CHEMIST AT WAR: WORLD WAR II ROLES OF JONAS KAMLET, CONSULTING CHEMIST

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Introduction

The role of chemists in our daily lives probably deserves a greater consideration and reflection than it commonly receives. Typically we recognize that chemists are involved in industry, academe, and government service. But it seems appropriate to reflect on the activities of chemists during times of political crises, such as wartime. Here we consider the World War II roles of Jonas Kamlet with the aid of the extensive information available in his personal and professional papers.

Previous publications (1, 2) described the creation and development of the Kamlet Laboratories, a small but singularly active consulting firm. It was founded by Jonas Kamlet (1914-1960) and his wife Edna (1915-2011). The University of South Florida was able to obtain the entire collection of the files of the Kamlet Laboratory (3), owing to the generosity of the late Edna Yadven Kamlet Rogers, who provided funds for transport of the files to USF and a sum to support the archiving of the papers in the USF Tampa campus library (1).

When the United States entered World War II late in 1941, Kamlet Laboratories in New York City was in the first year of development. The first couple of years were run at a net deficit (2), so it was fortunate that Jonas Kamlet had been granted a deferment.

The advent of World War II brought major changes into the lives of so many in the United States, including professional chemists. They responded in a variety of ways. Many chemists were associated with the now-famous Manhattan Project that led to the development of the atomic bomb (4).

At the Pennsylvania State College, for example, Dr. Frank Whitmore, college dean and an organic chemist, managed to obtain deferments for chemistry graduate students. His view was stated firmly in a letter to the college president, Ralph D. Hetzel (5):

> Personally, I shall fight to the last ditch to keep every chemist, chemical engineer, and physicist either actual or in training, where he can do the most good for the national effort. He must be used in technical work and nowhere else.

By the end of World War II, Dr. Whitmore, as chairman of The United States War Manpower Commission on Chemists and Chemical Engineers, had written more than 7,000 letters to draft boards requesting draft deferments for technical workers (5).

Though Kamlet was evidently an able-bodied person, married, but with no children, he was not drafted by the Selective Service Local Board 15 in New York City. He provided good reasons, that all of his work pertained directly to the war effort or to the maintenance of public health (6). He was on the National Roster of Scientific Personnel from its very inception. He wrote “I am also the head of the New York chemical research laboratory of the Miles Laboratories,” and he added (6)

> I am under contract to the Miles Laboratories, Inc., in whose behalf we have developed and are in the process of developing, a number of processes and products directly pertaining to public health, and in some instances, to the War Effort. Among these are the following: aids in medical diagnosis, synthesis of vitamins, derivation of vitamin-rich food concentrates by the microbiological utilization of industrial wastes, syntheses of anti-malarials, manufacture of tablets for the sterilization of contaminated water, manufacture and assembly of the ingredients of Army ration kits.

Aids in Medical Diagnosis

As noted previously (1, 7, 8), there was a major need for an analysis of glucose for monitoring its concentration in patients afflicted with diabetes then and now. Kamlet devised a method (8), but he needed a means of stirring the reactants placed in the blood or serum sample. A collaboration with a Miles Laboratories expert on effervescence, Maurice Treneer (9), led to a product called Clinitest, a pill which both delivered reagents and stirred them into the sample. Clinitest could be used to measure glucose colorimetrically. Moreover the task could be done in a doctor's office, and the results obtained in a short time (7, 9). The product was considered valuable for over forty years, before the development of the Clinistix system by Alfred and Helen Free at Miles (7, 9).

A second important diagnostic aid was the invention of a tablet that added to urine would detect acetone or acetoacetic acid. A color produced could be used to detect the constituents qualitatively and, using Beer's Law, quantitatively. The kit had a high degree of accuracy and could be used in a physician's office without specialized training or laboratory equipment (8). It could also have been used to screen *draftees* who may have been borderline diabetics. We found no proof that draftees were screened by a Kamlet method, but there was no superior method available. Unfortunately for the potential financial benefit of Miles and Kamlet Laboratories, Acetone Clinitest was not developed by Miles Laboratories, and a related product was successfully developed by Denver firm unknown to us (10).

Synthesis of Vitamins

Miles Laboratories' history includes a notable tendency to identify an human need, then to work to meet that need. In the early 1940s, it was malnutrition related to vitamin deficiencies. Accordingly, Miles personnel created vitamin supplements, and Walter Compton, M.D., actively encouraged this activity (9). Kamlet, possibly owing to his close association with Miles Laboratories, was interested in the synthesis of vitamins, and three examples of his interest and efforts are provided here.

One is his development of a synthesis for riboflavin, a substance that had been identified as identical with Vitamin B2. The synthesis eliminated steps from the contemporary synthesis, and it did not require the use of the pentose sugar D-ribose, which was not only difficult to obtain but also expensive (11).

Second, Kamlet mentioned the considerable amount of work (12) that had been done with the incorporation of Vitamin D and its precursors in soap for the purpose of compensating for the loss of irradiated ergosterol from the skin on washing. Ergosterol, (a precursor to Vitamin D), if absorbed in the diet can be transmitted to the skin where it is irradiated by ultraviolet light of the sun and is reabsorbed by the body as an anti-rachitic vitamin. Unfortunately, washing the skin results in a relatively great loss of ergosterol. But Kamlet devised a sound basis for incorporating Vitamin D into soap. This seemed useful because since the start of World War II, the Jergens-Woodbury Soap Company stopped producing soap containing Vitamin D because of the difficulty in obtaining ample supplies of this vitamin. However, Kamlet felt that the so-called yeast fat fraction (a source of the yeast *Torula utilis*) was ideally suited for vitaminized soap. He was looking forward to finding a ready market for some or all of the yeast fat fraction, even without recovery of ergosterol (12).

Third, Kamlet was interested in producing vitamin-rich food concentrates by microbiological utilization of paper mill wastes. It was later reported that in 1942 Kamlet helped develop a process for recovering from such wastes what had been a costly substance used to produce vitamin B2 riboflavin (13).

This interest became a joint project between Miles Laboratories (of Elkhart, Indiana) and International Paper Company. Kamlet was concerned (12, 13) with a patent application on deriving value from sulfite waste liquor. Sulfite solutions are used to remove lignin from wood pulp, leaving behind separated cellulose and a problem of disposing of the remaining sulfite liquor, which smells and would remove oxygen if disposed of in an aqueous environment. But sulfite liquor also contains wood sugars. Kamlet believed that the yeast *Torula utilis* could be brought up to the potency needed for use as a base of multi-vitamin tablets. His modification was to add crude riboflavin (Vitamin B2) to the fermenting medium

because unlike most yeasts, *Torula* was able to assimilate riboflavin from a riboflavin-enhanced medium, perhaps as much as 120 μg of riboflavin per gram of dry yeast. He also noted a precedent, namely that Anheuser-Busch personnel obtained *Torula* concentrates amounting to 7000 μg/gram of yeast. He was confident of his ability to do equally well (12).

He reported two fermentations with the addition of 50 g of synthetic riboflavin per liter of sulfite liquor. The vitamin concentrate was derived as usual (12). The resulting concentrate gave a very strong qualitative color reaction for riboflavin and seemed to be much richer in this vitamin than concentrates derived from unfortified sulfite liquor. He forwarded about ten grams of the resulting vitamin concentrate to Miles Laboratories and requested analysis for riboflavin and thiamin, which their personnel were well equipped to do (9, 13).

Tablets for the Sterilization of Contaminated Water

Kamlet thought Halazone tablets for water sterilization would satisfy a need of the U.S. Army. He had "previously done quite a bit of work on these tablets" and the files were said to be among the files of a Miles secretary (9). In addition to Halazone (*p*-dichlorosulfonamidobenzoic acid), the tablets contained sodium bicarbonate, sodium chloride and sodium acid phosphate. The staff at Miles Laboratories had given insignificant attention to the possibilities of Halazone, a compound already known to have disinfectant properties, until the advent of the K-Ration and related projects (13). (K-Rations were individual nutritional packages issued to some mobile combatants, and some rations included Halazone tablets.) Kamlet noted that there were numerous samples of Halazone tablets in the closet of Dr. Conklin's office. He knew of the tablets because he would frequently would provide samples of compounds of interest, either as powders or as tablets.

The information concerning the location in an office closet may seem odd at first glance, and some background information is helpful. First of all, Kamlet had been retained by Miles Laboratories (9), so he would have visited several times, and he knew the organization of the facilities. Secondly, owing to manpower shortages during World War II, laboratory management went to assist in the war effort. Conklin, a popular local physician, had been asked to assume part-time administrative responsibilities at Miles Laboratories (9), so he may not have been familiar with everything in his Miles office.

Kamlet concluded his letter by noting that two firms were making Halazone tablets: Abbott laboratories and a smaller, unnamed firm (13). A Dr. Milligan evidently had some misgivings about the soundness of the physiological principles involved, so Kamlet reviewed a patent (2,322,689) to provide background about current practice by the U.S. Navy (14).

Potable water is the goal of treating water. One requirement of such water is that it be hypotonic, diffusible into body tissues rather than drawing water from them. Kamlet reviewed the properties of a 1 *M* solution of sodium citrate (based on an Indian publication that he had ordered), which would give a calculated 1.21 moles of ions. Then he showed the results of calculations that seawater treated with sodium citrate could be made isotonic, but the potable water should be "slightly acid (pH 5.8)" to avoid a flat taste.

An employee of the Sunshine Mining Company, (Alexander Goetz) invented a process for producing potable water from non-potable saline water (15). He considered the taste aspect: A slight acidity would enhance the taste and would counteract a tendency toward alkalosis when much of the composition was ingested.

Kamlet proposed adding a small amount of solid organic acid (e.g., citric) by using the amount of silver citrate that would give a liter of potable water (14). Citric acid alone tended to react with the other component (bicarbonate) on prolonged standing and the tablets would crumble. Also, he noted concentration of citrate ion would be exceedingly low, considering that the values of successive citric acid dissociation constants K_1:K_2:K_3 would have ratios of $1{:}10^{-5}{:}10^{-10}$. Use of silver citrate effectively enhanced the concentration of citrate ion, but the treated water needed to be filtered to remove the silver chloride. The Goetz procedure was what the U.S. Navy currently used, but Kamlet noted that it did not diminish sodium ion concentrations. And Kamlet wanted to pursue the matter further (14).

Manufacture and Assembly of the Ingredients of Army Ration Kits

In April 1943, Kamlet brought to the attention of Miles management some opportunities he identified as a result of the discontinuation of K Rations (16, 17). The War Production Board (WPB) had announced that as of the end of March [1943], the manufacture of Ration K was to be discontinued. This would free up some Miles personnel and tablet machines for other work. The U.S.

armed forces would need a different supply of flavorants. If vanilla flavoring were produced in tablet form, it would reduce shipping weight and space by 90% compared to extract solutions. In addition, there would be a gain of accuracy in the concentration of the active component, an accuracy not easily attained by measuring a volume. Lack of such accuracy was a problem of contemporary medicine.

He further noted that such a product was already produced by a company in New York City. The product consisted of vanillin, coumarin, and an effervescent base with one five-grain pill equivalent to an "old fashioned teaspoon measure." As noted elsewhere, Miles, manufacturer of Alka-Seltzer, a well-known remedy for upset stomach (and hangover), had considerable experience with effervescent materials (9).

Kamlet wrote on April 1, 1943 (16):

> The Van Amerigen-Haebler Company, 315 Fourth avenue [NYC] have developed such a tablet and are selling it to the Army … We could make such a tablet with no difficulty at all. I am getting samples of this tablet from Van Amerigen and Haebler and will forward them to you as soon as they arrive.

On April 23, 1943, he had obtained the samples and had prepared his own tablets with formulation that differed in a significant respect: it was measured by weight, rather by volume. It, too, contained an effervescent component, a feature Miles Laboratories would have been very comfortable with (9). He was sending pills that he had prepared from the samples, and his letter concluded with the observation that there was a large market that could be met by using the equipment at Miles (17).

He also noted that a great savings could be passed on to the consumer and that the patriotic aspect involved in saving large amounts of glycerine and alcohol would appeal to the civilian market (17).

Syntheses of Sulfonamides

The discovery of sulfonamides in the early 1930s introduced the first and only effective antibiotic prior to penicillin (18). One compound became highly popular, and the unwise application led to the "sulfa craze" at a time when no testing was required. "Elixir Sulfanilamide" caused deaths of over 100 persons because the material was provided as a solution of ethylene glycol (a toxic liquid used as anti-freeze in car radiators), rather than ethanol, and no toxicity tests were made. The disaster resulted in the passage of the U.S. Federal Food, Drug, and Cosmetic Act in 1938 (19).

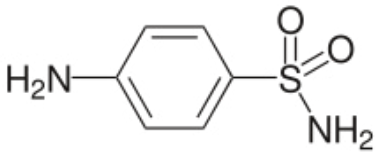

Figure 1*. Structure of sulfanilamide*

Jonas Kamlet was 24 years old when he was awarded his first patent (20) that described a novel synthesis of sulfanilamide (Figure 1). This was surely a miracle drug for its time including some remarkable cures obtained with its use in the treatment of gonorrhea. He reported obtaining the desired product "in an exceptionally pure state and in quantitative yield by submitting benzamide-*p*-sulphonamide to a Hoffman reaction" (20). Sulfanilamide was widely used in field first aid kits during the war, so Kamlet had done work potentially useful in World War II even before its outset. (There is no evidence, though, that his patent was used to produce wartime sulfanilamide.)

And Afterwards—Post August 1945

Jonas Kamlet expanded his consultancies (1), and managed to cover most of the United States and to become involved with a number of foreign countries. Unfortunately he died in the prime of his life and career. He was returning from Chicago after a consulting trip as a passenger on a United DC-8 jet that collided with a Trans World Airlines piston-engine Super Constellation over Staten Island on Friday December 16, 1960 (21). All 128 passengers on the two airplanes and six persons on the ground were killed. His widow, Edna Yadven Kamlet, continued on activities of the firm for an additional twenty years before her retirement (1).

The contributions of chemists during World War II were major ones, but those of Jonas Kamlet during this time provide a useful example of the contribution an individual chemist can make even in stressful, demanding times.

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1.. D. F. Martin and B. B. Martin, "Jonas Kamlet (1914-1960) Chemist/Entrepreneur," *Florida Scientist*, **2007**, *70*, 40-44.

2. D. F. Martin and K. Bidani, "Deficit and Surplus Data for the Kamlet Laboratories, 1941-1955," *Bull. Hist. Chem.*, **2012,** *37*, 96-101.

3. A. Huse, Guide to the Jonas and Edna Kamlet/Kamlet Laboratories Records, 1913-1989, Special Collections, Tampa Library, University of South Florida. http://digital.lib.usf.edu/content/SF/S0/03/18/67/00001/U29-00049-K27.pdf (accessed Nov. 7, 2019). The letters written by Dr. Kamlet and described in the present publication are available in the Kamlet papers, housed in the USF Special Collections of the USF Tampa Campus Library.

4. M. B. Stoff, J. F. Fanton, and R. H. Williams, Eds., *The Manhattan Project: A documentary Introduction to the Atomic Age*, Temple University Press, Philadelphia, 1991.

5. K. A. Yarmey, *Labors and Legacies: The Chemists of Penn State, 1855-1947,* The Pennsylvania State University, University Park. 2006, p 158, letter dated May 18, 1942. Whitmore wrote in the same letter:

   > I maintain that any individual who willingly leaves chemistry, chemical engineering, or physics to enter the armed forces for non-technical work is merely a complicated kind of traitor even though he may be posing as a patriot.

6. Kamlet to Selective Service Local Board No 15, New York City, May 15, 1944.

7. D. F. Martin and B. A. Reiger, "Kamlet Laboratories and Clinitest: Idea to Product," *Technology and Innovation,* **2013**, *15*, 81-86.

8. J. Kamlet, "Diagnostic Composition and Method," US Patent 2,283,262, issued May 19, 1942; assigned to Miles Laboratories, Elkhart, Ind.

9. W. C. Cray, *Miles 1884-1984: A Centennial History,* Prentice Hall, Englewood Cliffs, NJ, 1984.

10. Kamlet to John Gawley, Miles Laboratory, Oct. 18, 1943. The letter was written in response to a query made by Gawley. The development of a similar product by a rival firm was one of over 23 instances when Kamlet had been "scooped," i.e., ideas that for one reason or another did not ripen to proper fruition. Kamlet noted at the end of his letter:

    > The above information is for your own edification. It really should not concern us very much, since every Research organization has a whole morgue of ideas and even completed projects on which they were "scooped." It's all in the Game. It's the Future that concerns us, not the past. Some examples are listed in Table 1.

11. J. Kamlet, "Synthesis of Riboflavin and Intermediates Therefor," US Patent 2,406,774, issued Sept. 3, 1946; assigned to Miles Laboratories.

12. Kamlet to Raymond L. Conklin, Apr. 1, 1943, File XXII, Joint Project with Ontario Paper Co. Re: Utilization of Yeast Fat Fraction.

13. Kamlet to Conklin, Miles Laboratories, Mar. 17, 1944, File K-XIII, Joint Project with the International Paper Company. The procedure involved "dissolving torula in dil. NaOH, precipitating protein with HCl at pH 4.5, filtering off the protein, evaporating the filtrate under reduced pressure and drying overnight at 70°C."

14. J. Kamlet to Conklin and Morris P. Milligan, Miles Laboratories, July 12, 1943, File XLVII, Rendering Seawater Potable. Citric acid can exist as a monohydrate which is slightly deliquescent in moist air, and this property could make it difficult to get an exact amount of pure citric acid. Using crystalline silver citrate would obviate the hydrate, deliquescent problem.

15. A. Goetz, "Chemical Process for Production of Potable Water from Nonpotable Saline Water," US Patent 2,322,689, issued June 22, 1943; assigned to Sunshine Mining Company of Yakima, Washington.

16. Kamlet to Conklin, Miles Laboratories, Apr. 1, 1943, "Vanilla Flavoring Tablets."

17. Kamlet to Conklin, Miles Laboratories, Apr. 23, 1943, "Vanilla Flavoring Tablets."

18. K. Gould, "Antibiotics: from Prehistory to the Present Day," *J. Antimicrobial Chemotherapy*, **2016**, *71(3)*, 572–575.

19. C. Ballentine, "Sulfanilamide Disaster," *FDA Consumer Magazine*, June 1981, available at https://www.fda.gov/about-fda/histories-product-regulation/sulfanilamide-disaster (accessed Nov. 7, 2019). J. Epstein, "Drugs That Shaped the FDA: From Elixir Sulfanilamide to Thalidomide," *Bull. Hist. Chem.*, **2018**, *43(2)*, 102-110.

20. J. Kamlet, "Manufacture of Sulphanilamide," US Patent 2,111,913, issued Mar. 22, 1938.

21. "Biographical Sketches of Victims Aboard Two Airliners That Crashed Here," *New York Times*, Dec. 17, 1960, p 12.

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