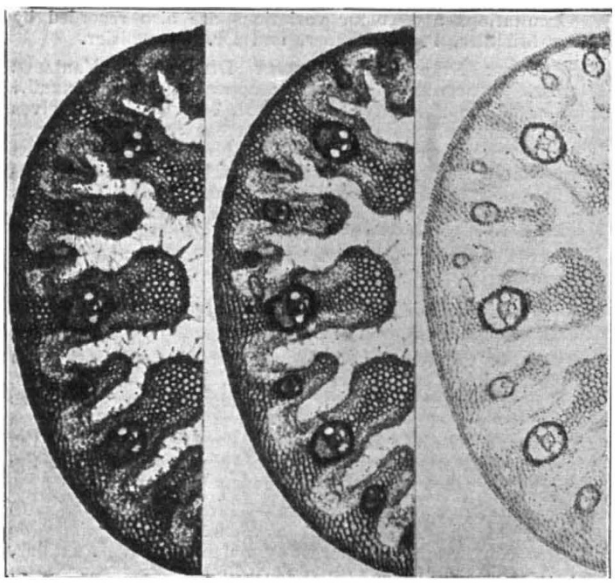
such a coloured object be examined by means of a spectroscope, it will be found that a portion of the spectrum is partly or completely missing. This missing portion appears as a black band, which is generally known as the absorption band of the colour. If a particular object absorbs most of the constituents 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

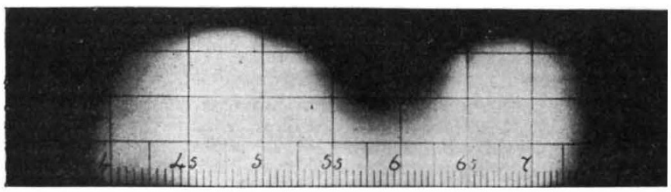


W.L. 5000 to 5400 5700 6400

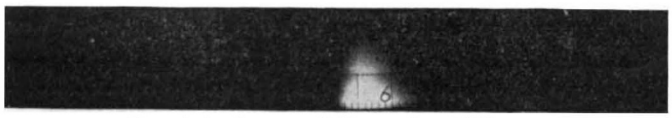
Photomicrographs of an Eosine stained section.

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),

for his monograph on the island of Delos, and Crépin-Bourdier de Beauregard (500 francs), for his guide to the geographical explorer; the Delalande-Guérineau prize to the Marquis de Segonzac, for his work in Morocco.

Physics.—The Hébert prize is awarded to M. Barbillion for his works on the technical applications of electricity; the Hughes prize to Alexandre Dufour, for his researches in spectroscopy; the Kastner-Boursault prize to M. Magunna, for his inventions in connection with multiplex telegraphy; the Victor Raulin prize to Gabriel Guilbert, for his meteorological researches in connection with weather forecasts.

Chemistry.—The Jecker prize is divided equally between A. Guyot and J. Bougault, for their researches in organic chemistry; the Cahours prize between MM. Brunel, Guillemard, and Jolibois; a Montyon prize is awarded to M. Taffanel, for his researches on explosives used in mining, and a mention (1500 francs) is divided between his assistants, MM. Fenzy, Le Floch, and Durr; the Alhumbert prize to Witold Broniewski, for his experimental studies on the electrical properties of the metallic alloys.

Botany.—No award was made of the Desmazières prize; Georges Bainier receives the Montagne prize, for his studies of the moulds; Hippolyte Coste, the de Coincy prize, for his book on French flora; Maurice Bouly de Lesdain the de la Fons-Mélicocq prize, for his memoir on the lichens in the neighbourhood of Dunkerque; G. Chauveaud the Bordin prize, for his memoir on the development and disappearance of the transitory tissues of plants.

Anatomy and Zoology.—The Savigny prize is awarded to Emile Brumpt, for his studies of African parasitic diseases; the Thore prize to Emile Massonnat, for his entomological studies.

Medicine and Surgery.—Montyon prizes (2500 francs) were awarded to G. Martin, Lebœuf, and Roubaud, for their report on the expedition for the study of sleeping sickness in the French Congo; to J. Déjerine and André Thomas, for their book on diseases of the spinal column; and to E. Perroncito, for his researches on the causes of pernicious anæmia in miners. Mentions (1500 francs) were awarded to Ch. Mantoux, for his memoir on the intra-dermo reaction with tuberculin; to P. Emile Weill, for his researches on the treatment of subjects with non-coaguling blood; and to MM. Moussu and Monvoisin, for their memoir on the milk of tuberculous cows. MM. Aynaud, Léon Bérard, and Jules Milhit receive citations. The Barbier prize is divided between A. Thiroux, for his memoir on sleeping sickness and the animal trypanosomiases in Senegal, and H. Bierry, for his work in experimental physiology; the interest on the Bréant prize is divided between Jules Bordet (3500 francs), for his work on immunity and studies on the serum of vaccinated animals, toxins, and antitoxins, and A. Taurelli Salimbeni (1500 francs), for his work in connection with cholera; the Godard prize is awarded to L. Ambard and E. Papin, for their study on urinary concentrations, very honourable mentions being accorded to MM. Carle, Hans von Winiwarter, and G. Sainmont; the Baron Larrey prize is divided between M. Chavigny, for his studies in military psychiatry, and Miramond de Laroquette, for his memoir on the scapular ring; the Bellion prize is divided between M. Imbeaux, for his work entitled "Statistical and Descriptive Annual of the Distribution of Water" (in collaboration with MM. Hoc, Devos, van Lint, Peter, Bétant, and Klein), and MM. Frois and Sartory; the Mége prize is not awarded, the interest being divided between Mlle. J. Joteyko and Mlle. Stefanowska; Séverin Icard receives the Dusgate prize, for his memoir on the signs of real death in the absence of a doctor.

Physiology.—A Montyon prize is divided between Ch. Livon, for the whole of his work in experimental physiology, and Marin Molliard, for his memoirs on the organic nutrition of the higher plants in its relations with morphology; the Philipeaux prize is awarded to Maurice Arthus, for his work on anaphylaxy; the Martin-Damourette prize to E. Laguesse, for his researches on the structure of the pancreas and their application to a rational treatment of various forms of diabetes; the Lallemand prize is divided between René Legendre and Aldo Perroncito, the former for his contributions to the knowledge of the nerve cell, and the latter his researches on the regeneration of the nerve cell. No memoir having been received on the question suggested for the Pourat prize, this has not been awarded, and is postponed until 1913.

Statistics.—MM. de Chabert and Gallois receive a Montyon prize (1000 francs) for their general atlas of Indo-China, with statistical tables, mentions of 250 francs being accorded to MM. E. Blin and Perrier.

History of Science.—The Binoux prize is awarded to Ernest Lebon, for the whole of his historical work, and especially his history of astronomy.

General Prizes.—Berthelot medals are awarded to MM. Barbillion, A. Dufour, Magunna, Gabriel Guilbert, Guyot, J. Bougault, Guillemard, Taffanel, and Broniewski; the interest of the Lannelongue foundation is divided between Mme. Cusco and Mme. Rück; Charles Fremont receives the Trémont prize; Arthur Robert Hinks the interest on the Leconte prize (2500 francs), for his researches on the solar parallax; Fabry and Perot a Wilde prize (3000 francs), for their researches on new interference methods in spectroscopy; Harel de la Noë the Caméré prize, for his improvements in bridge construction. The Lonchampt prize is divided between Albert Frouin (2000 francs), for his work on the use of calcium and magnesium salts after of orchids, F. Monier, F. Chesney, and E. Roux (1000 francs), for his researches on the influence of mineral salts in the therapeutics of fractures, and M. Fleig (1000 francs), for his studies on the intravenous injection of mineral solutions; the Saintour prize between Noël Bernard (3000 francs), for his researches on the biology of orchids, F. Monier, F. Chesney, and E. Roux (1000 francs), for their book on adulteration, and E. Kayser (500 francs), for his work as a whole. The Jérome Ponti prize is given to Henri Andoyer, an encouragement of 500 francs being accorded to M. Kimpflin. The Houllevigue prize is awarded to the late Bernard Brunhes, and an additional prize from the same foundation to Emile Gérards. M. Audibert receives the prize founded by Mme. the Marquise de Laplace, and MM. Audibert and Henry Weill the prize founded by M. Félix Rivot.

The Bonaparte Fund.

Thirty-four applications for grants out of this fund were received by the committee for the year 1910; after reducing the number to eleven, the total amount required still exceeded the amount available. Under these conditions, Prince Roland Bonaparte placed an additional sum of 5000 francs, making 30,000 francs in all, for the current year, out of which the committee recommend the following grants:—

5000 francs to M. Hartmann, for the experimental study of the distribution and development of elastic forces in bodies deformed by external stresses.

5000 francs to M. Urbain, for the extraction on the large scale of germanium, indium, and gallium from blende.

3000 francs to MM. Bauer and Moulin, for the construction of an electric furnace in platinum or iridium, to be applied to the determination of Stefan's constant and the distribution of the energy in the spectrum.

2500 francs to M. Blaringhem, to enable him to continue his researches on hereditary variations in plants, to prepare a complete collection of the plants studied during the last four years, and to purchase a suitable microscope.

2500 francs to M. Nicolardot, to enable him to pursue his studies on columbium and tantalum, especially for the purchase of the necessary platinum vessels.

2000 francs to M. Jules Baillaud, to enable him to complete his researches on atmospheric absorption, the amount to be applied to the construction of a special photometer.

2000 francs to M. Chevalier, to enable him to carry on his studies on the vegetation of French tropical Africa.

2000 francs to M. Eberhardt, for the extension of his exploratory studies on the economic botany of French Indo-China, and to complete the installation of his laboratory at Hué.

2000 francs to M. Gaillot, for the complenen of one

calculations necessary to the revision of Le Verrier's tables of Jupiter.

2000 francs to M. Bordmann, for the completion of his stellar photometer.

2000 francs to M. Quidor, for assistance in the publication of his memoir on the external morphology of the parasitic copepods.

SEX RELATIONSHIP.

PERHAPS one of the most subtle and interesting problems of life is the numerical relationship of sex and its influence on the body politic.

It has always been something of a puzzle why the proportion of each kind, apparently with little or no underlying reason, is produced in the right numbers. The argument that if such were not the case the particular species would not survive does not reveal to us the methods by which this object has been achieved by nature. That some mechanism must exist by means of which, within certain limits, the number of males and females born is regulated, is proved by the facts of history, where we have numerous examples of wars and other social upheavals where males have largely suffered, and yet within an apparently short period of time, as measured by such events, a balance has been again re-established. The sex equilibrium may be compared to that of a gyroscope, where the greater the disturbance of position the greater is the force tending to re-establish its natural stand whilst in motion. Nature in her methods never does anything exactly, but approaches an object by establishing lateral control, which guides her on her way, should any deviation occur. Thus she does not proceed along a straight line, but is continually oscillating to either side. Her progress may very well be likened to that of an inebriated person in search of his dwelling. All that can be said is that he has a tendency homewards.

The facts regulating sex must be something of the same type, and are such that the greater the oscillation in any one direction the greater must be the restraining force invoked to curb or neutralise the movement. All such movements have an inertia, and consequently, like a pendulum, pass the middle line and establish a negative phase. The history of any race in its sex composition would show us that such oscillations have occurred throughout time, modified, no doubt, in their regular sequence by such factors as wars and famine. These oscillations of sex balance have brought with them certain changes and movements in the people themselves; an excess of males would naturally tend to produce war, either civil or foreign, whilst a superfluity of females is easily associated with upheavals in the domestic polity of the community. There is no doubt that, could we trace the history of the world, or any section of it, we should see that man simply reacts to certain variations which are inevitable sequences in the establishment of this balance. Are there at present any indications of the methods upon which, or factors by which, this state is maintained? As is usually found, "truth is simple," and so the workings of nature, when once discovered, are easily understood. The sex constitution of our population, upon which such mighty issues depend, appears to obtain its regulating force from a very simple factor, and apparently is correlated with age only.

At the present time the sex balance is as follows:—At birth the ratio of males to females is about 1030 to 1000; at the fifth year, owing to deaths amongst the males, the balance is equal; from the fifth to the fifteenth year the mortality amongst the females is slightly higher than amongst the males, but from that time onwards the females relatively increase. If we take the male as a few years older than the female for the purpose of mating, then the balance is disturbed further still. The result of this is to produce in a community a section of women who cannot possibly perform that function for which they were fashioned. Their energies are naturally directed into other spheres, as evidence of which we see the revival of the movement for political recognition. The agitation is no new one, and apparently is dependent for its strength and virility on the position of the sex pendulum. If the present female oscillation has not yet reached its zenith the agitation will continue; if the reverse is happening, as there is reason to believe to be the case, then the present movement, after certain bursts of rejuvenescence, should slowly subside, to be again resurrected at some future epoch in the history of the world.

The following table gives the relationship of the age of the mother to the sex of the child:—

(*Taken from an Inquiry into Birth Conditions in the Town of Middlesbrough.*)

	Total number of births		Males born per 1000 females
	Males	Females	
All births up to 19th year ...	29 ...	44 ...	659
,, ,, 24th ,, ...	226 ...	264 ...	856
,, ,, 29th ,, ...	437 ...	455 ...	960
,, ,, 34th ,, ...	617 ...	617 ...	1000
,, ,, 39th ,, ...	720 ...	715 ...	1007
All births	772 ...	750 ...	1030
England and Wales (1910) ...	— ...	— ...	1033

If taken between the stated ages the figures are as follows:—

	Total number in each period		Males born per 1000 females in each period
	Males	Females	
Up to 19th year	29 ...	44 ...	659
From 20th to 24th year inclusive	197 ...	220 ...	895
,, 25th ,, 29th ,, ,,	211 ...	191 ...	1105
,, 30th ,, 34th ,, ,,	180 ...	162 ...	1111
34th year and over	155 ...	133 ...	1165

It is seen that, as a matter of fact, the tendency to produce females over males is present in young mothers; at more mature ages there is an excess of males. We can easily see how a self-regulating balance is established, depending upon this fact. In a state of society in which females are scarce they naturally, owing to demand, mate early in life, and tend thereby to reproduce an excess of their own kind (females), thus neutralising the state which recently existed. On the other hand, should the males be in the minority, the females will mate at more mature ages, at any rate at ages of twenty-five and above as is at present, in which circumstance an excess of males is produced. We see, therefore, that the natural tendency at the present time is to neutralise the female excess. We may possibly look upon ourselves at the present moment as being at the zenith of a female oscillation, and as time progresses, helped probably by a saving of infantile life, a more numerical equality of sex will be established.

The relationship of the age of the father to the sex of the child is much the same as the mother, and where disparity in age occurs the influences may neutralise each other, so that with a mother of about twenty years and a father of about thirty years the chance of a boy or a girl should be about as equal as nature can make such a problem. Education is attempting to teach the inhibition of self, and thus delaying the age of marriage, so that the preponderance of male births should go on increasing. If the present rate of progress is maintained, and allowing for the greater mortality of the male infant over the female, an average marriage rate of between twenty-seven and twenty-eight years should produce a population in which the males are at all periods in excess of the females.

R. J. EWART.

AVIATORS AND SQUALLS.

ON looking through the now formidable list of fatalities which mark the progress, and the dangers, of aviation, the reader is often struck by the number of accidents where the reason for the capsize of the machine is not apparent. "Holes in the air" is the explanation frequently tendered, but it seems more than probable that sudden gusts, or squalls, at critical moments may be the real factors causing the trouble. For this reason an article by M. Durand-Gréville in the December (1910) number of the *Bulletin de la Société astronomique de France* is of interest.

M. Durand-Gréville proposes a system of warnings of