where the disease is present in a field the greater infection occurs where the alfalfa weevil is also present. This disease is so injurious that fully 80 per cent. of the first cutting may be lost on account of it. However, while the chief damage is usually noted in the first cutting, the plants may be seriously injured in the crowns and roots, thus causing entire plants to be killed.

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May 16, 1914

Further Notes on Tamarisk

Judging from Mr. Carleton's remarks[1] and the writer's experience *Tamarix gallica* is another of those interesting plants that will grow in very dry as well as in exceedingly wet places. This species is extensively planted at Belle Isle, Vermillion Parish, in the broad coastal marsh of Louisiana. The soil here is always saturated with water and is subject to inundation by exceptional tides. The plant is known as salt-water cedar, and its main use is for firewood. Little of that commodity is needed in this austral locality, and sections of the limbs of *Tamarix,* in size from the thickness of a finger to that of the wrist, answer every purpose. The plants are pollarded and closely pruned but quickly produce a new crop of firewood.

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A Factor for the Fourth Chromosome of Drosophila

A new character has recently appeared in *Drosophila* in which the wings are "bent." The factor concerned does not fall within any of the three groups of linked factors so far described. There are four pairs of chromosomes in *Drosophila* (without taking into account possible complications of the *XY* pair). The number of chromosomes now corresponds therefore with the number of independent groups of factors. The correspondence goes even further than number, however, for the sex-linked group is known to be distributed with the *X* chromosome, and all the groups correspond in their size-relations with the chromosomes, there being three large groups and one small, just as in the case of the chromosomes. The factor for "bent" forms the small "group" by itself, and accordingly may be considered to lie in the small chromosome.

Hermann J. Muller

[1] Science, N. S., XXXIX., pp. 692–694, May 8, 1914.

Dickerson[1] on California Eocene

Two brief but valuable papers by Mr. Dickerson call attention to the fact that the apathy with which the Eocene of California has been treated since Gabb's time is less on account of any last word having been said on the subject than the overshadowing economic importance of the later Tertiary horizons of the state.

The use of the name Tejon to embrace all the post-Martinez Eocene of the Pacific coast and the recognition of the section south of Mt. Diablo as a standard for this formation can hardly meet with general approval. It appears that this section is composed exclusively of beds belonging to a formation stratigraphically younger and separated from the horizon at the type section in the Canada de las Uvas near Fort Tejon by several thousand feet of strata as well as a considerable time gap.

The writers[2] have shown that in Oregon and Washington the Eocene may be divided into three faunal divisions, the Chehalis, Olequa, and Arago or Ione formations. The

[1] Dickerson, Roy E., "Fauna of the Eocene at Marysville Buttes, California," Bull. Dept. Geol. Univ. of California, VII., p. 257–298, Pl. XI.–XIV., 1913; "Note on the Faunal Zones of the Tejon Group," *loc. cit.*, VIII., No. 2, p. 17–25, 1914.

[2] Arnold, R., and Hannibal, H., "The Marine Tertiary Stratigraphy of the North Pacific Coast of America," *Proc. Am. Phil. Soc.*, LII., No. 212, p. 559–605, 1913.

Chehalis formation is characterized especially by *Venericardia horni* Gabb, *Meretrix californica* Gabb and an austral flora, the Olequa formation by *Pecten (Chlamys) landesi* Arn., *Venericardia horni* Gabb, and a tropical flora, and the Arago or Ione formation by *Turritella merriami* Dickerson, a form of *V. horni* with obsolete ribs (variety *aragonia* A. & H.) and a tropical flora.

The Chehalis and Olequa horizons lie in juxtaposition, and constitute the coal-bearing Eocene of western Washington. The upper or Olequa horizon has not been definitely recognized in Califoria, but the lower or Chehalis horizon is the apparent equivalent of the Eocene of New Idria, Salt Creek, Coalinga, Canada de las Uvas, Simi Valley, Topa Topa Mountain, Santiago Canyon, and presumably Rose Canyon near San Diego, as well as the plant-bearing shales near Lake Elsinore.

Looking at a map of the Pacific coast, it is evident that these deposits were formed in two embayments. The Puget Basin covered western Washington from the south base of the Olympic Mountains to the Columbia River, an arm reaching northward to Vancouver, British Columbia, while the main body extended inland to the foot of the here more recently developed Cascade Range and probably farther, for the Swauk formation of central Washington apparently represents deposits formed near the east margin of the same great stretch of marsh and estuary. The Tejon basin covered the San Diego mesa, the Los Angeles coastal plain, and crossed the San Gabriel and Santa Ynez Ranges in a long arm extending into the San Joaquin Valley and northward through the Coast Ranges as far as New Idria. As the deposits are usually more or less marine in origin, it is evident that this embayment was rather of the type of an open roadstead than the partly detached brackish estuary in which the Washington deposits were formed.

The Arago or Ione beds represent a horizon younger than any Tejon recognized in the Tejon or Puget basins. They do not occur in juxtaposition, but are developed in different districts, lying indiscriminately across older rocks. The Arago or Ione beds have been recognized in three basins, the Crescent basin, a narrow arm extending inland along the north base of the present Olympic Mountains to the vicinity of Port Crescent, Washington; the Arago basin, a broad open roadstead covering the Coast Range, Williamette Valley, and Umpqua basin of Oregon, the marine deposits of the south and west being gradually replaced to the north and east by débris from the Eocene volcanoes of the Cascade Mountains; and the Ione basin which extended inland between the north terminus of the Mount Hamilton Range and the higher Coast Mountains of northern Lake County, to lap the base of the Sierra Nevada. This embayment spread southward through the San Joaquin Valley to Pacheco Pass and San Joaquin Canyon, and north to Oroville and perhaps beyond. Most of the deposits were laid down in a sea of considerable depth as shown by the glauconitic sandstones and the paucity of coal beds, but there is a tendency for the marine beds of the eastern border at Merced Falls, the Mokelumne River south of Ione, and South Oroville Table Mountain to grade up into the rhyolitic tuffaceous plant beds between Ione and Carbondale and at Oroville Table Mountain, while in the district about the Big Bend of Pit River only deposits of the latter type are known.

As already noted, the Tejon type section in the Canada de las Uvas was taken in beds of the Tejon embayment, and since the name Tejon series has always been used in a loose sense the writers have proposed to retain it in such a way as to cover the Chehalis and Olequa formations of the Puget embayment, as well as the deposits of the Tejon embayment.

The Arago or Ione beds, occurring as they do in basins distinct from those in which the Tejon series is developed and being formed at a different period, must be treated as a distinct division of the Eocene. The earlier name is the Ione formation,[3] the Arago having been given several years later.

[3] The gravels underlying the mud flows of Marysville Buttes often mapped as Ione are of very much later age.

If the section south of Mt. Diablo is considered as a standard for the Ione of California it would be interesting to see whether the divisions admitted by Dickerson may be recognized elsewhere. The series is at many points, especially in southern Oregon, extremely thick, and might easily include more than one faunal horizon as yet unrecognized.

On the whole the writers are in hearty accord with Mr. Dickerson's results. A most valuable point brought out is the discussion of the depths of the water in which the various beds were deposited. It should be the incentive to further studies of this sort which have been altogether too much neglected.

Ralph Arnold,
Harold Hannibal

SCIENTIFIC BOOKS

Artificial Parthenogenesis and Fertilization. By Jacques Loeb. The University of Chicago Press, Chicago, Ill. 1913. Pp. viii + 306. 39 tables and 86 figures. Price $2.50 net; $2.68 post-paid.

As stated in the preface, "Artificial Parthenogenesis and Fertilization" is in reality the English translation of an earlier work, "Die Chemische Entwicklungserregung des Tierisches Eies," enlarged and brought up to date by incorporation of the recent research in the field of development. The realm of artificial parthenogenesis is not a narrow one, by any means. It involves problems of wide physiological interest, the action of ions on tissues, the natural death of cells, immunity, hybridization and organic oxidation, a process coextensive with life itself. Thus we have chapters devoted not only to the history and methods of artificial parthenogenesis, but on "The Relative Physiological Efficiency of Various Isosmotic Solutions"; "Chemical Constitution and Relative Physiological Efficiency of Acids"; "Condition for Maturation of the Egg"; "Heterogeneous Hybridization"; "Hydrolytic Processes in the Germination of Oil-containing Seeds," etc. The chapters contain a mass of detailed results, chiefly those of the author, obtained by almost continuous experimentation over a period of fifteen years. Each is a model of what the experimental method should be—the observation of certain facts, the formation of provisional hypotheses to explain these observations and, most important of all, the subsequent testing of the hypothesis by experiment. Only in this way can a mass of unrelated details be welded together into a logical whole presentable to the general reader, as well as the special student of the field of development.

The more recent discoveries are naturally of greatest interest. One is impressed in reading Loeb's book, with the great variations in the conditions for development among closely related forms—variation in factors which we should expect to be fundamental and universal. Thus we find that the eggs of *Strongylocentrotus purpuratus* do not develop in neutral sea water, but only in slightly alkaline sea water, whereas the eggs of *Arbacia punctulata* develop not only in neutral, but even in a slightly acid medium. The response of eggs to different methods of artificial parthenogenesis varies greatly. All gradations occur from species which are normally parthenogenetic or occasionally parthenogenetic through those ready to respond to any method, even mechanical agitation, to forms developing only after very special treatment or not responding to stimulation of any kind.

A similar variation exists in regard to the oxidative process, which is of particular interest for the theory of development. The rate of oxidation in sea-urchin eggs increases sixfold after sperm fertilization or artificial fertilization. Apparently the sea-urchin egg has come to a rest because something inhibits its oxidations and the sperm can set them going again, with consequent development. With this hypothesis in mind we turn to the starfish egg, only to find that here the oxidations do not increase after the sperm has entered. The starfish egg undergoes a certain amount of development, maturation, in sea water and then comes to rest. The entrance of sperm or treatment of some