

FOCUS: PSYCHIATRY AND PSYCHOLOGY

Julius Wagner-Jauregg and the Legacy of Malarial Therapy for the Treatment of General Paresis of the Insane

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Julius Wagner-Jauregg, a preeminent Austrian psychiatrist was awarded the Nobel Prize in Medicine in 1927 for the development of malaria therapy for the treatment of neurosyphilis, or general paresis of the insane. Despite being only one of three psychiatrists to win a Nobel Prize, he has faded from public consciousness and his name recognition pales in comparison to his contemporary and fellow Austrian, Sigmund Freud. This paper explores his contributions to the field of biological psychiatry and also touches upon reasons, such as the growing bioethics movement, his controversial affiliation with the Nazi Party, and the evolution of neurosyphilis, that explain why Wagner-Jauregg is not more widely celebrated for his contributions to the field of psychiatry, even though his malarial treatment could be considered the earliest triumph of biological psychiatry over psychoanalysis.

INTRODUCTION

In the long history of psychiatry, only three Nobel Prizes have been awarded to psychiatrists for their contributions to medicine. The first was awarded to Austrian psychiatrist Julius Wagner-Jauregg in 1927 for his discovery of malaria treatment for neurosyphilis or general paresis of the in-

sane (GPI†). The second was awarded to Egas Moniz, inventor of the controversial lobotomy procedure, in 1949, and the most recent was given to neuropsychiatrist Eric Kandel in 2002. Despite the prestige of winning a Nobel Prize, Wagner-Jauregg's peer, Sigmund Freud, has overshadowed his legacy. Ironically, Wagner-Jauregg was

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†Abbreviations: GPI, general paresis of the insane.

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and remains a giant in Austrian psychiatry, and his contemporaries often overlooked Freud's psychoanalytical techniques. But the widespread popularity of Freudian psychoanalysis in the United States in the 1960s demonstrated the limited reach of Wagner-Jauregg's biological approach to psychiatry [1].

Neurology and psychiatry have had a tenuous relationship at best over the past centuries. During the early 20th century, neurology was practiced in large, inner-city hospitals and universities while psychiatry was practiced in rural sanatoriums and asylums. Early advances in biological psychiatry based on neurology and determining the organic cause of mental illness were centered on work from Germany and Austria. The dominance of German science during the 19th century can be traced to state-funded research universities in contrast to systems in Britain and the United States, where research was privately funded.

While Emil Kraepelin is generally accepted as the figure of biological psychiatry, historian of psychiatry Edward Shorter argues that the true founder of the first biological psychiatry was German psychiatrist Wilhelm Griesinger, who, like Wagner-Jauregg, was interested in both psychiatry and internal medicine and founded the preeminent journal *Archive for Psychiatry and Nervous Disease* in 1867 [2]. Griesinger's contribution to the emergence of a biological psychiatry grounded in neurology was his assertion that psychiatry must "emerge from its closed-off status as a guild and become an integral part of general medicine accessible to all medical circles," which Shorter calls "among the most portentous words ever uttered in the history of psychiatry" [3,4]. Ironically, the dominance of Kraepelin in the following years contributed to the end of this first biological psychiatry because of the emphasis on prognosis and the longitudinal course of disease rather than identifying the origin of disease. Much of his pessimism was due to the inability of physicians in providing therapeutic cures.

At the time, the only diseases that upheld the biological psychiatry model and

presented with abnormal brain anatomy were dementia, neurosyphilis, and thyroid deficiency; coincidentally, Wagner-Jauregg contributed significantly to the sparse psychiatric knowledge in relation to these diseases. While neurology and the portents of biological psychiatry dominated Germany during the time, the emergence of psychoanalysis can be traced to the lack of therapeutic cures to justify the neo-Kraepelinian "medical model" rather than the Engelian "biopsychosocial model" [5]. Biological psychiatry emphasized the union between neurology and psychiatry, which was necessitated by the desire to legitimize the field of psychiatry and elevate it to a true medical science. It was in this tumultuous period in which Wagner-Jauregg's malarial therapy for neurosyphilis instilled new hope for the neuropsychiatrists and the future of biological psychiatry.

REBIRTH OF BIOLOGICAL PSYCHIATRY: EARLY LIFE AND THE MALARIAL TREATMENT FOR GPI

Wagner-Jauregg originally aspired to study internal medicine. His interest in research, however, was undeniable. During his medical school years, Wagner-Jauregg approached Dr. Solomon Stricker, head of the Institute of General Experimental Pathology, to secure a research assistantship, which would prove to be critical in developing his interest in the pathophysiology of neurological and psychiatric illnesses. In addition, this early exposure would influence Wagner-Jauregg's later works focused on the relationship between abnormal physiologies as the cause of pathology and would firmly establish his belief in biological psychiatry. He was encouraged by his colleagues to apply for the post of an assistant at the First Psychiatry Clinic despite his lack of training in psychiatry. Upon reflection, Wagner-Jauregg later noted in his memoir that "this hasty decision had done neither him nor psychiatry harm" [6].

Wagner-Jauregg's medical training was in the biological sciences and focused on zoology, pathology, and physiology. When he

began his work at the First Psychiatry Clinic at the Asylum of Lower Austria in 1883, Wagner-Jauregg had access to a wide variety of patients suffering from mental illnesses; however, the opportunity to conduct research was limited by small facilities, inadequate resources, and his colleagues' lack of interest in pursuing research [7]. Despite this, Wagner-Jauregg began conducting research on brain anatomy and observing patients in the asylum, later publishing papers on paralysis and spinal cord damage [8]. In 1883, shortly after starting his first psychiatry position at the clinic, he observed a woman being cured of severe psychosis after an attack of erysipelas, an acute bacterial skin infection typically accompanied by a high fever [9]. While he would not formally work on fever therapy until 1917, this early case stuck with Wagner-Jauregg. He began conducting literature searches on the topic and published an article, "The Effect of Feverish Disease on Psychoses," in 1887 [10]. His past experiences and medical training in pathophysiology made him receptive to the idea of a biological cause for some forms of psychosis, and he reasoned that a therapeutic remedy should exist as well.

One form of psychoses was linked to neurosyphilis, which emerges during the tertiary stage of syphilis. Neurosyphilis, also known as the "disease of the century," was a frightening, fatal disease marked by grand delusions, paralysis, and dementia [11]. While neurosyphilis and GPI were used synonymously, the latter referred to the psychoses that emerged in the final stage of syphilis and the former included other symptoms such as spinal cord damage and ataxia [12]. Even more disturbing, the incidence of neurosyphilis increased significantly during the 19th century and was one of the major factors in the increase of the asylum population during this time. Approximately 5 percent to 10 percent of all psychiatric admissions before 1945 were attributed to neurosyphilis; therefore, these individuals comprised a significant group within the asylum population [13]. In addition, the disease predominantly afflicted middle-class males and the symptoms were

obvious: paralysis in conjunction with dementia or psychosis. Once the patient became symptomatic, the end was near. Death, in most cases, was welcomed as the final respite from the horrifying symptoms of neurosyphilis. Consequently, malarial treatment played a role in the emptying of the asylums and provided a viable alternative for a previously hopeless disease. Ironically, it was neurosyphilis that contributed both to the demise of the first biological psychiatry and its resurgence after the discovery of fever therapy. As Shorter notes: "Following the model of neurosyphilis, they [the early biological psychiatrists] were trying to identify specific lesions in patients whose illnesses seemed to be primarily psychiatric rather than neurological" [14]. In the early 20th century, psychological illness referred to any disease manifesting in symptoms of psychosis, mania, or depression, regardless of the causative agent of disease. Despite the fact that neurosyphilis was a side effect, an end stage of an infection caused by an organic agent, it was still considered the primary psychological illness of its time, hence the moniker of the "disease of the century."

Wagner-Jauregg's malarial treatment was not the first of its kind. The technique that is nowadays referred to as fever therapy was noted in the texts of the ancient Greeks as pyrotherapy. Early physicians like Galen, Hippocrates, and Pinel observed that pre-existing illnesses were often cured after the patient had contracted some sort of fever-inducing disease [15,16]. Malaria was not the only disease used in fever therapy. Other diseases that caused intermittent fevers such as typhoid, erysipelas, acute exanthemata, and cholera were also utilized, although not all of them were effective in curing psychosis.

Despite the widespread literature discussing the potentially curative nature of fevers in treating psychoses, intermittent fevers were not intentionally induced in patients until 1876, when psychiatrist Alexander Rosenblum induced fever using malaria, typhoid, and relapsing fever. He reported that 11 of his 22 psychiatric patients were cured after receiving treatment; however, his discovery did not receive widespread atten-

tion because his results were published in an obscure journal [17]. Due to the controversial nature of inducing fever in patients, especially with the rise of conservatism in Russia, Rosenblum omitted this fact in his article and in his correspondence with B. Oks, who was responsible for sharing these observations with the German scientific community. In 1935, at the International Neurological Congress in London, Wagner-Jauregg acknowledged that Rosenblum's experiment was a formative event in his decision to inoculate his patients with GPI with tertian malaria [18]. Despite this, Rosenblum's groundbreaking experiment did not gain widespread recognition in the international field of psychiatry until 1943, when S.J. Zakon translated the original article into English [9]. Zakon and his colleague at Northwestern University, Professor of Psychiatry C.A. Neymann, accompanied the translation with commentary stating that:

Rosenblum (sp) was certainly the first to appreciate the curative effect of fever itself on the psychoses. He understood and reported on the value of malaria and typhoid in the treatment of mental disease. He was the first to inoculate psychotic patients with a febrile disease. Rosenblum (sp), though practically forgotten for over half a century, must be acknowledged as the true pioneer in this field [19].

This rousing statement in support of Rosenblum as the "true pioneer" of fever therapy for the treatment of psychosis was further substantiated by a 1944 editorial in the *Journal of the American Medical Association* upholding this claim [20]. However, Professor of Neurology Walter L. Bruetsch published his own commentary with a translation of Wagner-Jauregg's 1935 manuscript on the *History of the Malaria Treatment of General Paresis*, delineating the reason as to why Wagner-Jauregg deserved acclaim for his malarial treatment for neurosyphilis [21]. Wagner-Jauregg himself even mentioned

that Rosenblum did not induce fever in his patients with the intent of curing mental illness, but rather to study "the transmissibility of recurrent fever to human beings" [23]. Bruetsch goes further and establishes:

It is true that Rosenblum inoculated a group of mental patients with relapsing fever, but he did not continue this mode of treatment and there was no fever therapy, as we know it today, until Wagner-Jauregg ... The merit of Wagner-Jauregg was that he soon realized the beneficial effect of fever was restricted to cases of dementia paralytica. For over 20 years he then focused all his efforts on this type of mental illness, using tuberculin, typhoid vaccines and even streptococci of erysipelas to produce fever [21].

As early as 1887, Wagner-Jauregg became convinced that infectious diseases could be used to cure mentally ill patients based on his personal observations and a review of relevant scientific literature. According to Wagner-Jauregg biographer Magda Whitrow, he "thought that the fact that the effect of fever on psychoses had been documented, challenged the physician to seize the chance of recovery that nature sometimes produced accidentally" [9]. He began a preliminary experiment in which he inoculated streptococci from erysipelas into several patients and was disheartened by the negative results [23]. A key event that allowed Wagner-Jauregg to continue his experiments was Robert Koch's discovery of tuberculin, an extract from the bacilli, which was originally used as a curative agent for tuberculosis. Wagner-Jauregg recognized that tuberculin was a means of artificially inducing fever in patients, a fact that he used to successfully cure two of his patients of their psychosis [24]. However, following the Siege cycle of therapeutic agents, dangers surrounding the use of tuberculin emerged, among them reports of death [25]. Reluctant to pursue this potentially promising applica-

tion of tuberculin, Wagner-Jauregg discontinued his experimentation and for the next few years dedicated himself to advancing his professional career and was appointed a chair of psychiatry at the University of Vienna and Director of the First Psychiatric Clinic at the Asylum of Lower Austria, where he had first started his work in psychiatry. Wagner-Jauregg noticed that his experiments with tuberculin were especially effective on patients with GPI, and between 1900 to 1901, he carried out a comparative study between 69 paretics treated with tuberculin and 69 untreated paretics. He discovered that the number of patients with remission from the tuberculin group was higher than those in the control group. Interestingly, the treatment was most effective for patients who had the strongest reaction to the drug [9].

The end of World War I provided him a serendipitous opportunity to carry out his hypothesis about the effects of fever therapy on curing psychosis in general paretics. The failure of Salvarsan and mercury in treating patients with GPI made his subsequent discovery of malaria therapy even more impressive and important to the scientific community. In 1917, Wagner-Jauregg received word from Dr. Alfred Fuchs that a soldier was suffering from tertian malaria, and he was asked if the patient should be administered quinine, which was the prevalent therapeutic for malaria during the time [23]. Wagner-Jauregg seized the opportunity and asked for a sample of the soldier's blood, which he subsequently injected into nine of his GPI patients. Of the nine, one passed away, two were sent to asylums, and six demonstrated considerable improvement; however, four of these last six later suffered from relapses. Nonetheless, the two remaining patients made full recoveries and were able to return to their jobs and homes. Wagner-Jauregg's therapeutic strategy for treating the patients was not as cold-hearted as some of his critics suggested. After 7 to 12 days of the fever, patients were administered quinine bisphosphate and Neosalvarsan, which were malaria and syphilis drugs, respectively [22]. Encouraged by his results,

he continued inoculating patients with tertian malaria, obtaining the plasmodium from blood of malaria-stricken soldiers from a nearby hospital. By late 1921, Wagner-Jauregg published an article reporting that more than 200 patients had been treated with malaria and 50 had recovered sufficiently to resume work [26]. He demonstrated that malaria therapy could be used successfully to treat syphilitics before the onset of paralysis; however, this practice was not universally accepted. Despite this, Wagner-Jauregg's work with malaria therapy on patients suffering from GPI would not only result in the first Nobel Prize in psychiatry but would also break through the impending sense of doom that hung over the field of psychiatry.

In 1927, Wagner-Jauregg was the first psychiatrist awarded a Nobel Prize in Physiology or Medicine for his malarial treatment of neurosyphilis. Wagner's Nobel Lecture remains one of a handful of his works that have been translated into English from German, reflecting his relative anonymity in English-speaking countries. Germany and Austria were the centers of scientific research and discovery during the late 19th and early 20th century, yielding giants in the history of science and medicine such as Robert Koch, Paul Ehrlich, and Sigmund Freud; however, Wagner-Jauregg is often lost among the sea of names. Ironically, Wagner-Jauregg was the pre-eminent psychiatrist in Austria during his lifetime and held the highly prestigious title as Chief and Director of the First Asylum at the University of Vienna. His lectures were well attended and lauded for their specificity and emphasis on using individual cases to support psychiatric theory. He inspired loyalty among his assistants, such as Edward Stransky, Emil Raimann, and Helen Deutsch, and was tolerant of those with scientific ideas that were different from his own, such as Freud and psychoanalysis. In addition to his work on the malaria therapy for the treatment of GPI, Wagner-Jauregg also contributed to the use of iodine in salt to prevent the growth of goiters. In Austria, he was a giant among his peers and published numer-

ous scientific works ranging from cretinism in the thyroid to later works on hereditary and eugenics [27].

In particular, the importance of his discovery of the use of malaria for the treatment of psychosis undermined the “therapeutic nihilism” that was being associated with Kraepelin and the neuropsychiatrists. His discovery demonstrated that psychosis could potentially have a natural cause, and Wagner-Jauregg predicted a rosy future for the field of psychiatry, urging his fellow scientists to search for treatments for psychiatric disorders by identifying the organic root of the problem. In his Nobel Lecture, Wagner-Jauregg emphasized that although the explanatory mechanism for malariotherapy was unknown, it should be classified as a specific rather than a non-specific treatment [28]. This distinction was important because it promoted the idea that induced fever had a direct, specific action on the organic root of GPI rather than a universal, non-specific course. The tenet of biological psychiatry depended on the demonstration that treatments were specific for the disease in question because the illness was caused by a specific abnormality in the brain anatomy or neurology. Additionally, despite the popularity of psychoanalysis in the United States, malariotherapy was accepted as the standard treatment for patients suffering from GPI. Wagner-Jauregg was concerned about the different methods of inducing malaria because he believed the optimal method was to inoculate the plasmodium subcutaneously in the back of the patient; however, in the United States and Britain, psychiatrists used *Anopheles* mosquitoes carrying the plasmodium to bite their GPI patients [28]. He was critical of this new method because it could lead to a public health disaster if the infected mosquitoes escaped.

The international response to his malaria treatment for treating neurosyphilis was stunning, and scientists and psychiatrists rushed to replicate his results. A review of the literature during the time revealed that out of 35 studies conducted by 1926 researchers, the results were as follows: 27.5 percent full remission, 26.5 percent partial

remission, and 46 percent deaths or no change [29]. Even more significantly, the number of articles published on malaria therapy escalated from fewer than five per year before 1927 to a peak of 160 articles in 1929. There was a gradual decline in the number of articles and a final plateau of around 30 articles per year in 1942 [30]. The subsequent plateau in the number of articles occurred due to John Mahoney’s paper in 1943 describing the success of penicillin in treating syphilis [31]. In America, the response to Wagner-Jauregg’s treatment was abated until after he was awarded the Nobel Prize in 1927. There were a few exceptions to this, however, and the first case in which malaria was inoculated in a patient took place in the United States 1922 at the St. Elizabeth’s Hospital in Washington, D.C. by Watson Eldridge [32]. Paul O’Leary in Rochester, Minnesota, also conducted one of the first longitudinal cases using Wagner-Jauregg’s malaria therapy between 1924 and 1926. O’Leary reported that:

The evidence still supports the assertion that ... malarial inoculation is beneficial if the general condition of the patient will permit him to tolerate it. ... Experience with the fever treatment of Wagner von Jauregg during the last three years in 278 cases has definitely proved that it is the most valuable method of treatment suggested for paretic parenchymatous neurosyphilis [33].

However, other American psychiatrists were not as forthcoming in crediting Wagner-Jauregg for his discovery. In a 1944 article written by Yale psychiatrists Louis Cohen and Virginia Hale, the pair proposed an alternative technique — intravenous induction of fever using an attenuated form of typhoid — that “appears to be therapeutically effective in producing fever in the paretic who has become malaria resistant” and failed to mention or reference Wagner-Jauregg in the entire article [34,35]. Despite the impact of Wagner-Jauregg’s treatment,

he had to wait 10 years until the retirement of B. Gadelius, a Swedish professor of psychiatry on the Nobel Prize Committee who refused to award the prize to “a physician who injected malaria into a paralytic, because he was in his eyes a criminal” [36]. These portentous words soon ring true in the eyes of the public.

FALL FROM GRACE: DISAPPEARANCE FROM PUBLIC MEMORY

A potential explanation for Wagner-Jauregg’s disappearance in modern texts and in the field of psychiatry is the emergence of bioethics in the post-World War II era. Although there were already some ethical concerns within the psychiatric community in regard to the use of malarial therapy for the treatment of neurosyphilis, the formalization of the field of bioethics helped cement Wagner-Jauregg’s fall from public memory. Popular sentiment against the Nazis was widespread and escalated during the subsequent Nuremberg Trials, or the Doctor’s Trial, when the atrocities of 24 Nazi physicians in concentration camps were revealed. One such experiment was carried out on a Polish priest in the Dachau concentration camp and consisted of the intentional infection of malaria in order to test anti-malarial treatments [37]. The international outcry against these experiments led to the development of the Nuremberg Code, which highlighted the four principles of the field of bioethics: beneficence, non-maleficence, justice, and autonomy. After the exposure of the Tuskegee Syphilis Study, in which the U.S. Public Health Service studied the progression of syphilis in impoverished African-American men under the auspices of providing free health care, the international medical community realized the need for clear and stringent research regulations, and the Belmont Report was conceived. This document sought to outline and protect the rights of human research subjects and drastically limited the types of research that could be conducted. Bioethics sought to engage scientists and physicians by imbuing a

sense of professional morality in their everyday practices, and therefore, the strict but necessary standards outlined by this new discipline reflected a shift in social attitudes toward these professionals. As both a physician and a scientist, Julius Wagner-Jauregg was an archetypal victim for the emerging public consciousness, especially due to his ethically ambiguous experimentation with fever therapy on non-consenting patients.

More recent historiography relating to psychiatric treatments provides insight on why malarial treatment has been erased from our memories. Historian Andrew Scull frames malaria therapy as breeding “colonies of malarial mosquitoes with which to infect tertiary syphilitics and so burn the offending parasites from their brains” and has disparaging comments for other early therapeutic psychiatric treatments, arguing that they have been passed over in an “embarrassed silence” [38]. However, despite Scull’s strong opinion regarding somatic treatments for psychiatry, particularly Wagner-Jauregg’s fever therapy that “seems more appropriate for moral censure than universal acclamation,” another explanation for the disappearance of this treatment may not only be the decline in patients with general paresis but the shift in psychiatry from somatic treatments — with the exception of electroconvulsive therapy — to psychopharmacological and psychological treatments [39]. Additionally, neurosyphilis was unlike other psychiatric illnesses in that it was contagious and organic in nature — the causative agent being the syphilis spirochete.

Wagner-Jauregg’s personal beliefs may have overshadowed his great contributions to the field of psychiatry. In the past years, new information emerged that verified his close tie with the Nazi Party. Although Wagner-Jauregg’s first wife was Jewish, he was an anti-Semitic who dabbled in eugenics research toward the end of his life. After Anschluss, Wagner-Jauregg became a staunch supporter of the Nazi movement, and records obtained from the Nazi Party indicate that he applied for membership twice in the final years of his life, the second time before the

passage of the sterilization laws. The official paper of the Nazi Party, *Völkischer Beobachter*, published an obituary upon his death in 1940 in which Wagner-Jauregg was credited for his scientific work and that “[w]ithout his genetics the stock of ideas constituting the national socialist view of society is no longer conceivable” [40]. Despite the documented evidence that demonstrated that the aging Wagner-Jauregg was in favor of the Nazi party, Whitrow draws upon testimonials of Wagner-Jauregg’s son and E. Stransky, who was Wagner-Jauregg’s most prized assistant, which claimed that “although Wagner-Jauregg was in favor of German nationalism, and at first supported National Socialism, when he saw how things were developing he did not withhold his criticism, particularly of the idea of disposing of the mentally ill and feeble” [41]. But the indisputable fact gleaned from Nazi records that he was sympathetic to the socialist agenda would mar his public figure and his legacy as a psychiatrist who contributed to humanity. The combination of the new bioethics movement and his association with the Nazi party, especially in light of the Nuremberg Trials for war crimes, highlighted new social attitudes that were unresponsive of Wagner-Jauregg’s malariotherapy and political views. Thus, the negative perception of those associated with the Nazi party sullied Wagner-Jauregg’s image and popularity. Despite his personal shortcomings, his contributions to the field of biological psychiatry extended beyond his immediate environment.

ENDURING LEGACY: IMPACT OF MALARIAL TREATMENT ON THE FUTURE OF PSYCHIATRY

The demonstration that a psychiatric disease could be cured using a combination of induced fever from inoculated malaria, quinine, and anti-syphilitic preparations such as Salvarsan provided psychiatry with a degree of legitimacy among the other medical specialties. However ethically disturbing the concept of intentionally infecting sick patients with a known infectious

pathogen, Wagner-Jauregg’s method was revolutionary and important for the development and rise of psychopharmacology [42]. It was one of the few methods that allowed asylum inhabitants to recover sufficiently to return to their normal lives as functioning individuals, thus foreshadowing the effect of chlorpromazine and the early psychotropic drugs in emptying the asylums. More importantly, it heralded the return of psychiatry to a true medical specialty because it demonstrated the biological (in this case, the nervous system) origins of psychosis and how it could be treated. Although Wagner-Jauregg’s name is not as universal as Freud’s in our modern consciousness, his method was applied successfully throughout the world, until as recently as the middle of the 20th century, to treat patients with neurosyphilis and even asymptomatic syphilitics who had a positive Wasserman reaction, which was the first definitive test for syphilis because it was a serological test that could identify the presence of the syphilis spirochete [9].

A key figure in Wagner-Jauregg’s malarial treatment for neurosyphilis was Paul Ehrlich, a German Nobel Laureate who discovered Salvarsan, hailed as the magic bullet for syphilis, and who also recognized the potential of methylene blue for the treatment of malaria. The development of these two therapeutic agents allowed for Wagner-Jauregg’s approach of treating the patient with anti-syphilitics in conjunction with the inoculation of malaria, and subsequently the use of quinine or methylene blue to cure malarial symptoms. In particular, derivatives of methylene blue were the precursors of the 1950 discovery of phenothiazines by the French company Rhone Poulenc and scientists J. Delay and P. Deniker, who had published an article in 1954 about the treatment of a diabetic general parietic with malariotherapy [43]. Thus, the tangled web between malaria, syphilis, methylene blue, and quinine played a major role in the discovery of the first psychotropic drugs [42]. Wagner-Jauregg’s fever treatment for GPI was also an ideological victory for the biological psychiatrists because it broke through the existing therapeu-

tic nihilism of the Kraepelinian tradition [44]. Therefore, the impact of Wagner-Jauregg's work on malariotherapy for general paresis was not only limited to immediate results during his lifetime in emptying the asylums, but also had an impact on the current hegemony of biological psychiatry.

CONCLUSIONS

While Julius Wagner-Jauregg's development of the malaria therapy for the treatment of GPI in patients with neurosyphilis had a significant impact on the field of biological psychiatry and the psychopharmacology movement, he remains a forgotten and often ostracized figure in the history of psychiatry. Malariotherapy, in conjunction with quinine and Neosalvarsan, saved the lives of thousands of patients who were suffering from debilitating paralysis, dementia, and delusions; however, the ethical ambiguity related to intentional inoculation of malaria was too troubling for an international community that was still recovering from the knowledge of the atrocities committed by the Nazis during World War II. In addition, Wagner-Jauregg's political views and known affiliation with the Nazi Party further tarnished his legacy. The introduction of penicillin and the evolution of the neurosyphilis bacterium served to make Wagner-Jauregg and malaria therapy obsolete. Nonetheless, it would be unwise to underestimate the significance of his discovery on the course of psychiatry. The malaria treatment was instrumental in breaking the therapeutic nihilism that plagued the neo-Kraepelinians and contributed to the current hegemony of biological psychiatry. Thus, despite his personal failings as an individual, the legacy of Julius Wagner-Jauregg and the impact of his work on the field of psychiatry must not be overlooked.

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