JEWELS, HONEY, BLINDNESS, AND SIGHT

Muzaffar Iqbal

Writing at the dawn of the sixth Islamic century, Abū Ḥāmid al-Ghazālī drew attention to the hexagonal structure of the beehive cells in a short treatise on the Qurʾān, *Jawāhir al-Qurʾān* (*The Jewels of the Qurʾān*). Written at an advanced age, when he had already composed his masterly expositions of Islamic intellectual science in such important works as *Iḥyāʾ ʿulūm al-dīn* and *Tahāfut al-falāsifa*, *The Jewels of the Qurʾān* presents the understanding and reflections on the Qurʾān of an accomplished ṣūfī master who had ascended to a spiritual and intellectual station which would make him a revered name in the east and the west for centuries to come. Known by the honorific titles of *Ḥujjat al-Islām* (the Proof of Islam) and *Zany al-dīn* (the Ornament of Religion), al-Ghazālī remains one of the most important persona in Islamic thought and spirituality to this day, partially due to the peculiar path he traversed and the times in which he lived—both of which have deep relevance to our own times—as well as due to the sincerity and clarity with which he chronicled his experiences, thoughts, and insights.

The Jewels of the Qurʾān, written as it is in his characteristic style indicative of a spiritual authority that cannot be taken lightly, invites sincere seekers of truth to dive deep into the fathomless depths and mysteries of the Book in order to discover its jewels and pearls. It is in the chap-

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ter entitled "The secrets of *sūrah al-Fātiḥah*, which demonstrates how this short *sūrah* comprises eight of the ten types of the valuables (*nafā'is*) of the Qur'ān" that one finds reference to the beehive, and this is not without deeper meaning for this chapter presents an exposition of the meaning of the two Names of Mercy—*al-Raḥmān, al-Raḥīm*—which occur twice in the *sūrah*, once in the opening *Basmallah* and once in the third verse of the *sūrah*. "Do you imagine that this [second occurrence] is a repetition?" Al-Ghazālī rhetorically and explains:

> There is no repetition in the Qur'ān, for repetition is defined as that which does not give additional benefit to the seeker; and the mention of Mercy after the mention of *Lord of all the worlds* (*Rabb al-'ālamīn*) and before the mention of *the Master of the Day of Judgment* (*Māliki yawm al-dīn*) has two great benefits in illuminating the paths of Mercy: one directs attention to the creation by the Sustainer of all the worlds; for He has created every one of these according to the most perfect and best of its kind and has granted it everything it needs. Thus, one of the worlds He has created is the world of the animals (*al-bahā'im*), the smallest among whom are the mosquito, the fly, the spider, and the bees…
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> And look at the bee and the innumerable wonders of its gathering honey and [producing] beeswax. We would like to make you cognizant of the geometry of its hive. It is built on the figure of the hexagon (*al-musadass*) in order that space may not be narrow for its inhabitants who crowd in one place in great numbers. Had it built a circular hive, there would remain, outside the circular hive, empty space since circles are not contiguous to one another. Likewise all other figures. As to squares, though they are contiguous to one another, the shape of the bee [itself] is inclined to roundness and so inside the hive there would remain empty corners just as, in a circular hive, there would remain corners outside the hive. Thus none of the figures other than the hexagon approaches the circular figure in contiguity—and this is known through geometrical proof—so consider, then, how Allah has guided the bee to the characteristics of this figure. This is [merely one] example [from the countless examples] of the wonders of Allah's creation (*ṣun'a*) and His Kindness and Mercy to His creation, for the lowest constitutes an evidence of the highest.

By the time al-Ghazālī wrote *The Jewels*, which would be cherished by generations of scholars for centuries to come, the wisdom of the bee was already well-known to Muslim scientists—for whom the Qur'ān was

neither a Book wrapped in fine cloth and placed on the highest shelf of the home nor a Book in which they sought to discover scientific theories of Greek scientists and philosophers but rather a Book of guidance, drawing their attention from the manifest to the hidden and from the observable signs (*āyāt*) to the Creator of the signs. They knew the bee had been guided by the One who created it: *And thy Sustainer revealed to the bee: prepare for thyself dwellings in mountains and in trees, and in what [men] raise; and then eat of all manner of fruit, and follow humbly the paths ordained for thee by thy Sustainer; and lo, there comes from within these [bees] a fluid of many hues in which there is health for people; in all of this, behold, there is a sign for those reflect* (*al-Naḥl*: 68-69).

Even though Muslim scientists of that era had not experimentally observed these matters, they had probably surmised that not only the particular variety of the bee found in their own geographical region (the species now called *Apis mellifera*) but all varieties of bees make hexagonal cells in their beehives. They may not, however, have known the remarkable mathematical precision and economy of the life of the bee and the beehive in quantitative terms, as is now known.

Hive populations range from thirty to sixty thousand bees. Of these the vast majority are worker bees, who do virtually all the work of the hive—from building the honeycomb and nursing the infant brood to foraging for nectar, water and pollen, and storing honey. Normally, a worker bee travels eight hundred kilometers over the course of her life, wearing out her wings in a mere six weeks at the height of her frenzied nectar gathering during spring, summer, and early autumn when plants are in full nectar-laden bloom, and producing less than 1/12 of a teaspoon of honey. If a worker bee is born toward the end of summer, however, it can survive for a whole year, even over the winter months, spending most of its time inside the hive, clustered in a heat-conserving ball around the queen where the temperature is steadied by the metabolization of the bees themselves at between 33.33^0 and 35^0 C. Muslim scientists of the pre-modern era probably had a rough estimate, though not the exact figure, of how many kilometers a colony must fly back and forth from flowers to the hive to produce a kilogram of honey—a figure that we now know to be approximately one hundred and seventy-five thousand kilometers.

These and other specific details of bee activity have now been known to modern science for almost a century. Our understanding of the communication system of the bees was significantly enhanced in 1923, when Karl von Frisch published his pioneering study on the bee dance, *Aus dem*

Leben der Bienen, a work that would eventually earn him a Nobel Prize in 1973. Anyone with necessary instruments and sufficient training observing a bee around a nectar-bearing plant can see that she sucks something from the plant into her honey stomach—a special expandable receptacle separated from her own stomach by a valve. She visits anywhere from fifty to one hundred plants before she needs to return to the hive to release her load. If she requires food while flying, she can release the valve separating her own stomach and the honey stomach and shunt nectar into her stomach.

Computer-aided models for determining optimal structures for storing the maximum amount of honey using the least amount of beeswax lead one to none other than those actually constructed by bees. Furthermore, we calculate that, for maximum strength, these hexagonal structures should connect to each other at a very precise apex angle of 70.529^0—and all species of bees construct their beehives to this exact specification, all over the world.

We now know many aspects of the remarkable chemistry that goes into the making of the honey—the delicious syrup in which there is cure for humanity, as the Qurʾān tells us. The tiny drop of nectar sucked by the bee contains sucrose, fructose, and water. While foraging, the bee secrets invertase, a digestive enzyme, that breaks down the sucrose in the nectar into two simpler sugars, fructose and glucose. When she arrives at the hive, she is met by a younger hive bee who begs the nectar off her, accepting it into her own mouth. Relieved, the foraging bee returns to the field to seek new flowers, and if she finds a particularly rich source of nectar, she gives directions to other bees of the hive by means of a dance wherein are signals and signs telling fellow foraging bees the direction, the distance, and the angle of the sun in relation to the location of the nectar-bearing flowers. A round dance indicates a nearby food source, a waggle dance means the food is further away, the duration of the dance precisely marks the distance and the direction is indicated by the orientation toward the sun.

While the foraging bees are going back and forth between the hive and the flowers, the hive bee inside the hive is squeezing the nectar from her mouth into her own honey stomach and back again, adding enzymes. In the process she also exposes the nectar to air in order to evaporate its excess water, eventually reducing its water content from 80 to less than 20 percent so that airborne yeasts do not sour the nectar through fermentation.

As the hexagonal cells of the combs fill with drops of nectar, the bees inside the hive split into groups. One group fans fresh air into the hive by flapping their double sets of wings 11,400 times a minute, the other directs damp, moisture-laden air out. This determined fanning—the buzz of the hive—is low and mild when the bees are busy and content, higher and louder when they are threatened or agitated.

After a few days, the bees cap the fully ripened honey with a thin layer of beeswax. Perfectly sealed, it remains there until needed by the bees for food or harvested by the beekeeper.

II

All of these details have become common scientific knowledge in our times, though mystery still surrounds the chemical reactions which occur during the process of ripening of the honey. As al-Ghazālī noted, it is not possible—even in the long lifetimes of many men—to completely study these wondrous phenomena from the realm of creation which He has revealed to humanity—and these matters are merely a small portion of what He has revealed to humanity, there being worlds upon worlds about which humanity has no knowledge. What is important here is not the yet-to-be discovered details of the life and work of the bee, but the fact that what has been discovered by modern scientific methods and instruments has not brought modern science and most of its practitioners to a greater degree of understanding of the nature of things as they really are.

When the essential reality of God is absent or veiled from the consciousness of those who undertake such detailed studies of the natural world, they cannot gain any substantial understanding of the purpose of all that surrounds them, and in the absence of such an understanding, the hearts remain blind and the eyes without any real sight (*baṣīrah*). Such knowledge profits neither the seeker nor those who receive it from such a seeker, for, as al-Ghazālī tells us, one's worth is according to the worth of one's reach and striving (*himmah*).

That modern science has led humanity to a cul-de-sac may not be obvious to those awed by the details it has discovered and the usages to which it has been put, but it is apparent to those whose vision has not been veiled and who remain steadfast on the straight path, traversing it with sincerity, gathering in their souls what is worthy of gathering—like the nectar car-

ried by the honey bees to their hives—in order to purify and beautify it so that one becomes worthy of being called on the Day with the sweet sounding words: *O tranquil soul, return thou unto thy Sustainer, well-pleased and pleasing; join thou My servants, and enter thou My Paradise* (*al-Fajr*: 27-30).

Wa mā tawfīqi illā bi'Llāh

Wuddistān
21 Shawwāl, 1428/November 2, 2007