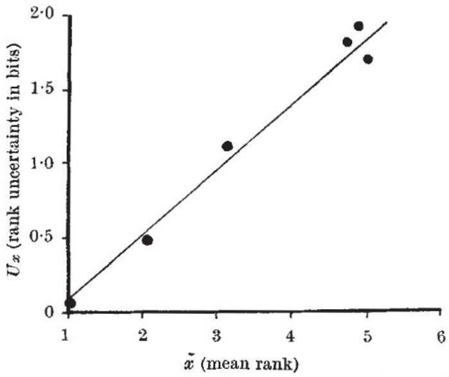

Fig. 1. The linear correlation between decreasing leadership rank ($\tilde{x}$) and increasing uncertainty of rank (U_x). Each of the six points represents a particular doe of the herd. The line is fitted by eye

It is possible that differences in responsiveness—dependent primarily on individual physiological factors (for example, sensory capacities and response latencies) and psychological factors (for example, nervousness)—produce the observed sequences. Alternatively, the data may illustrate a parameter of social organization heretofore not predicted by behavioural theory.

We thank Drs. Klopfer and R. MacArthur for their assistance. The study received support from National Institutes of Health grant M–4453, and was completed during tenure of National Institutes of Mental Health predoctoral and postdoctoral fellowships to J. P. H.

BARRIE K. GILBERT
JACK P. HAILMAN

Department of Zoology, Duke University, Durham, North Carolina, and
Institute of Animal Behavior, Newark, New Jersey.

[1] Allee, W. C., *et al.*, *Ecology*, **28**, 309 (1947).
[2] Gilbert, B. K., thesis, Duke University (1964).
[3] Shannon, C. E., *The Mathematical Theory of Communication* (University of Illinois Press, 1949).

Metabolism of *Spirogyra* during the Conjugation Process

METABOLIC changes corresponding with morphological change during the conjugation process of *Spirogyra* sp. were investigated.

The activity of endogenous respiration in intact cells was found to change during this process as seen in Fig. 1. The activities of NADH oxidase, NADH- and succinate-cytochrome *c* reductases, and cytochrome *c* oxidase were found to vary during the conjugation process in parallel

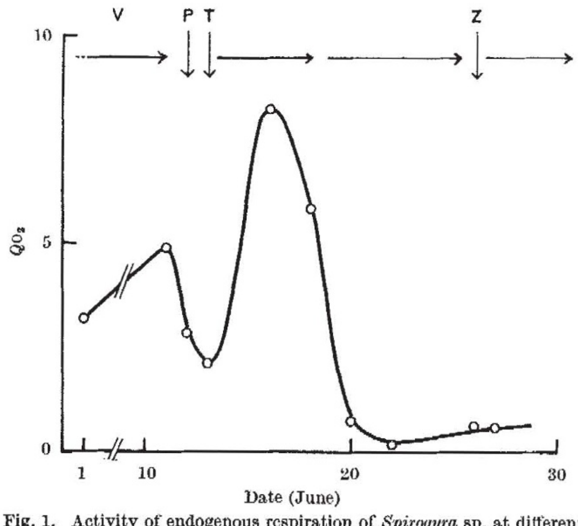

Fig. 1. Activity of endogenous respiration of *Spirogyra* sp. at different stages of the conjugation process. Conditions: intact cells, 200 mg wet weight; phosphate buffer, 0·02 M, pH 7·2; total volume, 2·0 ml; at 30° C

Table 1. AMOUNTS OF RNA AND DNA IN *Spirogyra* AT DIFFERENT STAGES OF CONJUGATION PROCESS

Cells	Modified Ogur–Rosen method (refs. 1, 2)					Schmidt–Thanhauser method (ref. 3)				
	μg/mg dry wt.		μμg/cell		RNA/	μg/mg dry wt.		μμg/cell		RNA/
	RNA	DNA	RNA	DNA	DNA	RNA	DNA	RNA	DNA	DNA
V*	6·17	1·37	840	187	4·5	6·20	1·13	845	154	5·5
T*	5·86	1·61	1,167	321	3·6	6·69	1·73	1,132	344	3·8
Z*	9·33	2·61	2,303	644	3·6	7·28	2·15	1,797	531	3·4

* V, Vegetative cells; T, conjugation-tube formed cells; Z, zygote.

with the change of respiratory activity. The amounts of oxygen evolved, the oxidative activity of reduced indigo carmine, and the activities of oxidation and reduction of cytochrome *c* in light, declined at the late conjugation stage both in intact and cell-free states.

The content of nucleic acids was also found to vary during the process (Table 1). The amount of DNA per mg dry weight of cells was increased by about 20 per cent in conjugation-tube formed cells (T-cells) and by about 200 per cent in zygote (Z-cells) compared with that of vegetative cells (V-cells), but there was not such a percentage increase of RNA. Calculation of the DNA content per cell showed that this was increased about 1·7-fold in T-cells and 3·4-fold in Z-cells compared with V-cells, while RNA was increased in T-cells and in Z-cells by about 1·4-fold and 2·7-fold, respectively. From these results one can see that the DNA and RNA per cell of zygote is approximately twice that of a T-cell. As shown in Table 1, the ratio of RNA to DNA in T-cells was the same as in Z-cells and less than in V-cells.

When the cells were growing and dividing normally, most of the cells observed by day were short in length (172–174μ) and elongated cells (342–344μ) were rarely observed. The width of both cells was about 115μ. The former were designated as 'short' cells and the latter as 'long' cells. It is of interest that T-cells were originated only from 'short' cells and not from 'long' cells, and DNA content of each 'long' cell was equivalent to that of a T-cell and about twice that of a 'short' cell. DNA in T-cells, half of which might be synthesized at the earlier conjugation stage, seems to be closely connected with conjugation-tube formation, because T-cells are formed without cell division and differ in length from 'long' cells.

Estimation of basic proteins in the larger particulate fractions (nuclear and chloroplast) showed a gradual increase during the conjugation process. From this fact, it may be assumed that the decline of enzyme activities, at the later stages of this process, is due to the action of some basic proteins depressing the formation of messenger-like RNA and of enzymes. Investigations on the properties of the basic proteins are in progress, and the details of this study will be published elsewhere.

We thank Prof. S. Usami for his advice during this investigation.

KIMIKO SASAKI
KATSURO TAKAYA
TETSUO ONODA

Department of Botany,
Faculty of Science,
Hokkaido University, Sapporo, Japan.

[1] Takaya, K., and Sasaki, K. (in preparation).
[2] Ogur, M., and Rosen, G., *Arch. Biochem.*, **25**, 262 (1950).
[3] Schmidt, G., and Thanhauser, S. J., *J. Biol. Chem.*, **161**, 83 (1945).

Variable Photosynthetic Responses of *Pinus resinosa* Seedlings to Herbicides

HERBICIDES have shown variable toxicity to young gymnosperms; the susceptibility of these plants greatly varies according to the chemicals and dosage used, the species, and the age of the plants[1-4]. Among the more obvious deleterious responses of young *Pinus* plants to certain herbicides are twisting and curling of cotyledons, distortion of old needles, chlorosis, and subsequent plant mortality. The incorporation of herbicides by the soil usually causes greater injury to plants than does the application of them to the soil surface[3,4]. Comparisons