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In Memoriam.**

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**The genius of Rudolf Stefan Weigl (1883-1957), a Lvovian microbe hunter  
and breeder.  
- In memoriam**

by **Waclaw Szybalski**

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**ABSTRACT**

**Rudolf Stefan Weigl (1883-1957) has made an enormous scientific contribution to microbiology, in general, by adapting the sucking insects, lice, to serve as laboratory animals. That permitted for the first propagation and studying of *Rickettsia prowazekii*, the agent of the typhus and production of the first effective vaccine against exanthematous (epidemic) typhus. Weigl has done it before and during the WWII in his Institute of Biology at the University of Jan Kazimierz (UJK), at that time in Lwów, Poland. The production of this vaccine was based on propagation of *Rickettsia prowazekii*, the microbial typhus agent, in the Weigl's strain of clothes lice, *Pediculus vestimenti*.**



The procedure of 1939 - 1945 consisted of:

(i) feeding of healthy lice with sucked blood, when kept in special cages placed on the skin of human 'feeders',

(ii) infection of lice and propagation of *R. prowazekii* in the midgut (stomach) cells,

(iii) the dissection of louse midgut, and

(iv) the final preparation of the phenolized vaccine. Significance of Weigl's vaccine was enormous, both potentially and practically, at the time when it was developed just before and during WW2. However at present, the threat of typhus is almost not existent because of antibiotics and since lice could be very effectively controlled. Weigl's scientific heritage retains a great importance in the history of world medicine, especially in relation to the humanitarian, political and historical ramifications of the very

**Photo. 1. Rudolf Stefan Weigl**

unique and trying period in the history of Central and Eastern Europe, including Lwów and Poland, during and after WW2.

## INTRODUCTION

This essay is an attempt to describe Professor Weigl as the man and scientist, mainly during the period between the WWI and WWII and especially during WWII and shortly after it. I knew Weigl rather well, as the friend of my Father, my boss, a biologist and the father of my schoolmate Turek Weigl. The story is cast as a part of Polish life of Lwów during that period of history which is now gone, with Lwów presently converted into an Ukrainian city of Lviv, with little connection to the life in the period described in present essay. However, the history of each city, especially of a great city like Lwów, is and should be precious, and the spirit of present Lviv demands it that it should be preserved, cherished and be a source of pride for all the present Lvovians.

### (a) Rudolf Stefan Weigl (1883-1957) as a man and scientist.

Weigl was a great man, probably a genius, and much about him was highly unusual. He was born in 1883 in Prerov, Moravia, as an Austrian with German-speaking parents. At that time there was no reason for him to become later a patriotic Lvovian and an outstanding Pole. The fate, however, ruled otherwise, as outlined below and based on accounts of Henryk Mosing and Stefan Krynski. Rudolf's father, who was in charge of a transportation establishment in Olomouc, was killed when testing a new model of a bicycle, and left a widow, Elisabeth Kroesel with three small children. Elisabeth moved to Vienna with Rudolf and with two years older brother Frederyk, and four years older sister, Lilly. There she met a Polish high school teacher, Jozef Trojnar, whom she married. Troynars moved to Jaslo, then Stryj and finally Lwów, all in the Polish-speaking part of the Austrian occupation zone of Poland. Growing up in the Polish environment, Rudolf Weigl has effectively chosen to become a Pole. He enrolled at the Lwów University (Biological Sciences), being under the spell of famous biology teachers, Benedykt Dybowski (1833-1930), and J. Nusbaum-Hilarowicz (1859-1917). After graduation in 1907, he was awarded a Privat-Docent degree in 1913 in the comparative zoology and anatomy.



**Photo 2. Rudolf Weigl (arrow) with his mother, brother Fryderyk and sister Lilly**

**With WWI approaching, he was drafted as parasitologist at the Army Laboratory in Przemyśl, and became interested in the of typhus, which at that time was spreading through the Easter**

## Europe. Thus Rudolf's scientific dice was cast !

**At that time typhus was a dreaded disease, which was killing millions and affecting world history. As described below, Napoleon was defeated by typhus, and only in Wilno, there were buried 30 000 French victims of this disease. The war plans of WWI were affected by the typhus epidemics in Serbia. Weigl realized, therefore, that his work could affect the World's history!**



**Photo.3. Rudolf Weigl in the Army Laboratory in Przemysl in 1914**

Weigl knew that lice are the vector of the typhus (Charles Nicolle received Nobel Prize for this discovery; Gross, 1996), but there was no way at that time to cultivate the typhus agent, *Rickettsia prowazekii*. Based on finding of Brasillian aristocrat, Rocha-Lima, Weigl also knew that the Rickettsia propagates in louse intestines. Thus Weigl has decided to use lice as an experimental animal to propagate the *Rickettsia prowazekii* bacteria and in this manner to have ample material to study them and maybe to develop a life-saving vaccine. However, there was no way to infect the lice, other then feeding them on the typhus victim, which was not a practical and reproducible method. What was needed now was the experimental genius of Weigl. Since he was not able to infect lice either by their natural sucking manner or by contact from louse to louse, he decided to inject a suspension of Rickettsia into the louse anus, using very fine glass capillary. That worked, thanks to Weigl's "golden hands" and in this way the history was made. As Weigl was quoted by Mosing, he remarked to Prof. Eisenberg of Kraków that "since lice refuse to suck the Rickettsia, I will stick those into their ass".



**Photo 4. Charles Nicolle, the Nobel Laureate, with his collaborator, Helen Sparrow visiting Rudolf Weigl in Lwów in Thirties**

In 1920, Weigl was appointed as the Professor of Biology at the Medical Faculty of the Lwów University. His laboratory became World renown, with frequent visits by the international community of Rickettsiologists, including Charles Nicolle, his collaborator Helena Sparrow from Tunis, Kuczynski from Berlin, and others. There is more about Weigl's successes in the following sections.

## (b) Louse as laboratory animal and the typhus vaccine

Before the era of vaccination and effective insect control, the louse-transmitted typhus was one of the major infectious diseases and a cause of disastrous epidemics. The first successful anti-typhus vaccine was developed by Prof. Rudolf Stefan Weigl(1883-1957) at the University of Jan Kazimierz (UJK) in Lwów, Poland (Weigl, 1920, 1930a,b, 1947). This vaccine was produced on a large scale in Weigl's laboratory before World War II (WW2) in Lwów, Poland, and used in China (Rutten, 1936,1943), Ethiopia (Mariani, 1939) and other countries. Production continued during the WW2, when Lwów was occupied firstly by Stalin's USSR, in 1939 - 1941, and then by Hitler's Germany in 1941-1944.



**Photo 5. Human cloth louse *Pediculus vestimenti*. A drawing from the Weigl's laboratory.**

In early Spring of 1944, Prof. Weigl was forced to leave Lwów and most of his Institute was forcibly evacuated to Germany by the retreating Nazi army or destroyed when Lwów was re-occupied by Stalin's USSR, soon afterwards annexed, and then ethnically cleansed (with USA as an effective accomplice of its Soviet ally).

After suffering waves of occupations, by Soviet Union (1939 - 1941), by Nazi Germany (1941 - 1944), and re-occupation by USSR in 1944, the Polish population of Lwów (at the beginning of WW2, the Polish citizenry of Lwów consisted of about 60-70% Roman-catholics, 20-30% Mosaic (Jewish) and 10% Armenian-catholic, Greek-catholic, Lutheran and others), if not liquidated earlier or deported to Siberia, was forcibly evacuated to the Western Poland, mainly Silesia.

As described above, Prof. Weigl had to leave his beloved city of Lwów, and he then moved to Kroscienko nad Dunajcem, where he established a small laboratory, then to Kraków (Cracow) as Professor of General Microbiology at the Jagiellonian University (1945-1948), and finally to the University of Poznan (1948-1951). After retirement, he died in Zakopane, Poland, in 1957, reaching only 74 years of age (Krynski, 1967a,b, 1997; Nespiak and Ojrzynski, 1994; Stuchly, 1994).

Weigl's accomplishments and procedures for adapting an insect, louse, as an experimental laboratory animal, and applying it in the production an anti-typhus vaccine are described below.

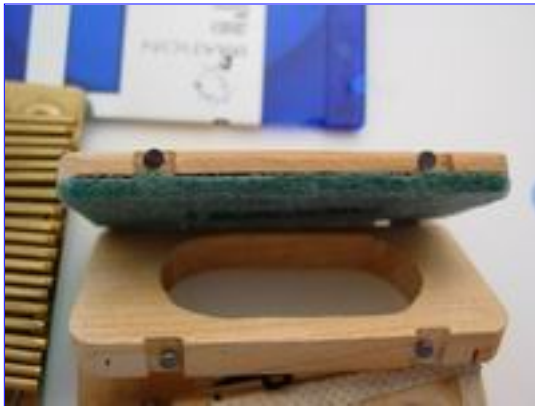
## LICE AND VACCINE PRODUCTION

To produce Weigl's anti-typhus vaccine, the typhus-causing microorganisms, *Rickettsia prowazekii*, were propagated in the midgut (stomach) cells of live lice and were killed by 0.5% phenol. The individual stages of the vaccine production, as based on my recollections in conjunction with a detailed and scholarly account in the monograph of Krynski et al. (1974), were as follows:

## **(1) Production of healthy lice**

### **(a) Louse strains**

The major accomplishment of Prof. R. Weigl was the introduction of an insect, louse, as the experimental animal, for the purpose of propagation of *R. prowazekii*. He has 'engineered' a special strain of lice, named *Pediculus vestimenti*, which was easy to breed, and was well adapted to the production of typhus vaccine. The strain was a Caucasus-African cross between lice isolated from the WW1 Russian prisoners (captured by Austrians) and Ethiopian lice received in 1939 by Weigl from the Laboratory for Rickettsiosis in Addis Ababa. This cross was designated as "Weigl strain" (Krynski et al. 1974; Mariani, 1939).



**Photo 6. A cage for the feeding and propagation of human cloth lice.**

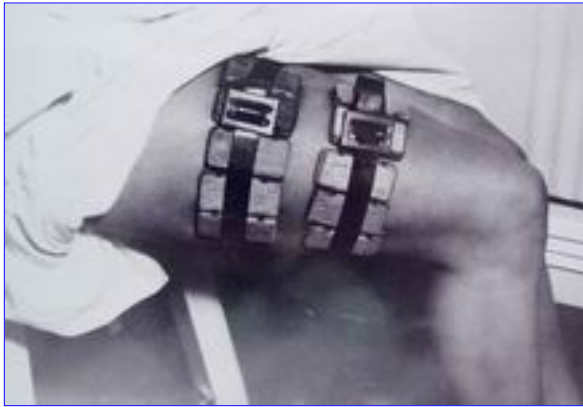
Reasons for cultivating *R. prowazekii* in lice were manifold:

- (i) At that time no suitable artificial media existed for cultivation of *R. prowazekii*,
- (ii) Subsequently proposed propagation of *R. prowazekii* in hen eggs resulted in the inadvertent selection of progressively less immunogenic variants of *R. prowazekii*, and
- (iii) Cultivation and passaging of *R. prowazekii* in the midgut of Weigl's strain of lice (*Pediculus vestimenti* or *Pediculus humanus corporis*) was resulting in the most potent and reliable anti-typhus vaccine (Krynski et al. 1974).

### **(b) Hatching of louse eggs**

Lice were depositing eggs on small squares of woolen fabric (see below). Each square was then held by a partial constriction near the middle of a cotton-plugged glass vial (hatching tube) and incubated at 32°C. The healthy lice larvae, which hatched after 3 to 8 days, were dropping to the bottom of the hatching tube and the crop of 400 - 800 larvae formed a pulsating yellowish ball of about 5 - 8 mm diameter. Larvae were transferred to the flat (of about 4x7 cm size) cages (Sikora, 1915, 1917, 1924) only about 5 mm deep and made of wood (for a drawing, see Krynski et al., 1974). One wall of these cages consisted of special screen adapted by Weigl, with his usual ingenuity, from screens routinely used for flour sifting in the Polish flour mill industry. Lice were able only to stick out only their heads through this screen, but were not able to escape. About 800 larvae were placed into each cage that contained a loose small square of woolen fabric (for depositing eggs), which during WW2 was made of discarded army uniforms, Russian or German. The cages were sealed with paraffin as to prevent escape of any tiny larvae.

### **(c) Feeding of lice on human legs**



**Photo. 7. Feeding of lice on the upper part of leg**

Depending on the size of calves or thighs, about 7 - 11 cages were placed screen-down on the leg of the 'feeder'. The screen walls of the cages were pressed against the skin, while cages were held under a wide garter-like elastic band. Sticking out their heads through the screen wall, the lice were able to pierce the skin and suck blood for about 45 minutes, once a day, for about 12 days. The resulting 1x2 inch reddish marks on the skin were washed with 60% alcohol, which contained  $\text{HgCl}_2$  as the disinfectant. Feeders could tolerate well the moderate discomfort and loss of blood (Finkel, 1932). Between WW1 and WW2, Weigl has tried to adapt pigs as large-scale louse feeders, but he did not succeed to make it practical (Weigl, 1920, 1930a,b, and personal communication).

**Men usually were attaching the cages to their calves, while women placed the cages on their thighs (as to hide the reddish marks under their skirts). After the 30 - 45 minutes feeding session, the louse gut as well as the entire body was swelling like a balloon, since each louse was ingesting the amount of blood equal to its entire body weight. Lice became rather dark colored (not red) with very shiny abdomens.**

### **(d) Handling of caged lice**

Cages were placed 'screen-down' in special holding boxes, as to keep lice dry and clean, while their feces, when drying out, did sift through the screen and collected at the bottom of the holding box. The boxes with cages were kept in 32°C incubators. Lice were periodically transferred (first time after six days, then more frequently) to the cleaned and heat-sterilized cages, each containing a square of woolen fabric for depositing eggs (see above). These transfers were necessary both for collecting eggs, and for removing any dead or unhealthy appearing lice and louse debris, including feces and products of molting. All operations were carried out under highly aseptic conditions, assuring that the lice colony remained healthy and free of any viruses, bacteria or other parasites. However, microbial epizootic infections did sometimes occur, requiring destruction of the contents of such infected cages (Krynski, 1967c; Krynski et al. 1974).



The healthy 12-day old lice were produced by "breeding units" (hodowle), each composed of the supervisor (kierownik hodowli) and 12-15 feeders (karmiciele), i.e., persons who fed the lice. The author of this chapter served as a supervisor of such an unit, and also as a feeder, between 1941 and 1944. Most of the feeders in my breeding unit were Professors of UJK (see the section on the Humanitarian,

**Photo 8. Temporary scars** Historical and Political Ramifications, below). The entire operation (reddish marks) after feeding of lice. was supervised by Dr. Stefania Pokorny.

## **(2) Infection of healthy lice with *R. prowazekii***



**Photo 9. Weigl's clamp with 20 spring-loaded holders (clamps) which permit to immobilize 20 individual lice.**

The next step in the vaccine preparation was the infection of lice with *R. prowazekii* at a concentration corresponding to one Rickettsiae-infected and fully homogenized louse midgut per ml ( $10^6$  to  $10^7$  infectious units per ml). Cages, each containing 300 - 400 of 12-day old healthy lice, were transferred to the completely separate "injection units", where the specially trained "injectors" (strykacze) were infecting lice manually with *R. prowazekii*, and then feeding the infected and caged lice for another 5 days. The entire injection operation was highly engineered, as to make it efficient (for details see Krynski et al.,1974).

As the first step, 20 to 50 lice were immobilized in a special device (Weigl's clamp) where each louse was held by a very gentle spring clamp, while the anal segment of their abdomen was exposed and easily accessible. These clamp devices were then placed under a 32x binocular microscope, and each louse was anally injected with a suspension of *R. prowazekii*.

**A 0.05 - 0.1 mm glass microcapillary (with its end cut on angle and fire polished, as to avoid injury to louse anus and intestine) served as an injection device.**

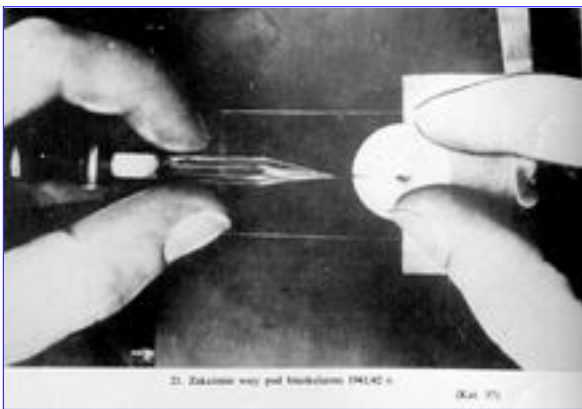
**Propagation of Rickettsiae was taking place in cells which lined the louse midgut, which is straight, strong and elastic; the anal part of gut (ampulla recti) is lined with very tough chitin and thus is resistant to injury by the glass capillary. Injection was mediated by a pulse of weak positive pressure, controlled by reducing valves, electrically actuated solenoid valves, and finally by the operator (injector) who was using a foot-operated pedal. Each injection cycle consisted of the insertion of the capillary into the louse anus, briefly depressing the pedal to effect the injection, and withdrawal of the capillary; the entire cycle required about one second.**

**Including all the auxiliary operations, a team of two highly skilled operators (one immobilizing and the second injecting the lice) was able to inject up to 2000 lice per hour.**



**Photo 10. Low-power binocular magnifier (microscope) for facilitating the lice injecting and resecting**

Each batch of about 500 injected lice was then loaded into a cage, and fed for 5 more days by sucking blood of the intensively vaccinated 'injectors'. Feeding of the infected lice attested to the efficacy of Weigl's vaccine, since no serious typhus cases occurred among the injectors. When population of *R. provazekii* reaches  $10^7$  per cell, the gut cells began to burst, resulting in leakage of the undigested and thus red human blood into the louse abdomen; thus in the final stage of the rickettsial infection, the lice bodies were turning bright red.



**Photo 11. Injecting of an individual louse**

Weigl's methods for large-scale breeding and infecting insects were quite a unique achievement, thus having an impact on other branches of experimental entomology. E.g., experiments were carried on the infection of lice by *Yersinia* and *Pasteurella*, and on testing the efficacy of antibiotics on the rickettsial infection (Becla, 1974; Becla and Krynski, 1972; Krynski and Becla, 1964; Krynski et al., 1966); analogous methods were used for infecting ticks (Becla, 1974). Moreover, the Editor of this Manual, Prof. Karl Maramorosch, had adapted some of these methods for cultivation of leafhoppers and for the construction of the "leafhopper clamp and injection" device (Maramorosch and Jernberg, 1970).

### **(3) Dissection of lice and preparation of the vaccine**

The entire production of vaccine at Weigl's Institute in Nineteen Forties was supervised by Dr. J. Starzyk (Starzyk, 1938). As the first step, cages with the infected lice (about 5 days after injecting with *Rickettsiae*) were inspected and cleaned of feces and debris. Those lice with adequate crop of *Rickettsiae*, i.e., those that turned red, were placed into jars filled with 0.5% phenol, earmarked for vaccine production, and consequently transferred to the "dissector's stations". "Dissectors" (preparatorzy) were harvesting louse guts that were heavily infected with *Rickettsiae*. My younger brother, Stanislaw Szybalski worked as a dissector, and helped to refresh my memory about some details described here. Many instruments are depicted in the review of Krynski et al. (1974). Using a fine scalpel and under the 16x binocular microscope, an incision was made between the thorax and abdomen of louse, and the *Rickettsia*-infected gut was pulled out using the needle and the tip of the scalpel. Dissection of about 300 lice per hour per dissector was the norm. Both ends of the gut were cut off, and the infected midguts were then transferred to the jars containing 0.5% phenol solution and subsequently ground to a fine suspension in the Weigl's mortar. Debris were then removed at 1000 rpm, the suspension sedimented at 6000 rpm, and finally resuspended in 0.5% phenol buffer. The



**vaccine was prepared at three different strengths and was composed of the vaccination fluid (buffer) containing fine emulsion of phenol-killed *R. prowazekii*, equivalents to 15, 30 and 45 louse guts.**



**Photo 12. Dissection of the louse gut (stomach).**

These three strengths of vaccine were packaged and distributed in sealed glass ampoules. At the time of my tenure at the Weigl's Institute, the entire course of vaccination consisted of three injections, administered at the increasing strength at one week intervals and amounting to a total of 90 infected louse guts.

The vaccine was safe with exception of sometimes serious allergic reactions, especially observed among the Weigl's Institute employees who often became sensitized to louse byproducts. Personally, I have developed asthmatic reaction to louse feces dust; moreover, I had a very strong anaphylactic shock after the third round of vaccination.

## SIGNIFICANCE OF WEIGL'S VACCINE

At the time of its development, the Weigl's vaccine was the first and only remedy against the dreaded typhus epidemics. Although at present, typhus does not appear to be of any major epidemiological importance, this disease was responsible for major epidemics and death of millions, up to the second half of the 20-th century. The extensive epidemiological, clinical and historical accounts could be found in the chapter of Snyder (1948). Only a few salient features are mentioned here. The first description of typhus is of year 1083 from a convent near Salerno, Italy, and similar accounts could also be found in the famous work of Fracastorius, "De Contagione", published in 1546. As described by Professor Stefan Krynski, a collaborator of Prof. Weigl, in several of his articles in 1995-1998 in the Gazeta AMG Gdansk (see especially, Krynski, 1997), the most severe epidemics of typhus usually accompanied the major wars and famines. One of the biggest epidemics was during Napoleon's retreat from Moscow in 1812, when more French soldiers died of typhus than from Russian bullets. One could say that lice have defeated Napoleon's armies; moreover, their retreat has spread the infected lice and typhus through the entire continent of Europe. Especially severe epidemics affected the Byelorussian and Lithuanian areas of the former Polish-Lithuanian Kingdom. Typhus has contributed also to the defeat of Napoleon III in the war with Prussia, when the fortress of Metz had to surrender because of the epidemics.



**Photo 13. Glass ampules with the Weigl's vaccine (WWII production of 1941)** During the WW1, typhus epidemics have killed 150,000 Serbs in 1915.

Therefore, the development of the first highly effective anti-typhus vaccine by Weigl was of such a major epidemiological importance, although his discoveries were barely noticed in the Western medical literature (Snyder, 1944; Anigstein, 1947). A total of 5 - 6 millions of individuals were vaccinated against typhus during German occupation in the eastern zone of war operations.

Weigl, although having Austrian parents and being born in Prerov (Przerow, in Polish) in the Moravian province of the Austro-Hungarian empire (presently in Czech Republic), after losing his Father early in life and moving with his mother and stepfather, a high school principal, to the Polish cities of Jaslo, Tarnopol, Stryj and later to Lwów, where he attended Polish schools, became by his own choice a very patriotic Pole (A Monograph, 1994; Krynski, 1967a,b, 1997). His son Wiktor was my close high school friend; Wiktor's mother, Zofia nee Kulikowska, the first wife of Prof. Weigl, was always very kind to me, as she was to all the Wiktor's friends.

It has been established in 1909 by Charles Nicolle of The Pasteur Institute, Paris, that louse was the vector for typhus. It has been proven in 1916 by H. da Rocha-Lima that the infectious agent carried by lice is *Rickettsia prowazekii* [named after the American and Czech investigators, H. T. Ricketts and S. von Prowazek (born as Stanislav Provazek), both of whom died of typhus when studying *Rickettsiae* as the etiologic agent]. Weigl was destined to make next critical contribution to the field; being a zoologist, parasitologist, comparative anatomist, histologist, and entomologist, and also a professor of biology at the University of Lwów, Poland, he became an expert in the biology and pathology of lice. In the early Twenties, feeding infected lice and testing typhus vaccine were all done with guinea pigs (Weigl, 1920), especially since Weigl, who was not a physician, was reluctant to perform human experiments. The latter were done without prior Weigl's knowledge, by a dedicated couple of technicians, Michal and Rozalia Martynowicz, who in this manner tried, however surreptitiously, to help their beloved Professor. Michal was a typhus survivor, and thus immune, whereas his wife Rozalia was never exposed to typhus. Without notifying his boss Prof. Weigl, Michal has vaccinated his wife Rozalia with Weigl's vaccine, and then she agreed to feed the *R. prowazekii*-infected lice. Only after both were sure that Rozalia did not contract typhus, they notified Prof. Weigl about their results. This experiment became crucial for Weigl's decision to perform large-scale vaccination trials in the regions of endemic typhus (Chodzko, 1933; Radlo, 1937). The very successful results were widely reported and praised in the Polish and World Media. Especially successful was the vaccination campaign in China carried out by the Belgian missionaries (Rutten, 1936, 1943). As cited from the report of Father Rutten: "Typhus was one of the greatest human enemies killing at that time more victims than all other epidemics combined. Of 130 Fathers active in

**China, 70% died of typhus in the years of 1908 to 1931." Father Rutten wrote further, that: "When news reached us, that a Polish Professor has developed a vaccine, we were first very skeptical, since many 'cures' were proposed or sold to us before, but all of these failed. Anyway, we decided to try the Polish vaccine and the results turned out to be dramatic. During the past 7 years, since we started using the Weigl's vaccine, not a single of our missionaries or of the vaccinated Chinese patients died of typhus. Your Polish vaccine saved lives not only of missionaries but also of many thousands of Chinese".**

Praises were heaped upon Prof. Weigl, including a kind statement by Charles Nicolle, a Nobel laureate, who established that louse is the typhus' vector; he wrote: "The 'war' with typhus did not appear promising, until it was joined by the brilliant Polish scientist, Professor Rudolf Weigl from Lwów, Poland. Weigl taught us how to cultivate the typhus agent in lice, and moreover, has developed a superior vaccine, which saved many thousands of lives. As person, Weigl deserves highest recognition, as a brilliant intellect, untiring worker and a fanatic of science" (Krynski, 1997).



**Photo 14. Medal and Diploma ("DYPLOM HONOROWY") posthumously awarded to R. Weigl as the "Righteous Among the Nations" for saving Jewish lives during WWII.**

Unfortunately, the well deserved Nobel prize has eluded Weigl because of the politics and WW2. However, he received many honors, including the Order of St. Gregory from the Pope Pius XI, the Leopold Order from the Belgian King, the Order of Polonia Restituta, and in addition he was elected to the Polish Academy (PAU or Polska Akademia Umiejetnosci) and many foreign Academies, and he became an honorary member of several scientific societies (A Monograph, 1994; Krynski, 1967a,b, 1997).

**Weigl's typhus research was continued for a few more decades by his collaborators and students, among them Anna Herzig-Weigl (Herzig, 1939), the second wife of R. Weigl, Stefan Krynski, Stanisława Woyciechowska (see Krynski, 1987), Henryk Mosing (Mosing, 1947), Zbigniew Stuchly, and Albina Kuchta (A Monograph,1994; Krynski, 1967a), but at present it is mainly of a historical interest.**

**In 2003, Yad Vashem of Israel honored Prof. Rudolf Weigl as Righteous Among the Nations.**

## **HUMANITARIAN, HISTORICAL AND POLITICAL RAMIFICATIONS**

### **(1) The period before WW2**



**Photo 15. The Old University Building (three storie building on the right) at the Mikolaj Street, where Weigl's Institute was located between WWI and WWII, and during WWII, and where Weigl's vaccine was produced. (To the right is the Church of St. Mikolaj (St. Nicholas), where the author of this essay was baptized and his parents were married.)**

Most of the methods for the cultivation of lice and production of the Weigl vaccine were developed before WW2 in the Department of Biology of the UJK in Lwów, which was then a Polish city, with several Universities or Schools of Higher Learning, best characterized as a counterpart of Boston in USA or Cambridge in England.

It had rich Western and international traditions, as reflected by its many names (Leopolis in Latin; Leopoli in Italian; Lemberg in German; Lvov in Russian; Lviv or Lwiw in Ukrainian, the spelling of Russian and Ukrainian names depending on the transliteration). Lwów was a city with about 600 years of Polish history and tradition and the extremely patriotic Lvovian citizenry. At the eve of WW2 in 1939, its population of about 350,000 was a rather homogeneous 'melt' with various ethnic and religious backgrounds: predominantly (about 60-70%) Roman-catholic, about 20-30% Mosaic (integrated and orthodox Jewish), the remaining about 10% Armenian-catholic (of Armenian origin), Greek-catholic (predominantly of Red Rutenian or Ukrainian origin), Lutheran (mainly Austrian or German) and others.

### **(2) The period during and just after WW2**

**WW2 started on September 1, 1939, and as results Lwów became occupied first by the Soviet and later by the Nazi's Armies. However, Weigl's Typhus Institute became a 'safe haven' for the intellectuals in 1939 - 1944, during both occupations. Otherwise, during this period, Lwowian universities have lost (killed or deported, mainly to Siberia) over 40% of Professors, with highest loss of about 90 % at the Medical School (Albert, 1989a).**

#### **(a) The period of Soviet occupation 1939 - 1941:**

**During the USSR occupation period of 1939 - 1941, Weigl did his utmost to protect the Institute employees from the systematic and inhumanely cruel deportation to Soviet gulags in the North (for men), and to Southern Siberia (for women and children, who were arrested at night and exiled by trucks and trains to very primitive kolkhoz'es situated mainly in the wilderness of Kazakhstan), where the death rate approached 30% per year, and where I lost many of my friends and colleagues (see also, Kopanski, 1997).**

**About the time when the Soviet secret police (NKVD or KGB) organized their first cruel deportation of Lvovian population to Siberia, the first secretary of the Ukrainian Communist Party, Nikita Khrushchev, has visited Weigl at his Institute and offered him the title of Academician and a directorship of an Academy Institute in Moscow. Weigl has politely rejected it, which fortunately did not cause any negative consequences; instead Weigl has received promises of additional buildings for his Institute in Lwów (Nespiak and Ojrzynski, 1994), and of an exemption for his employees from deportations to Siberia.**

**I learned about the details of the Khrushchev's visit from my father, who spoke fluent Russian (because long before WW1 he lived and studied in the Russian-occupied provinces of Poland, including Warsaw) . My father, Stefan Szybalski, a pre-WW1 graduate of the University of Toulouse, France, was asked by his friend Prof. Weigl (who was unfamiliar with Russian language, similarly as nearly the entire population of Lwów, including myself) to help him in dealings with Russian visitors and the Soviet Russian administration, including Khrushchev and the NKVD (who supervised arrests and deportations, during the 1939-41 period of the Soviet occupation of Lwów). It is a pity that Stefan Szybalski has not written up his memoirs of this period, since many famous Russian professors and Academicians, who were 'starved' of the contacts with the Western world made a pilgrimage to Weigl's Institute in Lwów, considered by Russian as a Vienna-like Western European city, though occupied then by Soviets. Posing as biologist in a laboratory attire, my father played deftly a role of Weigl's translator. Frequently, after a few glasses of vodka, the Russian visitors could not resist temptation of describing their hardships and then share their personal tales of horror related to life in USSR and to Stalin's terror; one of the Russian visitors, after getting drunk, gave the following very characteristic and helpful advice: "Do not ever join the Communist Party and do not steal excessively". He then elaborated: "If you are not a Party member, they will always court you to join, but once you join and then are kicked out of the Party this is your end. If you steal too much this will lead to your demise, but if you do not steal at all, you will starve; thus remember to steal only in moderation, just enough to survive !"**

**Through his influence, and often helped by my father, Weigl was able to help in securing the release and return to Lwów of several of the Siberian deportees. Among those was Stefania Skwarczynska (at that time at UJK, and after WW2 the Professor of Theory of Literature at University of Łódź, Poland, and a member of**

PAN), who was deported to Kazakhstan, because of her "guilt" of having a husband, who was a pre-WW2 colonel of Polish Army and at that time a war prisoner in a German 'Oflag'. Stefania was helped by her UJK major professor, Juliusz Kleiner, and by Weigl to return from Kazakhstan in Siberia with her mother and two very young daughters (one of her daughters, Maria Olszewska, is at present a Professor of Cytology and Cytochemistry of Plants at the University of Łódź, Poland, and a member of PAN). Weigl has provided Stefania with a safe employment in his Institute, and I trained her to become a louse breeder. While working with her at adjoining desks in 1941-43, I learned plenty about her own and her mother's and children's hunger and misery of the inhuman deportation. She was an enthusiastic and gifted raconteur, and as an accomplished story teller, she described to me some amazing and cruel experiences in the steppes of the Soviet Kazakhstan, hundreds of miles away from the 'civilization' (as represented by the nearest railway station).

My family have also been directly threatened by deportation to Siberia at least twice. Our Soviet 'passports' were first confiscated by NKVD and then the dreaded "paragraph 11" was added to them; this meant that we had to be moved to some place located hundreds of miles away from any even smallest town, which 'location' meant the wilderness of Siberia. Again, thanks to Weigl's help, my father was able to nullify this cruel ruling; however, the same happened to us again, but this time our second "paragraph 11" ruling reached us only one day before the Nazi invasion of Soviet Union.

Hitler's armies have attacked the Soviet army on June 22, 1941, and entered Lwów on June 29, 1941. During this ghastly last week of Soviet occupation there were massive arrests and all jails became overfilled with Lwowian citizens. Then in the middle of that week the Soviets have initiated the systematic mass murder of the prisoners.

Just after June 30, when Soviet retreated, we have succeeded to enter one of the prisons, because I was trying to help my friend in finding his father (who was a lawyer and a lice 'feeder' at the Weigl's Institute, and who was arrested by Soviets a few days earlier). What we found, were the heaps of the partially decomposing bodies stacked four to ten deep on the cell floors. In this prisons alone, the Soviets have murdered about 3500 prisoners before the Soviet retreat (Kopanski, 1997). During the next few days of the unusually hot weather, we searched other prisons, finally finding the body of my friend's father among the progressively more viscous mass of the victims of this Soviet atrocity of systematic ethnic murders. I lost then at least five Lvovian friends or their parents: three Roman catholics, one Greek-catholic and one Jewish.

## **(b) The period of German occupation (1941 - 1944):**

**During the Nazi occupation of Lwów (1941 - 1944), employment in Weigl's Institute provided some degree of protection from the random arrests and deportation to the Nazi concentration camps; Gestapo seemed to prefer to avoid 'dealings' with persons from whom they might accidentally acquire typhus-infected lice (it was well known that carrying lice was our occupational hazard). Moreover, all employees carried an impressive looking identification card ("Ausweiss") from the "Oberkommando des Heeres" (Office of the Commander-in-Chief of the German Army); this "Ausweiss" was another of Weigl's life-saving "inventions" (as partly "engineered" by my father). The Institut's Headquarter was in Krakow and the German microbiologist in charge was Dr. H. Eyer, who had a rather fair opinion as not interfering with Weigl's pro-Lwowian activities. After WWII, Eyer served as Professor at the Max-v.-Petterkofer Institute of Hygiene in Munich. He described the history of his years with Weigl (Eyer, 1967). Another interesting and partially related history of these years is by Lindenmann (2002), a Swiss Professor.**

**Weigl helped to protect many of the unemployed university professors and their associates by employing them as lice feeders; such employment entitled to special food rations and made them at least partially immune from arrests, deportations and/or death during the Nazi occupation. Some aspects of employment in Weigl's Institute had some elements in common with Spielberg's Hollywood movie "Schindler's List". I wonder if it is significant that both Weigl and Schindler were born in Moravia and both were recognized by Yad Vashem as "Righteous Among the Nations".**

**Since feeding lice occupied the feeders for only one hour per day, and since the University (with exception of the Institute of Technology, renamed by Germans as "Technische Fachkurse") was closed by Nazis, the 'feeders' had the remaining time left for organizing the underground University courses and for other educational and patriotic activities. For instance, I was supervising a 'breeding unit' consisting of feeders who were mostly mathematicians of the famous Lwów school of mathematics, including the world famous professor, Stefan Banach, and others including Jerzy Albrecht, Felix Baranski, Bronislaw Knaster, Wladyslaw Orlicz, and also other scientists like Tadeusz Baranowski (biochemist), Ludwik Fleck (bacteriologist; Fleck, 1947), Seweryn Krzemieniewski and his wife Helena (both famous bacteriologists), and Krukowski (archeologist). Famous artist Stanislaw Skrowaczewski (with whom I studied piano under Florentyna Listowska) was also a lice feeder; he became a composer and a famous conductor of the Minneapolis Symphony Orchestra, whom I was meeting frequently at his concerts in Madison, WI, in the Sixties or Seventies.**

**Lwów school of mathematics was also known as "Scottish", not because of any direct relation to Scotland, but because of the name of the Kawiarnia Szkocka (Scottish Coffee House), where Lwowian mathematician were routinely meeting and solving their theorems on the paper napkins, on disposable table cloth, or in the famous Scottish Coffee House Volume. The first computer language ("Polish" or "reverse Polish", as used by the Hewlett-Packard Company) was also created by this group. It was intellectually very stimulating but also somehow surrealistic, to**

**listen to their long discussions about frontiers of mathematics, including elements of topology and theory of numbers, while they were feeding lice. However, I had to watch that in the fervor of their discussion they did not overfeed lice, beyond 45 minutes, because our laboratory lice lost their natural instinct to stop feeding, with a disastrous consequence to them, because their guts started to burst due to 'sucking' too much blood.**

**During Nazi occupation of Lwów, 1941-44, Weigl used his fame and the pre-WW2 scientific connections with German biologists to protect all of us from Nazis. To achieve that, however, he also had to play dangerous and potentially questionable humanitarian role by being forced to produce his vaccine for Germans. At the same time, he had to resist a Nazi's offer to become a director of a special Institute to be established for him in Berlin and to become a German citizen called "Reichsdeutsche". Despite great personal risks, he made a brave response in 1941/42 to an offer by a high-ranking German Army emissary (as combined with subtle threats); he said that: "As biologist, I know the phenomenon of death; it is to you to accept me as Polish professor of Polish nationality". He also added that "it might appear questionable for the German officer, to offer honors to a Polish Professor, who by accepting the German offer would have dishonored himself". The high-ranking German officer, apparently a Heinrich Himmler's representative, understood that Professor Weigl was neither to be threatened nor to be bought. Professor Weigl has described this dramatic exchange, thereafter, my father, Stefan, who in turn related it to me. There are also more elaborate versions of this exchange between Weigl and Himmler's representative.**

**Weigl had a permission to have a radio, and allowed my father to listen to it and spread the political news among his trusted friends during this very bleak and sad time of the Lwowian history; this access to the radio was a blessing, since otherwise there was a death penalty for having a radio. Weigl was very courageous and not afraid to secretly cooperate with Polish Underground (AK or Polish Home Army) during Nazi occupation. Several shipments of Weigl's vaccine were surreptitiously and illegally delivered to the Warsaw ghetto and to other Nazi-established Jewish ghettos in other major cities, where typhus epidemics were rampant. My father, who was assisting Prof. Weigl in administration of the Exanthematous Typhus and Virus Research Institute, had more than once transported the vaccine to the Warsaw ghetto; I was helping him with that task and delivering the vaccine to Professor Ludwik Hirszfeld, as he describes it in his famous memoirs (Hirszfeld, 1989, pp. 267 and 269). Tomasz Cieszynski [whose father, Dr. Antoni Cieszynski, Professor of Stomatology of UJK, was murdered by Nazi Gestapo in Lwów in July 1941 (Albert, 1989b) as among the 25 massacred Professors of the UJK, Politechnika, and other Academic Schools of Lwów] has described one of the sessions in Weigl's office that preceded the second of the transports of Weigl's vaccine to the Warsaw ghetto by my father and me (Cieszynski, 1994). The importance of Weigl's vaccine in the Warsaw ghetto was stressed in the famous book by Szpilman (1946; 2002), who says that Weigl was "as famous as Hitler in the Warsaw ghetto", Weigl as a symbol of Goodness and Hitler as symbol of Evil.**



**The 'death penalty' threatened all of us engaged in the illegal vaccine transportation, but this did not deter us, since the everyday life was more than dangerous anyway. As an example of an enormous loss of life in general, of 120 Lvovian chemistry students (about 10 Roman-Catholics, 10 Greek-Catholics and 100 Mosaic Jewish), who together with me succeeded to pass the Communist-administered entrance examinations as to enroll in October/November 1939 at the School of Chemistry of the Lwów Institute of Technology (Politechnika Lwowska, with its name being modified depending on the changing occupations), only 14 could be accounted for by 1944.**

### **(3) Re-occupation by Soviet Union in 1944**

**Although successfully resisting the "enticing" German offers in 1942/43, Prof. Weigl was not able to resist the unavoidable forced move in 1944 from Lwów to central Poland. Soviet army re-entered Lwów in July 1944, and Weigl's beloved city was ethnically cleansed by the Soviet administration, as a consequence of the abominable USA-approved Yalta/Potsdam acts (see Introduction), which authorized the forced and cruel deportations. The annexation of Lwów and its ethnic cleansing were secretly planned in advance and signed by Roosevelt, (later Truman), Churchill and Stalin during the Yalta and Potsdam Conferences. This was done treacherously, behind the back of the Polish Government in Exile in London, the staunch WW2 ally of USA and UK. Thus, USA was in fact promoting the second, practically total ethnic cleansing of Eastern Poland by Soviet Union. Such first ethnic cleansing, even a more cruel one, was perpetrated by USSR in the years 1939-41, as a result of the Hitler-Stalin pact of 1939, but involved 'only' about 20% of the Lvovian population (and that of the Eastern half of Poland), because USSR did not have enough trains and time to deport to Siberia the entire population (Kopanski, 1997).**

**Moreover, by this act USA was also approving all the atrocities inflicted upon Lvovians during and after WW2 by the Soviet Union, although USA could have easily prevented this unnecessary tragedy. A few thousand of survivors and descendants of the pre-WW2 Lwowians (of Polish citizenship) still remain in Lwów (presently Lviv) and try to preserve their heritage, including the Roman-catholic Cathedral, a few churches, and some very monumental and old cemeteries.**



## **CONCLUSIONS AND COMMENTS**

**Weigl's scientific research flourished in Lwów, and led to the development of new approaches to study rickettsiology (and later virology) and to an effective anti-typhus vaccine. This happened in the period between WWI and WWII. Weigl's Institute remained very active during most of the WWII, but Weigl's association with Lwow**

**became terminated concurrent with the 1944/45 annexation and ethnic cleansing of Lwów and Eastern Poland by the Soviet Union. This annexation in favor of Stalin was very unfair, since Poland, after all, was the first country, which on September 1, 1939 has resisted Hitler's aggression, whereas Stalin's USSR was Hitler's ally between 1939 and 1941. USSR was actively supporting Hitler's war effort by supplying Germany with train loads of war materials and food. On the other hand, a very secret small unit of the Lwowian underground was charged with disrupting the Soviet supplies for Hitler's armies, which were attacking Western Europe; our unit has derailed or destroyed several Russian-German transport trains in 1940 and up to June 1941 (using explosives, which were secretly produced also by myself as the student at Politechnika Lwowska in the laboratory of the Organic Chemistry Department directed by Professor Edward Sucharda and with his 'blessing'). Derailing Soviet trains had a doubly beneficial role for the Eastern Poland and Allies, since the same trains that carried Soviet supplies for Hitler's armies, were used also for cruel deportation to Siberia of the pre-WW2 Lvovian citizenry and that of Eastern Poland (Kopanski, 1997).**

**During this period of close USSR-Nazi Germany cooperation, the USSR authorities have also confiscated practically all private property in Eastern Poland, including Lwów. These properties were never returned to the rightful owners (like, e.g., Professor Weigl, his family, many University Professors, including those who fed lice, or my family and myself), neither at the end of the WW2, nor even now. Moreover, the over 600 years of Polish history of Lwów and Eastern Poland, including many art galleries, museums, historical and scientific edifices, all that what was the essence of Polish culture, had perished as result of the forced resettlement and ethnic cleansing. This is the sad end to the personal fate of Prof. Weigl and many others like him, who gave so much to the science, medicine, and humanity in general, and as the 'reward' were deprived of their roots and have lost everything, many of them their lives.**

**One could add here, at the end, that the generally despised insect, louse, has played a double role during the WW2: it was not only a carrier of a dreaded disease, typhus, but ironically it was also protecting lives of those who worked with this insect and of those who were vaccinated with the product of Weigl's brilliant research effort. --- Moreover, one could also conclude that while Weigl was trying to help humanity by developing his insect cultivation methods and typhus vaccine, the Stalin's USSR (1939 - 1941 and after 1944) and Nazi Germany (1941 -1944) were engaged in murders and cruel deportations, whereas the naive and irresponsible USA policies of 1943-1950 were responsible for the further human misery in the USSR-dominated, annexed or occupied, but pre-WW2 independent Eastern and Central European countries, and moreover, for a definite possibility of a nuclear holocaust, which almost by miracle was avoided because of Stalin's death. Most of that seems to be now forgotten, and the insect louse plays practically no role in our lives. But the noble deeds, courage and scientific discoveries of Professor Rudolf Weigl and those associated with him should never be forgotten!**

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