April 11, 1930

Plane, Fokker, trimotor; weather clear, sunny; surface air temperature, 28° C.; air temperature aloft, 24° C. at 5,000 feet and 22° C. at 5,800 feet; surface wind S., 5.5 miles; wind at 6,000 feet S.S.E., 8 miles.

Plate no.	Medium	Altitude above sea-level, ft.	Speed of plane, M.P.H.	Number of colonies		
				Fungi	Bacteria	Total
1	Pot.	5,500		19	222	241
2	Nutr.	5,700	110–115	10	103	113
3						
4	Nutr.	5,500–5,800		11	165	176
5	Pot.	5,200	120	25	151	176
6	"	5,000	125	23	103	126
7	Nutr.	4,800–5,000		6	66	72
8	Pot.	4,300–4,500	115–120	20	43	63
9	"	2,300–1,500		38	158	196
		April 12, 1930				
		Same plane; weather clear, sunny, quiet.				
10	Nutr.	3,100–3,700	95–100	50	454	504
11	"	6,000–6,400	100–105	1	211	212
12	"	7,000–7,200	100–110	8	95	103

gray colonies of bacteria predominated, although there were numerous chromogens. The fungi and bacteria will be tested for pathogenicity on the most important economic plants of Arizona.

The viability of micro-organisms in arid regions has not been extensively studied, possibly because institutions of research usually are not located in or near deserts. On this subject the opinion is widely held that bacteria and fungi are quickly killed by the prevailing conditions of light, heat and dryness. No doubt the almost proverbial health of the native human inhabitants of arid regions has something to do with this belief, although their health is probably the result of the stimulating effect of outdoor life rather than of the absence of germs. At any rate, parasitic plant diseases are common, and bacteria and other micro-organisms are abundantly present.

The abundance of living organisms in surface dust and soil in Arizona has been shown by two investigators. In 1919 Miss Mary Estill,[1] now Professor M. E. Caldwell, isolated more than thirty species of bacteria from dust obtained in the streets of Tucson and adjacent country. Later the same investigator[2] showed that the bacterium of tuberculosis retained its virulence in dust, outdoors, for as long as seventy-two hours. Dr. Laetitia M. Snow[3] in 1926 studied the bacterial flora of wind-blown sand obtained near Tucson and isolated about eight times as many organisms as were later found to live in the wind-blown sand of dunes at Sandwich, Massachusetts.

That the micro-organisms in air ride on particles of dust has long been known. Dust and wind-blown sand carrying bacteria, fungal spores and even pieces of mycelia are lifted upward by the spiral "twisters" and the wind-storms of arid regions. Granted that the organisms remain alive during the aerial movement, the distance that they are carried becomes an important question. This will depend upon the height to which the dust and sand ascend as well as upon the air current. If the germ-laden particles reach the upper air currents the distance may be great. During the flights made by the writer, a maximum altitude of 7,200 feet above sea-level or 5,700 feet above the surface was attained and living bacteria found. Therefore dust must be lifted to that height. Redway[4] states that wind-blown dust rarely ascends over 2,000 feet. On the other hand, MacMahon,[5] an aviator, says of a South American trip, "On still another flight, while crossing the pampas, a sandstorm blowing 6,000 feet into the air forced us to fly blind for a time."

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THE RELATION OF THE THYROID AND PITUITARY GLANDS TO MOULTING IN TRITURUS VIRIDESCENS

STOPPING of the periodic moult in *Triturus viridescens* can be brought about by extirpation of certain of the endocrine glands. For example,[1] thyroidectomy inhibits skin shedding, and animals lacking thyroids become gradually blacker and blacker as layer after layer of cornified cells is formed and not sloughed off. This reaction is usually noticeable within two weeks (depending somewhat on the temperature) and by four weeks is markedly evident. Hypophysectomy also causes a cessation of moulting, and the experiments done by two of the authors (Adams and Kuder) show that the pars anterior is the part intimately involved in this result. Removal of it alone produces the same effect (lack of moulting and

[1] Mary Howard Estill, master's thesis, University of Arizona.

[2] Mary Estill Caldwell, "Viability of Mycobacterium Tuberculosis in a Semi-arid Environment," *Jour. Infect. Dis.*, 37: 465–472, 1925.

[3] Laetitia M. Snow, "A Comparative Study of the Bacterial Flora of Wind-blown Soil: I. Arroyo Bank Soil, Tucson, Arizona," *Soil Sci.*, 21: 143–161, 1926; "A Comparative Study of the Bacterial Flora of Wind-blown soil: II. Atlantic Coast Sand Dunes, Sandwich, Massachusetts," *Soil Sci.*, 24: 39–48, 1927.

[4] Jacques W. Redway, "The Dust of the Upper Air," *Ecology*, 2: 104–109, 1921.

[5] Harold E. MacMahon, "Blazing New Trails," *Liberty Magazine*, p. 47, May 3, 1930.

[1] A. E. Adams and L. Richards, "The Effect of Thyroidectomy in *Triturus viridescens*," abstract, *Anat. Rec.*, 44: 222, 1929.

blackening of the animal as the layers of cornified skin remain in place) as removal of the whole gland.

The similarity of the appearance of the specimens of *Triturus viridescens* after thyroidectomy or hypophysectomy suggests that there may be some interdependence of these two glands in the control of the moulting process, and a series of experiments was devised to answer the following questions. (1) Does thyroid removal in itself cause the inhibition of moulting or does it affect the pituitary in some way so that it is a maladjustment on the part of the latter rather than absence of the former that is at the root of the difficulty? Or (2) does hypophysectomy in itself directly cause the inhibition or does its absence affect the thyroid in some way so that it is essentially an upset of the thyroid that is the real trouble?

The tests were made by grafting thyroid glands (in a few cases by injecting thyroxin) or pituitary glands (whole glands or pars anterior only) into (1) thyroidectomized, (2) hypophysectomized or (3) hypophysectomized-thyroidectomized animals, all of which had stopped moulting after the respective operations and were very definitely black with the piled up cornified epidermal layers. Briefly the results were as follows. Thyroid glands of normal animals transplanted into thyroidectomized or hypophysectomized or hypophysectomized-thyroidectomized animals will induce a complete moult of the many-layered cornified epidermis within a short time, usually as early as two days after the transplant. Transplantation of the thyroids of hypophysectomized animals into hypophysectomized or thyroidectomized animals will have the same effect. Injection of thyroxin or immersion in it will cause moulting in thyroidectomized animals, and injection is likewise efficacious in hypophysectomized ones, but it has not yet been tried on ones from which both glands have been removed. Pituitary glands (whole glands or anterior lobes) transplanted into thyroidectomized or hypophysectomized-thyroidectomized animals (ones from which the thyroids and pituitary had been removed simultaneously or from which the thyroid had been removed just prior to grafting) will not bring about the moult. (In a few cases thyroidectomized animals, which had blackened somewhat, moulted after pituitary grafts, but a careful search always revealed the presence of some thyroid follicles.) If thyroids are transplanted into these animals subsequently to the pituitary grafts, the animals shed their skins. Pituitary glands (whole glands or anterior lobes) transplanted into hypophysectomized animals will induce moulting within a few days.

This combination of results at once suggests that the key to the explanation of the inhibition of moulting lies primarily in the thyroid gland. Thyroid grafts are able to stimulate moulting in all the operated animals (thyroidectomized, hypophysectomized or hypophysectomized-thyroidectomized) because they supply the essential hormone, but pituitary grafts are able to do it only in hypophysectomized animals where the thyroids are still present and can be activated by such grafts. In the thyroidectomized animals an athyroid condition has been produced, and although cornification of the skin continues, sloughing is discontinued. In the hypophysectomized animals, a hypothyroid state (possibly a functional athyroidism) has been brought about by the removal of the pituitary gland (either whole gland or pars anterior only) and this hypothesis is supported by a histological study of the thyroids in such animals. Instead of the usual cuboidal cells bounding the follicle and a moderate amount of colloid within the follicle, the cells are flattened and a large amount of colloid distends the follicle. However, these thyroids contain the active hormone because when removed from hypophysectomized animals and retransplanted into the same animal, moulting occurs just as quickly (in two days) as if thyroids from normal animals had been used. Such thyroids also will cause moulting in thyroidectomized animals.

From these experiments it seems probable that the thyroid hormone is essential for the normal moulting mechanism and that the secretion of the anterior lobe of the pituitary in some way regulates the thyroid gland. A full account of these experiments will appear later.

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BOOKS RECEIVED

DUNCAN, JOHN C. *Astronomy.* Pp. xix + 435. 65 plates. 180 figures. Harper. $3.75.

GOOD, M. E. *Hear with Your Eyes.* Pp. viii + 41. 32 photographic illustrations. Appleton. $1.00.

KOPPANYI, THEODORE. *The Conquest of Life.* Pp. xi + 263. 55 illustrations. Appleton. $2.00.

MACDOUGAL. *The Green Leaf:* Major Activities of Plants in Sunlight. Pp. 142. 22 illustrations. Appleton. $2.00.

MATHEWSON, LOUIS C., and JOHN W. YOUNG. *Elementary Theory of Finite Groups.* Pp. x + 165. Houghton Mifflin. $2.50.

PULVERMACHER, WILLIAM D., and CHARLES H. VOSBURGH. *The World about Us.* Pp. v + 382. 288 figures. Heath. $1.60.

ROBINSON, DANIEL S. *The Principles of Reasoning.* Second edition. Pp. xviii + 395. Appleton. $2.50.

SHAPLEY, HARLOW. *Harvard Observatory Monograph No. Two.* Star Clusters. Pp. xi + 276. 14 figures. McGraw-Hill. $3.00.

VAN CLEAVE, HARLEY J., HENRY R. LINVILLE and HENRY A. KELLY. *Biological Principles in General Zoology:* A Laboratory Manual. Pp. 185. Ginn. $ .80.