FOURIER INTEGRALS

Introduction to the Theory of Fourier Integrals. By E. C. TITCHMARSH. Oxford, Clarendon Press, 1937.

THIS book is more than an introduction. Several chapters of the theory, as, for instance, the theory of special (Plancherel, Hilbert) and general (Watson) transforms and of self-reciprocal functions—to which the author contributed substantially—are presented in full and are an excellent basis for further research in modern topics of Fourier analysis.

The book includes a great number of formulas and formal relations; formulas of the classical type as may be found in Burkhardt's article in the "Encyclopädie der mathematischen Wissenschaften"; formulas concerning Bessel functions and Gamma functions; and formal relations underlying modern theories of transforms. Problems of convergence and summability for the ordinary Fourier integrals and for related integrals are treated with great care in a very satisfactory way. Even Perron's formula for the coefficients of Dirichlet's series is included. The theory of transforms for different L-classes is also presented with much detail. But neither here nor anywhere else does the author introduce general Banach spaces and its operations.

Fourier-Stieltjes integrals are omitted completely. The omission will be felt not only by the analyst but also by the student of applied mathematics who, if properly equipped, can profit greatly from this treatise. The last two chapters are devoted to applications of the theory to the solution of differential and difference equations and of integral equations. They are written in a masterly fashion, combining the classical ease and flexibility of the formal set-up with a rigor which is unprecedented in standard works on the topic and yet does not weigh down heavily on the reader.

S. BOCHNER

SPECIAL ARTICLES

A PYOGENIC VIRUS IN THE RAT

WE have recently encountered in the white rat an agent closely resembling the known viruses except that it causes extensive necrosis and pus formation in the subcutaneous tissues.

In a number of experiments where rat sarcoma 39 had been mixed before inoculation with various organs of the rat, or with adsorbents employed to remove an antibody from tissue extracts, or had been incubated in such extracts or in Locke's solution, abscesses sometimes arose at the inoculation site, even though all materials had been proved sterile before use. No such occurrence has ever been observed during some twenty years' routine propagation of this growth, suppuration having been restricted to experiments where the sarcoma was treated in some way before implantation. Hence there is no evidence that the agent in question bears any relation to this neoplasm other than that of a chance contaminant, though why it should become manifest only under the conditions just recited we are quite unable to explain.

When aerobic and anaerobic cultures from these abscesses proved consistently sterile on a wide variety of media, and smears of the pus stained in several different ways revealed no organisms of any sort, the suspicion of a virus had to be entertained, though we knew of none whose activities were so eminently pyogenic.

It was found that the agent can be transferred by 10 per cent. extracts in physiological saline or Locke's solution, will pass a Berkefeld W filter, resist drying and retain its viability fairly well for at least seven days at room temperature or for twenty-one days in the ice-box. It remains active in 50 per cent glycerol-saline for at least a month in the ice-box, and withstands exposure for one hour to 56° C. but not to 60° C. It is killed, also, by 0.05 per cent. formol over night at room temperature but unharmed by two days' contact with 0.05 per cent. phenol in the ice-box. Ultra-violet light for one minute leaves it undamaged but abolishes its activity after fifteen minutes.

When 0.05 cc of a 10 per cent. extract of pus and abscess-wall are injected subcutaneously into a white rat of the breed used at the Crocker Institute there ensues a vigorous proliferation of the connective tissue accompanied by necrosis and pus formation until, by the third or fourth day, the process is indistinguishable from any bacterial abscess. At this stage the lesion may be as large as 5×1 cm, the excess of length over width resulting from the use of a long inoculating needle and flowing of the injected fluid back along its path. The overlying skin is moderately reddened, the surrounding connective tissue intensely congested, and the abscess-wall thick and fibrous. As time goes on more and more pus collects, the fibrous process recedes until the lesion has become a mere thin-walled pus sac, and cure is accomplished in about seven days if the abscess opens on the surface, as it often does, or after several weeks when it is absorbed without rupture.

If there is any constitutional disturbance it can not be very severe, for the animals retain a glossy coat, eat normally, do not lose weight, and none die. There does take place, however, a definite increase in the proportion of circulating polymorphonuclear leuco-

cytes, which sets in immediately after injection and lasts for about three days.

After the process has run its course the animal resists a second inoculation.

In affected rats the agent has been found in the lymph nodes, which readily transmit the disease, rarely in the spleen, and not yet in the heart's blood.

The testis is especially vulnerable, for the introduction of 0.2 cc of a 1:10,000 dilution of the original 10 per cent. extract into this organ has resulted in its total destruction by suppuration.

Intraperitoneal injection causes an occasional abscess in the abdominal cavity, as, for example, in the gastrosplenic omentum, but no generalized peritonitis or noticeable disturbance of health.

After intravenous inoculation the results are more serious. Within three days the feet often become edematous and reddened and in such an event abscesses are prone to develop there a few days later. By then the rats are obviously ill and lose weight rapidly, though how much of their emaciation is due to the disease itself and how much to the starvation entailed by their difficulty in obtaining food has not yet been determined.

In addition to this predilection for the feet this agent has the curious property, after introduction into the blood-stream or the testis, of frequently eliciting an abscess in the suprascapular region on one side or both. Such a localization is difficult to explain, for no lymph node occupies this site in the rat.

The agent has now undergone eight passages in the subcutaneous tissue of the rat with no diminution in virulence, and was transmitted for six in the mouse brain, though with some loss of infectivity for the rat at the end of the series. Mice that have been intracerebrally inoculated almost invariably die after from three to eight days with edema of the skin overlying the head and a mild degree of meningitis.

The rabbit is partially refractory and the guinea-pig almost completely so.

The agent is now in its sixth passage in the chorio-allantoic membrane of the chick. After the third it was tested in the mouse brain and the subcutaneous tissue of the rat, and found to display its customary activity.

Having found in the literature no account of this disease or of any resembling it we submit this brief report, which will be followed in due course by a more complete description.

WILLIAM H. WOGLOM
JOEL WARREN
INSTITUTE OF CANCER RESEARCH AND
DEPARTMENT OF BACTERIOLOGY,
COLLEGE OF PHYSICIANS AND SURGEONS,
COLUMBIA UNIVERSITY

THE INHIBITORY EFFECT OF OXIDIZED ADRENALIN

IN a recent paper from this laboratory (Lissak and Morison, in press) evidence is presented that 933F (piperidino-methyl-3-benzodioxane) increases the rate of oxidation of adrenalin *in vitro* and *in vivo*. In the course of this experiment it was observed that if oxygen or air was bubbled through an adrenal in solution (1:100,000) after one to two days it lost its positive effect on the frog heart and had a negative, inhibitory effect. In order to test further this negative inhibitory effect of oxidized adrenalin, different dilutions of adrenalin (Parke, Davis) were made with standard Ringer's solution. Through these adrenalin solutions oxygen was bubbled at room temperature one to four days. The evaporation of water from the solutions was compensated for by adding distilled water to restore the original volume. When tested on isolated hearts of winter frogs, according to the method of Straub, the adrenalin solution (1:100,000), treated as described above for 72 hours, has a negative inotropic and sometimes a negative chronotropic effect. The negative effect was not completely inhibited by atropine (1:50,000).

During the course of my experiments papers were published by Heirman[1] and by Bacq.[2] They have shown that oxidizing adrenalin with phenolase (tyrosinase, catecholoxidase) a substance "adrenoxine" appears, which has a negative, inhibitory effect on the frog heart and blood pressure of the cat and the rabbit, *i.e.*, the same effect as described above.

Furthermore, Bacq concluded that the non-pregnant uterus of the cat contains a catecholoxidase, which after 45 to 90 minutes transforms adrenalin into inhibitory "adrenoxine," and that the presence of this phenolase "undoubtedly" determines the inhibitory reaction of the non-pregnant uterus to adrenalin. Since Bacq did not report control experiments it seemed desirable to repeat his procedures with properly controlled tests. On doing so, using exactly his method, I found no evidence that extracts of either the pregnant or the non-pregnant uterus of the cat contain a ferment which destroys or transforms adrenalin, but that actually such extracts check adrenalin destruction. Apparently this is because the tissues contain an inhibitor which is very efficient in protecting adrenalin from auto-oxidation.[3, 4, 5, 6] Adrenalin, when mixed with extracts of the feline non-pregnant uterus, will produce, even after 3 to 4 days, typical reactions:

[1] P. Heirman, *Compt. rend. Soc. de Biol.*, 124: 1250, 1937a; *ibid.*, 126: 1264, 1937b; *ibid.*, 127: 343, 1938.
[2] Z. M. Bacq, *Compt. rend. Soc. de Biol.*, 127: 341, 1938.
[3] R. D. H. Heard and A. DeM. Welch, *Biochem. Jour.*, 29: 998, 1935.
[4] A. Láng, *Ber. ges. Physiol.*, 101: 675, 1937.
[5] A. DeM. Welch, *Am. Jour. Physiol.*, 108: 360, 1934.
[6] M. O. P. Wiltshire, *Jour. Physiol.*, 72: 88, 1931.