a result which has long been known for a stream-line, but, apparently, not so long known for a vortex-line. It holds also for an infinite number of curves that can be drawn through P, all lying on a certain surface, as is pointed out by Lamb ("Motion of Fluids," p. 173), the surface in question being formed of a network of stream- and vortex-lines. That such surfaces exist in the fluid when the external forces have a potential, is proved most satisfactorily by taking the integral of (α) along a circuit through P, of which a part consists of stream-line and a part of vortex-line; but into the details of this we need not enter.

I observe, also, that this equation (2) holds for the portion of any curve whatever connecting any two points, A, B, on a network surface, although this curve does not lie on the surface.

Another point to which I would call attention is an analytical expression of the state of non-vortical motion. The physical expression has, of course, reference to the non-rotation of the three principal axes of the little ellipsoid into which, at each instant, a small sphere is deforming. The analytical expression of the fact takes usually the form that there is a velocity potential, *i.e.* $\frac{du}{dy} = \frac{dv}{dx}$, with two Cartesian analogues. Here, again, I would suggest a single equation, having no reference to special axes. This equation is simply

$$\frac{d\dot{s}}{d\sigma} = \frac{d\dot{\sigma}}{ds} \quad . \; . \; . \; . \; . \; . \; . \; . \; . \; . \; . \; (\beta)$$

where s and σ denote arcs of *any two curves whatever* drawn at the point P, and $\dot{s}$ and $\dot{\sigma}$ the component velocities of the fluid along them.

It is obvious that these contain the whole three of the usual Cartesian expressions. The proof is very easy.

Cooper's Hill. GEORGE M. MINCHIN.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The following Examiners in Natural Science have been appointed for the Honour Examinations:—Mr. J. V. Jones and Mr. A. L. Selby (Physics); Prof. McLeod and Mr. V. H. Veley (Chemistry); Prof. Milnes Marshall and Mr. W. Hatchett Jackson (Morphology); Prof. Sanderson and Prof. Schäfer (Physiology); Prof. Boyd Dawkins and Prof. Green (Geology).

The conditions of tenure of the Burdett-Coutts Geological Scholarship are to be altered, so as to make it necessary for the holders to devote themselves to Geology, and to work with the Professor.

Scholarships in Natural Science are announced for competition at Merton and at New College. The examination begins on July 2.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 21.—"The Influence of Bile on the Digestion of Starch. (1) Its Influence on Pancreatic Digestion in the Pig." By Sidney Martin, M.D., B.Sc., British Medical Association Scholar, and Dawson Williams, M.D. (From the Physiological Laboratory, University College, London.)

The experiments of the authors have shown that if pig's bile be added to a solution of starch with pancreatic extract the digestion goes on with greater rapidity than without the bile. The rapidity of digestion is increased with the addition of quantities up to 4 per cent. of dried bile (equivalent to at least 30 per cent. of fresh bile). The rapidity was tested by noticing when the iodine reaction of starch had disappeared. On further research, it was found that this property of the bile depended on the bile salts (hyoglycocholate of sodium). The increased rapidity of digestion was well seen if 0·6 to 2 per cent. of bile salts were added to the digestive mixtures.

It was also found that not only was the change of starch into dextrine hastened, but also the change into sugar; and that the amount of dextrine and sugar formed when bile-salts wer present was one-fifth more than when they were absent. Fo the methods used in estimating the amount of dextrine and sugar, the original paper must be consulted.

"The Innervation of the Renal Blood-vessels." By J. Rose Bradford, M.B., D.Sc., George Henry Lewes Student. Communicated by E. A. Schäfer, F.R.S. (From the Physiological Laboratory of University College, London.)

The research was undertaken in order to map out the origin, cause, and nature of the renal nerves in the dog more accurately than had hitherto been attempted. The method employed consisted in exciting the roots of the spinal nerves, and observing simultaneously the effects produced on the general blood-pressure and on the volume of the kidney, the latter being investigated by means of Roy's oncometer. The anæsthetics used were chloroform and morphia. The general results were shortly as follows:—

No efferent vasomotor fibres were found in the posterior roots.

The efferent vasomotor fibres for the blood-vessels of the kidney leave the cord in the anterior roots of the nerves, extending from the second dorsal to the second lumbar. The renal nerves are, however, most abundant in the tenth, eleventh, twelfth, and thirteenth dorsal nerves.

In individual cases, however, there may be small variations in the number of fibres going on the one hand to the kidney, and on the other hand to the other abdominal viscera.

When quick rates of excitation are used, only contraction of the kidney and increase of general blood-pressure are observed, *i.e.* the vaso-constrictor fibres are excited.

With slow rates, however, expansion of the kidney with no increase of blood-pressure occurs, *i.e.* the vaso-dilator fibres are stimulated.

Hence the renal vessels not only receive constrictor fibres, but also dilator, and these are also most abundant in the eleventh, twelfth, and thirteen dorsal nerves.

Similarly when the peripheral end of the divided splanchnic nerve is excited with slow rates, a fall of blood-pressure is observed instead of the rise seen with quick rates.

Hence the splanchnic contains not only vaso-constrictor fibres for the abdominal vessels, but also vaso-dilators.

The results of reflex excitation can be summed up shortly by saying that the excitation of an afferent nerve causing a rise of blood-pressure is accompanied by a renal contraction, unless the nerve is one of what may be called the renal area. In this case the rise of blood-pressure is accompanied, as a rule, by either a renal expansion or else by a mixed kidney effect.

The main conclusion of this communication is the demonstration of dilator fibres in the splanchnic and in the renal nerves, and also the fact that these vaso-dilator fibres reach the kidney by the same paths as the constrictor fibres.

Chemical Society, February 7.—Mr. W. Crookes, F.R.S., in the chair.—The following papers were read:—Researches on the constitution of azo- and diazo-derivatives; compounds of the naphthalene-β-series (continued), by Prof. R. Meldola, F.R.S., and Mr. G. T. Morgan.—The action of nitric acid on anthracene, by Mr. A. G. Perkin. Hitherto, only anthraquinone and nitro-anthraquinones have been obtained by treating anthracene with nitric acid; the author, however, finds that nitro- and dinitro-anthracene can readily be prepared by the action of nitric acid upon anthracene if care is taken at once to decompose any nitrous acid which may be formed.—The preparation of glyceric acid, by Dr. Lewkowitsch.—The relation of cobalt to iron as indicated by absorption-spectra, by Dr. W. J. Russell, F.R.S., and Mr. W. J. Orsman, Junr. It is well known that when examined spectroscopically, some coloured metallic compounds are found only to produce a general absorption, but from previous observations it seemed possible to the authors that in some cases at least this might be resolved into bands by employing more powerful chemical agents than are generally used in such cases; experience had indicated that the chloride is usually the most suitable salt, and that it should be dissolved in chlorhydric acid and the liquid saturated with hydrogen chloride, also that, if possible, ether should be taken as solvent. Applying these views to iron, it was found that ferric chloride gave a banded spectrum strikingly similar to that of cobalt chloride. Irons of all kinds were examined: pig-iron, commercial cast-iron, and various manufactured articles; steel in the form of