8-faced cells may arise, as in the septa of cow-lily stems; or 11-faceted cells, as in a simple epithelium resting on a layer of cells of the same diameter; or 12-rayed cells, in Juncus pith, by loss of the vertical contacts; or 18- and 22-hedral fibers, as in pine wood, from elongation and bending—all these are accountable deviations from the 14-hedral type. Whatever hesitancy one might have in accepting this conclusion seems removed by Mr. Marvin's clear-cut observations, which clarify the entire situation.

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EFFECTS ON TISSUE CULTURES OF INTER-CELLULAR HORMONES FROM INJURED CELLS

As a part of the investigation of substances influencing cell metabolism found by us to be produced by injured cells,[1] and to which we propose to give the name "inter-cellular hormones,"[2] we have tested the effects of such factors on tissue cultures.

Fragments of embryonic chicken heart were grown on culture slides in Drew's solution and embryo juice. The six-day chicken embryos used in preparing the culture fluid were minced, mixed and divided into two portions, one of which was subjected to prolonged injury by full u.v. radiation. The "test" groups of cultures, receiving fluid from the u.v. injured cells, showed markedly greater growth and less degeneration at the end of 5 to 7 days than the control groups, to which fluid from uninjured cells was added.

Our investigations indicate the production of proliferation-promoting factors by injured cells to be a general biologic phenomenon associated with the repair after injury of such cell communities as plant and animal tissues.

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FISH REMAINS FROM THE TULLY FORMATION

AT rare intervals fragments of fossil fish have been reported as occurring in the Middle Devonian Tully formation of central New York.

During the last two years several new quarries have been opened in the Tully for road material and a few old ones reopened. In these the writer has collected a number of fossils, among them a series of specimens representing several species of different types of fish.

The finding of the first arthrodiran specimen in June, 1936, in the reopened Randall Quarry at the head of Skaneateles Lake (Cortland County), a nearly perfect left externo-basal plate of a dinichthyd closely resembling that of *D. ? oviformis* Gross 1933 of the Eifelian of Gerolstein led to careful search for more. To date, the Randall Quarry has yielded no more, but a new quarry in the extreme northeastern part of Cortland County, several miles from Cuyler, has proved richer. Ten specimens have been obtained indicative of two different arthrodires, one species of *Rhynchodus* and one bothriolepid. The arthrodiran remains consist of two large but rather badly damaged median dorsal plates of a species of *Dinichthys,* the surfaces of which are marked by fine pustules, one measuring 15×15 cm, showing a short sensory groove posteriorly, the other 13.5×23 cm; both very thick medially; the right anterior corner of another m.d. ornamented by larger pustules, exquisitely preserved as vivianite and pyrite; and several fragments of ventral plates of *Aspidichthys ? notabilis* Whiteaves, a species first described from the Upper Devonian of Lake Winnipegosis, later reported from the Hamilton of Ontario and western New York and the Genundewa limestone (Genesee) of western New York. The plates of *Aspidichthys,* even when fragmentary, are readily identified by the large pustules. The *Rhynchodus* specimen is like that figured by Eastman ('07, pl. 1, f. 6). The bothriolepid plate, poorly preserved, is a small (1.1×2 cm) median nuchal somewhat like that of *B. canadensis.*

The arthrodiran plates listed by Dr. Burnett Smith ('35, p. 111) have been kindly lent by him to the writer for study, and prove to be fragments of several large, thick plates (probably ventral) of *Aspidichthys ? notabilis.* They were collected about 1919 from a now disused and much overgrown quarry in Dutch Hollow (Skaneateles Quadrangle).

Just south of Fillmore Glen State Park, in Cayuga County, a new quarry has been opened. In it one small specimen was collected last summer containing 8 poorly preserved thin plates or scales averaging 0.5×1 cm apparently of *Rhadinichthys.*

In the large quarry of the Penn-Dixie Cement Company, east of Portland Point on Cayuga Lake, the Tully is not especially fossiliferous but after careful search on several occasions, several fish plates were found in large blocks of massive limestone blasted from the upper layers. They consist of fragments of

[1] Fardon, Norris, Loofbourow and Ruddy, *Nature,* 139: 589, 1937. Fardon, Carrol and Ruddy, *Studies Inst. Divi Thomae,* 1: 17, 1937. Fardon and Ruddy, *ibid.,* 1: 41, 1937. Norris and Ruddy, *ibid.,* 1: 53, 1937. Sperti, Loofbourow and Dwyer, *Nature,* 140: 643, 1937. Sperti, Loofbourow and Dwyer, *Studies Inst. Divi Thomae,* in publication.

[2] Loofbourow and Morgan, *Studies Inst. Divi Thomae,* in publication.

A. ? notabilis and two nearly complete bones of a large *Dinichthys*—a right suborbital lacking only the extreme anterior portion but showing an arrangement of sensory grooves quite different from that described in other species and an ornamentation of fine pustules distinct from that found on the specimens from the Cuyler Quarry. It measures 12 cm (average) in width and 17.5 cm along the ventral (incomplete) edge. Considerable labor was required with a sledge to get these bones from 500-lb. masses in shape for removal, and in reducing the block containing the suborbital just mentioned a portion of it was broken away, revealing beneath it a part of a slender plate, a left intero-lateral. This bone is rather rarely found in *Dinichthys,* and is especially interesting since from its ornamentation and size, as well as position in the rock, it probably belongs to the same individual as that represented by the suborbital.

The old Chamberlain Quarry north of Ovid (Seneca County), lately reopened, has produced two specimens from the upper layers. The better preserved is a part of a posterior median ventral of *A. ? notabilis* slightly smaller than the one described and figured by Whiteaves from Lake Winnipegosis. The other is a fragment of a finely pustulose plate of a dinichthyd.

A tentative list, pending further study of these interesting denizens of the Tully sea, follows:

Aspidichthys ? notabilis Whiteaves
Dinichthys 3 or 4 sp.
Bothriolepis ? sp.
Rhynchodus sp.
Rhadinichthys ? sp.

S. G. Williams ('87) lists a "fish spine" from the Tully. No fish remains are listed by Cooper and Williams ('35).

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MORE ABOUT "FLYING FISH"

HAVING read with considerable interest the numerous articles in SCIENCE about flying fish, I would like to make a few comments which, I believe, may explain their method of flying.

Innumerable observations of flights were made from the decks of the hydrographic surveying ships "Pathfinder," "Fathomer" and "Marinduque" of the Coast and Geodetic Survey by the writer while attached to these vessels when on duty in the China and Sulu Seas. At times as many as forty or fifty fish would be in the air at once, when frightened by the oncoming ship, and it was very common to see a dozen or more leave the water almost simultaneously, some ten to twenty feet ahead of the bow of the ship. In general, they spread out, fanlike, in their efforts to get away from the ship, very often leaving trails extending through 180 degrees from the bow of the ship, and in some cases a few would start in the reverse direction of the ship, indicating the fishes' desire to get away, in any direction, from the source of danger. Such flights have been seen in dead calms with glassy seas through all wind velocities to the monsoons of say about twenty-five miles per hour and waves ten feet high from trough to crest.

Such observations indicate that the fish can take off in any direction, either with or against the wind, and in any sea from smooth to choppy. Fish have been observed swimming to the surface, emerge and then immediately turn and soar away at right angles. Consequently, it is not necessary for him to have momentum to carry him forward. Momentum may help but is not necessary, and my own belief is that all the flying effort is produced after the body leaves the water; the propulsion being entirely by the lower portion of the tail used as an oar in sculling, except that it is not kept in the water but is dipped in, first on one side and then on the other. Better, it is probably not actually dipped into the water but is very efficiently pushed downwards and backwards against the water, lifted and repeated on the other side. The "dots" observed by other writers are not made by pairs, such as would be made by wings, but are alternated. The reason for believing that the lower portion of the tail may not dip clear into the water comes from observations of how a fish may continue his flight and increase his speed after having been out of the water for eight or ten seconds. When getting up speed at the beginning of the flight the water is lashed vigorously and considerable splashing is done and the "dots" are not distinct as they are at the latter part of the "take off."

The body of the fish then becomes horizontal, or nearly so, and with the wings fully spread but without any motion, so far as I could ever detect, the fish flies in a nearly straight course with gradually diminishing speed and decreasing altitude. This usually ends with a return to water, but occasionally the tail of the fish is depressed sufficiently to enable the lower part to reach the water, while the wings are kept outspread, and the sculling is repeated for maybe fifteen or twenty feet, during which time the speed is rapidly increased to as great or greater speed than at the first take-off. The tail is then lifted and the body resumes the horizontal position and the flight continued sometimes to even greater distances than the first portion. I do not remember of ever having seen this done a second time in one flight.

The "dots" made in the second acceleration had seldom, if ever, any accompanying splashing and appeared as depressions in the water rather than elevation. They were closer together at the beginning and