fects of fatigue on the following day. Both practice and fatigue are subject to large individual variations. Oehrn has studied the minor variations of practice and fatigue in a session of two hours' work, finding first a stage in which practice outweighs fatigue, and then a stage in which the reverse is true.

(8) *Miscellaneous and Individual Variations.* The complex re-actions, just as the simple ones are subject to the influences of distraction, vary under the action of drugs, in morbid conditions, and present large individual variations. These points, though frequently noticed incidentally, have not been subjected to special study, so that briefly citable and conclusive figures are lacking. Regarding the action of drugs, Kraepelin is inclined to believe that the distinction is, under their influence, almost always rendered more difficult, being only slightly subject to the period of shortened times, while the choice factor very readily becomes shorter than the normal. Marie Walitzkaja finds that the complex re-action times in the insane differ more from the normal than do their simple times. An adaptive re-action for the two hands which for the normal required 351–406σ, required 707–943σ in cases of general paralysis, and 1,085σ in a case of mania. These should, however, be regarded as individual rather than general results. The individual variations may be regarded as increasing with the complexity of the re-action. Men differ more from one another in the time needed for doing difficult things than in the time needed for simple things. Systematic experimentation upon this point is lacking: but a suggestion of the truth may be obtained by calculating the average deviation from their mean, of Merkel's ten subjects in their simple re-action times, their subjective distinction times, and their adaptive re-action times; the result being 2.23 per cent, 3.35 per cent, and 6.79 per cent.

JOSEPH JASTROW.

[To be continued.]

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

A Study of California Soils.

THE material greatness of California rests, in the last analysis, upon the vast range and high native fertility of its soils. California is a State with but few deposits of coal and iron, though possessing almost every other kind of mineral. Its food-producing resources, as shown by the character and extent of its soils, are very much beyond any thing that the Californians themselves have ever claimed.

The longest report on California soils that has ever appeared is that in the "Tenth Census Report;" but the work of soil-analysis has been going on ever since, and the larger number of the State University's agricultural bulletins are devoted to this and cognate subjects. The agricultural subdivisions adopted are as follows: the Sacramento valley; the San Joaquin valley; the Sierra foot-hills; the southern or Los Angeles region; the coast region north of San Francisco and San Pablo Bays; the coast region south of those bays.

In all of these districts the variety of soils is very great. Only a few especially representative soils can be tabulated at length in this article. The Sacramento valley, for instance, contains a great variety of rich sediment soils, gray or dun-colored, powdery loam, very rich and easy of tillage; also dark adobe loams, moderately heavy, paler in color a foot below the surface; also clay loams, brown-black when wet; also heavy, black adobes, the strongest of wheat-lands; also light, grayish-yellow "slickens," the mining *débris* deposit. All these soils have a sufficient and often a very generous supply of lime. In all the alluvial soils the amount of potash is large, sometimes very large. The supply of phosphates is not large. Professor Hilgard sums up the Sacramento valley lands by saying that the predominant soils are "fine-grained alluvial loams, with extensive belts of heavy clay," or, in the California phrase, "adobe lands." The California adobe is much like the black prairie soil of the Mississippi, but the phosphoric-acid supply is one-third higher.

Sacramento Valley Soils.

	River Alluvium.	Black Loam Soil.	Valley Soil.	Mining Sediment.
Insoluble matter, and silica	73.444	62.304	71.005	69.062
Potash	.652	.305	.929	.300
Soda	.077	.221	.124	.124
Lime	1.444	2.909	.770	.521
Magnesia	2.277	1.042	2.285	.768
Br. oxide of manganese	.015	.025	.106	.089
Peroxide of iron	5.804	9.342	8.011	6 586
Sulphuric acid	.030	.068	.120	.067
Alumina	10.397	13 038	9.159	14.229
Phosphoric acid	.087	.095	.111	.078
Water and organic matter	5.351	10 149	7.115	8.024
Total	99.578	99.498	99.735	99.848

In the great San Joaquin valley the prevailing character of the soil is sandy, often very coarse. There are also black adobes in narrow belts, near the rivers or sloughs, and hillocky plateau lands, either loamy or of gravelly clay, with much hard-pan. The "red soil" of the foot-hills shows many distinct sorts. Orange-red is nearly the prevailing tint. Red loam, red gravel, red clay, and the red soil of the placer mines, filled with decomposed slate, are among the kinds of Sierra foot-hills soils. The color comes from the presence of four to twelve per cent of iron oxide. The average of phosphates is low, but in some districts the supply is all that can be desired. These soils are eminently well adapted to vines, fruit-trees, and vegetables. In the Coast

San Joaquin Valley Soils.

	Black Adobe.	Brown Adobe.	Dry Bog Land.	Wire-Grass Land.
Insoluble matter and soluble silica	72.058	79.492	67.34	71.420
Potash	.396	.714	1.05	1.224
Soda	.479	.444	.84	3.043
Lime	1.927	1.769	6.51	3.043
Magnesia	1.640	2.048	3.96	.087
Br. oxide of manganese	.056	.041	.04	.030
Peroxide of iron	6.815	3.728	5.05	5.823
Alumina	11.620	7.988	7.97	7.137
Phosphoric acid	.179	.038	.32	.239
Sulphuric acid	.037	.074	.08	.655
Carbonic acid	—	—	4.42	2.546
Water and organic matter	5.871	3.244	3.71	7.091
Total	101.078	99.580	101.29	99.972

Range there seems to be all possible varieties and combinations of soils.

The nature of California soils can better be shown by taking some representative soils in the various districts, and giving the complete analysis from several different localities.

Bench Lands and Sierra Foot-hills.

	Fresno Plains.	Red Loam.	Red Foot-hills.	Red Chaparral.
Insoluble matter, and silica	88.579	82.592	69.52	68.864
Potash	.340	.249	.38	.417
Soda	.248	.035	.07	.052
Lime	1.163	1.021	.96	.288
Magnesia	.499	.471	1.09	.207
Br. oxide of manganese	.034	.018	.39	.087
Peroxide of iron	3.267	5.811	12.42	7.705
Alumina	3.221	6 283	10 97	14.443
Phosphoric acid	.097	.043	.16	.047
Sulphuric acid	.117	.019	.01	.074
Water and organic matter	1.789	3.644	5.14	7.680
Total	99.368	100.186	101.11	99.815

The famous bed-rock land, long considered worthless, lies on the borders of the valley. The soluble silica runs to six and eight per cent; alumina, above five per cent. There are only small quantities of potash, soda, and magnesia, but the sub-soil in a measure supplies these deficiencies. Lime is in adequate quantity. This is the soil where giant-powder is used to break up the bed-rock when planting orchards, and the trees afterwards thrive.

The dry bog soil is immensely rich, equal in native qualities to the famous buckshot soils of the Yazoo bottoms, but the surplus of alkaline salts prevents its use until reclaimed by fresh water or gypsum. The wire-grass soil is highly productive. There is a little alkali, but not enough to injure it. The brown adobe is a very representative soil, deep reddish brown in color, contains much sand, and is easily tilled.

Southern California Soils.

	Mojave Desert.	San Gabriel Valley.	Mesa Land.	Silty Soil. Lower Bench.
Insoluble matter and soluble silica	75 964	81.12	86.21	87.511
Potash	.928	.27	.48	.634
Soda	.078	.17	.14	.070
Lime	1.787	.68	.36	.759
Magnesia	1.782	1.77	.54	.593
Br. oxide of manganese	.026	.10	.01	.025
Peroxide of iron	5.478	6.30	3.69	3.350
Alumina	9.227	6.79	5.12	3 095
Phosphoric acid	.056	.16	.23	.200
Sulphuric acid	.012	.07	.03	.003
Carbonic acid	.456	—	—	—
Water and organic matter	3.903	3.07	2.60	3.132
Total	99.697	100.50	99.50	99.372

The foot-hill region ranges in width from ten to fifteen miles. The soils show very considerable differences, but the greater portion are of a "fair to high quality." There is a "mountain adobe" of the high valleys, which in some cases runs very high in magnesia, alumina, and ferric oxide. The "mining slum" is of exceedingly varying quality, some of it worthless for a long time; in other sections, a fair garden soil almost immediately. A large percentage of lime is present in many cases in the mining *débris*, or sediment.

The soils of the southern region—south of Tehachipi—are perhaps as varied as in any part of California. The great Mojave Desert is one of the important features. Here extensive tracts only lack water to make them of much cultural value. In fact, this high plain has ample lime and potash, though little humus, and hardly enough phosphoric acid. The arable lands of southern California consist of "bottoms," bench lands, mesas or high bench lands, mountain soils, and seacoast soils. The coast valleys are strong in phosphates; the mountain lands have more lime and humus. Reddish gravelly soils, excellent for fruit, are a characteristic feature.

There is a silty soil in many places, which retains its tilth so well that a man can easily thrust an axe-handle down to the head in the light-umber soil.

The Coast Range, like southern California, has so wide a range of sorts that a hundred analyses would not be sufficient to exhaust the number of typical cases. Many of the light soils show an especial power for absorbing moisture, and a high percentage of humus. Phosphates will probably be the first things to be exhausted. As a rule, they are adapted to fruits rather than to grains. There are black adobe soil, redwood bottom, yellow and brick-red mountain soils, gravels, loams, and almost every possible variety and combination.

CHARLES HOWARD SHINN.

Niles, Cal., Sept. 3.

BOOK-REVIEWS.

An American Geological Railway Guide. By JAMES MACFARLANE. 2d ed., revised and enlarged. New York, Appleton. 8°.

FROM a geologic point of view, this is a model handbook for tourists. The names of the railway stations are arranged as in an ordinary time-table, with the distances in miles from the beginning of the line; but, instead of the times of running trains, the traveller is informed of the age of the bed-rocks and the height of each station in feet above the sea. Abundant footnotes also call attention to localities of special interest to the collector of fossils and minerals, or to quarries, mines, oil or gas wells, remarkable waterfalls, gorges, or mountain views.

Dr. Macfarlane is well known by his earlier work, "The Coal Regions of America." Since his death in 1885, his son has bestowed much care and effort, during the scanty leisure allowed by professional duties, to the completion of this new edition of the "Railway Guide." In this work he has been aided by many geologists, both of this country and Canada, who have contributed the portions relating to the regions covered by their field-work. Among these names we note Broadhead, J. L. and H. D. Campbell, Chamberlin, Chance, Chester, Collett, Condon, Cooper, Crosby, Dana, Darton, Davis, G. M. Dawson, Dwight, Emmons, Fontaine, Gannett, Gesner, Gilbert, Hague, Hall, Hilgard, Hitchcock, Hunt, Irving, Johnson, Kerr, Lesley, Loughridge, McGee, Newberry, Orton, Owen, Procter, Pumpelly, W. B. Rogers, Russell, Safford, Shaler, Smith, Smock, Stevenson, St. John, Todd, Uhler, Upham, White, Whitfield, G. H. Williams, Willis, A. and N. H. Winchell, Worthen, Wright. The book is prefaced by tables of the geologic formations and their descriptions, occupying about fifty pages, "intended for railway travellers who are not versed in geology."

A Stem Dictionary of the English Language. By JOHN KENNEDY. New York, Barnes (Amer. Book Co.). 8°.

THE author of this work believes that children in learning to read should trace words back to the stem from which they are derived, but that in so doing they should not go out of the bounds of their own language. Thus, he holds that *bene-* in the word *benefit* should be treated as the stem of the word, without regard to its previous history in Latin. With this view he has prepared this dictionary, giving the most important stems derived from Latin and other tongues, with the principal words in which they occur and their definitions, and also the foreign words from which they are derived. Stems of Saxon origin are not usually given,