

The author, a 68-year-old medical marijuana patient and autodidact, updates the literature with addenda to Clarke's *Botany and Ecology of Cannabis*.

MARIJUANA OPTICS: An elaboration of the phytochemical process that makes THC

The resin exuded by the glandular trichome forms a sphere(1) that encases the head cells(2).

When the resin spheres are separated from the plant material by electrostatic(3) attraction and placed on a microscope slide illuminated with a 100W incandescent bulb, they appear very dark when observed through a 300X microscope. Since orange, red, and infrared are the component wavelengths of incandescent light, and since the absorption of light makes an object dark or opaque to the frequency of the incoming wave, one can conclude that these wavelengths are probably not directly involved in energizing the cannabinoid pathway(4).

However, the resin sphere is transparent to ultraviolet radiation(5).

The author found through trial and error that only one glandular trichome(6) exhibits the phytochemical process that will produce the amount of THC associated with pain relief, appetite stimulation and anti-nausea; euphoria and hallucinations are undesirable side-effects, however. This trichome is triggered into growth by either of the two ways that the floral bract turns into fruit(7).

Of all the ways that optics are involved in the phytochemical production of THC, the most interesting has to be how the head cells and cannabinoid molecules are tremendously magnified(8) by the resin sphere. These and other facts are curiously absent from the literature. Except for transmutation and turning base metals into gold, there has been more nonsense written about marijuana than on any other subject. The footnotes are the author's effort to rectify this situation and update the literature to include, to name just two, electrostatic separation of the resin sphere from the dried plant material and marijuana parthenocarpy.

(1)"For all spheres, a ray drawn perpendicular to the sphere's surface will intersect the center of the sphere, no matter what spot on the surface is picked, and the magnifying power of a glass sphere is greater the smaller its size: $I=333/d$, where I is the magnifying power and d is the diameter of the sphere expressed in **mm**. For example, a sphere of **1.66 mm** of diameter will obtain about a magnification of **200X**. Because of its small dimension, it is very powerful and must be kept at a distance of few tenths of a millimeter from the objects to be observed to be in focus. A sphere of glass can also bring light that is heading to a focus behind it to a point within it, with freedom from two aberrations, spherial aberration and coma, but not from chromatic aberration. Chromatic aberration results when different wavelengths are focused on different planes and is the most difficult of the aberrations to correct. The human eye lens also exhibits chromatic aberration, but a yellow pigment called the macula lutea in the fovea, an area at the rear of the eyeball, corrects this problem by the way it absorbs blue light."

Interestingly, the resin exuded by drug-type flowering female marijuana plants has a yellow tint. This pigment could work to correct chromatic aberration in the resin sphere like the macula lutea does in the fovea for the eyeball.

(2)Quoting from the Mahlberg and Kim study of hemp(a) "THC accumulated in abundance in the secretory cavity where it was associated with the: a) cell walls, b) surface feature of secretory vesicles, c) fibrillar material released from disc cell wall, and d) cuticle. It was not associated with the content of the secretory vesicles."

(a)<http://www.industrialhemp.net/mydomain/hempreport/issues/17/malbody17.html>

The head cells are encased in the resin sphere and travel with it whether dislodged or dissolved.

(3)The electrostatic collection of the resin spheres from dried marijuana plants with plenty of ripe seeds has been for hundreds of years the method indigenous people of North Africa and Lebanon have used to make hashish. Obtain a round metal can 8" or so in diameter x 3" or so in depth (the kind that cookies come in) with a smooth lid. Obtain 2 ounces of dried marijuana with plenty of ripe seeds in the tops. To remove the seeds and stems, sift the marijuana tops through a 10-hole-to-the-inch wire kitchen strainer into the can. Close the can with the lid and vigorously shake the closed can three or four times. This gives the resin spheres an excess negative charge. Let the can sit for a moment and then remove the lid. Opposites attract. The negative-charged resin spheres have been attracted to the metal surface of the can and lid which has an positive charge. Take a matchbook cover or credit card and draw the edge across the surface of the lid. Note the collected powder. Observed under 300X magnification, the collected powder from this "shake" is composed of resin

spheres with an occasional non-glandular trichome. As the marijuana is shaken again and again, and more of the resin spheres are removed from the plant material, the powder eventually turns from tan to green, and the non-glandular trichome has become more numerous than the resin sphere.

(4)"Cannabinoids represent a dimer consisting of a terpene and a phenol component. Cannabigerol (CBG) is the first component of the pathway. It undergoes chemical change to form either cannabichromene (CBC), or cannabidiol (CBD). Delta 9-tetrahydrocannabinol (THC) is derived from CBD."

(5)"Pate (1983) indicated that in areas of high ultraviolet radiation exposure, the UVB (280-320 nm) absorption properties of THC may have conferred an evolutionary advantage to Cannabis capable of greater production of this compound from biogenetic precursor CBD. The extent to which this production is also influenced by environmental UVB has also been experimentally determined by Lydon et al. (1987)." The author's own experience allow for a more specific conclusion: If the UVB photon is missing from the light stream(a), or the intensity as expressed in $\mu W/cm^2$ falls below a certain level(b), the phytochemical process will not be completely energized with only UVA photons which are more penetrating but less energetic, and the harvested resin spheres will have mostly precursor compounds and not fully realized THC(c).

(a)Examples of an environment where the UVB photon would be missing from the light stream include all indoor cultivation illuminated by mercury or sodium lamps and in glass, polyethelene or fiberglass covered greenhouses.

(b)"The maximum UVB irradiance near the equator (solar elevation angle <25 deg.) under clear, sunny skies is about 250 $\mu W/cm^2$. It was observed that the daily solar UVB in Riyadh, Saudi Arabia (24.4 deg. N) decreased from September to December by about 40% (Hannan et al. 1984). The further a person is from the tropics, the less UV radiation there is: the average annual exposure of a person living in Hawaii is approximately four times that of someone living in northern Europe."

(c)Cannabinoid pathway: Anywhere in this pathway UVB does a better job than UVA in energizing a photochemical reaction that will produce more fully realized THC, because "all cannabinolic compounds show an absorption maximum between 270 and 280 nm in the ultraviolet region."

(6)Capitate-stalked glandular trichome.

(7)#1) The ovum has been fertilized and there is a seed developing. In the areas of the Northern Hemisphere where indigenous people have grown heterozygous drug-type marijuana for hundreds of years, male pollen is used to trigger the growth of the capitate-stalked glandular trichome on the floral bract and concomitant leaves of the flowering females by fertilization and seed set before the autumnal equinox(a) so the majority of seeds will be ripe(b) by the

middle of October at the latest or **#2) The floral bract has become parthenocarpic:** Parthenocarpic fruits develop without fertilization and have no seeds. In marijuana parthenocarpy, the floral bract (the fruit) develops in size as though there were a seed growing inside, and the capitate-stalked glandular trichome is triggered into growth on the floral bract and concomitant leaves. Most popular supermarket tomatoes are parthenocarpic which was induced artificially by the application of dilute hormone sprays (such as auxins) to the flowers. In a trial, marijuana parthenocarpy was not induced by the application of the spray used on tomatoes. Only the photoperiod will trigger parthenocarpy in flowering female marijuana plants. **The longest photoperiod that will trigger parthenocarpy in unfertilized flowering homozygous(c) Indica female marijuana plants is 13 hours, give or take 15 minutes.** Out-of-doors, the same effect can be obtained in the month of August at 35 N, and because the capitate-stalked glandular trichomes received plenty of UVB during this month at this latitude, the harvested resin spheres had fully realized THC. **Rating:** euphoria and hallucinations, major appetite boost and pain relief, deep dreamless sleep. These plants seldom grow taller than four feet but potency makes up for the reduced harvest. This gene pool is the basis for the "sensimillia" myth and no other gene pool will fit the bill which is why a lot of so-called "sensimillia" has so little THC. **The longest photoperiod that will trigger parthenocarpy in unfertilized flowering heterozygous female marijuana plants is 11 hours, give or take 15 minutes.** Out-of-doors, the same effect can be obtained in the month of November at 35 deg. N. The harvested resin spheres evidenced slightly more THC than precursor compounds. **Rating:** mild to medium euphoria, appetite boost and pain relief, good snooze. This may be the outdoor photoperiod that will produce a parthenocarpic marijuana best suited for medical use because of mild euphoria and no hallucinations as a result of the low level of UVB in sunlight at this latitude in November. **All unfertilized flowering female marijuana plants will become parthenocarpic in a 9-hour photoperiod (15-hour dark period).** Out-of-doors, the same effect can be obtained in the month of December at 35 deg. N. At this latitude in this month there is not enough UVB in sunlight for precursor vitamin D3 to develop in human skin. The phytochemical process will not produce fully realized THC when UVB falls below a certain level of intensity as expressed in $\mu W/cm^2$. **Rating:** no euphoria, hallucinations, appetite boost, pain relief, sleep aid.

(a) In the Northern Hemisphere latitudes above 30 deg. N, the key to all marijuana potency is this: The more days of sunlight the capitate-stalked glandular trichomes' resin spheres accumulate before the autumnal equinox the more fully realized THC.

(b) It is recognized in the indigenous world that drug-type marijuana with a majority of ripe seeds will produce more euphoria, hallucinations, appetite stimulation, pain relief, and sleep aid than with a majority of unripe seeds. The amount of time it takes for the majority of seeds to ripen is three to four weeks.

(c)**Homozygous** is loosely used here. Even though marijuana is normally a monoecious plant, unfertilized Indica flowering females can have both anther and stigma growing from a floral bract. This phenomenon can be forced with a 10-hour photoperiod. In the Indica gene pool, this female pollen carries an allele for long-day parthenocarpy (parthenocarpy occurring before the autumnal equinox the author considers "long-day," and parthenocarpy occurring after the autumnal equinox is considered "short-day"). This female pollen and its allele for long-day parthenocarpy is carried into the gene pool by self-pollination and cross-pollination. **In areas of India, where the capitate-stalked glandular trichome is triggered into growth by parthenocarpy rather than by fertilized ovum**, great care is taken to make sure that all male marijuana plants are destroyed as soon as they reveal their sex. This is to insure that only female pollen will be floating around locally to attach to stigma. Seeds resulting from this female pollen will produce another generation of female plants that will exhibit long-day parthenocarpy during flowering. But if pollen from male plants is introduced into this gene pool, the resulting seeds will produce a generation of females that will exhibit short-day parthenocarpy instead.

(8)The author has more questions than answers about the resin spheres' magnifying power and how that relates to the phytochemical processes involved in the cannabinoid pathway.

