become a part of the Neptunian ring. Conceive the sphere at rest; let some unknown law cause it to rotate, with constantly accelerating velocity, until finally equatorial atoms are moving so fast that tangental force just counteracts gravity. The particles will be balanced and without weight. Increase rotation, and the atoms will move on a tangent instead of the surface of the sphere.

But they had to move 50,000 miles before it could be determined whether they were traversing the periphery or tangent, and over 50,000 more miles in order to attain an elevation of two miles! To do this the maximum force was required, as it alone was able to project matter to the tangent.

Nothing in nature can exceed the feebleness of this maximum tangental force. An atom on the equator required 8h. 54m. to traverse 107,000 miles, and then it was not quite two miles further from the centre. Yet this gentle force cast off a ring whose mass was 102 sextillion tons, if the Hypothesis is true.

No theory ever advocated concerning the development of the planets has so little in its favor as that of ring detachment. Below is a table showing the increase of distance of equatorial atoms from the centre of the sphere after having traversed different arcs from the point where they became balanced between the opposing forces, centripetal and tangental.

The first column gives the arcs, the second their length in miles, and the third shows the gain in distance from the centre of the nebula, after reaching the extremity of arcs, providing the matter touched the tangents.

Arcs.	Length in Miles.	Altitudes of Matter in Miles.
8″	107,824	1.94
10″	134,780	2.78
15″	202,170	7.
25″	336,950	20.
1′	808,671	117.
10′	8,086,710	11,759.
1°	48,520,266	417,061.

But no atom could rise above the periphery, for the entire periphery itself would rise. Thus, let a particle become subject to tangental force and fly along a tangent. Let the force be enormous, sufficient to hurl equatorial matter along a tangent of 1° or 48,520,666 miles, and it will then be 417.061 miles more distant from the centre. The next atom behind would follow and all others on the same line around the sphere. The next inner particle would become elevated, and the next until the space 417,061 miles filled with gas, the result of the process being that the equatorial diameter of the nebula increased 834.122 miles. But this diminished rotation allowed gravity to regain dominion and bring down the protuberance to a level as before. This mutation must obtain in all rotating masses so long as they remain gas or liquid, the areolar velocity being a constant. During the ascent and fall of the equatorial matter it is seen that no particle wandered away, but every one returned at the command of gravity. When a mass solidifies its rotary velocity cannot accelerate, and since matter is unable to part from a fluid sphere it cannot possibly leave a solid. Hence no cosmical mass, whatever its size, density or rate of revolution, ever detached an atom by force generated by rotary motion. Suppose the nebula received an impulse that imparted inconceivable velocity of revolution, causing peripheral matter to rush on a tangent of 20°, flattening the mass into the shape of a bi-convex lens, then rotation must have almost ceased, when gravity reasserted mastery. Let one imagine himself to have been placed on the equator of the nebula, assuming the gas visible, which was not the case. An ordinary tree could then be seen with a telescope at a distance of 50.000 miles! The top of a common terrestrial mountain would have been in sight at a distance of more than 100,000 miles! The observer would have found himself in the midst of a mighty plain, and would have been able to see mountains a hundred thousand miles in every direction, so slight was the curvature. At a distance of 1° or 48,000,000 miles the depression below a tangent was only 417,000 miles. The diameter of the sun is 852,000 miles; therefore, if it were placed on the circumference of the primeval sphere, its semi-diameter could be seen at that enormous distance. Reverse nature's laws, making it possible that tangental force can disrupt a revolving mass, then with the sphere's known rotation of 3.36 miles per second (admitting the Hypothesis true) could a ring have been abandoned? Could the rotary motion even cause currents to flow from the latitudes to the equator, or even produce an equatorial elevation in so vast a level capable of detection by some distant micrometer? We answer no, because Neptune, with the same velocity, keeps on its orbit. We fail to see why the theory of ring displacement was ever entertained, since no analogy in nature suggests it.

NEW WINDSOR OBS., *Aug.* 8, 1881.

MICROSCOPICAL TECHNOLOGY.

DR. CARL SEILER'S METHODS.

MOUNTING.

For mounting, both resinous and aqueous solutions may be used, which each possess advantages over the other, and for this reason a controversy has been going on for some time, between eminent microscopists, in regard to the advantages of glycerine, on the one hand, representing the aqueous mounting media and balsam, on the other, representing the resinous class. The truth is, that both should be used, as occasion requires. Glycerine, or its equivalents, should be used when it is desired to bring out delicate striæ, lines, hair-like projections, such as cilia on the epithelium of the respiratory tract, processes of the ganglionic nerve cells, and so forth, and for delicate vegetable preparations. Balsam should be used when clearness and transparency of the object, and brilliancy as well as durability of the staining is desired.

In order to clearly understand this the student will do well to mount two preparations of the same tissue, the one in balsam, or other resinous medium, and the other in glycerine or its equivalent, and then compare the results. He will find that the one medium is better suited for a particular preparation than the other.

Balsam. Among all resinous substances Canada balsam is the best for mounting purposes, provided it has been properly prepared. To do this, take a clear sample of balsam and evaporate it in a water bath, to dryness, that is, until, when hot, all odor of turpentine has disappeared, and, when cold, it is hard and brittle, like resin. This will take several days; and great care should be exercised in keeping the water bath full of water, for as soon as the temperature in the balsam is raised above 212° F. it turns brown, and is then unfit for use.

When thus evaporated the balsam is again heated in the water bath and enough of Squibb's absolute alcohol is added to dissolve it and make the solution of the consistency of thin syrup. It is now allowed to cool and poured into a spirit lamp, the wick having been removed, in which it is kept for use, the glass cap of the lamp protecting it from dust and preventing the evaporation of the alcohol. If, after using for some time, the solution becomes too thick, it should be warmed by placing the spirit lamp in warm water and adding to it some warm absolute alcohol. If the alcohol used in dissolving the balsam or in diluting the solution is not strong enough, a white precipitate will form, which may be redissolved by the application of heat, but will reappear when exposed to the air, in a thin layer on the slide, and the solution thus becomes useless for mounting.

Having cleaned his slides and covers, and having his balsam solution prepared, the student may now proceed to mount the objects in the following way: Place one of the stained sections which have been kept in alcohol in a small shallow dish containing some absolute alcohol, and allow it to remain there for some minutes, so as to remove all traces of water which may remain in it from the staining fluid and which have not been removed by the washing in the weaker alcohols. Then float it on the surface of some oil of cloves, also contained in a shallow glass or porcelain dish, until it has become transparent, when it should be removed from the oil, spread out on a glass slide and covered with a thin cover glass which has been taken from the bottle filled with alcohol and wiped dry with a soft rag. The specimen is now ready to be examined under the microscope, in order to see whether it will pay to permanently mount it in balsam. If found good the cover glass is carefully removed and all superfluous oil remaining on the section and on the slide is taken up with the edge of a piece of blotting paper, the object covered with a drop of the balsam solution, a fresh, dry cover is placed upon it, taking care to exclude any air bubbles, and pressure is made upon the cover to press out all superfluous balsam. In order to prevent the formation of air bubbles in the specimen the cover should be held by the forceps, near the edge, the opposite edge should be carefully placed into the balsam and the cover gradually lowered over the section until it lies flat upon it. If, after pressing the cover down, it is found that the balsam does not extend to the edge of the cover all round, a small drop of balsam should be placed near the edge, at the point where the balsam under the cover joins the empty space, when it will run in by capilliary attraction. The slide is then laid aside to allow the balsam to dry spontaneously, which will take place in from four to six weeks, or it may be placed in a drying oven, the temperature of which is not raised above 130° F., when it will be ready for finishing in a much shorter time. An excellent apparatus of this kind is sold by dealers in microscopical appliances. It consists of a box of copper containing movable trays, surrounded by another larger box, also of copper, so that a space remains between the two boxes, which, when the oven is used, is filled with water through an opening at the top. A thermometer is inserted through this opening, and a lamp is placed under the outer box, which raises the temperature of the water up to any desired degree, and thereby warms the air in the inner box. A current of air is established through the inner box by ventilators, both at the top and bottom. Specimens which have been double stained with indigo should not be exposed to either heat or sunlight, as they will fade under these circumstances.

The fact that the oil of cloves or other volatile oils which may be used in its stead shrink many of the more delicate tissues, and the difficulty attending the removal of large thin sections from one solution to the other, as well as the danger of tearing while they are spread upon the slide, has led the author to discard the oil of cloves as a clearing agent, and to adopt a plan of mounting in balsam, which avoids all these dangers and which has the advantage that the slides may be finished immediately.

MOUNTING IN BALSAM.

After one of a number of sections which have been stained together has been examined in oil of cloves, and has been found to be good, the others may be inferred to be also good and worth mounting. One of them is placed in absolute alcohol, and after it has remained therein for some time, is floated upon a cover glass, which need not be wiped dry after taking it from the bottle of alcohol in which the covers are kept, held in a pair of forceps whose ends have been bent so as to stand at right angles to the shafts, and to close on top of each other. The cover with the section on it is then lifted out of the alcohol, when the specimen will be found to be evenly spread out, needing but little unfolding at the edges, which sometimes fold over; the lower surface is to be wiped dry and a drop of the alcoholic solution of balsam is placed on the section, which, on the cover, is set aside in a place free from dust, to clear up and allow the balsam to get dry. After fifteen or twenty minutes another drop of balsam should be placed upon it, in order to prevent the drying of the tissue. After twelve hours the balsam has dried sufficiently on the cover so that the specimen can be mounted, in the following manner: Take the cover up with a pair of forceps and place a drop of crude benzole* on the balsalm and quickly place the cover, with the balsam down, on a clean slide, as near the centre as possible, and taking care to avoid air bubbles. Then warm the slide over a spirit lamp, place on a turn-table and quickly centre the cover so that its edge does not seem to shake when the slide is rapidly revolved. Next run a ring of cement around the edge, as will be described presently, and then press gently upon the cover, to cause the section to lie flat, and to press out the surplus of balsam, which, with a little management of the pressure, will run into the ring of cement. Another ring of cement may then be applied, when the slide is ready to be labeled and put away.

The cement for balsam mounting which is most satisfactory was devised by Mr. T. W. Starr, of Philadelphia, and is prepared as follows:

Clear Canada balsam,	370 grains.
Deodorized benzine,	140 grains.
Spirits turpentine,	120 grains.
Gum dammar,	185 grains.

Mix the balsam and benzine well together in a bottle, then add the turpentine and shake until mixed; finally, add the gum dammar, in selected pieces, and shake frequently till dissolved. If necessary, the solution should be filtered through absorbent cotton, previously moistened with turpentine. A portion of this is to be placed in a small glass-capped vial, to the cap of which is attached a small *sable* brush, which will come to a point, the ordinary camel's hair brush not being suitable for ringing, as it spreads too much. If the solution is too thick to flow readily it should be diluted with spirits of turpentine until the proper consistency is obtained. This fluid is also an excellent mounting medium when the object has previously been cleared in oil of cloves or turpentine. For ringing, this cement may be colored by adding to it a few drops of alcoholic solution of aniline of any shade desired, or it may be mixed with white zinc, when the resulting ring will appear as if made of porcelain.

The specimen to be ringed is placed upon the turntable, and if any balsam has soiled the slide or the cover it must be removed by scraping with a sharp knife and afterward wiping with a soft linen rag wet with benzole. As a matter of course, the balsam should be hard, so that the cover will not be displaced by the scraping and wiping. If the cover should not be in the centre, and a self-centering turn-table is used, the slide is to be warmed until the balsam becomes soft, when the cover may be centered on the turn-table. Having thus prepared the slide, the brush in the cement bottle is removed and the surplus scraped off, so that it is almost dry; with the left hand the turn-table is spun round rapidly and the point of the brush applied to the edge of the cover for a moment only, holding the brush slanting in

*The refined benzole or benzine, which is frequently sold for benzole, is to volatile for our purposes.

the right hand, and that hand resting upon the stand of the table. The brush is then moistened a little more with the cement and again applied to the edge of the cover, without, however, allowing the hair of the brush to touch the glass; the small drop at the point of the brush only should be in contact with the glass and be carried around by the rapid spinning of the turn-table. The slide is then set aside so as to allow the ring to become thick by evaporation of the benzine and turpentine, when the applications of cement may be repeated until the desired thickness is obtained.

If colored or white zinc cement is to be used it should not be applied until after the first rings of clear cement have become hard, as otherwise the colored cement will run in under the cover and be disseminated among the mounting medium. If white zinc cement has been used, it may be still further improved by running one or two fine lines of asphaltum varnish around it, but not before the cement has thoroughly hardened.

The making of a neat ring around the edge of the cover is an art which can only be acquired by practice and experience, and therefore a few hints in regard to the causes of failure will greatly help the beginner.

If the ring, when finished, shows irregularties both at its inner and outer edge, the cement used is too thick and should be diluted with turpentine. If the ring is too broad—wider than about one-thirty-second of an inch, unless intentionally widened—the brush has been pressed down too hard upon the glass, which causes it to spread, or too much of the cement has been applied at once. This is especially the cause when irregularities or bulging in the edges of the ring are noticed.

If the ring is filled with minute air bubbles, the brush has been kept too long in contact with the glass in making the first ring, or its point has been brought in contact with the first ring in making the second application, when only the minute drop should have touched the glass; or, finally, the solution may be too thick.

MOUNTING IN GLYCERINE.

When a preparation is to be mounted in glycerine, it should, after having been stained, be placed in dilute glycerine for twenty-four hours, and then for the same length of time in strong glycerine (Bower's), in order to make it transparent. The section is then carefully spread upon the slide; a clean cover, which has been wiped dry, is placed upon it and pressed down, to remove the excess of glycerine from under the cover, and a small spring-clip is applied, so as to hold the cover in position during the subsequent manipulation of washing. The excess of glycerine must now be removed as carefully as possible by washing it off with a stream of water, either from a syringe or from a tap, taking care not to displace the cover in doing so. The slide is then stood on edge to dry, the spring-clip still holding the cover, and when all the water has evaporated it is ready for ringing. In order to do this the spring-clip must be removed, the slide placed upon the turn-table, the cover centered and a ring of some water-proof cement applied, in the manner described above.

The best cements for this purpose are, first, the so-called Bell's cement, which may be obtained from any dealer in microscopical supplies, and the composition of which is a secret with the makers; and second, the author's gelatine cement, which is prepared as follows:

Take of—

Coxe's gelatine,	2 drachms.
Gum ammoniac,	10 grains,
Acetic acid, No. 8,	1 ounce.

Dissolve the gum ammoniac in the acetic acid and filter through absorbent cotton; then warm the acid and gum solution by placing the vessel containing it in a water bath and add the gelatine, stirring until it is dissolved, when the resulting solution should be filtered or strained through muslin. After a ring of this cement has been made around the edge of the cover, and has become set, it should be painted over with a solution of bichromate of potash in water (ten grains to the ounce) and exposed to either sunlight or ordinary daylight. The action of the light is to make the chromate of gelatine which has been formed insoluble and thus perfectly waterproof. After this gelatine cement ring has become hard, it should be covered with a ring of white zinc cement, when it will be found that none of the glycerine will leak out, even after the specimen has been kept for years.

If thicker pieces than thin sections, such as pieces of the mucous membrane of the intestine or bladder of animals, are to be mounted in glycerine or other watery medium, a cell must be employed. This consists of a ring made of either glass, rubber, metal or cement, and which is high enough to prevent the cover-glass from pressing upon the specimen when mounted. In order to do so, the ring, if it be of glass, rubber or metal, is first cemented upon the slide with marine glue or the gelatine cement, and is accurately centered with the turn-table. If the cell is to be made of cement a ring of the required diameter (which must be a little smaller than the diameter of the cover-glass) is spun upon a slide in the same manner as was described for applying the ring to the edge of the cover in finishing slides, and is built up to the required height by repeated applications of the brush. It should then be set aside to dry and harden. Any of the cements may be used for this purpose, provided they will stick well to the glass.

Just before mounting the top of the ring forming the cell must be moistened with gelatine cement; the specimen, which has been made transparent by soaking in glycerine, is then placed in the centre of the ring, enough glycerine is added to fill the cell and the cover is applied. If an air bubble is left under the cover the latter must be lifted up and more glycerine must be added; if, on the other hand, too much liquid has been used, the surplus must be washed off, as described above. A ring of gelatine or Bell's cement is next spun around the edge of the cover, in order to seal up the cell, and it is then finished with white zinc cement.

An excellent substitute for glycerine is Farrant's solution, which combines all the advantages of glycerine and some of those of balsam, inasmuch as it has nearly the same index of refraction as glycerine, and becomes hard like balsam, doing away with the necessity of a waterproof cement. The formula generally given in the text-books for this solution is not correct, and the author has found that the following formula is more satisfactory:—

Picked gum arabic,	4 drachms.
Camphor water,	4 fl drachms.
Glycerine,	2 fl drachms.

Dissolve and strain through muslin.

Specimens to be mounted in this medium must first be made transparent by soaking in strong glycerine, and may then be mounted as though the solution were a resinous mounting medium. Great care should be taken to exclude air bubbles, as they cannot afterward be gotten rid of. This medium is especially adapted for delicate animal membranes and soft vegetable tissues.

Some specimens, especially vegetables, such as seeds, pollen grains, sections of wood, etc., may often with advantage, be mounted dry, *i. e.*, without much previous preparation, and without any mounting medium, but they must then be examined as opaque objects, and must be viewed by reflected light.

If an object is to be thus mounted, a disk is painted with asphaltum varnish in the centre of the slide, which is spun around upon the turn-table while applying the brush with varnish. A disk of dead black paper may be pasted upon the slide, instead of the disk of varnish, to serve as a dark background. A cell ring is then applied around the edge of the disk, and the object is fastened in the centre of the cell by means of mucilage or glue. This done, the cover is placed upon the ring and cemented down as described above.—(*Compendium of Microscopical Technology.*)

THE DEARBORN OBSERVATORY.

The annual report of the Board of Directors of the Chicago Astronomical Society, together with the report of the Director of the Dearborn Observatory, dated May, 1881, is now published.

The first report is brief, and states that the Society has entered into a contract with the city of Chicago for furnishing standard time to the City Hall. In order that this contract may be more satisfactorily fulfilled, the Directors of the Society have ordered from Messrs. Howard & Co., of Boston, two new clocks, which will cost about $1000. The cost of running wires and other equipments has been $574.

The friends of the Society have contributed the funds required to meet the immediate wants of the Observatory, but the Society reiterate the often-repeated call for a permanent endowment, which will not only enable it to continue its present course of action, but to enlarge its sphere of astronomical work and take an honorable place among the prominent astronomical Observatories of Europe and America. The Directors express a hope that the time has arrived when the public-spirited citizens of Chicago will contribute the amount to accomplish this object, and we heartily trust that the confidence expressed in this respect may receive a prompt confirmation. The Dearborn Observatory is built and equipped with one of the finest equatorials in the United States; the question of endowment is therefore one which calls for immediate action.

In the second report Professsr G. H. Hough states the nature and amount of the astronomical work carried on at the Dearborn Observatory during the past year by himself and Messrs. Elias Colbert and S. W. Burnham.

The planet Jupiter has received the attention of a large number of astronomers during the past two years, especially of amateurs, and much writing of a miscellaneous character has appeared on the subject. As the proper study of markings and spots on celestial objects require the use of a telescope of great optical power, combined with good definition, the following report of observations on the planet Jupiter, made with the Dearborn equatorial, which possesses these conditions, will be read with interest, especially as they do not confirm many observations made under less favorable circumstances.

The planet Jupiter was made a special study during the past year. The first observation was secured on May 6, 1880, and the last on January 30, 1881. During this period the various spots and markings on his disc were subjected to micrometer measurements whenever practicable. It is readily apparent to any one who has examined contemporaneous drawings or sketches made by different observers and telescopes, that they are generally unreliable, unless based on micrometer measurement, and frequently give rise to erroneous deductions with regard to the phenomena in question. We believe the time has passed when mere estimations or sketches are of value in any department of practical Astronomy. Jupiter presents such a variety of phenomena on his disc, at different times, that it has been accepted as an established fact that his surface is subject to sudden and rapid changes, which may be accomplished in a few days or even a few hours.

The observations made at the Dearborn Observatory during the past two years does not confirm this statement. On the contrary, all minor changes in the markings or spots have been slow and gradual, such as might be produced by the operation of measurable mechanical forces. In fact, the principal features have been permanent, no material change being detected by micrometer measurement.

The following is a summary of the observations on Jupiter:

GREAT RED SPOT.

Longitude,	37 nights	560 measures.
Latitude,	12 "	34 "
Length,	20 "	67 "
Breadth,	10 "	32 "
Position of maj. axis,	5 "	16 "
Total		709 "

EQUATORIAL BELT.

Observed on 26 nights—

Position of the North Edge	87 measures.
Latitude " "	34 "
Width of the Belt	53 "
Total	174 "

EQUATORIAL WHITE SPOTS.

Observed on 18 nights—

Longitude	240 measures.
Latitude	15 "
Total	255 "

POLAR SPOTS.

Observed on 22 nights—

Longitude	144 measures.
Latitude	40 "
Total	184 "

Being a total of 1,379 micrometer measurements.

From the micrometer measurements for longitude of spots, the equatorial diameter of the planet is deduced on 50 different nights, and from the latitude measures, the polar diameter on 13 nights.

The following deductions have been drawn from these observations.

ROTATION OF JUPITER.

The period of the planet's rotation, as obtained by different observers, has varied between $9^h\ 49^m$ and $9^h\ 56^m$. The observations made on the great red spot during the opposition of 1879, gave for the rotation period about $9^h\ 55^m\ 34^s$; being 8 seconds greater than the previously accepted value.

The discussion of our longitude measures on the great red spot, made from September 25, 1879, to January 27, 1881, comprising a period of 490 days, gives for the mean value $9^h\ 55^m\ 35.2^s$,

When the individual observations are compared, however, with this value, there is found to be a well marked maximum displacement of the center of the spot amounting to $1''.4$ of arc, indicating that the center gradually oscillated to this extent in longitude, corresponding to an actual displacement on the surface of Jupiter 3,200 miles.

The observations are all well represented by making the rotation period depend on some function of the time.

The period $9^h\ 55^m\ 33.2^s + 0.18^s \sqrt{t}$ satisfies all the observations with a mean maximum error of $0''.5$ of arc. In which the zero epoch is September 25, 1879, and t is the number of days after that date.

This formula gives for the rotation at the date January 27, 1881, $9^h\ 55^m\ 37.2^s$, agreeing essentially with the value deduced directly from the observations made during the two months previous to that date.

The rotation period derived from the observation of polar spots was as follows;