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Lead Poisoning

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UNIVERSITY OF MINNESOTA HOSPITALS
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I. LEAD POISONING WITH SPECIAL REFERENCE TO PORPHYRIN METABOLISM

Fouad A. Bashour, M.D.

Lead, because of its many uses has long been a potential hazard in our modern civilization. Its beneficial uses were known to the ancients and to the Romans in the construction of their water-supply system. Its harmful effects received special emphasis in a letter from Benjamin Franklin to Cadwallader Evans in 1768[1] concerning the dry-belly ache among punch drinkers: "I have long been of opinion, that that distemper proceeds always from a metallic cause only; observing that it affects among tradesmen, those that use lead, however different their trades; as glaziers, letter-founders, plumbers, potters, white-lead makers and painters....".

Interest in the study of the clinical manifestations of lead poisoning was aroused by the increased use of lead, especially in the distillation of liquors in Europe. This culminated in the treatise on lead poisoning written by Tanquerel de Planches in France in 1839[2].

The use of this metal is, at present, common in industry and hazardous to the workers exposed to it. In the state of Minnesota, 280,000 workers are regularly employed in industry, and 5.1% of these workers are handling lead compounds in lead and battery plants.

In spite of the adequate medical safeguards including ventilation, frequent medical check-ups, etc., lead intoxication is still prevalent due probably to its cumulative effect which explains the insidious development of the disease.[4]

This report deals primarily with the disturbance in porphyrin metabolism encountered in the study of workers exposed to lead dust or fumes. The first group includes 44 men working in a lead plant; the second 13 men working in a battery plant. In addition one woman was studied in this hospital with signs of chronic lead poisoning. Urinary porphyrin abnormality has already been described as the first manifestation of lead poisoning.[5a,b]

(A) Clinical Manifestations

The clinical manifestations of lead intoxication have been fully described by Tanquerel de Planches, Aub et al,[6] Cantarow et al,[3] and experimentally established. In the following some of the common manifestations that are likely to be observed will be considered.

When lead is absorbed, either through the respiratory or the gastro-intestinal tract, it comes in contact with every organ of the body by the way of the circulatory system giving a complex clinical picture. However, the lack of pathological changes[7] observed at post-mortem in lead poisoning should be emphasized. This disparity between the clinical signs and symptoms and the morphologic changes is well known and it is clear that the anatomic diagnosis of lead poisoning is difficult. The common clinical findings are:

1) Pallor of the skin - this ashen color of the skin is seen in most of the workers exposed to lead and the exact mechanism is not understood, but certain factors such as the constrictive action of lead on the capillaries of the skin and the presence of anemia are chiefly responsible. In some cases a yellowish tinge is due to a mild hyperbilirubinemia.[3]

2) Lead line - or Burton's line, was first described by Grisolle in 1835 and until recently has been considered to be diagnostic of lead poisoning. This line consists of fine granular deposit of lead sulfide precipitated in the tissues[6] and is easily seen with a hand lens. Its presence indicates an increased absorption of lead. It is mainly encountered

in the presence of gingival infection.[8] According to some observers, this line is not common, probably because of good oral hygiene. The mechanism of its formation is still not settled. The hydrogen sulfide is formed by the decomposition of food particles deposited between the teeth. The first theory[6] claims that lead is brought in contact with H_2S and to the site of its deposition by the circulation. The other theory holds that lead is brought in contact with H_2S inside the buccal cavity either by way of the saliva or from the outside.

A recent natural experiment that occurred in a female patient supports the second theory. This patient had a lead line on the lower gum, and an upper lead line was evident on a denture. The blue-black line was made up of minute and agglomerulated particles that were easily seen with a magnifying lens. It became apparent while attempting to take a small amount of this material for a qualitative dithizone test (which was positive for lead) that these particles were embedded between the teeth and the plastic base of the denture. It is obvious that the lead came either through the saliva or from the outside.

3) Abdominal Colic. This is the commonest manifestation of lead poisoning, according to Tanquerel.[2a] "It is 10 times more frequent than lead palsy, 17 times more than encephalopathy." It is the earliest symptom that brings the patient to a physician. In most cases it is severe enough to require sedation. The attacks (usually the first manifestation of an acute episode) are preceded by a period of constipation and associated with a desire to defecate.[6]

The pain occurs mostly at night and is colicky or tearing in nature without a definite localization. It is usually accompanied by abdominal tenderness. In experimental animals, intense intestinal spasm was noted at post-mortem.[9] Lead was found to increase the tonicity of smooth muscles and independently to inhibit spontaneous contractions.[6]

Constipation is usually the rule. One of our patients had but one bowel movement per week. Anorexia, vomiting and nausea are sometimes associated.

(B) Hematological Findings[3,6]

The action of lead on the blood elements is almost entirely limited to the red cell series, although mild leukocytosis, with relative monocytosis has been described in the acute period, but usually the total leukocyte count or its differential count shows no alterations.

Changes in the red cell series have been considered characteristic of lead intoxication and are probably the most constant manifestations in the routine laboratory procedures.

1) Anemia - The anemia and the basophilic stippling usually parallel the state of health of the individual but do not necessarily indicate the severity of the condition.[6]

In general the anemia present in patients with lead intoxication is described as hypochromic[3] having a color index less than 1.0. An increased resistance of red cells to hypotonic saline solutions has been experimentally produced after exposure of the cells to lead.[6] In addition, it was noted that a large number of "leaded" red cells hemolyse when allowed to stand in Ringer's solution.[6] Aub postulated an increased fragility of red cells after exposure to lead and a

shortened life span of the red cells in lead poisoning patients.

It is known that the anemia in experimental acute lead poisoning is a result of hemolysis,[11] as indicated by an increase in the fecal urobilinogen and reticulocyte count. In chronic lead poisoning in human beings the anemia is probably the result of a low grade hemolysis, as demonstrated experimentally by Aub, and of disturbed hemoglobin synthesis. There is little doubt that the anemia is fundamentally related to disturbances in porphyrin and hemoglobin metabolism, although these are not yet clearly understood. This problem will be discussed more fully below.

A study of the blood picture of 49 men exposed to lead has revealed a moderate degree of anemia in the majority of these workers. The red cell count averaged 4.30 millions, with a range of 3.24 to 5.16 million per cu.mm. (Table I). Thirty-three workers had a count lower than 4.5 million per cmm. The hemoglobin content was also low, averaging 13.66 grams %. Thirty-four male workers had a hemoglobin level below 14.5 grams per 100 cc. The hematocrit was below 40% in 13 our of 42 workers. Determination of the red cell indices (Table II) revealed an average MCC of 31.9% in 41 workers, and in 20 of these workers the MCC was below 32%. Only 3 out of 49 workers showed a color index below 1.0. The MCV was higher than the average normal values in 36 of 41 workers. The MCD was determined in 8 instances (Table III). Although the number studied is small, the high values of MCV together with an increase in the MCD indicates that the red cells are not simply flattened but

TABLE I

BLOOD PICTURE .I

	Hemoglobin gm %	R.B.C. (millions)	Hematocrit %
Normal (Male)	16 ± 2.0	5.4 ± 0.8	47 ± 7.0
Exposed Workers. (males)	10.7 – 17.0 — 13.66	3.24 – 5.16 — 4.30	34.5 – 49.2 — 41.95
	< 14.5 — 34/49	< 4.5 — 33/49	< 40 — 13/42

TABLE II

BLOOD PICTURE. II

	M C C	M C V	Color Index	Basoph. Stp.
Normal (Male)	34 ± 2%	87 ± 5cu	1.0	0.01 %
Exposed Workers (Males).	29.3 – 36.5 — 31.9	83.9 – 111.1 — 98.76	0.94 – 1.19 — 1.09	0.21 %
	< 32 — 20/41	< 92 — 5/41	< 1.0 — 3/49	- none 9/52

TABLE III

BLOOD PICTURE. III

CASE	M.C.D.*	M.C.V.	Siderocytes	Bas.Stp.
1.	8.4 μ	108 cu	1 %	0.55 % F,C.
2.	8.2	92.4	0.4	0.65 F,C.
3.	8.0	104	0.3	0.2 C.
4.	7.9	89	0.1	0.2 F.
5.	7.7	94.8	0.4	0.1 F.
6.	7.7	--	1	0.4 F,C.
7.	7.6	95.3	0	0.3 F,C.
8.	7.6	85.2	0.4	0.5 F,C.

* Haden- Hausser Halometer.

are larger in all dimensions, supporting the view[3,6] that upon addition of lead the red cell swells slightly.

2) Basophilic stippling, siderocytes. Together with a change in size the red cells show abnormal inclusions in their cytoplasm. Cabot rings and Howell-Holly bodies have been noted occasionally.[12]

The frequency of the occurrence of basophilic stippling has made it diagnostic of lead poisoning. Normally there is a minimal amount of stippling in the peripheral blood not exceeding 0.01%.[10a] Nine of the present group of 52 showed no increase in basophilic stippling, while in 43 the basophilic stippling was 0.1% and over, the average being 0.21%.

The stippling is frequently of two types, coarse and fine. The coarse type may exhibit a Prussian blue reaction.[10b] Siderocytes in increased numbers have been reported in lead poisoning.[13] Siderocytes are more numerous in the bone marrow than in the peripheral blood.[10c] They are considered to be the result of defective hemoglobin formation.[13] This may be fundamentally related to the large content of free protoporphyrin in the erythrocytes which is so characteristic.

3) Bone marrow. Bone marrow examination was done in one case of chronic lead poisoning. A moderate increase in its cellular elements was seen. In general the marrow shows a normoblastic hyperplasia due probably to the hemolytic effect of lead, but subsequent to the prolonged effect of lead a decrease in the cellular elements occurs followed by fatty degeneration.[3] Stippling has been reported to be absent at this stage which may prove that the degree of stippling does not necessarily reflect the degree of lead toxicity.

(C) Disturbances in porphyrin metabolism.

Porphyrin abnormalities were first reported by Binniendijk in 1880[14] who found

increased excretion of urinary porphyrin in a patient with lead poisoning. In 1895 Stokvis demonstrated that this increased excretion could be produced in rabbits by the administration of lead acetate for a few days. Studies on human beings suffering from lead poisoning have shown consistent increases in the urinary porphyrin excretion.

In 1932 Grotepass[15] isolated coproporphyrin III from the urine of a lead poisoned patient and was not able to find an evidence of uroporphyrin. The finding of coproporphyrin III was further confirmed by Fischer and Duesberg experimentally in rabbits and by Watson in man.[17a]

In 1928 Van den Bergh observed an increase in the content of erthrocyte porphyrin which was quantitatively determined by Vigliani and Waldenstrom[16] in the study of their cases of lead poisoning.

It has been assumed that the increased erythrocyte protoporphyrin in lead poisoning was on the basis of partial enzymatic interference. Rimington[28] proposed that lead blocks the incorporation of iron into the porphyrin molecule resulting in the high content of red cell protoporphyrin with associated anemia, and that the coproporphyrin III formation was the result of this disturbance. Kench[29] has objected to Rimington's hypothesis, that anemia in lead poisoning was due to the prevention of iron - porphyrin formation, on the ground that the degree of hemoglobin deficit is out of proportion to the relatively small amount of porphyrin excreted. He proposed that protoporphyrin and hence hemoglobin production in the bone marrow is slowed, but that protoporphyrin and iron are properly utilized in hemoglobin formation. It is entirely possible, as proposed by Watson,[30] that lead acts through enzyme interference at a lower level in the pathway of hemoglobin synthesis, as for example at the stage of conversion of porphobilinogen to porphyrin. The recent observation in this laboratory that the urine in lead poisoning regularly contains small amounts of porphobilinogen (vide infra) indeed suggests such a disturbance.

Occurrence of coproporphyrin in the circulating red cells as established in this laboratory[30,33] and the study of coproporphyrin and protoporphyrin in the bone marrow and circulating erythrocytes in experimental anemias[31] have shown a consistent and close relationship between coproporphyrin and hemoglobin synthesis. It has been demonstrated that, associated with the increased erythropoiesis following hemolysis or acute blood loss there is a considerable increase of the total coproporphyrin in both the marrow and the peripheral red cells. The data thus far available in human and experimental lead poisoning indicates that there is a rough relationship between acuity and severity and the degree of elevation of erythrocyte coproporphyrin.

The quantitative excretion of porphyrin in the stool of lead poisoned patients has been found by some investigators to be within normal limits[17b,18] while others have described an increased fecal excretion of porphyrins.[19] Coproporphyrin I has also been found in stools.[17b]

Schwartz and co-workers studied intensively the porphyrin disturbances produced experimentally in rabbits and noticed some similarity to erythropoietic porphyria.

1) Urinary porphyrin. The purpose was to study the porphyrin disturbances by means of the quantitative measurement of each respective porphyrin and to isolate, if possible, any new porphyrin. In the two groups of workers we studied, six individuals had constipation and abdominal colic. A seventh worker had lead poisoning eight months prior to the study.

   In the urine, (Table Va) the outstanding abnormality was a marked elevation of the daily copropor-

TABLE IV

Workers	Type of Work	Lead in Air (mg /cm3)	Urinary Coproporphyrin mean	Urinary Coproporphyrin range µg/d.	Toxicity
		LEAD PLANT - WINTER			
12	Furnace Worker	0.12 - 8.2	2356	970 - 3182	4
17	Gen. Labor	0.02 - 1.4	1760	936 - 2730	1
3	Foreman	0.07 - 0.64	1767	1365 - 2565	-
5	Miscellaneous (Chemist,Janitor)	0.03 - 0.20	637	189 - 1438	-
		BATTERY PLANT - FALL			
3	Mixing, Pasting	0.01 - 1.50	2086	1920 - 2218	1
2	Casting, Grouping	0.05 - 0.29	1675	1659 - 1700	-
1	Connector burning	0.13	3960	-	+
1	Manager	0.03 - 0.11	374	-	-

TABLE Va

SUMMARY OF FINDINGS - URINE

	Normal Average µg/d.	Exposed Workers Number	Exposed Workers Average
Coproporphyrin	189 ± 79*	54	1698 ± 867 µg/d
Uroporphyrin	13.2 ± 10.3	36	96.2 ± 43.8 µg/d
Porphobilinogen	Negative	13	0.12 - 1.6 µ/d.

* Zieve et al, 1953.

TABLE Vb

SUMMARY OF FINDINGS - BLOOD

	Normal Average	Exposed Workers Number	Exposed Workers Average
E C P	0.5(0-2.0) µg%*	56	2.16 ± 1.1 µg %
E P	36.4 ± 8.5 µg %*	56	477 ± 228 µg %
Lead Level	0.06 mg %**	56	0.102 mg %
Basophilic Stp.	0.01 %	52	0.21 %

* Watson, 1950.

** Upper limit of Normal.

phyrin excretion averaging 1698 ± 867 gamma/d, and the range was 189-3960 gamma/d (normal value 189 ± 79 gamma/d.). The coproporphyrin was crystallized and was found to have a melting point of 142 - 145° C. The wide range of coproporphyrin was not directly related to the time of exposure (There is no significant statistical correlation), but (Table IV) workers exposed to a higher degree of lead concentration in the atmosphere have shown a higher excretion of coproporphyrin in the urine. It will be noted that one worker, with the history of acute lead poisoning 8 months previously, had a high coproporphyrin excretion although at the time of this study he worked in a normal atmospheric lead concentration (0.13 mgr. per m^3), showing again the increased susceptibility of certain individuals to lead. A correlation coefficient of 0.35 was found between the daily coproporphyrin excretion and the lead blood level.

A moderate increase in the uroporphyrin excretion was also observed in these workers, the average daily excretion of uroporphyrin being 96.2 ± 43.8 gamma/d. (normal value 13.2 ± 10.3 gamma/d) The uroporphyrin was crystallized

(picture) and the crystals melted at 283-285° C. Paper chromatography done on the mother liquor revealed uroporphyrin and traces of coproporphyrin and a lower carboxyl group compound. A significant correlation coefficient, r = 0.722 (significant at less than 1% level), was noted between the daily uroporphyrin and coproporphyrin excretion.

A preliminary study of the various zones of porphyrin observed on calcium carbonate chromatography columns by the Chu-Green method showed the presence of porphyrins with two carboxyl group also reported by Nicholas and Rimington.[20] Further study of these 2-COOH porphyrins has shown that one behaved like deuteroporphyrin on paper chromatography, while the other is still unidentified but probably is a mesoporphyrin.

The presence of porphobilinogen in the urine, reported previously by Dr. Watson,[21] was found to be consistent in these workers. This porphobilinogen behaved as a Westall type of porphogilinogen.

2) Porphyrin in the stools. This was limited to the study of fecal excretion in one hospitalized female patient. The values found prior to therapy were within normal limits, confirming the previous reports already mentioned.[17,18]

3) Porphyrin in the peripheral blood. (Table Vb). A marked increase in the erythrocyte protoporphyrin was found, the values ranging from (23-1100 gamma % M) with an average of 477 ± 228 gamma per 100 cc.

The only normal value of erythrocyte protoporphyrin (23 gamma %) encountered in this study was that of the chemist of the plant. This man worked in the plant for the 17 month prior to the study, under an atmorpheric lead content of 0.04 mgr./cm^3 and he had a normal hemoglobin, red cell count, hematocrit and urinary porphyrins (UCP 189 gamma/d., U.U.P. 17.5 gamma/day). The wide range of protoporphyrin values cannot be explained at this time. Statistical study has failed to show any correlation of protoporphyrin levels with the decrease in the hemoglobin content of the blood, although the hemoglobin decrease correlated (r = 0.503) with the daily coproporphyrin excretion.

A moderate increase in the erythrocyte coproporphyrin was observed, averaging 2.16 ± 1.1 gamma % with a range of (0.6 - 6.4 gamma %). The moderately high erythrocyte coproporphyrin (6.4 gamma %) was noted in a man with symptoms of acute lead poisoning. His hemoglobin was 12.0 gm%, urinary coproporphyrin 2468 gamma/d., urinary uroporphyrin 190 gamma/d. and his blood level was 0.195 mgr.%.

The serum porphyrin was studied in five individuals, and there was no measurable amount.

(D) Therapeutic Considerations

The hypothesis that lead retards hemoglobin production in the marrow and that this defect could be corrected with riboflavin,[29] led us to use this substance in three workers exposed to lead. These workers were left at work, and were given 15 mg. daily of riboflavin orally. At the end of 50 days, the blood protoporphyrin and urinary porphyrin determinations revealed no significant changes. Following the reported effect of Vitamin B_{12} on the urine coproporphyrin excretion,[24] both in rabbits and in workers exposed to lead,[25] this substance was also used orally in doses of 25 gamma daily in three individuals exposed to lead dust in a battery plant. After 50 days of therapy no changes were observed in the porphyrin content of the red blood cells and urine.

Sodium citrate administration has been reported[3,26] to produce good results

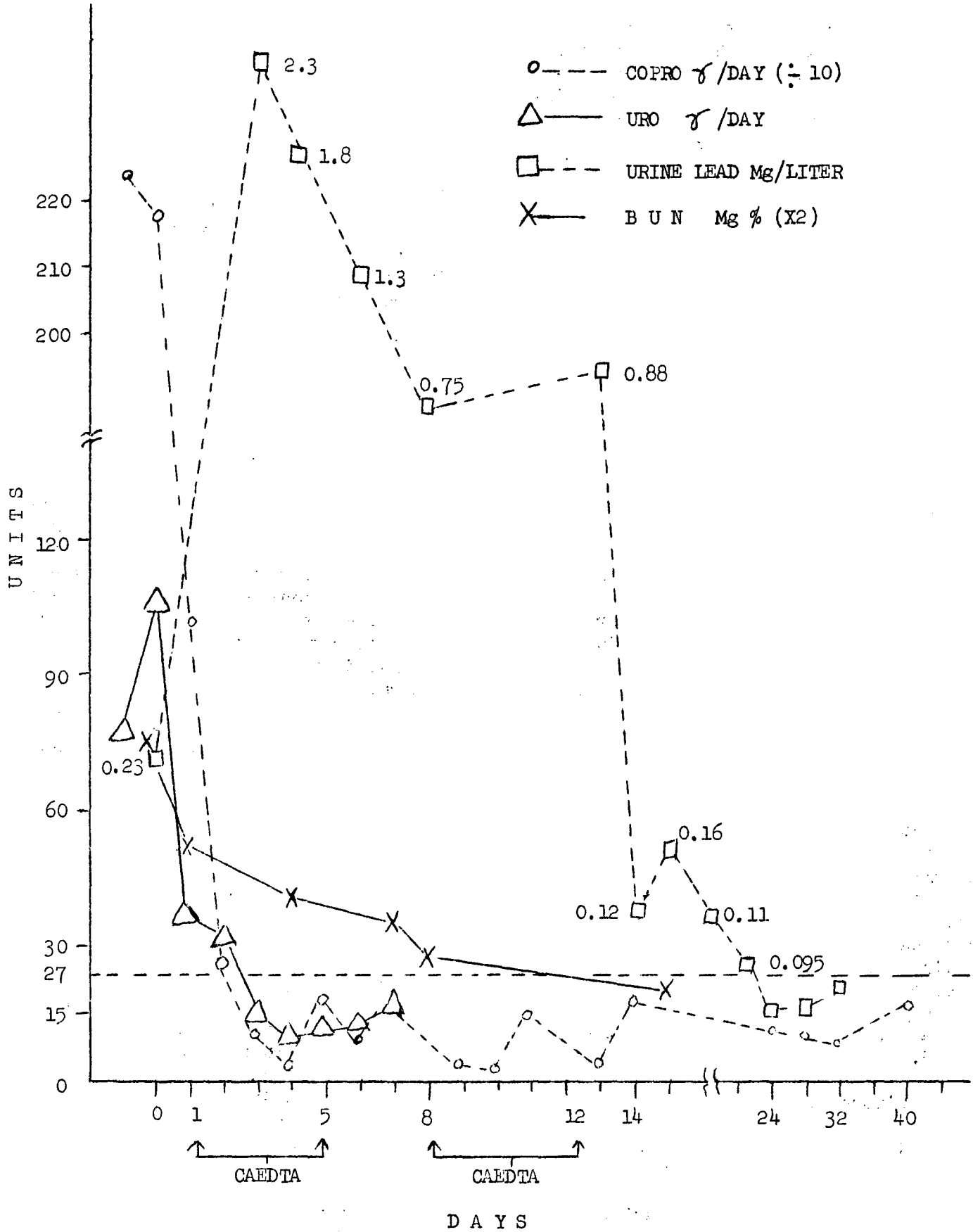
and this has been our own experience. Recently a more potent chelating agent, CaEDTA (calcium versenate) has been reported to form a water-soluble, nonionizable compound with lead.[27] This compound was used in a 25 year old woman with a history of lead intoxication of 10 weeks' duration. Upon admission the patient complained of a metallic taste, anorexia, severe constipation, abdominal colic, shooting pain in the upper and lower extremities with weakness of her right peroneal muscles, and, in addition, a lead line on the gum. Her pertinent laboratory findings were: hemoglobin 11.9 gm.%, urinary coproporphyrin 2214 and 2184 gamma/day, urine uroporphyrin 76.4 and 108 gamma/day, erythrocyte protoporphyrin 765 and 718 gamma percent and BUN 36 mgm. percent. The patient received two courses of calcium versenate intravenously, a total of 9 gm. each, over a five-day period. On the third day the urinary uroporphyrin and coproporphyrin excretion had declined to within normal limits. (Figure 1) The erythrocyte protoporphyrin, however, declined but very slowly, and it is doubtful that this rate of decline can be correlated solely with the life span of the circulating erythrocytes. In the same figure 2, a direct comparison is made with similar data obtained in a case of simple iron deficiency (post-hemorrhagic) anemia, as the effect of iron therapy is achieved. It is seen that in the latter case the decline of the erythrocyte protoporphyrin is more rapid than in the present case of lead poisoning under versenate therapy. It is noted that in this case the BUN had declined to 13 mg.% fifteen days after versenate was started. The patient was entirely free of symptoms within seven days after versenate therapy was commenced.

E. Discussion

The detection of lead poisoning among industrial workers has been a problem to the physician. The determination of lead content in the blood or urine is a difficult and time-consuming test, and often the results do not reflect the degree of toxicity.

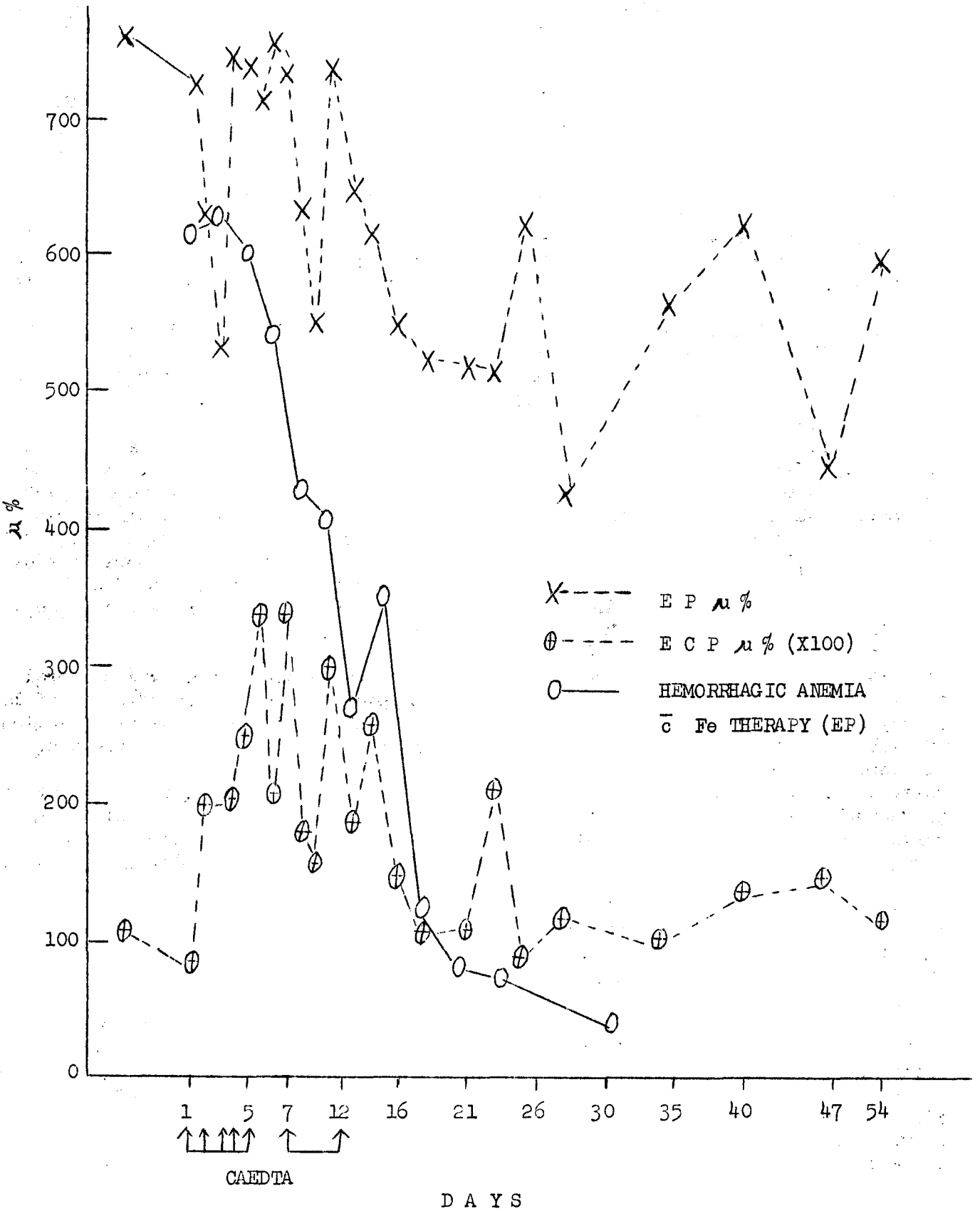
Porphyrin determinations in the urine have been employed in recent years and have aroused considerable interest as a relatively simple test of lead toxicity. The early appearance of increased coproporphyrin excretion in the urine as described by de Langen and ten Bergh, indicates that their simple test is of value in the routine examination of workers for the detection of incipient cases of plumbism. On the other hand variable dilution of the urine and masking or porphyrin fluorescence in varying degree, make it clear that quantitative determinations of the urinary coproporphyrin are desirable in the diagnosis of lead poisoning. Another factor of importance here is that a considerable fraction of the urinary coproporphyrin, even a distinct majority is excreted as a colorless chromogen which does not fluoresce.[23a] This may easily be unappreciated in simple qualitative tests, but is included in the quantative procedure which is now employed.[23b] The urinary coproporphyrin (UCP) is regularly increased to a marked degree in lead poisoning, but is not specific, as it is similarly increased in other heavy metal intoxications, certain chemical poisonings, alcoholism and alcoholic cirrhosis,[22] and to an even greater degree in porphyria of all types, at least during active stages of the disease.

Urinary uroporphyrin excretion was also significantly increased in lead exposed individuals. The presence of an abnormal quantity of uroporphyrin in the urine has been regarded heretofore as a criterion for the diagnosis of porphyria i.e., an inborn error of metabolism. The finding of elevated values in lead-exposed workers further emphasizes the fact that uroporphyrin formation and excretion is more a quantitative than a specific qualitative disturbance in porphyrin metabolism. The finding that the excessive uroporphyrin excretion in these individuals is at least mainly uroporphyrin I, confirms previous observations in this laboratory in experimental porphyria, both as regards the bone marrow[32a] and the urine.[32b] Thus it is clear that in lead poisoning there is a



URINARY PORPHYRINS IN LEAD POISONING FOLLOWING VERSENATE THERAPY

FIGURE 1.



ERYTHROCYTE PROTO & COPROPORPHYRIN IN LEAD POISONING FOLLOWING VERSENATE THERAPY

FIGURE 2.

striking dichotomy or "dualism" of porphyrin formation, i.e., a marked over production of coproporphyrin III, and at the same time appearance of uroporphyrin I in significant excess. This observation in itself supports the view that these porphyrins are independently synthesized from smaller building blocks, quite possibly from differing porphobilinogens or similar monopyrrolic variants, in accordance with recent observations with Schwartz and others in this laboratory.

Elevation of the erythrocyte protoporphyrin (EP) in workers exposed to lead was striking. The absence of correlation between hemoglobin level and free protoporphyrin in the red cells suggests that lead affects hemoglobin and protoporphyrin formation by mechanisms which are more complex than that of simple interference with the combination of protoporphyrin and iron, as proposed by Rimington.[28]

The fact that coproporphyrin excretion is abruptly affected even though lead is still present in the body, after the administration of calcium versenate, suggests that the action of versenate on coproporphyrin metabolism is in some way direct, rather than indirect, through the interference of lead on porphyrin metabolism. The failure of the red cell protoporphyrin to decrease rapidly with versenate therapy is receiving further study.

Vitamin B_{12} and B_2, given in the amounts previously recommended, have failed to have a significant effect on the porphyrin disturbance found in lead poisoning.

The increases of porphobilinogen, uroporphyrin, coproporphyrin in the urine, and of the red cell protoporphyrin, are in accord with the findings of Schwartz and co-workers[32b] in experimental lead-phenylhydrazine poisoning in rabbits.

CONCLUSION

Study of porphyrin disturbances in workers exposed to lead has revealed abnormal quantities of porphyrin in the blood and urine:

Urinary coproporphyrin is markedly elevated. This is a simple and very sensitive test. It is of a diagnostic significance. The coporporphyrin crystals were of Type III.

The excretion of abnormal quantity of uroporphyrin in the urine was observed. Uroporphyrin I was crystallized.

Porphobilinogen, of Westall type, appears to be consistently present in small quantities in the urine of workers exposed to lead.

A marked increase in the erythrocyte protoporphyrin was found. The absence of correlation between the hemoglobin and the erythrocyte protoporphyrin suggests that the action of lead on the hemoglobin synthesis is more complex than simple interference with the incorporation of iron into the porphyrin ring.

A rough correlation was observed between the acuity and severity of lead poisoning and the degree of elevation of the erythrocyte coproporphyrin.

Calcium versenate, a new chelating agent, probably has a direct action on the coproporphyrin metabolism rather than through its chelating action on lead.

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II. MEDICAL SCHOOL NEWS

Coming Events

Feb. 28 - March 2	Continuation Course in Clinical Hematology for General Physicians and Internists
March 3 - 5	Continuation Course in Clinical Dietetics for Dietitians
March 16	Family Doctors' Day; Division of Urology; Hospital Dining Room; 12:15 p.m.
March 16	Society for Experimental Biology and Medicine Meeting; Owre Amphitheater; 8:00 p.m.
March 21 - 23	Continuation Course in Cardiovascular Diseases for General Physicians

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Student-Faculty Dance

The second annual Student-Faculty Dance, sponsored by the Medical Inter-Fraternity Council and the Minnesota Medical Foundation, will be held on Saturday evening, February 26, at the Interlachen Country Club beginning at 9:30 p.m. All members of the faculty are cordially invited to attend. The dance will be informal and the price is $2.50 per couple. Tickets may be purchased in the Medical School Office.

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Faculty News

Dr. Dennis W. Watson, Professor, Department of Bacteriology and Immunology, has been appointed to the Microbiology and Immunology Study Section of the National Institutes of Health of the U. S. Public Health Service.

Dr. F. H. Van Bergen, Associate Professor and Director, Division of Anesthesiology, participated as a member of the Subcommittee on Anesthesia of the National Research Council in Washington, D. C. on February 3. He presented a paper entitled "Development of a New Intermittent Positive Pressure Breathing Apparatus."

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Publications of the Medical School Faculty

Schwab, J. H. and Watson, D. W.: Host Factors in Experimental Group A Streptococcal Infections. The Role of Tissue Thromboplastin. J. Infectious Dis., 95: 267, 1954.

Swigart, R. H. and Williams W. L.: Histochemical Composition and Vital Staining of Denervated Skeletal Muscle of the Mouse. The Anatomical Record, 120: 449, 1954.

III.

UNIVERSITY OF MINNESOTA MEDICAL SCHOOL
WEEKLY CALENDAR OF EVENTS

Physicians Welcome

February 28 - March 5, 1955

Monday, February 28

Medical School and University Hospitals

9:00 - 9:50 Roentgenology-Medicine Conference; L. G. Rigler, C. J. Watson and Staff; Todd Amphitheater, U. H.

9:00 - 10:50 Obstetrics and Gynecology Conference; J. L. McKelvey and Staff; W-612, U. H.

10:00 - 12:00 Neurology Rounds; A. B. Baker and Staff; Station 50, U. H.

11:30 - 12:30 Physical Medicine and Rehabilitation Staff Seminar; Film: "Techniques for Getting From Wheelchair to Standing."; Film: "Bathroom Techniques for Wheelchair Patients."; Heart Hospital Theater.

11:30 - Tumor Conference; Doctors Hitchcock, Zimmermann, and Stenstrom; Todd Amphitheater, U. H.

12:15 - Obstetrics and Gynecology Journal Club; Staff Dining Room, U. H.

12:30 - 1:30 Physiology Seminar; The Interference Microscope -- A New Histochemical Research Tool; David Glick; 214 Millard Hall.

1:00 - 2:00 Roentgenology-Surgical-Pathological Conference; Paul Lober and L. G. Rigler; Todd Amphitheater, U. H.

1:30 - 2:30 Pediatric-Neurological Rounds; R. Jensen, A. B. Baker, and Staff; U. H.

1:30 - 3:30 Dermatology Hospital Rounds; H. E. Michelson and Staff; Dermatology-Histopathology Room, C-394 Mayo Memorial.

4:00 - 6:00 Anesthesiology Conference; F. H. Van Bergen and Staff; Todd Amphitheater, U. H.

4:30 - Public Health Seminar; The Integration of Veterinary Medicine and Public Health; James H. Steele, Atlanta; Rm. 100 Mayo Memorial.

4:30 - Pediatric-Medicine Infectious Disease Rounds; Station 33, U. H.

5:00 - 6:00 Urology-Roentgenology Conference; C. D. Creevy, O. J. Baggenstoss, and Staff; Eustis Amphitheater.

Ancker Hospital

8:00 - 9:00 Pediatric Contagion Rounds; Richard Lein; Contagion 5.

8:30 - 10:30 Medical and Surgical Chest Conference; Dr. Gehlen and Staff; Auditorium.

9:30 - 12:00 Visiting Staff Rounds.

10:00 - 12:00 Surgery Grand Ward Rounds; Begin Floor E4.

11:00 - 12:00 Pediatric Rounds; Harry Orme; Contagion 1.

12:30 - 2:30 Surgery Out-Patient Clinic; Room 8.

Monday, February 28 (Cont.)

Ancker Hospital (Cont.)

2:00 - 3:00 Routine EKG Interpretation; Dr. Sommers and House Staff; Medical Record Library.

2:30 - 3:00 Discussion of Problem Case; Auditorium.

3:00 - 4:00 Surgery Journal Club; Classroom.

3:00 - 4:00 Lectures on Electrocardiography; Ben Sommers; Auditorium.

4:00 - 5:00 Medical Clerk Journal Club; Auditorium.

Minneapolis General Hospital

10:30 - 12:00 Medicine Rounds; Thomas Lowry; Station 31.

11:00 - Pediatric Case Discussions; Erling Platou; Station 4.

11:00 - Orthopedic and Fracture Rounds; Drs. John Moe and Arthur Zierold; Station 20.

12:30 - Surgery Grand Rounds; Dr. Zierold, Station 21.

1:30 - 2:30 Tuberculosis Conference; J. A. Myers; Station 8.

2:00 - Pediatrics Rounds; William Krivit; Stations 4, 5, & 6.

Veterans Administration Hospital

9:30 - Infectious Disease Rounds; Drs. Hall, Zinnemann, and J. Brown.

1:30 - Cardiac Conference; Drs. Smith, Berman, Hoseth, Simonson, Tamlyn, and Farquhar; Conference Room, Bldg. I; Rounds immediately following conference.

Tuesday, March 1

Medical School and University Hospitals.

9:00 - 9:50 Roentgenology-Pediatric Conference; Samuel Feinberg, John A. Anderson and Staffs; Eustis Amphitheater, U. H.

12:30 - 1:20 Pathology Conference; Autopsies; J. R. Dawson and Staff; 104 Jackson Hall.

12:30 - Physiological Chemistry Seminar; Chemical Nature of Agents Affecting Cell Differentiation; M. Steinberg; 214 Millard Hall.

12:30 - Bacteriology and Immunology Seminar; "Extra-Mendelian Mechanisms:" Cytoplasmic Inheritance in Yeast (Ephrussi, Spiegelman, Lindegren); Frank Roth; 1050 Mayo Memorial.

12:30 - Anatomy Seminar; Experimental Study of Growth of Adrenals of Fetal Rats; Albina Yakaitis; 226 Jackson Hall.

3:30 - General Physiology Seminar; 323 Zoology Building.

3:30 - Pediatric Seminar; Non-Penetrating Wounds of the Abdomen with Special Reference to Intramural Hematomas of Duodenum; Catherine Root; 1450 Mayo Memorial.

4:00 - 5:00 Pediatric Rounds on Wards; John A. Anderson and Staff; U. H.

Tuesday, March 1 (Cont.)

Medical School and University Hospitals (Cont.)

4:00 - 5:00 Physiology-Surgery Conference; Todd Amphitheater, U. H.

4:30 - 5:30 Clinical-Medical-Pathological Conference; Todd Amphitheater, U. H.

5:00 - 6:00 X-ray Conference; Presentation of Cases by Veterans Hospital Staff; Eustis Amphitheater, U. H.

Ancker Hospital

8:00 - 9:00 Pediatric Rounds; Dale Cumming; Contagion 1.

9:00 - 10:30 Visiting Staff Rounds.

9:00 - 12:00 Practical Diagnostic Clinic; Harry Orme; Out-Patient Department.

11:00 - 12:00 Medical X-ray Conference; J. R. Aurelius; Auditorium.

2:30 - 4:00 Routine EKG Interpretations; Resident Staff.

4:00 - 5:00 Medical-Pathological Conference; W. F. Mazzitello, Auditorium.

Minneapolis General Hospital

9:30 - Pediatric Rounds; Elizabeth Lowry and A. Bridge; Station 5.

10:00 - Psychiatry Grand Rounds; R. W. Anderson, Station 3.

11:30 - 12:30 Neurology-Neurosurgery Conference; Classroom, Station 8.

12:30 - 2:30 Dermatology Rounds on Clinic; Carl W. Laymon and Staff.

12:30 - ECG Conference; Boyd Thomes and Staff; 302 Harrington Hall.

1:00 - Tumor Clinic; Drs. Eder, Coe, and Lipschultz; Classroom.

3:30 - Pediatric-Psychiatry Rounds; Jack Wallinga; Station 4.

Veterans Administration Hospital

7:30 - Anesthesiology Conference; Surgical Conference Room, Bldg. 43.

8:30 - Hematology Rounds; Drs. Hagen and Wexler.

8:30 - Surgery Journal Club; Conference Room, Bldg. I.

9:30 - Surgery-Pathology Conference; Conference Room, Bldg. I.

10:30 - Surgery-Tumor Conference; D. Ferguson and J. Jorgens.

1:00 - Review of Pathology, Pulmonary Tuberculosis; Conference Room, Bldg. I.

1:30 - Combined Medical-Surgical Chest Conference; Conference Room, Bldg. I.

2:00 - 2:50 Dermatology and Syphilology Conference; H. E. Michelson and Staff; Bldg. III.

4:00 - Thoracic Surgical Problems; Conference Room, Bldg. I.

5:00 - Fluid Balance Conference; Conference Room, Bldg. I.

5:30 - Physiology Seminar; Surgical Conference Room, Bldg. 43.

Wednesday, March 2

Medical School and University Hospitals

11:00 - 12:00 Pathology-Medicine-Surgery-Pediatrics Conference; Todd Amphitheater, U. H.

12:30 - 1:20 Radio-Isotope Seminar; Kenneth Wood; Betatron Room in Cobalt Underground Section, U. H.

1:00 - 2:00 Dermatology Clinical Seminar; F. W. Lynch; 300 North Clinic.

1:30 - 3:00 Pediatrics Allergy Clinic; Albert V. Stoesser and Lloyd Nelson; W-211, U. H.

3:30 - 4:30 Dermatology-Pharmacology Seminar; 3rd Floor Conference Room, Heart Hospital.

4:30 - 5:50 Dermatology-Infectious Disease Seminar; 3rd Floor, Conference Room, Heart Hospital.

5:00 - 6:00 Radiology Residents Lectures; The Significance of "Idiopathic" Pleural Effusion; William Stead; Todd Amphitheater, U. H.

5:00 - 5:50 Urological-Pathological Conference; C. D. Creevy and Staff; A503, Mayo Memorial.

5:10 - 6:10 Endocrine Seminar; Surgery and Adrenal Stimulation; B. Zimmermann; 271 Lyon Laboratories.

5:30 - 7:30 Dermatology Journal Club and Discussion Group; Hospital Dining Room.

7:30 - 9:30 Dermatology Seminar; Review of Interesting Slides of the Week; Robert W. Goltz; Todd Amphitheater, U. H.

Ancker Hospital

8:30 - 9:30 Clinico-Pathological Conference; J. Noble; Auditorium.

11:00 - 12:00 Pediatric and Contagion Rounds; Harry Orme; Contagion 1.

11:00 - 12:00 Medicine Resident Rounds; W. F. Mazzitello.

3:30 - 4:30 Pediatric Surgery Conference; Harry Orme and I. D. Baronofsky; Auditorium.

Minneapolis General Hospital

10:30 - 12:00 Medicine Rounds; Thomas Lowry and Staff; Station 11.

11:00 - Pediatric Rounds; Erling Platou and Richard Raile; Station 6.

12:00 - Surgery Seminar; Arthur Zierold, Classroom.

12:30 - Pediatrics Staff Meeting; Classroom, Station 4.

Veterans Administration Hospital

8:30 - 10:00 Orthopedic X-ray Conference; E. T. Evans and Staff; Surgical Conference Room, Bldg. 43.

8:30 - 12:00 Neurology Rehabilitation and Case Conference; A. B. Baker.

9:00 - Gastro-Intestinal Rounds; Drs. Wilson, Zieve, Ferguson, Brakel, Swenson, Nesbitt and Sadoff.

10:30 - Psychosomatic Conference; C. K. Aldrich; 7th Floor, Bldg. 43.

Wednesday, March 2 (Cont.)

Veterans Administration Hospital (Cont.)

12:30 - Medical Journal Club; Doctors' Dining Room.

12:30 - X-ray Conference; J. Jorgens; Conference Room, Bldg. I.

1:30 - 3:00 Metabolic Disease Conference; Drs. Flink and Williams.

3:30 - Urology Pathology Slide Conference; Dr. Gleason; Conference Room, Bldg. I.

7:00 - Lectures in Basic Science of Orthopedics; Conference Room, Bldg. I.

Thursday, March 3

Medical School and University Hospitals

9:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; Room 3.148 Mayo Memorial.

11:00 - 12:00 Cancer Clinic; K. Stenstrom, B. Zimmermann; Todd Amphitheater, U. H.

12:30 - 1:55 Physiology Seminar 210; Transport; Selected Topics in Permeability; Nathan Lifson; 214 Millard Hall.

1:30 - 4:00 Cardiology X-ray Conference; Heart Hospital Theatre.

4:00 - 5:00 Anesthesiology Seminar; F. H. Van Bergen and Staff; Room 100, Mayo Memorial.

5:00 - 6:00 Radiology Seminar; Roentgen Aspects and Treatment of Wilms Tumor; M. Azad; Eustis Amphitheater, U. H.

7:30 - 9:30 Physiology 211 Seminar; Selected Topics in Heart and Circulation: Hemodynamics; M. B. Visscher and Robert Evans; 271 Lyon Laboratories.

Ancker Hospital

8:00 - 9:00 Pediatrics Clinical Staff Conference; Contagion Classroom.

9:00 - 10:00 Pediatric Contagion Rounds; Alexander Stewart, Contagion 5.

9:30 - 10:30 Medical Grand Rounds; Auditorium; Visiting Staff Rounds immediately following Grand Rounds.

11:00 - 12:00 Pediatric X-ray Conference.

11:00 - 12:00 Medicine Resident Rounds; W. F. Mazzitello.

2:00 - 3:00 Routine ECG Interpretation; Ben Sommers; Medical Record Library.

Minneapolis General Hospital

9:30 - Neurology Rounds; Heinz Bruhl; Station 4.

9:30 - Pediatric Contagion Rounds; R. B. Raile; Station 4.

10:00 - Psychiatry Grand Rounds; R. W. Anderson and Staff; Station 3.

11:30 - 12:30 Clinical Pathological Conference; John I. Coe; Classroom.

12:30 - 2:30 Dermatology Rounds and Clinic; Carl W. Laymon and Staff .

1:00 - Fracture X-ray Conference; Drs. Zierold and Moe; Classroom.

1:00 - House Staff Conference; Station 4.

Thursday, March 3 (Cont.)

Veterans Administration Hospital

8:00 - Experimental Surgery Laboratory Meeting; Conference Room, Bldg. I.

8:30 - Hematology Rounds; Drs. Hagen and Doe.

9:00 - Surgery Grand Rounds; Conference Room, Bldg. I.

9:00 - Surgery Ward Rounds; D. Ferguson and Staff; Ward 11.

11:00 - Surgery-Roentgen Conference; J. Jorgens; Conference Room, Bldg. I.

1:00 - Infectious Disease Conference; Conference Room, Bldg. I. (Rounds immediately following conference.)

4:00 - 5:00 Medical-Surgical Conference; Medical Conference Room, Bldg. I.

Friday, March 4

Medical School and University Hospitals

8:00 - 10:00 Neurology Grand Rounds; A. B. Baker and Staff; Station 50, U. H.

9:00 - 9:50 Medicine Grand Rounds; C. J. Watson and Staff; Todd Amphitheater, U.H.

10:30 - 11:50 Medicine Rounds; C. J. Watson and Staff; Todd Amphitheater, U. H.

11:00 - 12:00 Vascular Rounds; Davitt Felder and Staff Members from the Departments of Medicine, Surgery, Physical Medicine, and Dermatology; Eustis Amphitheater, U. H.

11:45 - 12:50 University of Minnesota Hospitals Medical Staff Meeting; Patient Education in the Management of Diabetes; Anette Haseth, Frederick Goetz, C. Knight Aldrich, and Florence Brennan; Mayo Memorial Auditorium.

1:00 - 2:50 Neurosurgery-Roentgenology Conference; W. T. Peyton, Harold O. Peterson and Staff; Todd Amphitheater, U. H.

1:00 - 2:00 Physiology Seminar 212; Selected Topics in Respiration: Respiratory and Circulatory Effects of Hypothermia; E. B. Brown; 214 Millard Hall.

1:30 - 2:30 Dermatology Grand Rounds; Presentation of Cases from Grouped Hospitals (University, Ancker, General and Veterans) and Private Offices; H. E. Michelson and Staff; Eustis Amphitheater, U. H.

2:30 - 4:00 Dermatology Hospital Rounds; H. E. Michelson and Staff; Begin at Dermatological Histopathology Room, C-394 Mayo Memorial.

3:00 - 4:00 Neuropathological Conference; F. Tichy; Todd Amphitheater, U. H.

3:30 - 4:30 Dermatology-Physiology Seminar; 3rd Floor Conference Room, Heart Hospital.

4:00 - 5:00 Physiology Seminar 213; Selected Topics in Advanced Neurophysiology; Role of the Vestibular Apparatus and the Cerebellum in the Extrapyramidal Motor Activity; Werner Koella; 129 Millard Hall.

4:30 - 5:20 Ophthalmology Ward Rounds; Erling W. Hanson and Staff; E-534, U. H.

5:00 - Urological Seminar and X-ray Conference; A503, Mayo Memorial.

Friday, March 4 (Cont.)

Ancker Hospital

8:00 - 9:00 Pediatric Rounds; Charles Steinberg; Contagion 1.

10:30 - 11:30 Pediatric Contagion Rounds; Richard Smith; Contagion 1.

11:00 - 12:00 Contagion Rounds; Harry Orme; Contagion 5.

2:00 - 3:00 Routine EKG Interpretation; Resident Staff.

3:00 - 4:00 Medical-Surgical-Pathological Conference; Auditorium.

4:00 - 5:00 Medical Journal Club; Conference Room, E5.

4:00 - 5:00 X-ray Surgery Conference; Auditorium.

Minneapolis General Hospital

10:00 - Otolaryngology Conference; Robert A. Priest; Large Classroom.

10:30 - Pediatric Surgical Conference; Tague Chisholm and B. Spencer; Classroom, Station 4.

12:00 - Surgery-Pathology Conference; Drs. Zierold and Coe; Classroom.

1:00 - 3:00 Clinical-Medical Conference; Thomas Lowry; Classroom, Station 8.

Veterans Administration Hospital

10:30 - 11:20 Medicine Grand Rounds; Conference Room, Bldg. I.

11:00 - 12:30 Psychiatry Case Conference; Werner Simon; Psychiatry Department, VA Hospital Annex.

12:30 - Urology X-ray Conference; X-ray Department.

1:00 - CPC Conference; Conference Room, Bldg. I.

2:00 - Pathology Slide Conference; E. T. Bell; Conference Room, Bldg. I.

Saturday, March 5

Medical School and University Hospitals

7:45 - 8:50 Orthopedic X-ray Conference; W. H. Cole and Staff; M-109, U. H.

9:00 - 9:30 Pediatric Grand Rounds; Eustis Amphitheater, U. H.

9:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; Heart Hospital Amphitheater.

9:15 - 10:00 Surgery-Roentgenology Confereence; Alexander R. Margulis, Owen H. Wangensteen and Staff; Todd Amphitheater, U. H.

10:00 - 11:30 Surgery Conference; Todd Amphitheater, U. H.

10:00 - 12:50 Obstetrics and Gynecology Rounds; J. L. McKelvey and Staff; Station 44, U. H.

10:00 - 12:00 Otolaryngology Seminar on Current Literature; L. R. Boies and Staff; Todd Memorial Room, A-675, Mayo Memorial.

Saturday, March 5 (Cont.)

Ancker Hospital

8:30 - 9:30 Surgery Conference; Auditorium.

9:30 - 11:00 Medicine Grand Ward Rounds; W. F. Mazzitello.

11:00 - 12:00 Medical Clerk Case Conference; W. F. Mazzitello.

Minneapolis General Hospital

8:00 - Urology Staff Conference; T. H. Sweetser; Main Classroom.

9:00 - Psychiatry Grand Rounds; R. W. Anderson; Station 3.

9:30 - Pediatrics Rounds on all Stations; R. B. Raile.

11:00 - 12:00 Medical X-ray Conference; O. Lipschultz, Thomas Lowry and Staff; Main Classroom.

Veterans Administration Hospital

8:00 - Proctology Rounds; W. C. Bernstein and Staff; Bldg. III.

8:30 - Medical X-ray Conference; Conference Room, Bldg. I.