cent gas mantles now employed give an excellent light much appreciated by passengers, and gas commends itself to the companies on account of but little skilled attention being required. Points which might be considered are a more generous use of steel in the body of the coach, and the adoption of fire-proof paint, as on the District Railway. Extinguishers and a few fireman's tools might be provided in every guard's van. Lastly, it might be asked whether it is not possible to reduce the chances of telescoping? It is only natural that the two front coaches of the train in question should be crushed; they were situated between two engines and a sleeping-car weighing about 40 tons. A uniform weight for passenger-carrying vehicles would appear to be a point worthy of attention.

OUR ASTRONOMICAL COLUMN.

DISCOVERY OF AN EIGHTH-MAGNITUDE NOVA.—A telegram from the Kiel Centralstelle announces that a new star was discovered by Mr. Espin, at Tow-Law, on December 30, 1910. Measurements were made at 7h. 35·9m. G.M.T., and the position of the nova is given as

R.A. = 22h. 32m. 9·5s., dec. = 52° 15′ 21″ N.

This is just circumpolar in our latitudes, and, as the object is at present of the eighth magnitude, numerous observations should be possible, weather permitting.

This object will be known as Nova Lacertæ, as it lies in that constellation, forming the apex—to the north-east—of an approximately equilateral triangle, of which the base is the line joining α and β Lacertæ; it lies in the southern border of the Milky Way in that region. As Lacerta transits during the afternoon, observations should be possible during the greater part of the evening, and as Mr. Espin records "bright lines," spectroscopic observations are desirable wherever possible.

Later reports state that the star is red, and that bright helium and hydrogen lines have been seen in the spectrum. Photographs of the nova were taken at Greenwich on December 31, and the magnitude was reported as 7·5.

METCALF'S COMET, 1910*b*.—A continuation of Dr. Ebell's ephemeris for comet 1910*b* appears in No. 4462 of the *Astronomische Nachrichten.* The present position of the comet lies in Corona at 15h. 52m., +36° 45·4′, and is moving northwards and slightly towards the west; the magnitude is nearly constant at 12·0. Although not very favourably placed for observation, the comet may still be observed during the hours of the early morning.

ELEMENTS FOR FAYE'S COMET, 1910*e*.—From observations made on November 11, 18, and 25, Prof. Ristenpart and Dr. Prager have calculated new elements for comet 1910*e*, and now publish them in No. 4462 of the *Astronomische Nachrichten.* These elements confirm the identity of the comet with Faye's comet, and give the time of perihelion passage as 1910 October 30·04 G.M.T.; the eccentricity of the orbit is given as 0·5169, and the comet's period as 5·96 years.

A set of elliptic elements, calculated by Mr. Meyer and Miss Levy, of the Berkeley Astronomical Department, and published in No. 186 of the Lick Observatory Bulletins, gives the time of perihelion passage as 1910 November 12·413 G.M.T., the eccentricity as 0·5459, and the period as 6·926 years.

A NEW MAP OF THE MOON.—A map of the moon, prepared by Mr. Goodacre, was exhibited during last session at the Royal Astronomical Society, and was enthusiastically received by the selenographers present. Mr. Goodacre now proposes to have the map reproduced on such a scale that the lunar diameter will be 60 inches, and to issue it in the form of twenty-five separate charts, each 13 inches square. If 200 subscribers are forthcoming this can be done at the price of 22*s.* 6*d.* per set. The map shows all the known lunar features, their accurate delineation depending upon the positions of 1433 points given in Mr. Saunder's memoir (the *Observatory*, No. 429).

THE TOTAL ECLIPSE OF THE MOON, NOVEMBER 16, 1910.—Reports of the observations made at a number of Continental observatories during the total lunar eclipse which took place on November 16 appear in No. 4460 of the *Astronomische Nachrichten.*

Dr. Max Wolf gives the times of entry and exit of various features as recorded by a number of observers at Heidelberg; detailed observations of the various colorations of different features are also reported.

Father Fenyi, at Kalocsa, also records colours and remarks on the general brightness of the eclipsed surface; at 12h. 33m. 12·37s. G.M.T. he observed the occultation of the star B.D. + 18° 489.

Occultations and colour variations are also recorded by Herr Mündler, Prof. Küstner, and Dr. Courvoisier.

NINETEEN STARS WITH NEWLY DISCOVERED VARIABLE RADIAL VELOCITIES.—In a paper appearing in vol. xxxii., No. 4, of the *Astrophysical Journal*, Mr. O. J. Lee gives the measures of the spectra of nineteen stars which have recently proved to be spectroscopic binaries. The spectra were photographed at the Yerkes Observatory, the dispersion of one prism being usually employed. The stars are σ Andromedæ, ι Cassiopeiæ, ρ Tauri, ν and ϕ Geminorum, 42 Camelopardalis, γ Cancri, θ Hydræ, σ Leonis, 23 Comæ Berenices, η and γ Coronæ, ι and π Serpentis, γ Ophiuchi, ϕ Sagittarii, 13 Vulpeculæ, 16 Lacertæ, and α Pegasi.

The multiple character of some of these stars was announced by Prof. Frost and Mr. Lee at the Cambridge meeting of the Astronomical and Astrophysical Society in August, but ι Cassiopeiæ, γ Ophiuchi, and α Pegasi are now included for the first time. Some of these binaries are members of visual multiple systems, and in others the examination of the H and K lines suggests that the stars may belong to that class of binaries in which the calcium lines appear to have a constant velocity.

OBSERVATIONS OF PLANETS.—The December (1910) number of the *Bulletin de la Société astronomique de France* contains some interesting notes, by M. J. Halley, on observations of Venus made at Roubaix during 1909–10.

M. Halley used a Secretan refractor of 135 mm. aperture, and was favoured with excellent atmospheric conditions. He records, in addition to the bright polar areas, several markings which persisted during his observations; the chief of these is a pair of dark streaks, divided by a bright lane, running from the terminator towards the south; a dark patch, which appeared to lengthen, in the northern hemisphere near the bright limb; and a dark area bordering the bright area at the north pole.

Several of the photographs of Saturn exhibited by Prof. Lowell are reproduced to illustrate a paper on planetary photography which appears in the November (1910) number of the Bulletin.

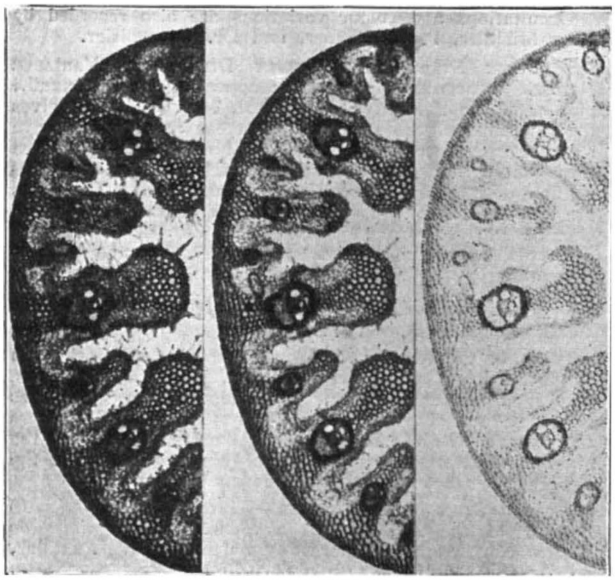
COLOUR CONTRAST IN PHOTOMICROGRAPHY.

THE latest of the series of booklets issued from the laboratory of Messrs. Wratten and Wainwright, Ltd., Croydon, deals with photomicrography. This booklet differs from most of the more pretentious works dealing with photomicrography in that but little attention is paid to the instrumental side of the subject, which is dismissed with only a few words of practical advice, attention being concentrated upon the relation between colour and contrast, especially from the point of view of the photography of stained sections.

A perusal of most books on photomicrography indicates that the more difficult parts of the subject technically, such as the high-power photography of diatoms or minute bacteria, receive a somewhat undue amount of attention compared with their importance to the average worker in science, the difficulties which less expert workers find in obtaining really first-rate photographs of sections or preparations being somewhat apt to be overlooked. The greatest difficulty found is usually that the contrast between the structure to be examined and the background is insufficient, and the main control of contrast is supplied by the colour of the light used for illumination.

A coloured object is, of course, coloured by virtue of the property which it possesses of absorbing some of the constituents from white light; if the light reflected from such a coloured object be examined by means of a spectroscope, it will be found that a portion of the spectrum is partly or completely missing. This missing portion appears as a black band, which is generally known as the absorption band of the colour. If a particular object absorbs most of the constituents from white light, so that only a small portion of the spectrum is transmitted, then that portion may be referred to as the transmission band.

Since the light which is not absorbed falls upon the eye, the sensation of colour produced is the reverse, or

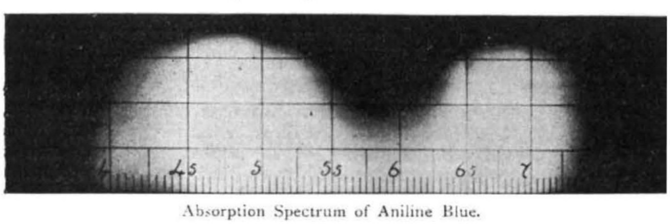


W.L. 5000 to 5400 5700 6400

Photomicrographs of an Eosine stained section.

complementary, to the colour which is absorbed, so that a light-blue object has an absorption band in the red of the spectrum, a magenta in the green, an orange in the blue-green, and a yellow in the blue-violet. Now this consideration shows that if a colour is to be rendered as black as possible, then it must be viewed or photographed by light which is completely absorbed by the colour, that is, by light of the wave-lengths comprised within its absorption band.

A useful example is given by the photomicrographs of



Absorption Spectrum of Aniline Blue.

Transmission Spectrum of Wratten B and E Screens.

a section stained with eosine; this section appears pink, eosine absorbing green and blue-green light from λλ 4700 to 5400. If the section is photographed by green light of wave-lengths 5000 to 5400, completely absorbed by eosine, the section is entirely black, the maximum amount of contrast being obtained, and, owing to an excess of contrast, the detail of the section is blocked up. Photographing at λ 5700, on the border of an absorption band, a greatly lessened contrast is obtained, which for this particular section will give the best result. If we photograph by red light of wave-length 6400, which is completely transmitted by the section, the contrast disappears and the results are flat and useless.

This section thus demonstrates the close connection between the colour of the illuminating light and the contrast produced. A different procedure is required if contrast is to be obtained, not against the background, but within the object itself.

A good case of this is the photography of an unstained section of whalebone; this is of a yellow colour, and shows ample detail to the eye, but it completely absorbs blue-violet light, and if it is photographed on an ordinary plate sensitive only to blue-violet light, then it shows far too much contrast, appearing as a black detailless mass against the background, and presenting an exaggerated example of the loss of detail which has already been noted in the eosine section photographed by light which it completely absorbs.

The proper procedure in this case is to photograph the object by the light which it transmits. The whalebone section, for instance, photographed by red light, gives perfectly satisfactory results, showing ample detail in structure.

The best method of determining the contrast required by any object is to examine the object visually under the microscope first by means of a combination of screens transmitting light absorbed as completely as possible, and then by other screens transmitting light less completely absorbed, until the degree of contrast obtained is satisfactory to the eye.

In the booklet on photomicrography, Messrs. Wratten and Wainwright, Ltd., publish a list of the chief microscopical stains, giving their absorption bands. By the help of a special set of screens a section stained with any of these colours can be illuminated in such a way as to produce any required degree of contrast.

The accompanying illustration shows the absorption spectrum of aniline blue, and the transmission band of the filters chosen to produce the maximum degree of contrast.

In order to estimate exposure, tables are given showing the various factors involved, and including a table giving the multiplying factors of the screens used singly and in pairs, the light sources given ranging from the oil lamp to the open arc.

PRIZE AWARDS OF THE PARIS ACADEMY OF SCIENCES.

AT the annual public meeting of the academy, held on December 19, the prizes awarded for the year 1910 were announced as follows:—

Geometry.—The grand prize of the mathematical sciences was not awarded, no memoir having been presented on the stated problem; Emile Lemoine receives the Francœur prize, and M. Riquier the Poncelet prize.

Mechanics.—A Montyon prize is awarded to Jules Gaultier, for his inventions in connection with surveying instruments; the Fourneyron prize was postponed to 1912.

Navigation.—The extraordinary navy prize was divided between G. Hilleret (3000 francs), J. L. H. Lafrogne (1500 francs), and J. Lecompte (1500 francs); the Plumey prize was not awarded.

Astronomy.—The Pierre Guzman prize was not awarded, but the interest accrued was attributed to the late Maurice Lœwy, for the whole of his scientific work; the Lalande prize to P. H. Cowell and A. Crommelin, for their researches in connection with Halley's comet; the Valz prize to Stéphane Javelle, for his work on nebulæ and periodic comets; the Janssen medal to W. W. Campbell, for his researches in stellar spectroscopy.

Geography.—The Tchihatchef prize is divided between Dr. Verbeek (2000 francs), for his geological explorations in Borneo, Sumatra, and Java, and Louis Vaillant, for his explorations in Central Asia; the Gay prize is not awarded, but Carlos Porter receives a mention for his work on the fauna and flora of Chili; the Binoux prize is divided between Emmanuel de Martonne (1000 francs), for his work in physical geography, A. Bellot (500 francs),