or cube of sun's radius multiplied by its angular velocity, is proportional to a Keplerian constant for the solar system, $2\pi rv^2$, or planetary orbit multiplied by the square of orbital velocity, e.g., in cm/s units:

$$2\pi rv^2 = (6.28 \times 6.95 \times 10^{10}) \cdot (4.38 \times 10^7)^2 = 8.37 \times 10^{26}$$
$$r^3\omega = (6.95 \times 10^{10})^3 \cdot (6.28/2{,}510{,}000) = 8.4 \times 10^{26}$$

This equivalence suggests that planetary motions are related to the sun's rotation and regulated by electromagnetic laws, as Kepler surmised.

CORNELIUS O'CONNOR

3276 Harrison Street,
San Francisco, California

Corneal Contact Lens Reference?

It has been widely quoted that Sir John Herschell was the first to suggest the possibility of making a corneal contact lens. Can any of your readers give us the exact reference in Sir John's writings regarding this idea?

KATHERINE FERGUSON CHALKLEY

Manuscript Editor
American Journal of Ophthalmology,
Lake Geneva, Wisconsin

Guarded Circuit Bridge

A precision guard circuit has been constructed to operate in conjunction with a Modified Schering Bridge so that three terminal guarded measurements can be made on solid and liquid dielectrics over the operating frequency range of the bridge; namely, 100 cycles/sec to 300,000 cycles/sec.

The detector system used with this equipment is made up of a matching amplifier with built-in selective frequency filters between the output of the bridge and main amplifier. The main amplifier has a flat frequency response of 40 db from 60 cycles/sec to 1,000,000 cycles/sec. The output of the main amplifier is fed to one set of plates of a standard oscilloscope. The other 'scope plates are fed directly from the bridge supply oscillator through a phase shifter.

Amplifiers are operated at full gain with the signal forming an ellipse on the 'scope screen. Controls are adjusted so that resistance balance opens and closes the ellipse and capacity balance tips the closed line right or left from horizontal.

Accurate balance is obtained over the complete frequency range of the bridge.

The guarded circuit bridge enables one to make dielectric constant and dielectric loss measurements under controlled humidity conditions and at different temperatures, which are impossible with a two-electrode system. Surface leakage on a dielectric cannot be separated from volume resistance using an unguarded bridge. Edge corrections for electrostatic fringing are also eliminated by means of the guarded test electrode.

STANLEY I. REYNOLDS

General Electric Research Laboratory,
Schenectady, New York

Report from Sweden

The more important scientific activities of the Scandinavian countries are known in this country by way of the Scandinavian journals and abstracts in our own American medical journals. Therefore, when I went to Stockholm to visit the larger hospitals and state and municipal laboratories, I did so with a good many preconceived ideas and the feeling of at least a surface familiarity with the work in progress. I found, however, a laboratory organization quite different from that in the U. S., owing to some extent, to the absence of large commercial pharmaceutical plants and also to the semi-socialization of medicine in this country.

In this account I shall not attempt to give a complete picture of all the important laboratory activities in progress. My visits were confined almost exclusively to Stockholm. However, I was assured that the organization here is prevalent throughout Sweden.

Swedish laboratory medicine is now centralized to a large extent. In recent years demands for decentralization have increased, and to some degree plans for this process have been made and will be carried out within the next decade or two. Stockholm (and all the larger communities in Sweden) maintains one central municipal bacteriological laboratory that works with and for all the city hospitals except the Medical Institute—Karolinska Hospital—which is to a large degree self-sufficient. Individual hospitals maintain small bacteriological laboratories to do a few routine tests, but send most clinical diagnostic work to the municipal laboratories. But all the hospitals maintain adequate chemical, hematological and pathological laboratories.

The Municipal Bacteriological Institute is rather inadequately housed in an old converted school house, but plans for new quarters have been drawn up by the directing head, Prof. Davide. Funds are available and it is hoped that in three or four years the new quarters will be ready for use. The plans call for a continuation of the present organization into four scientific departments: clinical bacteriology, i.e., cultures and antibiotic tests; serology, including Wassermann and Widal tests, antistreptolysin titers, and staphylococcal lysin titers; intestinal infection; and tuberculosis. To this will be added a fifth and very important section—a virus department in which Prof. Davide tentatively plans an emphasis on encephalitis investigations.

Opportunities for research in the present cramped quarters are of necessity restricted. In the new building, however, adequate space for research is planned for, so that each department head will have a small laboratory for private scientific investigations. Prof. Davide is continuing his extensive 15-year work on bacterial metabolic products with bactericidal action on *Mycobacterium* tuberculosis. His associate, Dr. Pakalin, is also continuing with his work on the effect of generalized infections on the clinical course of tuberculosis. Both men were most kind in showing me their work, as were their staff, and the staffs in all the institutions I visited. English is generally spoken, usually very fluently, and older doctors speak excellent German.

No teaching is done at the municipal institute, but in the new quarters provisions are made for teaching clinical bacteriology to medical students. The staff consists of six doctors and about 20 technicians. The professional staff here and at the hospitals is predominantly male. I was assured constantly that the dearth of woman physicians merely reflected the fact that here women prefer a home and husband to a medical career. The technicians, on the other hand, are exclusively female. Incidentally, the status of the Swedish laboratory technician is considerably different from that of her American counterpart. She is not college-trained, but is given special training for a period of eight months to a year, to qualify her for routine laboratory work. All diagnostic results are supervised, checked, and officially reported by a member of the staff holding a university degree. This state of affairs is becoming more and more deplored by the laboratory directors, and there has been considerable agitation for more adequate scientific training of technicians.

I visited several of the hospitals of Stockholm. Two of these, Sabbatsberg (where the new municipal center will be housed) and St. Eriks, are good examples of the average city hospital. Both of these maintain only very small bacteriological laboratories, using the municipal center for almost all of their bacteriology, but maintain all the clinical laboratory divisions in adequate form. At Sabbatsberg, where the hospital is quite old but the laboratory quarters are housed in a new and extremely modern building, the main research problems are pathological, initiated by the director, Prof. Bergstrand, and concern morphological and biochemical analysis on changes in liver and kidney diseases. The equipment here, as indeed in all the laboratories except the municipal one, which will be completely reequipped, is astonishingly modern and considerably more than adequate. Binocular microscopes, usually of German, Swiss, or English make, are used exclusively. Large built-in, stainless steel autoclaves are found everywhere; stainless-steel centrifuges holding 24 tubes are of Swedish make and, I am told, excellent. There is usually no difficulty in obtaining the standard laboratory equipment. Libraries are, by American standards, inadequate. Each institute usually has only a small library of journals and books pertaining to its own medical specialty. However, the Karolinska Medical Library is excellent, fully equipped not only with American and central European works but also with a good selection from eastern Europe. This library is available to all the other medical institutions of Stockholm.

At St. Eriks Hospital, where Dr. Josephson was most kind in showing me his equipment, I was again impressed by the excellent laboratories in a comparatively old hospital. Here, as in all the other hospitals, there is a workroom with trained mechanics who can manufacture a good deal of the equipment. Dr. Josephson is working on the excretion and tubular function of kidney metabolism and plans to publish his results in a new English-language journal, the *Scandinavian Journal of Clinical and Laboratory Investigations*. I asked him about the effects of the semisocialization of Swedish medicine on research, and he assured me that, although he gets his funds from the Swedish State Medical Council, there is no state control of research at all, either in his own or in any of the other institutions.

One of the oldest hospitals in the city is the institution for epidemic diseases, aptly called Epidemi Hospital. Here again there are plans ready for a whole group of new buildings, especially a large central laboratory department, with adequate bacteriological and virus quarters. Dr. Hedlund, who is one of the consulting physicians there and in charge of the bacteriology laboratories, emphasized the fact that he and the other staff physicians will have adequate quarters in the new building for private research. He is engaged in serological studies on polyarthritis and hopes to continue along these lines. Like all the physicians I spoke to, he expressed the greatest interest in the U.S. All without exception either have visited our country in the past or hope to do so soon.

The show piece of Stockholm medical circles is Söders Hospital, a new ultramodern institution. Here the planned decentralization of laboratories has to a great extent become a reality. There are large individual laboratories where all the necessary tests can be carried out so that very little is sent to the municipal center. The work here is mostly routine diagnosis, and very little research has been done so far.

The Swedish State Bacteriological Institute is one of the most modern laboratory establishments to be found in Sweden. Opened about 12 years ago it is independent of the Swedish Medical Board and stands directly under the public health authorities. Its functions are both diagnosis and research.

The institute is headed by Prof. Olin, whose work, especially the *Salmonella* phase of it, is familiar to Americans. The permanent staff—about 25 professional persons and 200 technicians—is distributed among a diagnostic department, a virus department, a division for chemical bacteriology, an antibiotic division, and a department for the production of vaccines and serums. The latter produces most of the vaccines and sera used in middle and central Sweden. Only smallpox vaccination is compulsory, but diphtheria vaccination is available free of charge to all school children.

The equipment of the institute is modern and complete. Microscopes are exclusively binocular, of German and Swiss make; Swedish centrifuges, electrofreezers, and autoclaves are excellent and the customary workshop in the cellar can produce a large percentage of the laboratory equipment. Karolinska's library is used extensively but there is a fair stock of current journals of the bacteriological field in the institute. The electron microscopes at Karolinska are available for research, as is also the one at Uppsala. Here, as everywhere, plans are being completed for new buildings, especially for enlarging the virus department and facilitating more work on polio and hepatitis.

When the State Institute was built provision was made for each doctor to have adequate space for research. Since most members of the staff are affiliated as consultants with one or more of the city hospitals, coopera-

tion and interchange of information are excellent. All the departments carry on research, to a large extent in connection with their diagnostic routine work.

So far as medical education is concerned here, conditions are quite a bit different from those prevailing in the U.S. It takes between eight and ten years to complete the course for a practicing medical degree in Sweden. Medical courses are offered in the universities, and also in the two large state medical centers, each divided into a public health department, a hospital, and a series of institutes for medical education and rsearch. One of these state centers is Karolinska (Caroline) Institute in Stockholm, where I spent several days, and where Dr. Heden and Dr. Svartz in particular were extremely kind in showing me around. Karolinska Institute is an up-to-date institution somewhat on the scale of the Columbia University-Presbyterian Medical Center in New York City. The large routine laboratory of the hospital is very well equipped and able to handle a tremendous amount of routine work per day. I was interested to see, for instance, that although Sweden has only a small amount of aureomycin and almost no chloromycetin available, sensitivity tests and body fluid levels for these drugs had already been developed and were being applied.

Of much greater interest were the individual institutions. I visited two, the Institute for Cell Research, a Nobel establishment, and the King Gustav V Research Institute. At the cell research center Dr. Malmgren and Dr. Heden are engaged in studies on the nucleotide metabolism of bacteria. The biochemistry department works with isotopes, on tuberculosis, and on the isolation and study of respiratory enzymes. Optical studies on cell composition are in progress in the large and excellently equipped optical department. This boasts an American-made electron microscope, available also to the other research institutions of Stockholm, and good modern ultraviolet apparatus. The central optical department is separated from the rest of the house by air spaces between the walls to prevent vibration, and has collapsible walls so that rooms can be rearranged according to need. The three ultraviolet microscopes are used at present to study hemoglobin synthesis. A soundproof acoustical measuring room is also found.

The King Gustav V Research Institute was built and endowed with donations by the Swedish people at the 80th birthday of King Gustav V. His Majesty desired that the institute should devote a greater part of its energies to rheumatic disease investigations. Dr. Schwartz who heads the institute, impressed me as an extremely able scientist who, through her own boundless enthusiasm, energy, and vast knowledge of the field, led and inspired her co-workers' endeavors. Rheumatic diseases are studied from the bacteriological, serological, chemical, and physiological standpoints. The chemistry department studies the body fluid protein fractions as pertaining to rheumatic diseases, that is, both blood specimen and joint exudates. Dr. Svartz told me that they had been able to verify that the ß- and γ-globulin fractions in the blood of animals injected with living pneumococci, staphylococci, and enterococci cultures showed an agglutination against red sheep cells and that investigations along this line are continuing. The department owns a Swedish-made electron microscope and I was able to convince myself of its excellence by means of several pictures of untreated and penicillin-treated typhoid bacilli which I was shown. They were extraordinarily clear, taken at a magnification of 150,000 to 190,000 times, the untreated bacteria showing a wealth of morphological detail and the treated ones tremendously elongated, the cell body thinning and emptying.

Several other minor fields of research are pursued at the King Gustav V Institute. Dr. Nieman works on substances to decrease blood pressure, there is some allergy research, and plans have been made for virus work as soon as the virus laboratory is equipped. I came away from Karolinska with my head fairly whirling with the scientific activity I had seen there.

The oldest university in Sweden is Uppsala University, founded in the late 15th century, where arts and sciences are taught to about 4000 students. The Department of Hygiene and Bacteriology, where I was the guest of its head, Prof. Löfstrom, has been in existence since 1935. The department is housed in the new Pathology Building; eventually it is planned to separate the hygiene division and turn it into a preventive medicine department, so that the Bacteriology and Virus Department can spread out a bit and add courses to its teaching program. The department now offers a six-week clinical bacteriology course for freshmen medical students but hopes soon to add an additional course for more advanced students.

Prof. Löfstrom, who had been appointed only eight months ago, was kind enough to show me about and explain the research in progress. The department consists of its director, six associates and assistants, and about 20 technicians, who do routine diagnostic work from the university hospital and also help in the research in progress. When the planned virus department materializes, poliomyelitis and bacteriophage research will be done. Prof. Löfstrom is continuing his work on immunology, his associate is working on tuberculosis in relation to sensitivity tests to a Swedish antibiotic (PAS—*p*-aminosalicylic acid). Future work on immunology and quantitative measurements on airborne infections seem to be the main interests of the bacteriology department director and his co-workers.

In concluding this report from Sweden I should like to thank all the doctors who extended to me the hospitality of their institutes in such generous fashion. I hope that we in America will be able to reciprocate to some extent when we shall play host to them here.

LOTTE R. WEILHEIMER
517 East Fifth Street, New York City