunenfeld Bruno. 2013. "Management of Infertility: past, present and future from a personal perspective". *Journal of Reproductive Medicine and Endocrinology*: 10 Special Issue 1 on 50 years of Gonadotropin Therapy.
- Lunenfeld, Bruno, Sulimovici, S. and Rabau, E. 1962. Les effets des gonadotrophins urinaires des femmes menopausees sur l'ovaire humain. *C.R. Soc. Franc. Gynecol.* 32(5): 29.
- Mashiach, Shlomo and Birenbaum-Carmeli Daphna and Maschiach Roy and Dirnfeld Marta. "The contribution of Israeli researchers to reproductive medicine" in: Birenbaum-Carmeli, Daphna and Yoram, Carmeli, eds. 2010. *Kin Gene, Community: reproductive technologies among Jewish Israelis*. New York: Berghahn Book. 51-57.
- Massad, Joseph. 2005. "The Persistence of the Palestinian Question." *Cultural Critique* 59: 1-23.
- Messer-Yaron, Hagit. 2011. "Technology Transfer in Countries in Transition: Policy and Recommendations, **XXX**
- Nahman, Michal. 2006. "Materializing Israeliness: difference and mixture in transnational ova donation." *Science as Culture* 15(3): 199-213.
- Nahman, Michal. 2008. "Nodes of desire: Romanian egg sellers, dignity and feminist alliances in transnational ova exchanges." *European Journal of Women's Studies* 15(2): 65-82.
- Nahman, Michal. 2008. Synecdochic ricochets: biosocialities in a Jerusalem IVF Clinic, in: Sarah Gibbon S. And Carlos Novas., *Biosocialities, genetics and the social sciences: making biologies and identities*, New York, Routledge, 2008, pp. 117-135.
- Nahman, Michal. 2013. *Extractions: An ethnography of reproductive tourism*. Hampshire: Palgrave Macmillan.

- Novick, Tamar. 2014 (forthcoming). *Milk & Honey: Technologies of Plenty in the Making of Holy Land, 1890-1965*, PhD Dissertation, History and Sociology of Science Department, University of Pennsylvania.
- Pavone, Vincenzo and Arias, Flor. 2012. "Beyond the Geneticization Thesis: The Political Economy of PGD/PGS in Spain". *Science, Technology, & Human Values* 37(3): 235-26.
- Portuguese, Jacqueline. 1998. *Fertility policy in Israel: the politics of religion, gender and nation*. Westport: Praeger.
- Prainsack, Barbara. 2006. "Negotiating life: the regulation of human cloning and embryonic stem cell research in Israel." *Social studies of Science* 36(2): 173-205.
- Prainsack, Barbara and Ofer Firestone . 2006. "Biotechnology in Israel: Science for survival: biotechnology regulation in Israel." *Science and Public Policy* 33(1): 33-46.
- Prainsack, Barbara and Ayo Wahlberg. 2013. *Situated bio-regulation: Ethnographic sensibility at the interface of STS, policy studies and the social studies of medicine*. *BioSocieties*, 8(3), 336-359.
- Rajan, Sunder. 2006. *Biocapital: The Constitution of Postgenomic Life*. Duke University Press.
- Remennick, Larissa. 2006. "The quest for the perfect baby: why do Israeli women seek prenatal genetic testing." *Sociology of Health and Illness* 28(1): 21-53.
- Rose, Nikolas. 2007. *The politics of life itself: Biomedicine, power and subjectivity in the twenty-first century*. Princeton: Princeton University Press.
- Rouach, Daniel. *Israeli universities support industry: Interview of Prof. Michel Revel, Israel Valley*, <http://www.israelvalley.com/articles/137-israeli-universities-support-industry-interview-of-prof-michel-revel>

- Senor, Dan and Saul Singer. 2011. *Start-up Nation: The story of Israel's economic miracle*. New York: Twelve.
- Shalev, Carmel. 2010. "From woe to woe: Egg donation in Israel." *International Women's and Gender Studies in Lower Saxony* 6: 71-90.
- Shalev, Carmel and Gabriele Werner-Felmayer. 2012. "Patterns of globalized reproduction: egg cells regulation in Israel and Austria." *Israel Journal of Health Policy Research* 1(15): 1-35.
- Shalev, Carmel and Yael Hashiloni-Dolev. 2011. "Bioethics governance in Israel: an expert regime" *Indian Journal of Medical Ethics* VIII (3): 157-160.
- Shohat Ella. 1988. *Sephardim in Israel: Zionism from the standpoint of its Jewish victims*. *Social Text*, No. 19/20 (Autumn, 1988), pp. 1-35.
- Shvarts Shifra, *Health and Zionism: the Israeli health system 1948-1960*, University of Rochester Press, Rochester, 2008, pp. 322.
- Spar, Deborah. 2006. *The Baby Business: How Money, Science, and Politics Drive the Commerce of Conception*. Boston: Harvard Business School Press.
- Stockmarr Leila, *Seeing Is Striking: Selling Israeli Warfare*, Jadaliyya, 18/01/2014, http://www.jadaliyya.com/pages/index/16044/seeing-is-striking_selling-israeli-warfare .
- Sufian Sandra, *Healing the Land and the Nation, Malaria and the Zionist Project in Palestine, 1920-1947*, University of Chicago Press, 2007.
- Veracini, Lorenzo. 2006. *Israel and settler society*. London: Pluto Press.
- Vertommen Sigrid. 2015a (forthcoming). "Political economy of egg donations: doing it the Israel way", edited volume on 'Critical Kinship Studies: Kinship (Trans)formed', Charlotte Krollokke, Routledge.

- Vertommen Sigrid. 2015b (forthcoming). "Baby's from behind the bars. Stratified assisted reproduction in Israel/Palestine" . edited volume on "Assisted reproduction in a European and globalized perspective - notes on the overall frameworks" Eds. Merete Lie and Nina Lykke, Routledge.
- Vogel, Gretchen. 2002. "In the Mideast, pushing back the stem cell frontier" *Science* 295(5561): 1818-1820.
- Waldby, Catherine . 2002. "Stem Cells, Tissue Cultures and the Production of Biovalue." *Health* 6: 305-323.
- Waldby, Catherine and Robert Mitchell. 2006. *Tissue Economies: Blood, organs and cell lines in late capitalism*. Durham: Duke University Press.
- Waldby, Catherine. 2008. "Oocyte markets: women's reproductive work in embryonic stem cell research." *New Genetics and Society* 27(1): 19-31.
- Weinstock. 1965. "Pergonal, the magical drug". *Maariv*, 01/02/1965.
- Weiss, Meira. 2002. *The chosen body: the politics of the body in Israeli society*. Stanford: Stanford University Press.
- Wolfe, Patrick. 1999. *Settler colonialism and the transformation of anthropology: the politics and poetics of an ethnographic event*. London, Cassel.
- Wolfe, Patrick. 2006. "Settler colonialism and the elimination of the native." *Journal of Genocide Research*, 8(4): 387-409.
- Wolfe, Patrick. 2007. "Palestine, Project Europe and the (un-)making of the new Jew. In memory of Edward Said", in *Edward Said: the legacy of a public intellectual*. ed. Ned Curthoys and Debjani Ganguly, 313-337. Carlton: Melbourne University Press.
- UK Stem Cell Initiative (UKSCI). 2006. "Global positions in stem cell research: Israel." http://www.dh.gov.uk/ab/UKSCI/DH_096199 , last consulted on 19/06/2014.
- Yuval-Davis, Nira. 1998. *Gender and nation*. London: Sage.

- Yuval-Davis, Nira and Daiva Stasiulis. 1995. *Unsettling Settler Societies: Articulations of Gender, Race, Ethnicity and Class*. London: SAGE Publication.
- Zeller, Christian. 2008. "From the gene to the globe: Extracting rents based on intellectual property monopolies." *Review of International Political Economy*, 15(1): 86-115.
- Directive 2004/23/EC of the European Parliament and of the Council of 31/03/2004 on setting standards of quality and safety for the donation, procurement, testing, processing, preservation, storage and distribution of human tissues and cells.
http://eurlex.europa.eu/LexUriServ/site/en/oj/2004/l_102/l_10220040407en00480058.pdf (last consulted 07/02/2014).
- http://www.emdserono.com/en/about_us/history/History.html (last consulted 27/02/2015)
- <http://www.bertarelli.com/family/serono/> (last consulted 24/02/2015).
- Office of Chief Scientist. 2014. Catalogue of R&D Incentive Programs.
www.economy.gov.il/madan (last consulted on 08/07/2014)
- www.kadimastem.com (last consulted on 07/06/2014)
- The Israel Tech Transfer Organization. <http://www.ittn.org.il> (last consulted on 15/06/2014)
- Yissum Technology Transfer. <http://www.yissum.co.il/> (last consulted on 08/06/2014)
- Israel Advanced Technology Industries. Israel Innovation Conference : MIXiii Hi-Tech Biomed. 20-22/05/2014. Catalogue.

ⁱ According to David Rosenberg's analysis (Haaretz, 29/01/15) Israeli start-ups raised \$3.4 billion in investments in 2014, the most ever. Venture capital funds, which provide most of the investments for start-ups, drew in \$910 million. Exits – money received by companies acquired or conducting initial public offerings – reached \$6.9 billion in 2014, making it one of the best years ever. <http://www.haaretz.com/blogs/david-s-harp/premium-1.639703> last entry 01/03/15)

ⁱⁱ In 2008 the OECD average expenditure on R&D was 1.9% (OECD, 2008). In 2008, Israel was the highest of all OECD countries, with an expenditure on civilian R&D of 4.7% of its GDP, mostly directed towards the industrial sector.

ⁱⁱⁱ <http://www.globes.co.il/en/article-doctors-perceived-as-most-respected-profession-1000927018> (last entry 24/02/2015)

^{iv} Israel performs the highest number of IVF treatment cycles per capita in the world. In 2004 3844 IVF cycles were conducted per million, while in Spain “only” 2051 and in the UK 661

(ICMART, 2004 <http://www.icmartivf.org/icmart-world-report-art-2004.pdf> last entry 01/03/15)

In 2010 34.538 treatment cycles were performed in Israel, resulting in 29.961 transfer cycles and 5.612 live births which equated 4.1% of the total live births (Ministry of Health, Department of Health Information, Medical Facilities and Equipment Licensing Division, 2013). In that same year in the UK 57.652 treatment cycles of IVF or ICSI were performed, resulting in less than 2% of the total live births

(HFEA, 2010 http://www.hfea.gov.uk/docs/2011-11-16_-_Annual_Register_Figures_Report_final.pdf last entry 01/03/15).

In Spain 58.735 treatment cycles were performed in 2010, resulting in 17.014 live births which stands for 2.2% of the total live births.

<http://www.eshre.eu/~media/emagic%20files/Data%20collection/EIM/Manuscript%20EIM%202010%20published.pdf> last entry 01/03/15)

^v Although pronatalist, Israel's reproductive policies should be viewed as highly stratified. The work of Benjamin & Amir (1992), Portuguese (1998), Kanaaneh (2002), Weiss (2002), Yali Hashash (2004), Ducker (2006), Madmoni-Gerber (2009) and Vertommen (2015) has indicated that it were mostly European Jews or Ashkenazim and not and Palestinians and Arab Jews or Mizrahim that were encouraged to be fruitful and multiply.

^{vi} Harvey (2005) has defined neoliberalism as a new capitalist mode of accumulation by dispossession that took shape in the late seventies as a way to resolve the Fordist-Keynesian crisis. According to Peck and Tickell (2002:37) neoliberal projects consist of two phases. The roll-back phase refers to "the active destruction of Keynesian-welfarist and social-collectivist institutions through privatisation, deregulation, cutbacks in public services while the roll-out phase refers to "the consolidation of neoliberalized state forms, modes of governance and new trade and financial regulations by international governance institutions in an attempt to create a competitive workfare state.

^{vii} Although I strongly sympathize with the critique of Tyfield and Birch (2013:299) on the fetishization of everything 'bio' and the flawed interpretation of Marxist concepts such as surplus, bio-value, capital in some of the STS scholarship on the bio-economy, I do opt for the term bio-value as introduced by Waldby (2001) since her work puts strong gender emphasis on the role of women as reproductive labourers in the bio-economy.

^{viii} Bernard Zondek mapped three human varieties of gonadotropins, one produced in the placenta during pregnancy and two extractable from the pituitary (Birenbaum-Carmeli, 2011).

^{ix} To extract gonadotropins the menopausal urine has to pass through a kaolin cake which absorbs the gonadotropins after which the crude gonadotropins can be extracted from the kaolin batch (Lunenfeld, 2013).

^x Israel State Archive, File 2, 40/15.

^{xi} Some members of the Centre for Demographic Problems opposed the free distribution of Pergonal to all infertile women. A few doctors raised concerns about spending a big part of the Demographic Centre's limited resources to an experimental drug such as Pergonal whose efficiency had not been tested properly. (Israel State Archive, File 2, GAL 2091/6, Centre for Demographic Problems, Letter from Professor Halpert 03/11/1969)

^{xii} Israel State Archive, File 2: 40/15.

^{xiii} Personal archive Bruno Lunenfeld, Consulted on 28/8/13 in Tel Aviv. Translated with the kind help of Tamar Novick and Bilal Dirbas.

^{xiv} This was not the first time in Israel's history that experimental fertility research caused unforeseen side-effects, as was the case with the synthetic hormone diethylstilbestrol known as DES. This hormone was distributed to thousands of Israeli women between 1949 and 1975 in the erroneous belief that it would minimize the risk of pregnancy complications. However, investigative journalist Avi Valentine discovered that the drug manufacturers Teva and Assia, the Ministry of Health and the Health Fund were negligent in marketing a drug

that was supposed to sustain pregnancies, contrary to the warnings in professional literature that it actually caused infertility and increased risk of cancer (Interview Avi Valentin, Herzliyya, 15/07/2013).

^{xv} Deborah Spar (2006: 40) calculated that in 1991 Serono sold \$260 million worth of fertility drugs and between 1992 and 2003 it doubled its sales. In 2003 the company's sales rose by 31% to \$519 million, with a profit rate of 75%, an astounding \$390 million.

^{xvi} The Office of Chief Scientist in the Ministry of Economy is empowered by the Law for the Encouragement of Industrial Research and Development of 1984 to oversee all government-sponsored support of R&D within Israeli industry (www.economy.gov.il/madan last entry 07/02/2014)

^{xvii} Israeli biotech was given a boost by the establishment of a \$222 million venture capital Life Sciences Fund which is being managed by OrbiMed Advisors, the largest healthcare investment fund in the world. The fund was initiated by an Israeli government tender and investment of \$50 million. 13 companies are enjoying financial input from this venture capital fund (www.economy.gov.il/madan last entry 02/04/2014)

^{xviii} Yeda was rated first in the world in technology transfer revenues in 2006. In 2003 it has been reported yearly royalties income of \$93,000,000. In 2003, more than three billion dollars worth of products licensed by Yeda were sold world-wide, and at least twenty new companies were established in connection with technologies transferred from the Weizmann Institute (Messer-Yaron, 2011)

^{xix} These institutional changes include the Bayh-Doyle Act, the ground-breaking case of Diamond versus Chakrabarty, TRIPS.

^{xx} Parts of these paragraphs on the Law on Egg Cell Donations, and its close connection to stem cell research have already been described in earlier work (citation removed because of anonymity requirements)

^{xxi} Somatic Cell Nuclear Transfer is a laboratory technique that attempts to create personalized stem cells for regenerative therapies.

^{xxii} Pre-implantation genetic testing is a technique used to identify genetic defects in embryos created through in vitro fertilization (IVF) before pregnancy. Pre-implantation genetic diagnosis (PGD) refers specifically to when one or both genetic parents has a known genetic abnormality and testing is performed on an embryo to determine if it also carries a genetic abnormality. (<http://emedicine.medscape.com/> last entry 02/06/2014)

^{xxiii} As explained by Pavone and Arias (2012: 252) in their research on the political economy of PGD/PGS in Spain, embryos discarded from PGD carry a broad range of different 'defects', varying from either recessive monogenic disorders to predispositions to multi-genetic, complex disorders. This has radically altered the definition of 'life threatening', 'early-onset' and 'serious' diseases and has lucratively broadened the actual scope of the technology.

^{xxiv} Informed Consent Form for Genetic Research, Shaare Zedek Medical Center, dr. Gheona Altarescu and dr. Rachel Eiges (via personal communication 18/07/2012)

^{xxv} Quoted in Stockmarr Leila, Seeing Is Striking: Selling Israeli Warfare, Jadaliyya, 18/01/2014, http://www.jadaliyya.com/pages/index/16044/seeing-is-striking_selling-israeli-warfare

^{xxvi} From a demographic-reproductive point of view the Law on Egg Cell Donations was also quite significant since it required the donor and the recipient of the egg cell to have the same religion, which inhibited Palestinian women from benefitting from the law since they hardly ever donate egg cells in the framework of the law (Vertommen 2014a).

^{xxvii} As one of the reviewers aptly remarked, there are also important differences between the two generations of Israeli tissue providers, despite their strong similarities. Although Labour Zionism was far from being socialist in its practical materialization in Israel/Palestine, it did serve as a powerful societal narrative until the late seventies. In this sense, the elderly women in the sixties were more prone to donate their urine than Israeli women today are willing to donate egg cells. In spite of doubling the compensation fees for egg donors from 10.000 to 20.000 shekels (\$5,776) in 2013, Israel's Egg Donation Law is not managing to attract many egg donors, neither for reproductive nor for therapeutic purposes. Between 2012 and 2014 only 42 egg donors had been registered by the Health Ministry <http://www.haaretz.com/opinion/premium-1.580728>

^{xxviii} Drawing on the work of Tyfield and Birch (2012:322) I agree that Israel's reproductive-embryonic industry is mainly an asset-based enterprise rather than commodity-based one. Their current value is mostly derived from trade in intellectual property and financial investments, not yet from the production of bio-commodities, seen that up to now many Israeli biotech companies have simply not produced any therapies for sale.

^{xxix} Thanks to the anonymous reviewer for pointing out to this important nuance between demand -and supply-side state interventions in the bio-economy.