

## **Analysis of Essay, "What Did Gregor Mendel Think He Discovered?"**

Within the essential domain of their essay, "What Did Gregor Mendel Think He Discovered?" (Published in *Genetics* 131: 245-253, 1992) Hartl and Orel prove quite adept at showcasing both sides of most issues pertaining to the significance of Mendel's scientific methodology and life, as related to the latter. However, some elements of Mendelian discernment seem to have been skimmed over at the expense of others, thereby not receiving the proper attention they deserved. Examples of such briefly covered topics include the roles religion and spirituality may have had on Mendel's approach to science and his perceived 'traits', how his discoveries shaped his vision of the world, who additional mentors of his may have been, etc.

According to the vantage of critics who question the essential features of his contributions, Mendel's approach to biology may have appeared exceedingly focused and singular, throughout the span of his career. Four main views of his work are very nearly pitted one against another. Due to their comical and very nearly juxtapositional stances, their credibilities seem lessened. So, which is it: Mendel as hybridist or founding father of genetics/heredity? The sad aspect of posing such a question is that it's akin to believing that a scientist should choose a stance and then stay with the latter throughout his career, in order to be considered authentic in his discipline. Yet, most scientists do alter their perspectives of and approaches to science somewhat throughout their careers. The other question asked, "Was Mendel the fictitious fabricator of monohybrid features?" seems pretty farfetched, when one takes into consideration how much integrity Mendel involved in his work. However, if many of his monohybrid experiments were solely performed in his mind, would this truly negate the significance of his contributions to the field of genetics (i.e., Was Einstein denounced for any thought experiments he may have had?)

Mendel's initial interests seem most likely to have been the manipulation of empirical methods in the formation of hybrids for breeding purposes at the monastery. However, it's ludicrous not to think that later on, the numerical relationships he discerned might not have influenced his thinking in terms of progeny achieving the repaired 'traits' of previously segregated parental alleles. Of course, Mendel's perception of pollen and germinal cell contributions reflected the mark of his genius, because such microscopic deductions were akin to leaps of faith; they couldn't be visually proven at mid-nineteenth century. For those opponents of Mendel's having been dubbed, 'the founder of genetics', they should be reminded that he did not ask for such a title, and wouldn't have understood its meaning, anyway. Because two scientists of the early 1900's discerned the hereditary components of cells around the same time, to avoid dissent in the community, Mendel was given full credit for the initial achievements.

Additionally, it's important to appreciate that the most significant discoveries in science were not made due to preconceived notions, but rather, by mistake. Watson and Crick did not initially intend on finding double-stranded DNA, the genetic material of all cells. By chasing after their 'errors', they found what could only be considered pivotal to the essence of biology. In many respects, Mendel did the same. Although at first, he may have been confounded that *Herbicum*'s progeny did not produce the constant hybrid ratios that *Pisum* did, once he was able to explain initially complex observations in more simple ratios, his basic tenets were made.

Although the essay mentions Napp as having been one of Mendel's mentors, his 2-3 year education at the University of Vienna is merely brushed over. The latter seems peculiar, in light of the fact that some of the most important historical figures in science taught Mendel. For a man

interested in monastery duties of quantification (breeding), the eminent physicist, Dr. J. Doppler, must have inspired him to a large extent. Doppler's perception of sound was based on a simple yet elegant mathematical scheme that described elements of symmetry in the effect he quantitated. Is there no better way to prove the existence of completeness in the universe than via numerical evaluations? Save for instances of being in a vacuum or speeds over Mach, his equation could also have been described in the fashion Mendel described his own later discoveries, "no basic differences could be found, in important matters." Therefore, did Doppler's mathematical approach to the world influence Mendel to any extent? When it is stated that Mendel discovered the factor that so far received little attention (i.e., segregation), is it meant that what really stood out for him were phenotypic variations or the mathematical patterns of those phenotypes? Due to the fact that he related F1 genotypes (traits) to F2 phenotypes in ratio fashions, mathematical analysis proved instrumental in Mendel's deductions. Although certain historians like Olby seem deadset on reinterpreting issues like the meaning of the inscriptions on Nozinblatt, only one true conclusion about the latter can be drawn: Mendel was concerned with the ratios and mathematical manipulations of dihybrid crosses.

Ultimately, Mendel seemed to perceive an element of constancy and order in his results, an idea that is apparent when he stated, "No basic difference could exist in important matters, since UNITY in the PLAN of development of organic life is beyond doubt". From such a powerful quote, inferences about the universal existence of a 'Master Plan' or 'Master Design' seem apparent. Interestingly, many of the most prominent scientists in history became more spiritual in their approach to life, after achieving their notable discoveries, as though they realized that the perfect order and symmetry involved in their discoveries could not have been achieved by entropy alone. After completing his work on both the special and general cases of relativity,

Einstein attributed such theories to the driving force of a supreme mind, far more advanced than ours. As a monk, a man devoted to charity and religion, Mendel must have perceived his discoveries as the workings of a God, who 'unifies' things and places them in order. The question is more: How much influence did his spirituality have in the way he conducted his research? While the latter is an unapproached topic in the essay, it could partially explain why Mendel's data did not showcase extreme segregations. Perhaps for Mendel, unity was equated with simplicity. Rather than chasing after deviant values, Mendel may have ascribed more meaning to the simpler patterns. Of course, as his one letter to Nageli showed, his vision of constancy (in terms of hybrids) was muddled when his crossings with *Hieracium* panned out in incongruent fashion.

Additionally, not enough information was presented in Haiti and Orel's essay to reveal his true stance on evolution and how he tied in his perceptions with the latter. However, inferences can be made. Mendel's first paper was published around the same time that Darwin defended his *On The Origin of Species*, which took a few years to be digested and accepted in the scientific community. In his April 18, 1867 letter to Nageli, Mendel revealed his fears in his results not being compatible with that of his 'contemporaries', which he realized as "dangerous for the experimenter and for the cause he represented." Therefore, while Mendel may have been influenced by and taken with Darwin's notions of evolution (his monastery's copy of the book had Mendel's scribbles all over it), his mere three references to evolution in *Versuche* may have reflected his fear of ostracism. The latter may have occurred in both the scientific and religious communities of which he was a member (i.e., evolutionary ideas of change are not exactly compatible with creationist perspectives of constancy). Perhaps, Mendel felt torn by what the church and his monohybrid crosses told him of 'constancy' versus what Darwin and his

polyhybrid crosses revealed to him of 'change'. Perhaps, it took him a while (i.e., a few years in his career) to embrace and interweave the elements of both constancy and change. His appreciation for heterogeneity and openness to new things in the latter part of his career was mirrored in the words he used to describe *Herbacious*, "This genus possesses an extraordinary perfusion of distinct forms that no other genus can compare with."

It's rather unfortunate that some interpreters have appeared so adamant about denouncing Mendel's clearly important role in defining heredity, to the point of raising the question of whether or not he perceived his heritable 'formative elements' as fluids, emulsions, or solids. Haiti and Orel should be commended for recognizing that such a distinction is irrelevant, compared with the fact that he recognized that such 'elements' emerged from germinal cells and "unchanged from their associations". Also, the authors do a good job in grounding many of Orel's farfetched criticisms (e.g., proving that when dealing with *Pisum*, Mendel DID have independent factors in mind).

Ultimately, while Mendel tried to discover ways of obtaining 'new color variants' to his enhance his cloistered position as a 'practical breeder', he discovered segregation and the independent assortment of traits. In his eyes, though, Mendel clearly found vindication in his gardens that the hands of God were very much at work, even at microscopic levels, as revealed in the symmetries of mathematical patterns of phenotypes (colors, shapes, and all that appeals to the senses).