and pathogenicity of the parasites, and by cross-inoculation studies.

E. suis is a large *Eperythrozoon* containing somewhat more chromatin material than other species of this genus. A ring structure which averages about 0.8 μ in diam is the principal form of this extracellular parasite. At the height of parasitic attacks very large ring and discoid forms are present. These vary in size from 1 μ to 2.5 μ. Many of the large ring forms are of distorted shapes, and exhibit an irregular distribution of the chromatin at various points about the ring. Discoid forms appear as flat, solid chromatin masses. Coccus, rod, and various budding forms are also observed. The organisms are usually found upon the erythrocytes, and may be so numerous as to cover the red blood cells completely. Morphological changes occur within a few minutes in citrated or oxalated blood samples. Coccus and rod forms predominate in samples so treated.

E. parvum is observed primarily as small coccus forms and occasional ring structures. The rings are approximately 0.5 μ in diam, and the coccus forms are somewhat smaller. This parasite has displayed a tendency to accumulate in large numbers upon individual erythrocytes, even when very rare in the blood smear. According to Weinman (*4*) this organism is very similar in appearance to *E. dispar*.

Animals used in inoculation studies were held in fly-proof stalls. At least 30 days were allowed following splenectomy or experimental inoculation to determine the presence or absence of parasitic infection. All animals inoculated, with the exception of mice, were injected intravenously with citrated blood.

Four splenectomized pigs which had relapsed with *E. parvum* only, with no ill effects, were injected with blood from a known carrier of *E. suis*. *E. suis* appeared in all four pigs after an incubation period of from two to five days. Acute eperythrozoonosis was evidenced by an acute, febrile, ictero-anemia which developed in each animal. Two subsequently succumbed to the infection. Conversely, two splenectomized pigs that had recovered from acute, clinical infection with *E. suis* were infected with *E. parvum*. A heavy parasitic infection developed, following incubation periods of seven and ten days, but no symptoms or blood damage ensued. One pig known to be susceptible to both parasites was infected with both upon experimental inoculation. In mixed infections *E. suis* has rapidly displaced *E. parvum*.

The two swine species were differentiated from *E. wenyonii* and *E. ovis* by inoculation of heavily infected blood into a susceptible calf and lamb. Both animals remained negative for 30 days, and were then proved susceptible by infecting each with its own *Eperythrozoon* species. Conversely, a susceptible splenectomized pig remained free of parasites following injection of pooled blood heavily infected with *E. wenyonii* and *E. ovis*. Fifty-eight days later the animal was experimentally infected with both *E. suis* and *E. parvum*, the former organism producing an acute ictero-anemia.

Differentiation of the swine species from *E. coccoides* and *E. varians* was accomplished by the intraperitoneal injection of mice with blood heavily infected with the swine parasites. One Swiss white mouse and two local white-footed deer mice of the species *Peromyscus maniculatus*[2] were used, the rodents having first been proved susceptible following splenectomy. All three remained negative for sixty days. Differentiation from *E. dispar* of the vole has not been undertaken. The failure to infect closely related rodents suggests that the *Eperythrozoon* species of swine are not closely related to *E. dispar*.

Splitter and Williamson (*3*) and Splitter (*1*) have demonstrated that *E. suis* is the causative organism of a sporadic disease of swine occurring in the Midwestern United States, which has been known as "ictero-anemia" or "anaplasmosis-like disease." Specific therapy has been obtained with neoarsphenamine (*2*). *E. suis* and *E. parvum* have been found to be common blood parasites of swine in northeastern Kansas.

[2] Identification by H. T. Gier, Department of Zoology, Kansas State College.

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Procedure in Dose Distribution Measurement of 25-Mev X-Rays[1]

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In the preparation of the 25-Mev betatron in the College of Medicine for human therapy (*1*) and animal experimentation, extensive measurements of depth-dose and isodose distributions have been made under a variety of conditions. Two general techniques have been employed, one based on small ion chamber measurements and the other on x-ray film density response.

The ionization measurements were made in a water-filled phantom shown in Fig. 1. This phantom had a front window of taut Nylon sheet (0.003 in. thick) to facilitate measurements close to the surface. The position of the ion chamber in the phantom was remotely controlled by selsyn motors from the control room of the betatron building. The driving selsyns in the control room also acted as indicators of the precise location of the ion chamber. Size No. 1 selsyns have proved entirely satisfactory in operation and precisely position the ion chamber to within ½ mm of the position indicated in the control room. Cylindrical and flat ion chambers have been employed. The diameter and height dimensions of the cylindrical chamber were 5 mm, with a central collection

[1] This work was supported in part by a grant from the American Cancer Society.

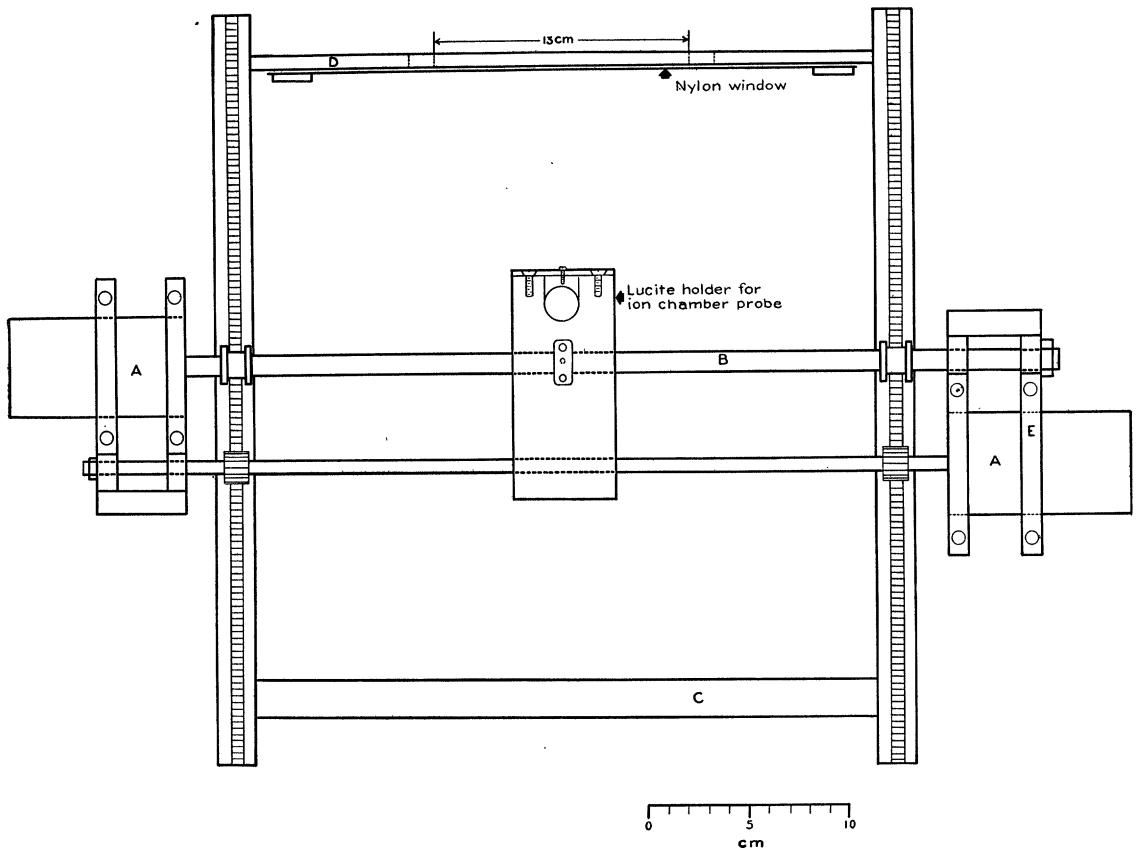

FIG. 1. Remote-controlled water phantom. A denotes selsyn motors; B, square-thread lead screw; C, wooden sides; D, front surface supporting thin Nylon windows; E, aluminum mounting brackets.

electrode of graphite rod. The flat chambers had a thin Nylon front surface (0.003 in.) coated with Aquadag. The collecting electrode consisted of a thin carbon disk 5 mm in diam located 1.5 mm behind the Nylon surface. The volume of these chambers was about 30 mm³. A conventional inverse feedback, direct current amplifier was used, employing the Victoreen VX-41A as a cathode follower in the first stage. The amplifier output was observed directly on a large microammeter, or was further amplified and automatically registered on a graphic recorder. Linearity and reproducibility tests indicated an uncertainty of not greater than 1% in dosage measurement. With this amplifier and remote-controlled arrangement[2] a complete isodose distribution could be obtained in a single uninterrupted operation of the betatron.

A series of measurements of the dose-density relation of industrial x-ray films established a linear relation $r = mD$ for type A and type M films. D refers to the net density measured with an electronic densitometer employing a photocell and amplifier, and r refers to the dose as recorded by a Victoreen thimble chamber. For type A film $m = -0.27t + 8.88$, where t is the developer temperature in the 20° C to 25° C range. For type M film $m =$ 7.09 at 23° C. Kodak rapid developer was used with a development time of 5 min. Great care in the control of temperature, development time, and developer condition was needed to obtain reproducible results.

For relative dose distribution measurements the x-ray films were inserted between 3.2-mm-thick sheets of a Presdwood phantom (density 1.02). The phantom was sealed in a light-tight box with a front surface of paper 0.001 in. thick. All films in a single exposure were developed simultaneously. Fig. 2 displays the experimental depth-dose points obtained in a single film phantom exposure. The x-ray beam was collimated to a circular cross section of 5-cm diam at 80 cm skin target distance. The first 5 cm of the solid curve is based on four sets of data. The vertical dashed lines represent maximum deviations of three depth-dose curves obtained with a flat ion chamber in the water phantom. The skin dose appears to be about 8% of the maximum dose on the basis of film measurements. Ion chamber measurements commence at 0.25-cm depth and average higher than the film data. In the region where the dose gradient is less steep the two methods agree more closely.

In Fig. 3 is shown an isodose distribution obtained in a single continuous operation of the betatron with a flat ion chamber in the water phantom. These data were taken with a beam 10 cm in diam at 80-cm skin target

[2] The remote-controlled water phantom was designed in May, 1948, when the treatment of a patient with the betatron in Champaign (*1*) showed need for such apparatus.

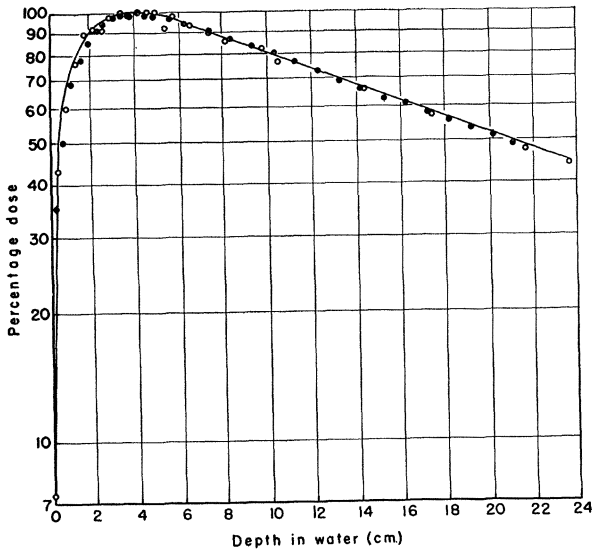

FIG. 2. Depth-dose distribution. Solid points are data obtained with ion chamber in water phantom with 5-cm field at 80-cm skin target distance. Hollow points are data obtained with a film phantom exposed under the same conditions.

distance. The surfaces were shaped by the use of a differential absorber in the x-ray beam consisting of a conical ensemble of fiber disks. No deviation greater than 2½% from perfectly flat isodose surfaces exists. The average of more than one ion chamber or film determination yields even flatter surfaces than those shown. The intensity of radiation 5 cm outside the geometrical edge of the beam is less than 1% of that within the beam.

The depth-dose distribution obtained with a 1-cm-diam beam falls off more rapidly at depths beyond 5 cm than with beams of larger cross-sectional area. The dependence of depth-dose on beam area is much less than the strong dependence which characterizes lower energies (*2*). A detailed analysis of these data is in preparation.

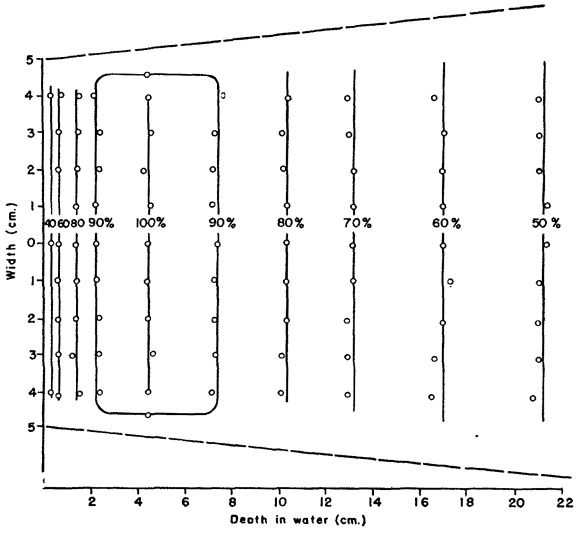

FIG. 3. Isodose distribution obtained in single operation of betatron with ion chamber in remote-controlled water phantom. Beam 10 cm in diam at 80-cm skin target distance filtered with hydrocarbon absorber.

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Antifolliculoid Activity of Vitamin A[1]

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Continued cornification of vaginal epithelium is considered to be a reliable early manifestation of vitamin A deficiency in female rats (*1*). Sherwood *et al.* (*9, 10*) reported that feeding large amounts of carotene suppressed the estrous vaginal smear picture in the normal rat; however, other workers administered high doses of vitamin A orally (*3*), or by injection (*2*), and found no inhibition of the vaginal response to estrogen. Recent studies on mice (*11*) tend to corroborate the observations of Sherwood *et al.*

Inasmuch as the liver is known to store and inactivate most of the ingested vitamin A (*5*) and probably much of the injected material, we doubted that these methods would result in making available a really high level of vitamin A to any particular target organ. A series of experiments have been conducted involving the intravaginal instillation of various substances by the method employed by Krichesky and Glass (*6*).

Bilaterally ovariectomized rats of an inbred strain were estrogenized by subcutaneous implantation of α-estradiol pellets.[2] After estrous (cornified) smears were obtained from the vagina, sesame oil, cod liver oil, and vitamin A alcohol in sesame oil and in acetone-sesame oil[3] were applied intravaginally in 0.05-ml daily doses, using a blunt 18-gage needle on a tuberculin syringe. Vaginal smears, taken daily during and subsequent to the period of administration of oil solutions, were stained with Wright's stain. The vaginal pictures were classified according to the dominant cell types seen: leukocytes, nucleated epithelium, nucleated vacuolated epithelium, precornified cells (i.e., with nuclear remnants), and cornified cells.

Table 1 demonstrates that topically applied vitamin A results in definite alteration of the keratinized picture produced by estrogen. The appearance of ovoid and round cells with vesicular nuclei, including many with large vacuoles in their cytoplasm, characterizes most smears after two or more days' treatment with vitamin A (Fig. 2). Some cornified and precornified cells were

[1] Aided by research grants from the University of California Board of Research.

[2] Generously supplied by Dr. W. H. Stoner, Schering Corporation, Bloomfield, N. J.

[3] Prepared from crystalline material produced by Distillation Products Industries, generously supplied by Dr. Philip L. Harris and C. J. Staud, Eastman Kodak Co., Rochester, N. Y.