indirect ionic yields are available (Table 1). The two substances, ribonuclease and tobacco mosaic virus, are of widely different molecular weights (M), however. The striking similarity of the yields for each substance should encourage further comparative studies.

TABLE 1

Substance	Quantum yield	Ionic yield	Molecular wt
Ribonuclease (*1*, *2*)	0.026	0.03	15,000
Tobacco mosaic virus (*1*, *2*)	0.000043	~ 0.0001	42,000,000

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Successful Treatment of Ulcer Disease in Brook Trout (*Salvelinus fontinalis*) with Terramycin

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Prior to this report, all chemotherapeutic agents employed in the treatment of ulcer disease of trout proved unsatisfactory (*1–4*). Investigations on the treatment of this disease were hindered by the lack of adequate information concerning the etiological agent involved. Recently Snieszko *et al.* (*5*) proved *Hemophilus piscium* to be the causative agent of ulcer disease in the Eastern United States, and Flakas (*6*) isolated an unidentified gram-positive bacillus from a similar disease in Wisconsin. Snieszko *et al.* confirmed the assumption that ulcer disease frequently occurs as a mixed infection in conjunction with *Bacterium salmonicida,* the cause of fish furunculosis.

Investigations carried out by Gutsell (*7*) and Snieszko *et al.* (*8*) had shown that fish furunculosis could be treated effectively with certain sulfonamides. Further observations indicated, however, that ulcer disease was apparently refractory to treatment with these drugs. It therefore seemed likely that the few instances in which ulcer disease had been successfully treated with sulfonamides occurred only in cases of mixed infections.

Some of the newer antibiotics, such as aureomycin (*9*) and terramycin (*10*) were employed in an attempt to treat infections of ulcer disease. These drugs can be administered orally with food without significant loss of their therapeutic properties. This is an important factor, since parenteral administration of drugs to fishes is impractical.

During the summer of 1950, three pilot experiments were run with separate lots of fingerling brook trout having ulcer disease. Aureomycin hydrochloride was used in form of "Spersoids" (Lederle) at the rate of 50 mg/kg trout/day. Terramycin hydrochloride (Pfizer) was given at a rate of 75 mg/kg fish/day. The dosages were calculated as the pure substance without filler. The drugs were mixed with the food, and the fish were fed twice each day; the temperature of the water was 13° C; the weight of the trout in various lots ranged from 6 to 12 g per fish, and the fish used in each experiment were of fairly uniform size. Examination had shown that in all outbreaks *H. piscium* was present in the lesions and tissues of infected trout. In all outbreaks of the disease, some trout were also infected with *Bact. salmonicida.*

Ulcer disease usually has an incubation period of 2–3 weeks, and trout with advanced pathological changes can live for a number of days and sometimes even recover. Infected fish usually have oral ulcerations that hinder feeding (*2*). Therefore, the success of any oral treatment depends to a large degree on the number of fish in the treated lots which still can take the medicated food at the start of the treatment.

Of the two antibiotics used, aureomycin had no therapeutic value. Terramycin was effective, the proportion of surviving trout depending on the rate of mortality at the onset of treatment. In the first experiment, with 6.5% mortality per day at the start, the losses were 80% in the treated fish, and 90–95% in controls after 2 weeks of treatment. In the second experiment, with an initial mortality rate of 1%/day, after 40 days of treatment 25% of the trout died in the treated lot and 97% in controls. In the third experiment, with approximately 3% mortality per

TABLE 1

Mortalities in Fingerling Brook Trout after Treatment with Terramycin

Periods	Terramycin-treated			Controls		
	Replicates		Av (*A* and *B*) % mortality per day*	Replicates		Av (*A* and *B*) % mortality per day*
	A	*B*		*A*	*B*	
August 4–8	7	6	2.3	13	6	3.2
" 9–13	9	12	4.4	8	6	3.1
" 14–18	2	5	1.8	14	8	6.0
" 19–23	2	1	0.8	3	9	4.0
" 24–28	2	2	1.2	6	6	5.8
" 29–						
September 2	1	0	0.3	1	11	6.4
September 3–7	0	0	0	2	1	3.1
Total number dead	23	26		47	47	
Initial number of trout	55	55		55	55	
Average wt/trout	12.7 g	12.7 g		13.0 g	12.4 g	
Total dead (percentage)	42	47		85	85	

* Calculated from total mortalities during 5-day periods.

day at the start, the total losses after 35 days of treatment were 43% and 47% in the lots receiving terramycin and 85% in the controls.

The data obtained from the third experiment, which gave about average results, are presented in Table 1.

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Initiation of Vinyl Polymerization by Means of High-Energy Electrons

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The recent development of equipment able to deliver controlled amounts of high-energy electrons suggested a continuation of the studies of polymerization of unsaturated compounds started by W. D. Coolidge in this laboratory in the 1920s (*1*). The initiation of vinyl polymerization by means of γ-rays has been the subject of recent investigation (*2–5*). The only report in recent years of the use of high-energy electrons for this purpose indicated negative results (*6*).

In the present investigation, a cathode-ray generator of the resonant transformer type, operating at 800 kvp, has been employed. It has been found that high-energy electrons can induce the polymerization of various monomers, including acrylates, methacrylates, styrene, and acrylonitrile. The susceptibility toward polymerization by this method is in the order given. Difunctional vinyl monomers, such as tetraethyleneglycol dimethacrylate (TEGMA), polymerize much more than monomers containing only one double bond. Thus, irradiation of 1-ml samples, in air, with 2.5×10^6 equivalent roentgens (R)[2] accumulated in 17.5 sec, produced only 1% of high polymer from methyl methacrylate. Similar irradiation in the case of TEGMA produced a solid polymer in which 45% of the double bonds had been utilized, as measured by heat evolution. The electrons appeared to function as catalysts in initiating chain growth; the number of double bonds reacting per ion pair was of the order of 10 in the former case and 500 in the latter. In the polymerizations studied, the conversions were increased by either an increase in the dose or an increase in the length of time employed to administer the same dose.

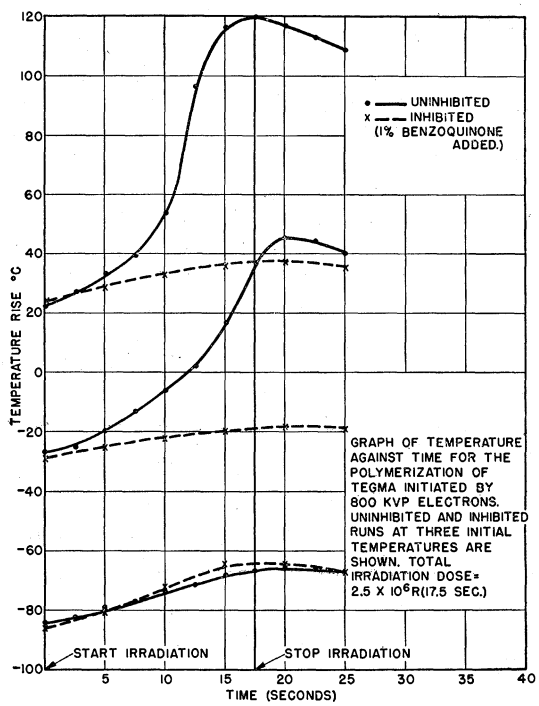

FIG. 1.

Since materials can be irradiated at any temperature without undue temperature rise from irradiation, it was of interest to determine whether there was a minimum temperature at which polymerization could be induced. For this purpose, the polymerization of TEGMA was examined in some detail by measuring the temperature rise caused by its heat of polymerization. The measurements were made by means of a thermocouple immersed in the monomer contained in a small Petri dish. The output of the thermocouple was connected to a G-E photoelectric potentiometer recorder, so that the temperature of the sample could be measured before, during, and after irradiation. The Petri dish was supported on an aluminum block in a Dewar flask and covered by a thin sheet of aluminum. The initial temperature of the sample was regulated to a constant value by cooling or warming it and the block. In all cases, 5-ml samples of TEGMA were irradiated with total doses of 2.5×10^6 R accumulated steadily over 17.5-sec periods.

The curves in Fig. 1 show the temperature rises at various times, after start of irradiation and at three widely different initial temperatures. Since the temperature rise of the polymerizing sample during irradiation was a result of both the heat of polymerization and the irradiation energy, it was necessary to make a correction for the latter. Similar measurements, therefore, were carried out with samples of TEGMA containing 1% benzoquinone, which completely inhibited polymerization. Inhibited runs corre-

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[2] Equivalent roentgen measurements were made with a special air ionization chamber. Values given are those incident at the surface of the monomer.