

The Open Court

A MONTHLY MAGAZINE

Devoted to the Science of Religion, the Religion of Science, and the Extension of the Religious Parliament Idea

Founded by EDWARD C. HEGELER

VOLUME XXXIX (No. 8)

AUGUST, 1925

(No. 831)

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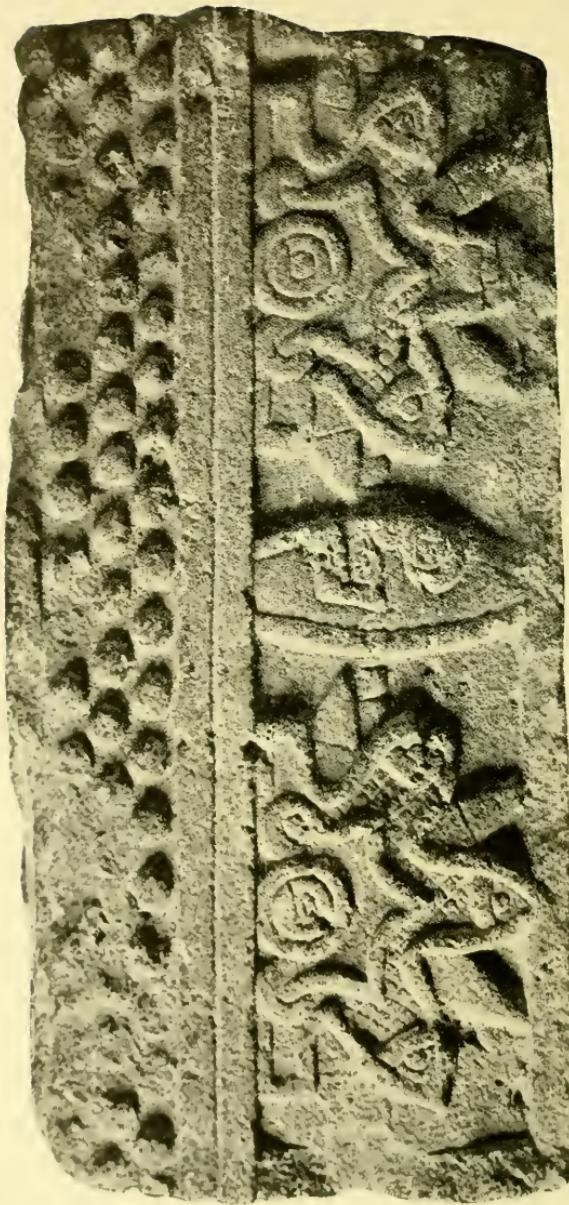
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AZTEC STONE OF SACRIFICE SHOWING OBSIDIAN KNIFE WITH HUMAN VENTURES,
FLANKED BY THE BUTTERFLY SYMBOLS OF THE GODDESS TZPAPALOTL.

(In the Peabody Museum)

Frontispiece to The Open Court.

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VOL. XXXIX (No. 8) AUGUST, 1925 (No. 831)

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THE OBSIDIAN RELIGION OF MEXICO

BY LEWIS SPENCE

FEW fields of study can have yielded results so meagre in comparison to the extraordinary amount of research involved as that of Mexican antiquity. Nearly half a century of intensive inquiry has not yet made clear to us the outlines of Mexican history, or successfully disentangled the ravelled skein of Mexican religion. After twenty-five years of isolated labor in the latter department of Isthmian research, the writer is convinced that although the general plan of the Mexican pantheon is slowly becoming apparent, the spirit of the cult which underlies it is still remote from our comprehension.

It is not alone the complex nature of the subject which renders Mexican religion so difficult of apprehension. The mingling of cultures, so apparent to the student at an early stage of his inquiry, scarcely seem to have such sanction from Archaeology and Ethnography as to warrant the conclusion that each of the cults of which the Mexican faith was originally composed was accompanied by a separate material culture. The extremely vague and involved traditions relating to this faith, and handed down by Spanish ecclesiastics and civilized natives, although illuminating enough in some instances, are still much too conflicting to justify complete dependence upon them. The religion of Mexico as known at the Conquest period, was the outcome of later religious and ethical impulses brought to bear upon a simple rain-cult, which, judging from the atmospheric conditions essential to it, must have been indigenous to the country. Although the cults of the several deities still retained some measure of distinctiveness, all had become amalgamated in what was really a national faith. A fully developed pantheon had also been evolved, which mirrored an elaborate social system in

caste, rank and guild, but the mythical material from which this might have been reconstructed in its entirety is only partly available.

What were the original and basic cults which had become coalesced in this national faith, the outward manifestations of which were roughly noted by Cortes and his companions? In my view they were at least three in number—the cult of Quetzalcoatl, which was probably an importation from the Maya civilization in Central America, the religion of Tlaloc, the God of Rain, which I believe to have been in existence in the Valley of Mexico prior to the introduction of the Quetzalcoatl cult there, and the Obsidian Religion of the Nahua peoples, who came from the North at some time in the seventh or eighth century A. D., and who for many generations occupied the steppe region to the north of the Valley before descending to the conquest of that area. It is to the consideration of the last of these cults that I wish to confine myself in this paper.

For many years I was aware, in common with most Americanists, that obsidian played a very considerable part in Mexican religion, but it was only when I essayed the grouping of the gods as departmental agencies that it was borne in upon me that it must have possessed a much deeper significance than I had formerly realized. Even then I did not fully comprehend the true importance of my surmises. It had long been known to me that the names of at least three of the Mexican gods contained the word obsidian (*itztli*) and the frequent representation of that mineral in the native paintings had previously aroused an occasional and passing consideration.

But it was only after comparing what I now saw to have been a distinct and separate cult with the many traditions associated with jade in China that the real importance of my theory was at length apparent to me. Employing this valuable analogy to the full, I almost at once found myself overwhelmed with evidence of the former existence of a separate religion in Mexico, radiating from the central idea of the obsidian stone, and developing from its employment as a weapon of the hunt into a religious complex which, in the event, was to find its way into every department of the life of the ancient Mexicans.

Obsidian, a volcanic glass varying considerably in color and texture, is found in extensive deposits in the western half of North America, in Mexico and Central America. To be more precise, the sites at which it is chiefly found are Obsidian Canyon in the Yellowstone National Park, among the mountains of New Mexico, in

Nevada and Arizona, and in the Pacific States. It is, indeed, still worked by certain tribes of Indians in California. In Mexico proper the best known mines are situated in the State of Hidalgo, about twelve miles north of the city of Pachuca, on the mountain known as Sierra de las Navajas, or "The Mountain of the Knives." Holmes, describing a visit to this site, states that the deposits there must have been vigorously worked for centuries, and the remaining debris proves at once how extensive must have been the labors of the early miners who exploited them. He says: "It is well known that the ancient dwelling sites of the general region, including the Valley of Mexico, are strewn with countless knives which have been derived by fracture from faceted cylindrical nuclei, partially exhausted specimens of which are widely distributed, and evidence of the getting out of these nuclei was to be expected on the quarry site. Examination developed the fact that here the rejectage deposits abound in abortive nuclei which were rejected because lacking in some of the qualities necessary to successful flake blade-making. It was requisite that the material should be fine-grained, flawless and uniform in texture; the shape had to be roughly cylindrical, and it was essential that one end should be smoothly squared off, so that the flaking tool would have the proper surface for receiving the stroke or other form of impact for removing the long, slender blades. Of course, the flake knives were not made on the quarry site, as the edges of the blades were so delicate that transportation would have subjected them to injury; therefore the selected nuclei were carried away, and the knives made by expert workmen, whenever and wherever they were required."¹

Torquemada, a Spanish friar of the sixteenth century, who resided in Mexico and had exceptional opportunities for the observation of native handicrafts, describes the manner in which the Aztecs manufactured obsidian knives from the core. He says: "They had and still have, workmen who made knives of a certain black stone or flint, which is a most wonderful and admirable thing to see them make out of the stone: and the ingenuity which invented this art is much to be praised. They are made and got out of the stone (if one can explain it) in this manner: One of these Indian workmen sits down upon the ground and takes a piece of this black stone, which is like jet, and hard as flint, and is a stone which might be called precious, more beautiful and brilliant than alabaster or jasper, so much so that of it are made tablets and mirrors. The piece they

¹ *Handbook of Aboriginal American Antiquities*, Part I, p. 220.

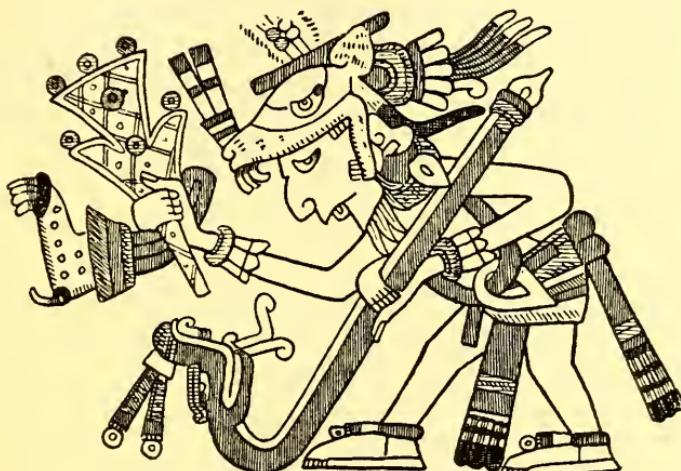
take is about eight inches long, or rather more, and as thick as one's leg or rather less, and cylindrical. They have a stick as large as the shaft of a lance, and three cubits or more in length, and at the end of it they fasten firmly another piece of wood eight inches long, to give more weight to this part, then pressing their naked feet together they hold the stone as with a pair of pincers or the vice of a carpenter's bench. They take the stick (which is cut off smooth at the end) with both hands, and set well home against the edge of the front of the stone, which also is cut smooth in that part; and then they press it against their breast, and with the force of the pressure there flies off a knife, with its point and edge on each side, as neatly as if one were to make them of a turnip with a sharp knife, or of iron in the fire. Then they sharpen it on a stone, using a hone to give it a very fine edge; and in a very short time these workmen will make more than twenty knives in the aforesaid manner. They come out of the same shape as our barbers' lancets, except that they have a rib up the middle and have a slight graceful curve toward the point. They will cut and shave the hair the first time they are used, at the first cut nearly as well as a steel razor, but they lose their edge at the second cut; and so to finish shaving one's beard or hair, one after another has to be used; though indeed they are cheap, and spoiling them is of no consequence. Many Spaniards both regular and secular clergy, have been shaved with them, especially at the beginning of the colonization of these realms, when there was no such abundance as now of the necessary instruments and people who gain their livelihood by practising this occupation. But I conclude by saying that it is an admirable thing to see them made, and no small argument for the capacity of the men who found out such an invention."²

It seems probable that the Nahuas were acquainted with obsidian before their entrance into Mexico. Dr. G. M. Dawson has made it clear that the coastal tribes of British Columbia engaged in trade with those of the interior along the Frazer River and far to the south. The Bilquila of Dean Inlet have traditions extending to a hoary antiquity that they possessed a trade route by way of the Bella Coola River to the Tinné country, and along this route broken implements and chips of obsidian have been found. Many other routes in British Columbia have likewise yielded obsidian flakes, which, the Tinné Indians stated, had been obtained from a mountain

² *Monarquia Indiana*, Book VI.

near the headwaters of the Salmon River.³ The theory that the Mexican Nahua originally came from British Columbia, a hypothesis which is supported both by their art-forms and mythology, appears, therefore, to receive archaeological support from this circumstance.

If it be granted that the Nahua were acquainted with obsidian and its properties before their entrance into the Valley of Mexico, sufficient time had elapsed for their development of a cult, which, at the era of the Conquest, exhibited traces of a very considerable antiquity. It was, naturally, as a hunting people that they employed weapons of obsidian. The herds of deer on the flesh of which they



(Figure 1)
THE GOD MIXCOATL WEARING HIS DEER-DISGUISE.
(From *Codex Borgia*.)

chiefly lived roamed the steppes, and proof abounds that the customs of the chase strongly influenced the religious ideas of the early Nahua. Certain of their gods, indeed, appear to have been developed from cervine forms (Fig. 1), for among barbarous races the animal worshipped is often that which provides the tribe with its staple food, or, more correctly, a great eponymous figure of that animal is adored—for example, the Great Deer, who sends the smaller deer to keep the savage in life. In like manner barbarous fisher folk are wont to worship the Great Fish, which sends them

³ Dawson, "Notes on the Shushwap People of British Columbia," *Proceedings and Transactions of the Royal Society of Canada*, 1891, Vol. IX, Section II, Montreal, 1892.

its progeny or subjects to serve as food. These deer gods or hunting gods in some way connected with the deer—Itzpapalotl, Itzcueye, Mixcoatl, Camaxtli—had also stellar or solar attributes. The deer was slain by the obsidian weapon, which therefore came to be regarded as the magical weapon, that by which food was procured. In the course of time it assumed a sacred significance, the hunting gods themselves came to wield it, and it was thought of as coming from the stars or the heavens where the gods dwelt, in precisely the same manner as flint arrowheads were regarded by the peasantry of Europe as “elf-arrows” or “thunder-stones,” that is, as something supernatural, falling from above.

When the nomadic Nahua adopted an agricultural condition of life, obsidian had doubtless been regarded as sacred for generations. It was by virtue of this magical stone that the nourishment of the gods was maintained by the sacrifice of deer; but when the Nahua came to embrace a more settled existence within an agricultural community where deer must have been more scarce, the nourishment of the gods had necessarily to be maintained by other means. The manner in which this was effected is quite clear. Slaves and war-captives were sacrificed instead of beasts of the chase, and at the sacrifice of Mixcoatl, the greatest of the gods of the nomadic Nahua of the steppes, women were immolated in the place of deer, and after being slain were carried down the steps of the earth-mound where the sacrifice took place, their wrists and ankles tied together in precisely the same way as that in which a deer is trussed by the hunter. The transition from deer-sacrifice to a human holocaust and from the hunting to the agricultural condition is well illustrated by an ancient hymn relating to the goddess Itzpapalotl (Obsidian Butterfly) who was associated with the god Mixcoatl (Fig. 2):

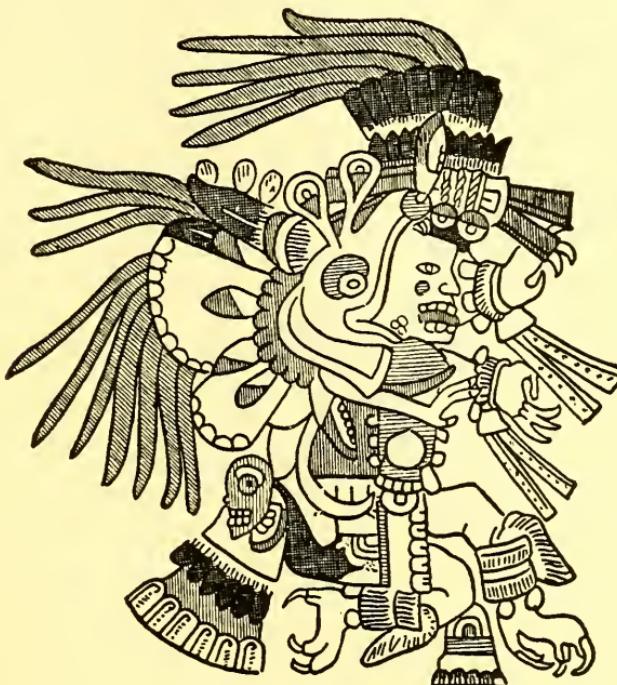
“O she has become a goddess of the melon cactus,
Our mother Itzpapalotl, the Obsidian Butterfly.
Her food is on the Nine Plains,
She was nurtured on the hearts of deer,
Our mother, the earth-goddess.”

The inference in these lines seems to be that whereas Itzpapalotl was formerly a goddess of the nomadic Nahua of the steppes, who sacrificed deer to her, she has now become the deity of the melon-cactus patch and an agricultural community. Her first human victim is mentioned by Camargo, who states that the Chichimec, or

wild Nahua, coming to the province of Tepeueuec, sacrificed a victim to her by shooting him with arrows.⁴

As regards Itzpapalotl's name, the butterfly in Mexico, as among the Celts, was thought of as a spirit or soul, so that the inference is plain enough. Itzpapalotl is the soul of the obsidian, that is the fetish or animating influence of that mineral.

But the idea most closely identified with obsidian was the great god Tezcatlipoca. His general character is so complex and he



(Figure 2)

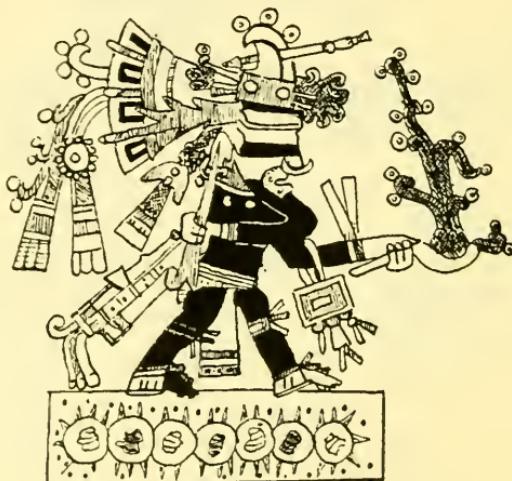
THE GODDESS ITZPAPALOTL (Obsidian Butterfly).
(From the *Codex Telleriano-Remensis*, Sheet 18 Verso.)

reached a prominence so great in the Mexican pantheon that it is usual to class him as its chief. Nevertheless, his origin as an obsidian fetish cannot be gainsaid. From a passage in Acosta we are justified in assuming that Tezcatlipoca's idol was of obsidian, and, like the Quiche god Tohil, mentioned in the Central American collection of myths known as the *Popol Vuh*, he wore sandals of obsidian, as is witnessed by one of his representations in the *Codex Borboni-*

⁴ *Historia de Tlaxcallan*, Chap. V.

cus, where his footgear is painted with the zig-zag line of the obsidian snake.

Tezcatlipoca was unquestionably the god of the *itztli* (obsidian) stone, and Seler has identified him with Itztli, the stone-knife god.⁵ In certain codices, too, he is represented as having such a knife in place of a foot, and we know that it was a fairly common practice with the Mexican artists to indicate the name or race of a god or individual by drawing one of his feet in a hieroglyphical manner. I believe, too, that the net-like garment worn at times by this god above his other attire is a symbolical adaptation of the mesh-bag in which Mexican hunters carried flints for use as spear- and arrow-heads.



(Figure 3)
THE GOD ITZLACOLIUHQUI.
(From the *Codex Caspi*, Sheet 12)

This, as well as the fact that he was the god of the sharp-cutting obsidian from which such weapons were made, caused him to be regarded as patron deity of the wild hunting tribes of the northern steppes, a connection which is eloquent of his once primitive character. But another important link connects Tezcatlipoca with obsidian. Bernal Diaz states that they called this stone *tezcat*. From it mirrors were manufactured for use as divinatory media by the wizards. Sahagun says that in this form it was known as *aitzatl* (water obsidian) probably because of the high polish of which it was capable. The name Tezcatlipoca means "Smoking Mirror" or,

⁵ Commentary on the *Codex Fejérvary-Mayer*, page 34.

perhaps, just "Obsidian Mirror," and the god was thought of as witnessing the deeds of humanity, good and evil, in this scrying-glass.

The god Itztlí is merely a surrogate of Tezcatlipoca in his guise of the obsidian knife of sacrifice, and as such is, of course, representative of the paramount connection of that god with the obsidian cult. Itztlí is, indeed, nothing more or less than a personalization of the obsidian knife. His name implies this, and the picture of him in *Codex Vaticanus B.* (sheet 19), where he is seen looking out of the head of an obsidian knife *naualli* or disguise, affords absolute proof, if more were required of the identification.

Itzlacoliuhqui-Ixquimilli (The Curved Obsidian Knife) (Fig. 3) is also a variant of Tezcatlipoca in his character of the obsidian knife of sacrifice, the god of the stone knife, and therefore of blood, avenging justice, of blinding, of sin, of cold. The obsidian knife was regarded as the instrument of justice, the tool by which the criminal was despatched. In the courts of law the penal judges drew an arrow of obsidian across the manuscript sentence of death to render it absolute.

Mexican tradition makes it very plain that obsidian, because of its blood-procuring properties, came to be regarded as the source of all life, as the very principle of existence. Tonacaciuatl, the creative goddess, gave birth to an obsidian knife, from which sprang sixteen hundred demi-gods who peopled the earth, and the infant which the goddess Ciuacoatl leaves in the cradle in the market-place undergoes transformation into an obsidian knife. As the Aztec manuscripts show, grain is frequently pictured in the form of the obsidian knife of sacrifice. Thus all the elements which make for growth and life were identified with this mineral, even the sun itself being regarded as the obsidian mirror of Tezcatlipoca. The idea that the sun could not exist without human blood was a purely Nahua conception arising out of an earlier belief that it must be nourished on the blood and hearts of beasts. The hunter's weapon which supplied the necessary pabulum became in turn the weapon of the warrior who procured victims for the holocaust, and the sacred knife of the priest who offered them up to the deity. Obsidian was thus chiefly the war weapon and the sacrificial weapon, but the traditions relating to it refer to practically all the offices of human art, industry and activity generally.

Lest this hypothesis seem overstrained, analogies may be indicated. That which is initially sacred in a primitive cult frequently comes to have interrelations with the whole environment of its deit-

ties. Thus the worship of the oak by the Druids appears to have conferred an oak-like virtue to the oracular birds which dwelt in its branches, to the soil from which it grew, to the sky above it, to the priests who ministered to it and to the sacred implements they employed. The same may be said of the oak cult of Zeus and the vine cult of Dionysus. Thus in the worship of the gods whose cult was connected with obsidian, well-nigh everything with which it had interrelations came to partake of the nature of obsidian, was, so to speak, "obsidianized"—grain, the earth, the atmosphere, the sun, the stars, the priesthood, blood, and rain.

We have already seen that obsidian was in a measure connected with the origin of human sacrifice, that women came to be substituted for the deer whose hearts were originally offered up to the deer-god. Obsidian also must have its payment for the part it performed in the slaying of the deer, just as the hound must have his umbles. When the Indian hunter of New Mexico kills a deer today, he removes the liver, and taking an image of his prey-god from his pouch, he smears its lips with blood. The Nicaraguan kept his sacred fetish wound up in cotton cloth, and, when he desired to placate it, unrolled its wrappings and smeared the blood of rabbits on its surface. The probabilities are that the early Mexicans treated their obsidian fetishes in like manner. Not only do we find that part of their later ritual ceremony prescribed the painting of the lips of their idols with human blood, and that many of these images were carved from obsidian, but we also find that the gods Itzatl and Itzlacoliuhqui are represented, the first in the *Codex Fejérvary-Mayer* (sheet 2) as wrapped in a cotton cloth with a fringed hem, and the second in the *Codex Borgia* as wound up in a bundle like a mummy.

The practice of wrapping up fetish stones is fairly widespread. In the island of Fladdahuan off the west coast of Ireland a stone fetish called Neevougi was formerly kept wrapped up in woolen cloths, and unwound only when a wind was required for the fishermen. It is interesting to note in this connection that Tezcatlipoca was a god of the winds of the four quarters. The mandrake, that strange human-shaped root so frequently employed as a fetish or familiar by mediaeval wizards in Europe, was likewise often so swathed. The practice, I believe, had an early association with or reflection from, the rite of mummification. The mandrake, after being unearthed, was washed in wine, wrapped up in red and white silk, and afterwards rolled in white linen bands. This ritual completed, it was then placed in a box, the "head" alone remaining

uncovered in order that it might reply to such questions as the sorceror put to it. This is obviously reminiscent of the ritual of embalmment. One of the Mexican gods, Xolotl, took the shape of a double-rooted plant like the mandrake, and when pulled up by the roots, shrieked as that plant is said to do. His symbol, the *ollin*, bears a close resemblance to the mandrake.

The obsidian knife came then to be regarded not only as the sacrificial tool, but also as something possessing "soul," or at least personality and volition of its own. On the hafts of some of these

knives which have been preserved is the representation of an undoubted fetish or sprite. That it was personalized in the forms of at least two deities has also been demonstrated. Again and again in the Aztec manuscript, it is represented as having a human face, and sometimes even limbs (Fig. 4). It was, indeed, obsidian in the form of the life-drinker. Tezcatlipoca was known by one of his names as "the Night-drinker," "he who has his sport with the people," the insatiable spirit of human sacrifice. Obsidian was also regarded as one and the same with blood and even with rain, the fertilizing essence. Just as the blood of Tawiscara, the god of the Algonquins, fell from the sky in the shape of flint-stones, so obsidian was thought of as the blood or broken flesh of the gods. If it was not actually pabulum or food, like maize or fish, which were regarded as divine flesh by the Mexicans, it was that which gained or acquired pabulum for the people, and so came to be confounded with it.

A proof that the obsidian knife was regarded as a "flesh-eater" or "blood-drinker," or even as blood itself, is to be found in the figure of the Chalchiuhtotolin, "the jewelled fowl," or turkey,

which is ruler of the eighteenth day-sign (the *tecpatl* or obsidian knife) in the Mexican calendar. This figure strikingly exhibits the large red wattle and lobe of the American turkey. In most manuscripts it wears Tezcatlipoca's obsidian mirror at the temple, as does the god himself, and in *Codex Borbonicus* it appears as a *naualli* or disguise of the god, having his crown painted with stars and his

(Figure 4)



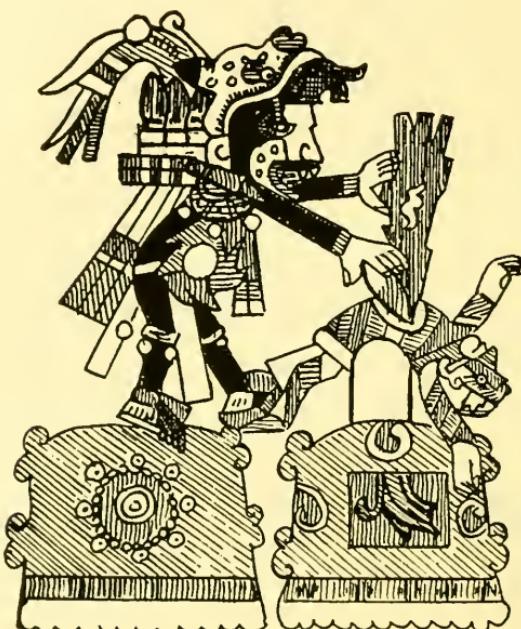
OBSIDIAN KNIFE AS HUMAN FACE.



ITZTLI, THE GOD OF THE OBSIDIAN KNIFE.

(Both from *Codex Bologna*.)

anauatl or ring of mussel-shell. On sheet 6 of *Codex Fejérvary-Mayer*, the bird appears as an image of Tezcatlipoca and is represented along with the signs of mortification and blood-letting, as it also is on sheet 17 of the *Aubin Tonalamatl*. Indeed, it represents the blood-offering connected with the worship of Tezcatlipoca. The turkey-cock's foot, too, is sometimes symbolic of the god. The bird is to be conceived as symbolical of rain, which was believed by the Nahua to be nothing else than the magically altered blood shed in penance or sacrifice. It may be that the red wattles and lobe of the



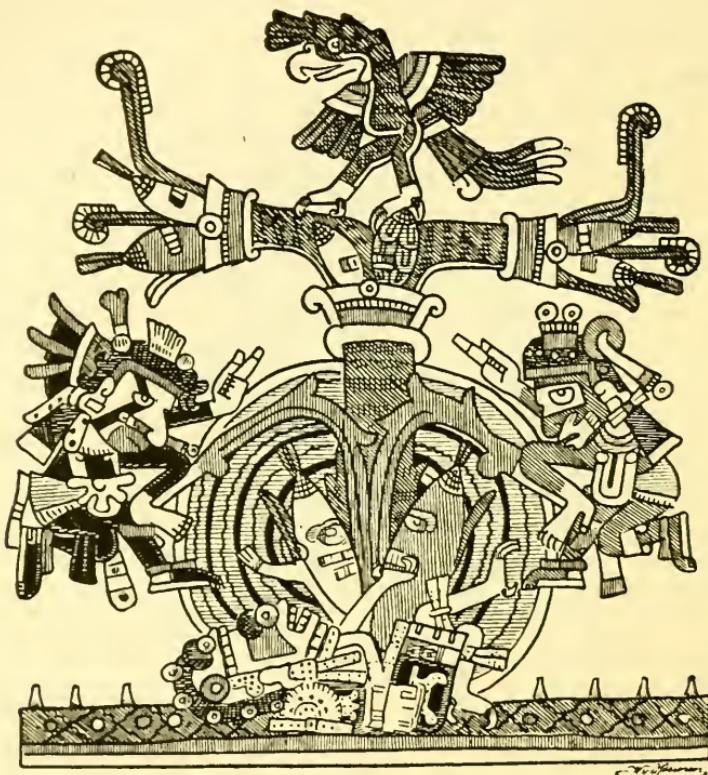
(Figure 5)

PRIEST OPENING THE BREAST OF A VICTIM WITH AN OBSIDIAN KNIFE.
(From *Codex Nuttall*.)

turkey suggested the idea of blood, and that the shades in his plumage were equally suggestive of water, as we know those in the plumage of the quetzal bird were held to be by the Mexicans. Thus it would come to be regarded as the blood shed by the obsidian knife of sacrifice. It is also obvious that Tezcatlipoca's patronage of slaves, who were strictly regarded as his property, arose out of the idea that those unfortunates, whenever used for the purposes of sacrificial ritual, constituted the "food" of the obsidian knife. (Fig. 5.)

The connection of obsidian with the ritual of war is sufficiently obvious. The *maquahuitl*, or Mexican "sword," was a wooden blade set at the edges with sharp obsidian flakes, but capable of inflicting a severe wound, as the Spanish Conquistadores found to their cost. The obsidian arrow had its divine counterpart in the sacred arrows of the war-god Uitzilopochtli, armed with which Guatemotzin, the last of the Aztec emperors, believed himself invincible. In the ritual of the maize-god Cinteotl are to be found circumstances which reveal the importance of obsidian in military ritual. At the annual festival of his mother, Tlazolteotl, also a deity of maize, his priest set out alone and in a hasty manner, followed at a decent interval by a large body of warriors, to a point on the frontiers of Mexico where a small hut stood, and at this place he left a mask and cap which he had worn at the festival of the goddess, made from the thigh-skin of a sacrificed woman. The cap in question is represented in the Aztec manuscript as serrated, and resembles the cock's comb of the mediaeval jester. It was held to symbolize the sharp-cutting knife of sacrifice. The occasion on which it was deposited on the frontier was that on which notice was given to a neighboring tribe, the Tlascalans, that the Aztecs would on such-and-such a date meet them in battle for the mutual purpose of striving for war-captives to be immolated in sacrifice. For the understanding of this strange compact it is necessary to take into consideration the basis on which Nahuatl theology rested. The Mexicans regarded the sun as the supreme deity, the principal source of subsistence and life, and the heart, the symbol of life, as his especial food. It was supposed that the luminary rejoiced in offerings of blood, and that it constituted the only food that could render him sufficiently vigorous to undertake his daily journey through the heavens and quicken the crops. He had, it was thought, been preceded by other suns, each of which had been quenched by some awful cataclysm of nature. The old suns were dead, and the living sun was no more immortal than they. He must, therefore, be nourished by every possible means if mankind were to continue to exist. Naturally a people holding such a belief would look elsewhere than within their own borders for the means of placating such a deity. This could most suitably be found among the inhabitants of a neighboring tribe. The adjacent source of supply was the little state of Tlascala, the people of which were of cognate origin with the Aztecs, and adhered to a similar belief. A strange and horrid compact was arrived at between them. On a given day in the year their forces met at an appointed spot for the

purpose of engaging in a strife which should furnish both sides with a sufficiency of sacrificial victims. There was little bloodshed in these strange combats, the champions on either side preferring to bring back their captives in such a condition that they would be fit for immolation. From the blood of the captives thus captured and slain by the obsidian knife, the sun was supposed to receive his obsidian character.



(Figure 7)

THE TREE OF THE MIDDLE REGION SHOWING OBSIDIAN KNIVES AT THE ROOTS
AND ON THE BRANCHES.

(From the *Codex Fejérvary-Mayer.*)

In Mexican art, as has already been said, obsidian is very frequently depicted. A good example is to be seen on an Aztec stone of sacrifice housed in the Peabody Museum at Yale University (see Frontispiece). On the side of this stone is represented the obsidian knife of sacrifice with a human face, flanked by the butterfly symbols of Itzpapalotl, the whole being symbolical of the taking of the life or soul by the god of Obsidian. In the accompanying illustration of the

Tree of the Middle Region, from the *Codex Fejérvary-Mayer*, its roots can be seen issuing from obsidian knives, while similar instruments decorate its branches or sprout from it as leaves (Fig. 7).

It may, then, be not unreasonable to infer among the early Nahua the gradual development of the obsidian stone, first into the fetish and later into the god. The process by which this Nahua cult became amalgamated with those of Tlaloc and Quetzalcoatl seems fairly clear. With the cult of Tlaloc, the rain-god, it would fuse easily enough. The salient necessity of the Mexican agriculturist is rain, and when the Nahua adopted an agricultural mode of life they would necessarily adopt the cult of Tlaloc as essential to its proper performance. Upon their settlement in the Valley of Mexico it is plain from the terms of certain myths that the Nahua did not regard the cult of Quetzalcoatl in any friendly manner. Tezcatlipoca is spoken of as driving him out of the country, and it is probable that to begin with a certain amount of persecution may have been inflicted upon his adherents. But the Nahua would undoubtedly come to recognize the value of the calendar system connected with his cult, and it is clear that they did so from the fact that we find included in it certain of their chief gods. The final process of amalgamation probably took place during the eleventh and twelfth centuries A. D., for, as witnessed at the Conquest period, the union of the three great cults of Mexico must have occupied several centuries. Such a duration of time was necessary for the development of a homogeneous and involved symbolism, which was obviously based on a tacit recognition of the unity of the Mexican faith. Initial disparities seem to be indicated principally by ancient traditions, of which perhaps the most notable was that which told of the different heavens of the three original cults, the Tlalocan of the worshippers of Tlaloc, the Tlapallan or oversea paradise of the Quetzalcoatl cult, and the sun-house or Valhalla of the Obsidian religion. A striking proof of the adjustment of the chronologies of the three cults is found in the myths which tell of the existence of several "suns" or ages prior to the historical era, the "rulers" or patrons of which were, according to the most trustworthy sources, Tezcatlipoca, Quetzalcoatl, Tlaloc, and Chalchihuitlicue, goddess of the Tlaloc cult. It is obvious, then that the early Nahua cult of obsidian not only amalgamated with the other faiths cherished by the peoples of the Valley of Mexico, crossing with their theologies as woof crosses with warp, but that no department of Mexican life was at a later stage uninfluenced by ideas which accompanied its ritual acts.

THE FAUST-BOOKS AND THE SYNOPTIC GOSPELS

BY J. T. HATFIELD

THE first Faust-Book, of 227 small pages, published in 1587, carried a potency of which its unnamed compiler doubtless never dreamed; from it, directly and definitely, came the countless German Faust-Books and ballads of the 16th, 17th, 18th, and 19th centuries. The stern demands of these earlier books for the persecution of necromancers may well have added fagots to the many flames lighted for witches during the 17th century. Immediately translated into English, it spread the legend over British soil, and gave Marlowe the stuff for his grandiose tragedy; this, being brought to Germany, was the parent of the Faust-spectacles and puppet-plays which led to the dramatic suggestions of Lessing, and bore full fruit in Goethe's chief life-work and masterpiece.

This book (hereafter referred to as "A") was written about forty years after the death of its well-documented protagonist. Its historic foundations are little to our purpose. A is by no means necessitated by its sources—least of all by reality. The most obvious of these sources are works having no honest relation to Faust at all—conspicuously Schedel's *Chronik* of 1493, from which the writer borrows not only countless details for use in fabricating Faust's journeys through Europe and the Orient, but much impertinent matter applied to Faust's surveys of Paradise, astronomy, the evolution of the world, and theological speculation.

The sweeping success of this cheap production was natural: it has Form; it is an effectively grouped relation of the life and doings of its subject; its sensationalism, brevity, proverbial style, fervid emotion and aggressive piety explain its wide human appeal.

Given such popularity, the issuance of an "improved" rival work became a foregone conclusion. Widman's huge *Historic* (Hamburg, 1599) raised the 227 pages of A to 671 considerably larger ones. While Wi never refers by name to his source, his frequent

sharp bites at the hand that was feeding him sufficiently prove that A was always set before his eyes. A specious originality is gotten by copious new chapters at the beginning. Widman's most obvious device consists in shattering the well-ordered scheme of A, and remoulding it nearer to his heart's desire—which is, to conceal theft. His first wholesale appropriation is chapter 10 of A, which he hides in the 25th chapter of his second book, about half-way through the volume. It properly belongs among the early negotiations with Mephisto, but is put among pranks and adventures. A 15 is taken over, practically word for word, but most illogically removed from theological inquiries and put among more secular performances. Widman omits a long bill-of-fare found in A, so comprehensive as to be compromising, but works part of it (much concealed) into a later banquet. A begins its third division effectively with the conjuring-up of Alexander the Great, a dignified tale thrown by Widman into the middle of a series of vulgar practical jokes. In general, when he reaches this third division of A, Wi drops the mask of originality, and borrows *plenis manibus*. Chapter 46 he takes word for word, but expands the framework and stuffs it with much extra matter: 47 and 48 are as literal as possible, but switched into Wi's second book.

That pestilential editorial passion, to "re-write" and improve, is seen even in the contemporary English translation of A, which professes to be "according to the true copy, printed at Frankford." The Englishman had traveled, and enriches the account by liberal additions, some of which were taken into Marlowe's play. Such creative activity is as nothing to Widman, who twists his source at every point—even to his own disadvantage. He is determined to show himself more authentic than his rival, even at the expense of self-contradiction: he reproves his predecessor for putting Faust's great Alexander-conjuring during the reign of Charles V, instead of in Maximilian's time. Near the beginning, however, Wi asserts that, according to original written evidence, Faust received his *first* gift of necromancy from Mephisto in 1521, but that it "was in the year 1525, after he had previously given himself over, body and soul, to the Devil, that he really came first into public notice." Maximilian died on January 11, 1519.

One example, typical of every page: A. er wolte mit ime für das Thor hinaus gehen =Wi: ire Gnaden wolle mit jhm einen spatzier weg für das Thor nehmen. (Wolle=wolte: mit jme für das Thor=mit jhm (3 words) . . . für das Thor; gehen=satzier weg

nehmen.) The orthography is constantly, but inconsistently, varied. This extends to the capricious substitution of small letters for capitals, and *vice versa*. Wi is no purist: on one page he prints "Schloss" in three different ways. When taking over the word "tantzen" he changes it, for variety, to "dantzen," but, where he inserts the same word independently, spells it "tantzen." "Voll und Doll," in A—"toll und voll"—changing order, capitalization, and phonetics in that one brief phrase. Dass er nimmer weder *ritte*, noch *fahre*=das er nimmer weder *fuhr* noch *ritt*; A: der Dölpel *wegerte vnd abschluge* = er jhm *abschlug* vnd *wegert*.

Varying the discourse from historical account to direct dramatic dialogue is one of the easiest of devices, already exemplified freely in the English translation of A: Darnach forderte der Keyser den Faustum in sein Gemach, hielte jm für, wie jhm bewust, dass er ein erfahrner der schwartzten Kunst were=(the emperor) called unto him Faustus into his privy-chamber; where being come, he said unto him: "Faustus, I have heard much of thee, that thou art excellent in the black art." Just so, A: was er nemmen wolte=Wi: höre, mein Freundt, was wiltu nehmen? The exact opposite: A: ich drey Fläschen in meinen Garten gesetezt habe=darauff hat D. Faustus drey flaschen in seinen garten gestellt. Narrative=question: A: In solchem Fürhaben gehet ein Sturmwindt seinem Hauss zu = Wi: Was folgt darauff? alsbaldt gehet ein grosser Sturmwindt seinem hauss zu. The historical present is changed to the preterit, A: wirfft jn in die Stuben hineyn=wurff jhn in die Stuben hinein. Concrete terms are changed to abstract, A: ward ein guter Astronomus oder Astrologus=war in der Astronomie und Astrologia so wol erfahren—and thousands of similar transparent changes for change's sake. No deeper meaning need be sought for variations in fact. A: Faust was born near Weimar=born in Anhalt: A: Wagner, his Famulus, whimsically changed throughout by Wi to Johan Wäiger (though Pfitzer, seventy-five years later, and all other sources hold to "Wagner"). Wi changes the ten infernal realms to nine, probably not suspecting that the source of A at this point was Anselm's *Imago Mundi*. Of like sort are A: name *zwo* silberne Schüsseel=Wi: nam 3. silberne schlüsseel; A: einen breiten Mantel=seinen *nachtmantel*.

Again, we note expansion by adding new details. A: wem war banger dan dem guten Herrn=er stiess an die fenster, tobt und wütet, als ein wilt thier; A: Perlen=Orientalische perlen; A: ein spitzig Messer develops into: ein spitziges *Schreib messerlin*; A:

genug essen lassen=gnug für einen Salat grunmat essen lassen; A: sie tapffer sangen, sprangen, vnd alle Kurtzweil trieben=da trieben sie allerley kurtzweil mit springen, singen *vnd tantzen*. A: ein schön herrlich Pferd=Wi: ein schön *brauns* herrlichs Pferdt—to which Pfitzer, who claims to hold strictly to his original, Widman, gives the crowning touch, “ein schönes *lichtbraunes* Pferd!”

Morphologically, the development of the synoptic gospels is identical with that of the Faust-books. The anonymous little work known as “Mark” is of the type “A”. It was originally known simply as “The Gospel”; later, to distinguish it from rivals, *κατὰ Μάρκον*; still later, it was widely known as “The Memoirs of Peter.” The consensus of critics puts its completion at just about forty years after the death of Jesus. The writer, as in the case of A, had many sayings and stories given into his hand: Christianity was a lively factor in the Roman world by the time of Nero, as we know from Tacitus’ *Annales* (xv., 44), and from the accredited epistles of Paul. This first of the gospels is a well-constructed, freely sketched brochure, giving a succinct, literary, unified history of Jesus. The author ignores any miracles connected with the birth of Christ, and covers, in general, John the Baptist’s mission, the temptation, calling of the disciples, various parables and miracles, the transfiguration, entry into Jerusalem, prophecy of the second coming, betrayal, Gethsemane, the trial, crucifixion, and resurrection.

The chief pseudo-source of Mark is apparent, namely the Septuagint. The little story, taking only sixteen pages of the Revised Version, draws on Gen., Exod. (iv.), Lev., Numb., Deut. (iv.), I Sam., Psalms (iii.), both Isaiahs (vii.), Jer., Dan. (iii.), Joel, Zech. (ii.), and Mal. It is fair to assert that *all* these citations are, in their original context, quite irrelevant. The story of the crucifixion is partly built on Ps. xxii., which only the most determined theological intention could connect with Jesus. The process is carried further in Matthew’s story of the same event, where he draws with equal irrelevancy on Ps. lxxix. (“They gave me also gall for my meat and in my thirst they gave me vinegar to drink”), and records: “They gave him wine to drink mingled with gall.” Here the King James Version helps along by forcing the reading “vinegar to drink”—honorably restored to “wine” in the Revised Version of 1881. Matthew also adds another touch from Psalm xxii.: “He trusted in God: let him deliver him now if he will have him.” Mark’s report on the prophecy of the coming of the Son of Man is a cento of unrelated phrases lifted from Isaiah, Daniel, Zechariah and Deuteronomy.

Mark was a true *Volksbuch*, adapted to be widely circulated, and it was eagerly welcomed by a large and fast growing body of Gentile Christians. It is colloquial in its word-order, the use of certain popular terms like *κράββατος* and *σφυρίς*: of diminutives, double meanings, the historic present, and pleonasms. I would be the last to speak lightly of words of love and hope, hallowed by sacred associations, and glorified in art and music—but Professor Goodspeed is undoubtedly right in maintaining that the language is that of common, everyday life. That master-Grecian, Gilbert Murray, in one of his latest publications, points to the “mere beauty of language” of the gospel narrative, citing only two examples: “And there came unto him a certain rich man,” and “Verily I say unto you.” The first quotation does not exist; the second, in the form *ἀμὴν λέγω ἡμῖν*, scarcely has musical charm, and, repeated fourteen times in this little book, becomes a wearying mannerism—not to speak of John, who, protesting still more stoutly, uses the enhanced phrase, *ἀμὴν ἀμὴν λέγω ἡμῖν*, twenty-four times! The white glow of Tyndale’s martyr-zeal, and the stately language of the seventeenth century have transposed this humble text into a very different key.

Mark is a *Volksbuch*, also, in having its interest largely centered in demonology and exorcism: as Bacon says, it is “the nucleus and core of Mark’s Christology.” I find thirteen such allusions, including the long account of the man among the tombs, possessed by a legion of spirits which ran into 2,000 swine that were choked in the sea. In the generally discredited ending (x., 9-20 of the last chapter) there is also an allusion to Mary Magdalene who had been possessed of seven devils, and a final assurance to the apostles that the casting out of devils should be a sign following those that believe. Of popular appeal is the sensational prophecy of the terrors of the last day, occupying all of chapter xiii., and made more poignant by the most solemn of all possible asseverations that “this generation shall not pass away, until all these things be accomplished.”

Matthew is the moral equivalent of Widman: in general, every device of the latter in superseding A is exemplified by Matthew’s use of Mark. It is more than one and one-half times as long (Luke, following Matthew, is somewhat longer than Matthew). In making additions, Matthew, like Widman, provides an entirely new beginning—in this case, as well as in Luke, of two chapters—commencing with the genealogy of Joseph, which is absolutely and mathematically irreconcilable with a rival genealogy at the beginning of Luke. The preaching of John the Baptist is much expanded.

In chapter iv., Matthew takes over the two verses of Mark which make his entire account of the temptation, varying them for the sake of variation, and adding to them in the precise manner of Wi. One brief example of Matthew's procedure, sufficing for hundreds: Mark: *καὶ ἐδίδον αὐτοῖς ἔξονσιαν τῶν πνευμάτων τῶν ἀκαθάρτων* = Mat.: *ἔδωκεν αὐτοῖς ἔξονσιαν πνευμάτων ἀκαθάρτων*, etc. The same main verb is used, but changed from the imperfect to first aorist; indirect and direct objects are identical; objective genitive identical, except that Mark has the article twice, and Matthew omits both. Matthew adds: "and to heal all manner of disease and all manner of sickness." The most convenient and convincing illustration of Matthew's systematic borrowing under cover of trivial variants is the Parable of the Sower, making the first nine verses of both Mark iv. and Matthew xiii. A comparison, verse by verse, seems to me to dispose, once for all, of the "memory-tradition" theory supported by learned and ingenious New Testament scholars. Recurring to the temptation, Matthew spreads Mark's two verses into his verses one, two, and eleven, and fills his verses three to ten with a dramatic dialogue between Jesus and Satan, constructed from Deut. viii.. 3; Ps. xci., 11ff.; Deut. vi., 16; Deut. vi., 13.

The long sermon on the mount is not found in Mark, but Matthew puts into its construction scattered passages from Mark, taken out of their logical setting, and in the following order: Mark, chapters ix., iv., xi., iv. At chapter viii. Matthew goes on from Mark, chapter i., but in the order, verses 21, 40, 29. Then very direct borrowing from Mark, chapter iv. and v., going back in Matthew's chapter ix. to excerpts from Mark, chapters ii., v., iii., vi. The brief saying of Jesus, "For he that hath, to him shall be given," etc., occurring once in Mark, is repeated by Mat. at xiii., 12, and xxv., 29, and by Luke at viii., 18, and xix., 26.

Matthew's unnecessary expansions are quite in the spirit of Widman, e. g., Mark's simple and effective phrase, "Which, when it is sown upon the earth," is produced into "which a man took and sowed into his field": Luke, varying on this extension, writes: "which a man took and cast into his own garden"—altering two words, and adding one new one. Mark has a dramatic interval in the story of the withered fig-tree, which Matthew makes less effective by leaping over some seven intervening verses. Matthew, in following Mark, chapter vi., unexpectedly lifts a passage from Mark xiii., from its original setting in a discourse on the second coming, which Matthew treats as a whole in chapter xiv., where

he repeats his verse from x., 22. At x., 26, Matthew introduces, with complete irrelevancy, "for there is nothing covered, that shall not be revealed; and hid that shall not be known"—wrested from its logical setting far back in Mark iv., 22. At Matthew xxiii., 6, Mark's order, 1, 2, 3 = 3, 2, 1; and similar shifts in other places, while following the original *words* of Mark very closely. At the beginning of Mark x. the order of discourse is logical and clear. Matthew takes it over with notable verbal agreement, changing the order of paragraphs to 2, 1, 4, 3—a triumph of mathematical permutation. Similarly at Mark i., 7-8 the order is simple, effective, climactic: Matthew puts the sequence 2, 1, 3, 4. In Mark, where one asked, "Good master, what shall I do that I may inherit eternal life?", Jesus replies simply and consistently: "Why callest thou me good?" Matthew alters this infelicitously to "Why askest thou me concerning that which is good?"—which even Luke refuses to accept. Mark's pungent "I adjure thee by God, torment me not" is put by Matthew: "Art thou come hither to torment us before the time?" while Luke reads, "I beseech thee, torment me not." The phrase "whose shoes I am not worthy to loose" (Matthew, Luke, Acts) is not improved by Matthew's change: "whose shoes I am not worthy to bear"—nor the "rent asunder" of Mark by Matthew's "opened," though here Luke follows Matthew. The parable of the vine-dressers, simply and well built up by Mark, is muddled and diffused in Matthew's arrangement.

At the beginning of chapter xiii., Matthew, like Widman, wearies of piece-meal mosaics, and, taking up the beginning of Mark iv., follows his model systematically and as literally as his method permits, through Mark's chapter iv. (Mark, chapter v., had already furnished its materials for Matthew viii.), and from Mark vi. to xvi., which is the end. The borrowing throughout is so literal as to be practically identical.

Matthew, like Widman, is prone to heighten his source incrementally: for one blind man he gives two; for "a colt" he gives "an ass and a colt"—mechanically (but rather inconsiderately) correcting here Mark's ἐκάθισεν ἐπ' αὐτὸν τοῦ ἐπεκάθισεν ἐπάνω αὐτῶν: "and he sat on *them*." Mark's "5,000 men" who were fed by five loaves and two fishes, become "5,000 men, beside women and children." According to Mark, Joseph wound the body of Jesus in a linen cloth, and laid it in a tomb; Matthew, using the same diction, adds that it was a *clean* linen cloth, and *his own new* tomb. Mark and Matthew record that one of those with Jesus struck off the ear of the high

priest's servant; Luke adds that it was his *right* ear, and that the ear was restored: the much later John specifies *Peter* as the agent, and gives the name of the servant, *Malchus*—all according to the general law of this class of books: the further away from the event, the more numerous and exact the details.

Matthew transposes words, even in quoting from Isaiah, and alters the commandments. Such changes are piously ascribed to personal usage, or a better literary feeling. In transferring ‘*Παββούει*’ from Mark, Matthew uses, to be sure, the Greek word *Kύριε*—but hardly on puristic grounds, for at Mark xiv., 45, he takes over the word ‘*Παββεῖ*’. Mark always uses the phrase *μετὰ τρεῖς ἡμέρας*, which Matthew, followed by Luke, alters to *τῇ τρίτῃ ἡμέρᾳ*—but not for consistency, as is clear from Mat. xxvii., 63: *μετὰ τρεῖς ἡμέρας*.

The variation from historical narrative to direct dialogue (noted under Wi) offers abundant illustrations. Mark: “the disciples asked”—Matthew: “Peter said, ‘Tell us.’” Also the exact opposite, Mark: “Thou art”—Matthew: “This is.” Mark: “Master, behold!”—Matthew: “His disciples came to show him.” The simple assertion of Mark, “That kingdom cannot stand,” is turned into a question by Matthew: “How shall his kingdom stand?” Mark’s question, “Is it not written?” becomes Matthew’s simple assertion, “It is written.” Mark’s plural “those that are sown” is turned by Matthew into the singular, “he that was sown.” *Pars pro toto.*

At this point I must omit a further comparison of Pfitzer’s *Leben Fausti* with the gospel of Luke, though this would fortify the main thesis.

The history of the Faust-books, as well as that of the gospels, reveals a series of emulations, rivalries, survivals, and defeats: *habent sua fata libelli*. Widman’s pretentious revision of A put that book completely out of circulation, though it was in the hands of Pfitzer. No mention need be made of the numerous Wagner-books, *Fausts Höllenzwang*, *Dr. Faustens Miracul-Kunst- und Wunderbuch*, and the like. Mark was almost completely eclipsed in the early church by the later and higher claims of Matthew, and probably survived only because popularly supposed to derive directly from Peter (curiously enough, it is Matthew who stresses Peter’s personality most dramatically). Many products of a similar kind came into competition: any popular one was called “the Gospel.” They offer a tangled jumble of late, supposititious “claims” to authority. “No valid distinction can be drawn between the New Testament and early Christian writings of the first and second cen-

turies" (Moffatt). Few laymen suspect—at least it was never made a part of my strenuous Sunday-school instruction—the number of rival gospels, orthodox and heretical, whose compilers provided them with the names of saints and apostles, and supplied credentials in the way of pretended letters to and from church-fathers. Montague James' splendid new work (Clarendon Press, 1924) presents scores of such apocryphal New Testament texts. The following had an even fighting-chance of being put in the canon: The Revelation of Peter; the Epistle of Clement; the Epistle of Barnabas; the Acts of Paul; the Shepherd of Hermas. Irenaeus, in the second century, used the Book of Questions Addressed to Jesus, and His Answers. The Epistle of Paul to the Laodiceans is mentioned from the fourth century, and frequently found included in manuscript New Testaments. The Gospel of Nicodemus is edited by Tischendorf from eleven Greek and nineteen Latin manuscripts; there are also ancient versions of the first part of this gospel in Coptic, Syrian and Armenian—all of which points to its widespread acceptance. The book of James, later called the Protoevangelium, is as old as the second century. The gospel according to the Hebrews is quoted by Jerome. The Apocalypse of Peter, next in popularity and date to the book of Revelation, belongs early in the second century.

The sum of this paper is the conclusion that there is a natural history in these matters, an eternal recurrence, and that the organic relations of such products cannot be ignored.

As those great spirits, Lessing and Goethe, rescued the profound Faust-myth alike from the degrading superstitions of the orthodox and the shallow contempt of the Age of Enlightenment, may we not hope that some spiritual genius may also lead our own day from the absurd literal cult of these primitive documents to a new and worthy evaluation of the sublime legend of Jesus?

THE STATICS OF LEONARDO DA VINCI*

BY IVOR B. HART

INTRODUCTORY NOTE ON THE MANUSCRIPTS

Leonardo da Vinci lived in the fifteenth and early sixteenth centuries (1452-1519). At the age of fourteen he was apprenticed to Andrea Verrocchio, a famous artist of those days. Verrocchio's tastes, and as a consequence his circle of acquaintances, were wide, and from all these Leonardo imbibed and developed a passion for scientific inquiry side by side with his development as an artist. At Florence, in his early days, he came under the influence of such men of science as Benedetto del' Abbaco, Giovanni Agiropulo, L. P. Alberti and Toscanelli.

In 1483 Leonardo migrated to Milan, where he took service under Ludovico Sforza in the capacity of consulting engineer, architect and sculptor, and he was busily employed in all these capacities. His chief scientific friendship during this period was with Fra Luca Pacioli, the famous mathematician.

Leonardo's stay in Milan ended in 1499 with the collapse of the power of Ludovico Sforza, and for some years we find da Vinci back again in Florence. In 1506, however, he accepted an invitation from Louis XII of France to return to Milan. He remained there till 1512, and later, in 1515, Francis I of France, Louis XII's successor, invited him to take up his residence in the Castle of St. Cloud, near Amboise. Here he spent the remainder of his days. He died on May 2, 1519.

The reading of Leonardo da Vinci's manuscript has been a task of enormous difficulty with which is honorably associated the names of a small band of enthusiastic students, chief among whom may be mentioned J. Paul-Richter, G. Piumati, and C. Ravaission-Mollien.

* These chapters will be incorporated in a forthcoming book, *The Mechanical Investigations of Leonardo da Vinci*, Open Court Publishing Co., Chicago.

Leonardo, from the time he was twenty years of age onwards, invariably wrote in a manner apparently calculated to confound his would-be readers. We may summarize the characteristics of his script under four heads.

(1) He wrote from right to left after the fashion of the Semitic group of languages; (2) his handwriting was of the kind known as "mirrored," i. e., reversed in a manner such as would be produced by looking at a normal script through a mirror; (3) he employed an elaborate scheme of abbreviations, and (4) he omitted the use of punctuation. It is accordingly much to the credit of the patient workers to whom reference has been made above that in spite of these difficulties the writings of this great genius of the Italian Renaissance have been rendered available to the world of science and letters generally. The chief of Leonardo's manuscripts are collected together and housed as follows: (1) the Codex Atlanticus, a huge miscellaneous collection at Milan, in Italy; (2) a number of note-books, lettered consecutively A, B, C, D, etc., housed at the Institute of France, Paris; various volumes in England at the British Museum, the South Kensington Museum, at Molkha Hall, Leicester, and at Windsor Castle.

PART I

IT is proposed in this paper to consider the various contributions by Leonardo da Vinci in the field of statics, a study to which he referred as the "paradise of the mathematical sciences."¹ His notes on this subject are found scattered throughout his writings with a frequency and a persistence which show clearly the importance which he attached to it. They have at various times been considered by a number of students—notably by Grothe,² and Schuster³ (and more superficially by Seailles)⁴ in the realms of theoretical mechanics, and by Feldhaus⁵ in the study of Leonardo's applications of mechanical principles to mechanisms. At the outset it may frankly be stated that Leonardo suffered badly from the want of a precise and an accurate scientific vocabulary. All the modern ideas of force, motion, mass, inertia, work, moment, etc., are constantly to be found amongst the note-books of our philosopher; but they are cloaked in a phraseology which is rarely precise, which is frequently puzzling, and which is seldom rigid. Yet condemnation for this would surely be most unjust. The notion of rigidity in scientific thought had no place in the fifteenth century. Looseness of expression is frequently the result of ignorance. A wealth of such looseness is not an unknown device as a cloak of assumed wisdom—a pseudo-learnedness, as it were. No one, however, can accuse Leonardo da Vinci of belonging to this class of writer. There is, however, the other side of the picture—the looseness of expression due to a sheer inadequacy of words to convey new ideas such as may occur to a writer who lives ahead of his times. It is to this side of the picture that Leonardo belongs. Many of his ideas, lost with the dispersal of his manuscripts, had to be rediscovered by others long after him. That these later philosophers had the benefit of a later and a more complete terminology with which to state their discoveries is a fact

¹ Ms. E., Fol. 8v.

² H. Grother, *Leonardo da Vinci als Ingenieur und Philosoph.*, Berlin.

³ F. Schuster, *Zur Mechanik Leonardo da Vinci*, Erlangen, 1910.

⁴ G. Seailles, *Leonardo de Vinci, l'Artiste et le Savant*, Paris, 1906.

⁵ F. M. Feldhaus, *Leonardo da Vinci Als Techniker und Erfinder*, Jan.,

that need neither detract from the credit due to Leonardo, nor blind us to the difficult path of inadequate language through which he had to grope his way. Yet one other factor requires mention in this connection. Clarity of thought in the exact sciences could not properly come into its own until the test of experiment had been recognized and practised. It is a commonplace in the history of science that little real headway was made until the advent of such pioneers of experimental science as Galileo in Italy and Gilbert in England. These preachers, by inaugurating a new era in scientific research, heralded the downfall of the dogmatists, and paved the way for such an advance in accurate scientific knowledge as to render absolutely imperative an expansion of technical vocabulary.

Leonardo, more than one hundred years before Galileo, was most definitely an experimentalist. If the great Tuscan philosopher was indeed the "Father of the Experimental Philosophy," then da Vinci was its grandfather. "Experience (i. e., experiment)," says he, "never deceives; it is only our judgment which deceives us, promising from it the things which are not in its power."⁶ The appeal to experiment pervades all his writings on scientific topics. Small wonder, therefore, that his ideas and his discoveries outstripped his language. Living and thinking in terms of the late sixteenth and seventeenth century, he was yet compelled to express himself in the restricted language of the fifteenth. Vagueness of expression in the circumstances was inevitable. For these reasons, therefore, it behooves us to approach the notes on mechanics in no hypercritical spirit, but to make due allowances by assuming for ourselves rather the role of the "man in the street" to whom ideas of scientific rigidity are foreign and are replaced by what he would call "the common sense of it."

Introduction.—Da Vinci's Statics covers a very wide field. In a sense this is not surprising. Unlike dynamics, the way had been pointed by his predecessors. He had at hand the fruits of the labors of Aristotle, Archimedes, Jordanus Nemorarius and his anonymous successor, and of others; and he applied these materials in his own way with his usual vigor and independence. If the range of da Vinci's statics was wide, it was also within the possible limits of his days, thorough.

Centers of Gravity.—The fundamental contributions to Mechanics by Aristotle and the later Alexandrian school centered chiefly round the lever laws, or the laws of the balance, and the conception

⁶ Codex Atlan., fol. 154r. See also fols. 3r and 119r.

of centers of gravity. Naturally, therefore, the traditional approach to the whole subject by all later writers was through these fundamentals, and in this respect Leonardo was no exception.

The law of the balance, imperfectly presented by Aristotle, received its real scientific development at the hands of the great Syracusean philosopher. Its demonstration was based on certain definitions and axioms,⁷ amongst which is the statement that in every heavy body there is a definite point called *a center of gravity*, at which we may suppose the weight of the body collected.

A consideration, therefore, of Leonardo's pronouncements upon the subject of centers of gravity constitutes a suitable starting point for our study. This was a subject of peculiar importance and interest to da Vinci. It touched upon matters vital to his professional career. As an engineer he was concerned with the stability of the structures and the machines he was called upon to devise; as an artist he was interested in the balance of the human frame. References to the center of gravity are therefore plentiful.⁸ Yet it is difficult to find any actual attempt at definition. This, however, need not be surprising. The conception of the center of gravity was one which had grown up literally through the ages. It had permeated all existing writings on mechanics. It was, so to speak, a commonplace of ancient and mediaeval science. Let us remember further, that da Vinci has not left a complete treatise, but only a compendium of notes. Where he might have attempted a general definition in a text-book, one can understand its omission from a collection of notes. Nevertheless, that Leonardo regarded the conception of center of gravity as fundamental to mechanics is clear enough from his remark that, "Mechanical Science is very noble and useful beyond all others, for by its means all animated bodies which have movement perform their operations; which movement proceeds from their center of gravity. This is situated at the center, except with unequal (distribution of) weight."⁹ It is clear, too, that he studied the subject experimentally. In Manuscript "B" is shown a sketch of a suspended weight with the note, "The center of all suspended weights is established under its support."¹⁰ and in a similar sketch of a suspended artificial bird we read, "This is done to find

⁷ These have been ably presented by J. M. Child in a recent paper, "Archimedes' Principle of the Balance and Some Criticisms Upon It," in C. Singer's *Studies in the History and Method of Science*, Vol. II, p. 490. Oxford, 1921.

⁸ Eg. Codex Atlan., fol. 86ra; Ms. A, 5r; Ms. G, 78v; Ms. H, 105r; Ms. M, 37r.

⁹ *Sul Volo degli Uccelli*, fol. 3r.

¹⁰ Ms. B, fol. 18v.

the center of gravity of the bird."¹¹ A number of da Vinci's notes on this subject occur as incidental to his studies on the poise of the human figure. They bring out his appreciation of the need for a due distribution of weight about the "axis" (i. e., the vertical line through the center of gravity) under such varying circumstances as standing, sitting, kneeling, walking up and down hill, mounting stairs and ladders, and so on.

The following is quoted as a typical example: "A sitting man," we read, "cannot raise himself if that part of his body which is in front of his axis does not weigh more than that which is behind that axis without using his arms. A man who is mounting any slope finds that he must involuntary throw more weight forward—that is, in front of the axis and not behind it. Hence a man will always involuntarily throw the greater weight towards any point whither he desires to move than in any other direction. A man who runs down hill throws the axis onto his heels, and one who runs uphill throws it onto the points of his feet; and a man running on level ground throws it first on his heels and then on the points of his feet."¹² It is worthy of note that Leonardo was aware of the possibility of the center of gravity of a body being actually outside itself. Thus in the course of a long note in the *Codex Atlanticus*, attached to a sketch, we read, "Occasionally the center of gravity is to be found outside of the body, that is to say not within the weight of the matter, that is to say in the air."¹³

So far we may say that apart possibly from the experimental aspect we see here little that is really an advance on what had been done before. There is one aspect of the whole question of centers of gravity, however, for which claims of pioneer work may justly be made on behalf of Leonardo, namely, in the finding of centers of gravity of solid figures. Archimedes had made a thorough study of the centers of gravity of *plane* surfaces in his "*Treatise on the Equilibrium of Planes and of their Centers of Gravity*", deducing his results on Euclidean lines. Up to the time of da Vinci, however, none appears to have considered mathematically the problem of the center of gravity of the solids. It is of peculiar interest, therefore, to find in Manuscript F the following note accompanied by a sketch of two figures from which it is clear that Leonardo certainly considered the case of the tetrahedron: "The center of gravity of a pyramid is in the fourth of its axis, towards the base; and if you

¹¹ *Sul Volo degli Uccelli*, fol. 16 (15)v.

¹² Ms. A, fol. 28v.

¹³ *Codex Atlant.*, fol. 153v.b.

divide the axis in four equal parts, and as you cut between two of the axis of this pyramid, one such intersection comes out at the above mentioned quarter."¹⁴ Apart from this note on the two figures we have no further guide as to how da Vinci arrived at his result. The treatment appears to be modern enough, and it embodies a result which formal history had hitherto attributed to Commandin & Maurolycus in the middle of the Sixteenth Century.¹⁵

Leonardo's work on this subject was not undertaken in vain. Duhem has shown in a discussion on da Vinci's influence on his successors¹⁶ that the sixteenth century philosopher, Jean Baptiste Villalpand (1552-1608) took up the study of centers of gravity, and clearly borrowed freely, though without acknowledgement, from Leonardo's writings. The importance of this lies in the fact that Villalpand was freely quoted in this, as in other subjects, by the well-known sixteenth century commentator in Mathematics, Father Mersenne in his widely read *Mechanicorum Libri*. Similar remarks apply equally to Bernardino Baldi.¹⁷

THE PRINCIPLE OF THE LEVER

We turn next to the second of the two chief legacies of antiquity to the Statics of the Middle Ages, namely, the Principle of the Lever. We find this stated by Leonardo in its simplest form in manuscript "A". He speaks of the long arm as the lever, and the short arm as the counter lever, and his note reads: "The weight attached to the extremes of the lever made of any material whatever will lift up at the extremity of a counter lever a weight superior to itself by the same proportion as is the counter lever to the lever." Nothing could be simpler than this. The fact that the principle is more clumsily expressed, as for example in the *Codex Atlanticus*, need not seriously concern us. Schuster stresses the fact that in this collection Leonardo expresses the relationship mathematically in an unnecessarily complicated form,¹⁸ but inasmuch as he also expressed it as above in its simplest form, all cause for doubt as to the clear mindedness of our philosopher is removed.

¹⁴ Ms. F, fol. 51r.

¹⁵ See Libri, *Histoire des Science Mathematique en Italie*, p. 40. Paris.
See also Dahlen, *Etudes Sur L. de V.*, Vol. I, pp. 35-36.

¹⁶ Dahlen, *Etudes*, etc., p. 80.

¹⁷ Dahlen, *Etudes*, etc., p. 101.

¹⁸ Schuster, *Zur Mechanik Leonardo da Vincis*, Erlangen, 1915, p. 34.

He realizes completely the direct consequences of the principle. In Manuscript "A", to which we have already alluded, we find a sketch illustrating the practical utility of the lever with the remark, "10 lbs at the end of a lever will do the same as 20 lbs. at the mid point, and as 40 lbs. at the fourth part." Leonardo was not alone influenced by Archimedes in his treatment of the balance. Wöpcke quotes from an Arabic work of Greek origin¹⁹ a series of four axioms embodying various conditions under which a varying loaded lever remains horizontal. Of these, the second, which gives in effect the lever principle in its simplest form, is to be found in the *Codex Atlanticus*,²⁰ and the fourth (which states that in a beam loaded with a number of weights to produce equilibrium, if one weight on one side of the fulcrum is moved inwards, and another on the same side is moved outwards by a suitable amount, the beam remains horizontal) occurs in both Manuscripts "A" and "E".²¹ It

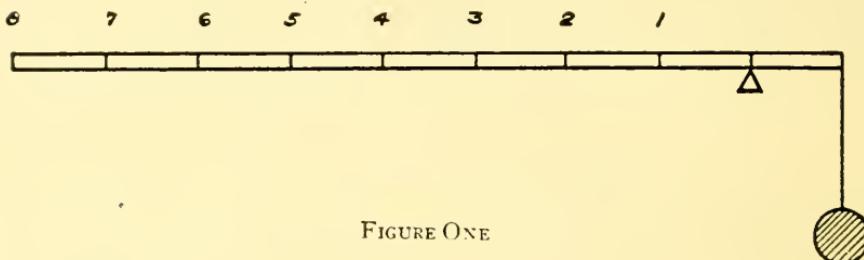


FIGURE ONE

is interesting to note that with all Leonardo's clarity of thought on this subject, he occasionally blundered over simple but not unimportant points. In a sketch²² strongly suggestive of the steelyard,²³ (Fig. 1) we find a short arm at the extremity of which is a suspended weight, and on the other side of the fulcrum an arm eight times as long with divisions marked as shown. The lever is assumed to be heavy, and the problem Leonardo sets himself is to ascertain what weight he must suspend at the extremity of the short arm in order to counteract the effect of the heavier arm, given that each section of the balance weighs one pound. A simple calculation shows the result to be $31\frac{1}{2}$ lbs. Leonardo makes it 35 lbs., and the fault of his argument lies in his unfortunate view that the

¹⁹ Wöpcke, *Das Buch des Euklid über die Wage*, Berlin, 1851. See also Dahem's *Etudes*, Vol. I, p. 65.

²⁰ *Codex Atlanticus*, fol. 154v.a. It also occurs in the *De ponderibus* of Jordanus Nemorarius.

²¹ Ms. A, fol. 5r; Ms. E, fol. 143r.

²² Ms. A, fol. 51v.

²³ It is worthy of note that the actual discussions of the Roman steelyard as such is unexpectedly absent from Leonardo's manuscripts.

weight of each section acts at the *outer end*, and not at the mid-point. On this basis, he says in effect that the weight of the short arm is cancelled out by Section 1 of the long arm, so that the weight must equal the sum of 2 lbs. (to balance the one pound of Section 2 at twice the distance) and 3 lbs. (to balance the 1 lb. of Section 3 at three times the distance), and so on to the eighth section at 7 times the distance, i. e., $2+3+4+5+6+7+8 = 35$ lbs. Happily, this did not satisfy our philosopher, since a later sketch is accompanied by the correcting remark that the weight must act in the middle of each portion. In this self-correction we see another reminder of the fact that the materials left to us are notes and memoranda *only*, jotted down as they occurred to the mind of the writer, so that faults were often cancelled out as occasion arose in later notes.

THE BENT-ARM LEVER-CONCEPTION OF POTENTIAL ARM

Leonardo's next step in what we may regard as his logical scheme is of the greatest importance, since upon it hinges a number of applications which undoubtedly carried our philosopher very far. This concerns what is in effect the modern bent-arm lever. So far the lever or balance has been straight and the weights perpendicular to it. What if one arm is now bent relative to the other, so that the corresponding weight is inclined to it at some angle? The fundamental experiment upon which Leonardo bases this problem has been oft quoted, and is illustrated in Figure 2.²⁴ A bar *at* is pivoted at *a* and has a weight *o* suspended from *t* at *m*. A second weight is also attached to *t* by means of a horizontal cord *tn* passing over a pulley *n*. The problem is to find the ratio of the weights depending from *t* and *n* as a condition for the equilibrium of the rod *at*. Leonardo regards this as a lever problem in which the lever arm for the weight *o* is not *at*, but what he calls the *potential arm* or *potential lever ab*, and for the weight at *n* the lever arm is the potential arm *ac*. He also speaks of these potential arms as *real* (i. e., in the sense of the effective arms) and the lines *ctn* and *btm* (i. e., the real lines with the cord extensions) as *semi-real*. Alternative terms also used by Leonardo are "spiritual lines" and "corporeal lines." Leonardo's conclusion therefore becomes that, as with the

²⁴ Ms. E, fol. 65v.

simple balance, the ratio of the two weights will be inversely as the ratio of their potential arms.

How did da Vinci arrive at this conception? The point, in view of the many problems upon which it is based, is one of importance.

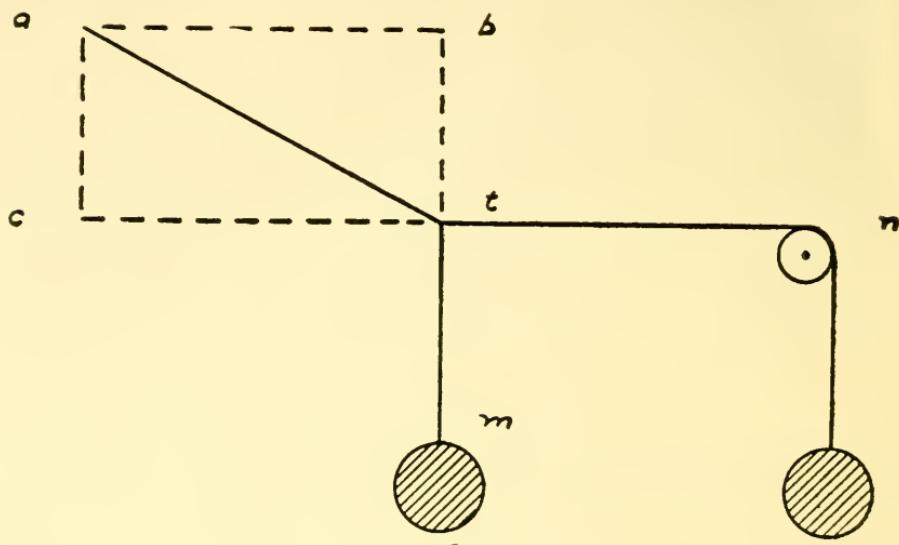


FIGURE TWO

Mach²⁵ has suggested the following as Leonardo's train of thought. Imagine a string laid round a pulley A (Fig. 3) and subject to equal tensions on both sides. Since BC is the portion in contact, EF will

be a line of symmetry and the system will be in equilibrium. But it is to be noted that the only essential parts of the pulley are the two rigid radii, AB and AC. These suffice to determine the form of the motion of the points of application of the two strings, and the rest could be cut away without disturbing equilibrium. Hence, although the radius BA produced will cut the string at D, the lever arm for the right hand force is not AD but the potential lever AC. The view offered in this reasoning is naturally not impossible, but it seems improbable as a natural line of approach. It belongs rather to the sequence of thoughts which might be developed after the conception of the "potential arm" than to those which

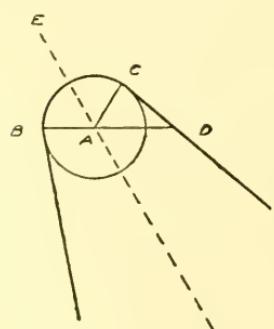


FIGURE THREE

²⁵ E. Mach, *The Science of Mechanics* (Eng. edition) p. 21. London, 1911.

preceded it. A more plausible origin of the conception is, however, suggested by note which appears in Manuscript "E." accompanied by a sketch (Fig. 4) which reads, "The junction of the appendices of the balances with the arms of these balances is always a potential rectangle, and is not able to be real if these same are oblique,"²⁶ and again, "The real arms of the balance are longer than the potential arms, and as much more as they are nearer the center of the World"²⁷ (i. e., nearer the vertical through the fulcrum). Finally, on the next page, we read, "And always the real arms will not have in themselves the potential arms if they are not in the position of equality."²⁸ Here, surely, we have a more natural approach to Leonardo's important conception of the potential arms. The swinging of the arm of the balance has at all times been a familiar sight, and with da Vinci's powerful imagination, it is pertinent to believe in his quick ability to seize upon the significance of the diminishing perpendicular distance between the two suspended weights.

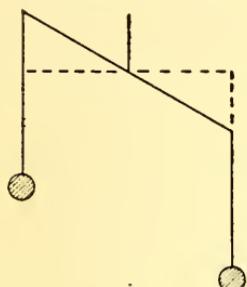


FIGURE FOUR

potential arms, and as much more as they are nearer the center of the World"²⁷ (i. e., nearer the vertical through the fulcrum). Finally, on the next page, we read, "And always the real arms will not have in themselves the potential arms if they are not in the position of equality."²⁸ Here, surely, we have a more natural approach to Leonardo's important conception of the potential arms. The swinging of the arm of the balance has at all times been a familiar sight, and with da Vinci's powerful imagination, it is pertinent to believe in his quick ability to seize upon the significance of the diminishing perpendicular distance between the two suspended weights.

THE CONCEPTION OF MOMENTS

An interesting and important problem next arises. In view of the fact that the conception of the potential arm involves *both* the weight or force factor *and* the perpendicular distance on to its line of action from the point of suspension or fulcrum, did Leonardo knowingly have in his mind the idea of moments as we understand it today? Some controversy has not unnaturally developed regarding this point. Duhem,²⁹ and with him Mach,³⁰ favors the view that Leonardo understood and employed the idea of moments; Schuster³¹ takes the opposite view. We are bound to express the opinion here that the balance of argument is distinctly against the statement that Leonardo conceived

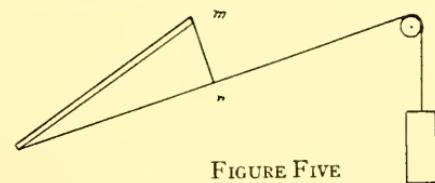


FIGURE FIVE

²⁶ Ms. E. fol. 64r.

²⁷ Ms. E. fol. 65v.

²⁸ Ms. E. fol. 65v.

²⁹ Duhem, *Etudes*, Vol. I, p. 143.

³⁰ E. Mach, *The Science of Mechanics*, p. 20 and Supplementary Vol., p. 7.

³¹ Schuster, *Zur Mechanik*, etc., p. 43.

the idea of the moment of a force about a point. Duhem's case is an ingenious one. He cites first a passage from Manuscript "I", which, referring to a sketch (Fig. 5) of a force applied by a cord to take a mass out of the vertical, reads as follows: "*To know to each degree of movement the extent of the force of the power which moves and of the cause of the thing moved. Make as you see in mn (i. e., drop a perpendicular on to the line of the force which moves) with fh.*"³² The point Duhem makes here is in the dropping of the perpendicular. He now quotes Leonardo's use of a tangential circle of which he speaks as the "circumvolute."

Thus in Manuscript "M"³³ we find a diagram (Fig. 6) of a lever fm , having a weight of 4 lbs. suspended vertically from m and one of 8 lbs. at an inclined direction fp through the use of the pulley p . Leonardo clearly indicates his use of the perpendicular

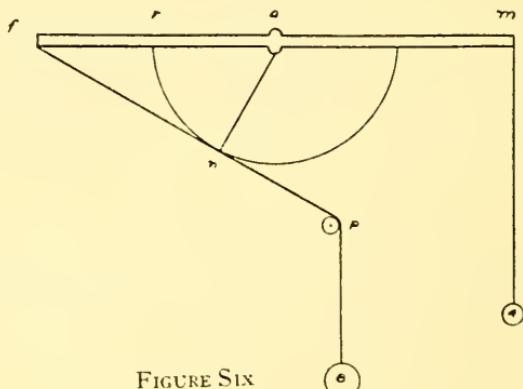


FIGURE SIX

to the line of action of the force by his employing of the "circumvolute." It clearly emerges from the above that Leonardo da Vinci appreciated the significance of the perpendicular on to the line of action of the force. Where we cannot agree with Duhem, however, is in the contention that it follows from this that Leonardo *both* used the product of force and distance, *and* attached to this product the significance of the measure of the turning power of the force about the fulcrum. The essential alternatives are really as between the general use by Leonardo of either the factor of proportion or of the product of force and distance. The principle of the balance was to the effect that for equilibrium the *ratio* of the weights was inversely as the lengths of the arms (or of the potential arms in the

³² Ms. I, fol. 30r.³³ Ms. M, fol. 40r.

case of inclined forces). The principle of moments applied to the balance would express the fact that the *product* of the weight into the length of the arm was the same on both sides. These are the two alternatives, and the whole case again Leonardo's conception of the idea of moments lies in the fact that wherever possible Leonardo employs the ratio factor and not the product factor. In the light of this undoubted fact it is therefore difficult to believe that our philosopher was the originator of the conception of moments.

THE FUNCTION OF THE PULLEY, AND THE LENGTH OF THE STRING

In connection with the general theme of the potential balance arm, we find interspersed through the Manuscripts³⁴ a number of

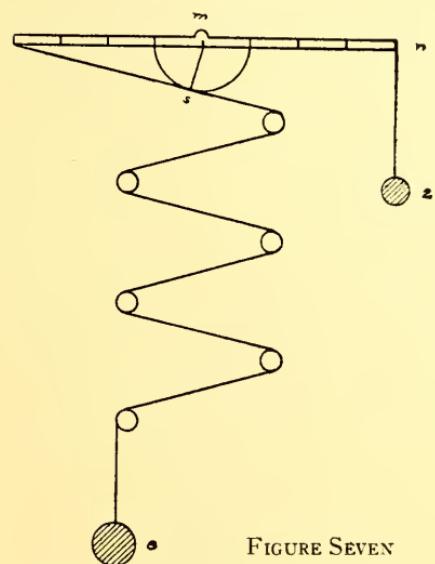


FIGURE SEVEN

variations of Fig. 6. Common to all these figures we have a graduated balance, with the arms horizontal, and with the fulcrum at the mid point. Also in every case we find at one extremity a weight hanging directly downwards, and at the center a "circumvoluble" circle. The variations occur at the other extremity. The cord comes directly from it at some angle, tangentially to a "circumvoluble," and thence by varying pulley connections to the second hanging weight. An extreme case is illustrated in Fig. 7. Here there

are six pulleys, with the radius of the circumvoluble, and therefore of the potential arm one-quarter of the real arm, and the weights are as 8 to 2. As Leonardo puts it, "In the same relationship in which *mn* stands to *ms* stand inversely their powers."³⁵ Clearly Leonardo understood (1) that neither the length of the cord nor the number of pulleys had the slightest influence on the relationship between the powers, and (2) the arrangement of pulleys was purely a matter of convenience.

³⁴ E. g., *Codex Atlanticus*, fol. 100r.b.

³⁵ Ms. M, fol. 38r.

LEONARDO'S APPLICATIONS OF THE LEVER PRINCIPLE

We are now in a position to consider the various applications by Leonardo of the principle of the lever to mechanisms in General. As a preliminary we may consider the class of problem in which a suspended weight is deflected out of the vertical by the action of a disturbing force inclined to it at an angle. In Fig. 8,³⁶ we have a weight of 4 lbs. at the end of a cord deflected from the vertical *ab* into the position *am* by a tangential force *mf* applied by the weight of 1 lb. passing over the pulley *f*. The angle *amf* is therefore a right angle. Leonardo shows the position of equilibrium as such that each of the four divisions *bd*, etc., of *ab* is equal to *ac*. This is in direct accordance with the lever laws, since the potential arm for the 1 lb. weight is *am* and that for the 4 lb. weight is *ac*, so that $4 : 1 = am (= ab) : ac$. Indeed, in a further sketch Leonardo traces the increase in the

necessary deflecting load along *mf* from zero in the lowest division at *b* to its maximum value when *am* is horizontal. Another case of interest is that in which the deflecting force makes an obtuse angle with the suspending cord³⁷ (Fig. 9). The sketch is somewhat defaced in the *Codex Atlanticus*, but the meaning is, however, clear. A weight of 9 lbs. is deflected from the vertical *bm* to *bd* so that the point *c* immediately above *d* is one-third of the radius *bf* (equal to *bm*). Also the deflecting

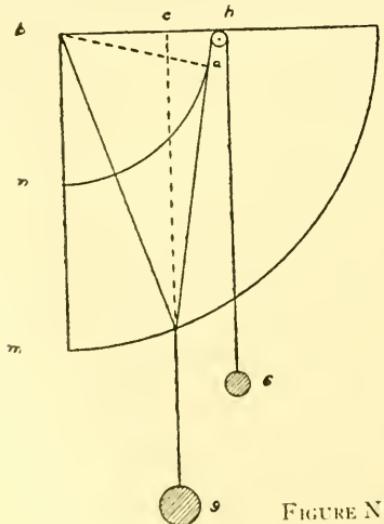


FIGURE NINE

weight passes over a pulley *h* such that *bh* is a half of *bf*. The problem Leonardo sets himself is to determine the value of the deflecting weight for equilibrium in this position. The potential arm of the 9 lb. weight is *bc* equal to one-third of *bf*, and that of the

³⁶ *Codex Atlanticus*, fol. 268v.b. See also fol. 365v.a.

³⁷ *Codex Atlanticus*, fol. 115r.a.

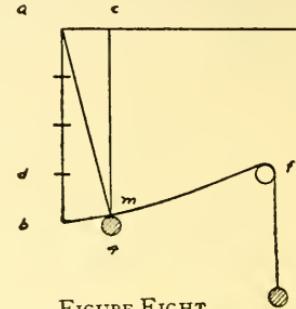


FIGURE EIGHT

deflecting weight is ab the perpendicular on to dh , equal to one-half of bf . Hence the ratio of the potential arms is 2 to 3, and the ratio of the powers must therefore be 3 to 2. Leonardo thence correctly concludes that the deflecting weight must be 6 lbs.

THE INCLINED PLANE

For the next application of the principle of the lever we turn to Leonardo's treatment of the inclined plane. Stevinus,³⁸ as we know,

has received the tribute of orthodox scientific history as having introduced the first complete treatment of the subject.³⁹ However, Leonardo, some 70 or 80 years before him had also tackled the problem. He shows little

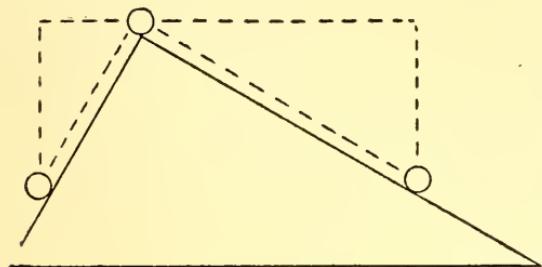


FIGURE TEN

more than a few detached notes and sketches and his treatment is incomplete and undoubtedly lacks the brilliance of his Dutch successor. Interspersed throughout the note-books we find sketches—with and without accompanying notes—showing a double inclined plane with two weights connected by a pulley at the top. His linking up of this problem with that of the lever is clearly shown in a sketch in Manuscript "G"⁴⁰ (Fig. 10) in which we see added to the usual diagram of the double inclined plane, what we might call an equivalent simple lever, the two weights being common to the two systems. Clearly he regards the ratio of the weights

for equilibrium as equal to the ratio of the basis. Again, in the *Manuscript on the Flight of Birds* we find an elaborate diagram

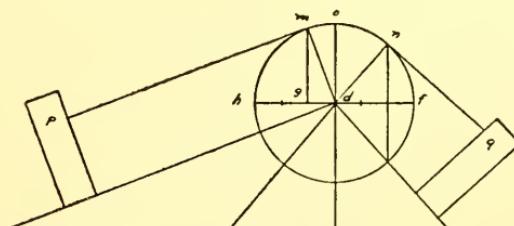


FIGURE ELEVEN

³⁸ Simon Stevinus of Bruges (1548-1620).

³⁹ Thus in Cox's *Mechanics*, Cambridge, 1904, p. 41, we read, "His discovery constitutes the second important step in the historical development of Mechanics."

⁴⁰ Ms. G, fol. 49r. See also Ms. E, fol. 1.v.

(Fig. 11) in which the values are so proportioned that the perpendicular mg on hd makes gd to one-third of hd , and de two-thirds of df . We read against this sketch as follows: "The weight q , because of the right-angle n above df at the point e , weighs two-thirds (i. e., referring to the pull on the rope nq) of its natural weight, which was 3 lbs.; and is a force of 2 lbs. The weight p which was also 3 lbs., is a force of 1 lb.: because of m , right angle on the line hd at the point g . Then we have here 1 lb. against 2 lbs.⁴¹ The application of the principle of the lever is clear. With d as the fulcrum, the potential arm for the pull in the cord nq is nd (equal to df) and that for the weight q (considered at n) is de . Hence the pull is to the weight as 2 is to 2; and similarly for the other side of the figure.

⁴¹ *Sul Volo degli Uccelli*, fol. 4r.

(To be continued)

DUTY AND THAT NOBLER LARGESSE

BY HARDIN T. MCCLELLAND

SOME time ago I was passing a vacant lot when I noticed several boys urging two dogs to fight. They finally succeeded and seemed to find great delight in watching for blood and hearing the incessant misery of growling and biting. But afterwhile some other boys, apparently owners of the dogs, came along and after somewhat of a scuffle released the poor unknowing brutes and took them home. After having viewed the whole episode I caught myself saying: Such is the World of Life. Much of our struggling, pain and confusion make only a theatrical pastime for those who have no care or interest in what we do. But those more dutiful bring sympathy and understanding to the scene of our tribulation and attempt as best they can to alleviate our suffering and release us from our mistaken squabbling with each other.

I. ERADICATING EVIL THOUGHTS

Oftimes as it may happen in the lives of common men, there is a strange and irrepressible desire to bemoan and execrate the seeming favoritism of others' luck and the unexplainable adversity of our own inborn fate. It is almost too common a condition of modern life to see a people, so otherwise keen to perceive causes and effects, draw down the curtains of their spiritual insight and grope in the darkness of prejudice and disaffection. Do they not sometimes feel the bathos of their ludicrous position? It seems strange to me in the humble and unworldly quiet of my literary solitude that those who so often acclaim a personal fund of ordinary intelligence should still not have the rare common sense to be calm and considerate, and thus give themselves opportunity to partake of what they look upon as fortunate adjuncts in the lives of their neighbors.

However, if we are ever to be saved the trouble and often the disgust of listening to the lack-luster fault-findings of an oppressed and discouraged people, we must right away make preparations and efforts to be their honest teachers and worthy exemplars. We must take immediate and determined steps to eradicate the evil thoughts which supply fuel to our own suspicions and twilight anxieties for personal welfare. For it is morally impossible to be an exemplar of virtue and benevolence to a vulgar and disgruntled world when one is himself a member to the mischief which causes the discontent. It is no satisfaction to the spiritual need if we claim to be trying to allay the maddening poverty, strife and suffering when we are really but so many parties to the clamor and casuistry behind which we work our strategy of exploiting others. Just recently at the international conference to decide on steps for putting an end to the traffic in narcotics the delegates of every single nation but one (Persia) voted to continue the despicable pandering to the dope evil, and that one lonesome delegate was holding off *only in barter for a loan to his government*. The whole conference was rife with mercenary membership in the very evil which they were sent there to eradicate.

Therefore it is a question right now well in hand for us to ask: What are we going to do about such an appalling condition of affairs? Just because we ourselves are innocently "on the outside," just because we ourselves don't happen to be poor dead-souled Chinamen or Hindus weazened to scrawny skeletons with dope addiction, is no just reason to think that we are altogether blameless for or unaffected by the pejorism of the situation. Most of us are a long time starting in any measure of alleviating the world's sorrow, ignorance and delusion.

What are some of the primary parts of our counterpoising apparatus? How are we to proceed in first acquiring the necessary moral discrimination, the cosmic intelligence, the international mind, the public conscience or even the necessary skill in applying *some sort* of spiritual force toward furthering what meagre altruism we do fortunately have? What is the exact nature of the problem which is behind all our problems, social, economic, political or humanitarian, and which is more and more inevitably becoming a crisis in this heedless age of blind and moiling men? And why, oh why, are there so many people who, on learning what is really the world's most dire necessity now as well as in the past, still say that it is useless to try to help or improve the age in which they live, and hence lay down in base submission to the Juggernaut of ignorance, fear,

cupidity and moral cowardice? Their very impotence deprives them of the "nerve" which alone often carries the rogue through his robbery or the villain through the vile consummation of his crime. It is one of drama's undeniable postulates that the hero is as much in need of courage and moral prowess as the villain requires corrupt desire and opportunity to play on others' weakness or misfortune.

The reason is this: Truth and goodness can never have any actual survival value or power to animate and transform the fickle souls of men unless they follow the eternal miracle of rebirth; they must, like the phoenix of Memphis, be immortal enough to arise from the dead ashes of past folly and transgression, and take on the beautiful irridescence of a new and nobler life. People who live phoenix-lives are ever a comfort to their relatives, an inspiration to their friends, and a deathless pattern of loyalty to all posterity. But they can't take up this rebirth like they don a new suit of clothes, all in a few minutes and only at a few dollars' expense. It is a spiritual reorganization and purification, and as such requires long months of seriously determined effort to remodel the inner man. No sudden sophist change of policy can ever carry the same effectual transfiguration that obtains when one gives thorough overhauling to his mind and character.

II. PURIFYING PERSONAL DESIRE

The very first fact to understand is that purity of one's personal desire is a difficult quality to acquire. This age can boast of very few people who are absolutely habitual in benevolence or virtue. An inclination for doing good and being honest may be partly a natal heritage, but the actual and deliberate effort of soul called being an original Christian and living the exacting life of such is no easy quondam affair. Starting from the usual carnal birth and harassed by all the usual temptations and indiscretions of adolescence, the coming into maturity pure in one's desires, impulses, hopes and ambitions is indeed a very personal and sudeiferous achievement. So many people are soulless and inane, weak and vacillating, when the very life and future fortune of their days have inevitable foundation in what they desire, what they wish to do, or how they expect to accomplish what they aim at. The peerless elasticity of their consciences is what impresses me more than the vast hoard of

worldly desires and habits that has been employed to lackey them. Such people use lots of soap and water to look clean, but true spiritual purity they know not of.

It seems a pity that a few little measly ephemeral ambitions are capable of so engrossing a man's attention that he never notices his soul slipping into perdition. But it has been ever thus with this poor old grovelling world, so I guess there will always be a hopeless minority in favor of rehabilitation and betterment. And yet this veery meagre minority holds all our hopes, all our confidence and vicarious realization in man's ultimate transfiguration. Those few courageous souls who are not afraid to be devout and good have ever been the world's exemplars, and have often been called upon to be the heroes of an occasional martyrdom. They try as best they can through counsel, culture and commanding personality to show the righteous way, to give us patterns of what constitutes a noble useful life, and in the gratitude for having their amiable aids and comforts now and then we should appreciate the encouragement of all such benevolence, from whatsoever quarter it may be derived.

Even if we are not able to follow strictly after their devout example, we can at least know they have not served or strived against us, but have tried to be our friends and counsellors, giving freely from the generous vicary of their enviable experience. This would at least show what measure we ourselves had taken of truth and goodness, what little progress we ourselves had made in that truer life which takes record only of the mind and heart. For we never know the full report of this world's spiritual chronicle until we have ourselves taken some measure of decisive action aiming toward the purification of our personal desires. And after some years of such intentional effort our own peculiar manner of living may lay claim to those broad and honorable credentials of innocence and spirituality which saints and sages always offer to the world.

III. GENEROSITY

Another point in the discussion of what constitutes our melioristic apparatus is that of generosity. Here is a spiritual quality which plays an important role in all the affairs of life. At least it shares honors for importance with its great imperious correlative, selfishness. This latter is altogether too common a trait in human nature and is too apparently one of the main factors in what portends to

be a whole world's spoliation and miserable bondage; so I will mention only some of its most precarious situations and try to show why so many people brave the hazards of both local contempt and ultimate damnation while seeking to gain the specious rewards of worldly wealth and material acquisition.

In order to be selfish a person has first to be proud, narrow-minded, and determined on taking more than he gives; being so myopic spiritually that he is set only on ephemeral satisfactions, he requires to hold his aims and wishes in great self-esteem, and yet withal he will seek only the narrow interest of his own individual concern and welfare. Thus also is he shown to be both cowardly and ignorant, for his lack of charity and benevolence springs from lack of courage while his narrowness of viewpoint and the poverty of his interest in the world of life arise from the fact that he values nothing if it does not minister to the finite aims of his own private pleasure or advantage. It is indeed a most dangerous undertaking to try to make mere affability and politeness cover up one's cold-blooded calculations for reward and personal satisfaction. And it is as surely a precarious feat to attempt to gather to one's bosom the wealth and power of a whole nation while assuming the philanthropic and kindly countenance of charitable redistribution through Foundations, Endowments, Monuments or Libraries.

Danger of far greater moment but far less ambitious aims than any of these is braved almost daily in the lives of miners, woodsmen, seamen, explorers and sincere social reformers. It is not selfish reward nor any other private ministration that *they* are living for, but courage, heroism, service and the expansion of man's estate. They have some far off but not necessarily vague ideal and they are anxious to realize it by strict attention to whatever duty lies at hand, by enlarging man's field of knowledge and achievement, by doing pioneer work on new paths, so that those less courageous may have a beaten track to follow. But the selfish man, alas, is little concerned in any matter requiring true courage or idealism for the establishment of a better or happier form of civilization. He looks only toward the day of his own satisfaction and is usually impatient of its slow approach.

The generous man, on the other hand, is almost totally estranged from any motive, wish or resolution which is merely private in interest or which in any way smacks of the ephemeral. He is devoutly concerned for universal aid of all who suffer, toil or weep. He longs to grow erect in virtue and the rare ability to feel no mean

regrets at the giving of his time or treasure. This is his one great spiritual credential in the world of life. It is his happiness to know of goodly deeds well done, of worthy causes helped; and when the sun of many summers has bleached his hair pure white he still can revery over his younger days of ready helpfulness and amiable acquaintance. Such things as these are the generous man's only anticipated rewards, but he considers them sufficient and well worth his effort. It would be a reversal of his whole moral apparatus, creed and conscience if he should descend to the level of feeling that he should have had *something more*. The primary effort of generosity is to give freely, not begrudge the gift nor calculate what might prove to be the return benefit.

To be really generous then requires that there shall be present a certain decision of spirit to share with others what we have or to cheerfully do what our abilities enable us to do properly, thus helping them perhaps to get what we do not ourselves have. It is just as the term originally meant: a generating or productive sort of activity. And a generous man truly enough produces what the moral situation of the world most needs: every deed of benevolence produces something which did not exist before. Be it only the feeling of want supplied or of mercy shown, a recollection of friendly counsel or of sympathy in one's sorrow, it is still one of the various little tokens of generosity and humble service.

We have little obscurity of vision when we keep the mind's eye open, and we would likewise have but little spiritual blindness were we just once in a while capable of keeping the heart's eyes open. This is another world to some people and they never know its sweet reflexes from a generous effort until they have left their crabbed shell and sought out at least in some measure the newer life of Gethsemane. The fruits of *that* garden are never altogether sour or bitter.

IV. THAT NOBLER LARGESSE

Looking back over the many centuries that mark the world's slow progress out of savagery, I find that the spirit of man has been ever groping after the light of goodness and truth, and just as constantly has he been ever harassed and persecuted by the evil intrigues of clever sophists whose folly has thus pledged their souls to the devil. But I am solaced with the often emaciated fact that, even though

the latter number the far greater majority of the world's populace, there are still enough good and generous souls to keep us from dropping into a mood of total and irreclaimable pejorism. It is a quite common maxim of many thinkers that we cannot conceive of any world having the least vestige of a moral order and a divine dispensation, which does not also have some sort of a melioristic system whereby its life, its loves, hopes, efforts and aspirations may be built up and in a degree, at least, partially satisfactory, realized. An absolute lack of such a code or melioristic possibility in the Universe would spell an eternal discord, a desolate vale of doubt and death; and all our fond affections, both the joy of good things relished and the grief of broken faith, both the dream of high hopes realized and the incubus of futile effort for long-cherished happiness—all would be lost in the chaos of a wild and vulgar degradation.

Fortunate indeed are we to live under the protecting canopy of Heaven, relying upon the plain but wholesome nurturing of Mother Earth. Our lives are no more miserable than we ourselves consent to make them; our souls are no more atrophied or dead than we ourselves have slowly smothered them. But oh, what a fine and rejuvenating token of the Divine Handiwork this poor old world would be if everyone but saw the folly of their spiritual death! We are so little given to seeing clearly into the causes and effects of everyday life that most of us totally miss the beauties and the warmth of any finer-woven garment than that of selfishness and material ambition. I sometimes think that these two defects in the mind and character of man are the arch-enemies of all true culture and civilization. It is certainly a remiss system of education which fosters keen commercial perception but almost totally overlooks the development of honesty, generosity and *that nobler largesse* of mind and heart which so far have all too completely been sheltered only within the cloistered walls of mysticism and romantic morality. Why should there not be a more popular patronage and pursuit (if not able emulation) of their obscure but worthy heritage? Resurgent souls will always flee the sordid and risque, the fickle and inane; and we can only ask that they but take us by the hand and we will share the fascinating and courageous emprise of their flight.

This is a simple exercise in the repudiation of worldliness, but it is the first necessity of all who aspire to generosity and purity of private desire. We are already well on the road to enlightened thought, so if we will only brighten up the pathway of our spiritual progress, if we but have the bold and irrepressible ambition to help

others instead of the vicious cunning for enslaving or exploiting them, we will soon bring on the millennium and find our aspirations being gradually reified above the muddy stream of worldliness. It is the first true indication of generosity and largesse which, if given pure and adequate exercise throughout the workaday world, relieve just that much the strain of mortal existence in a soulless and vulgarian age. Who is so dull or conscience-less that he has no feeling of urgency to join in this eternal procession of torch-bearers, at least not help the vandal hoodlum mob to slander or impede them?

V. THE VOYAGE OF LIFE.

Speaking from a purely personal viewpoint, I must confess that whatever I say or try to make exemplary to others is soaked through and through with my own pet theories, prejudices, hopes and fears. It is not to be expected that any particular writer himself should be a perfect adept at everything he mentions or discusses, nor a model of spiritual excellence in all that he tries to advise others to do. It is to be held reasonable or at least sufficient if he is only able to hold up the mirror of life and lend his flickering torch to his neighbors who, in the occasional illumination of its light, can see at least the true proportions of their own reflection, and thence make their way a little clearer and more hopeful.

This is something which I have never been fortunate enough to do for others, but have enjoyed such service many times from those who were *unfortunate* enough to be *my* friends. Still it is not so far beyond my power that I cannot aspire to shuffle off my gnarled shell of low desire and take to the high seas of Life where those great mariners of time sail bravely on, regretting not their past and fearing not their future. The Voyage is all that is important, and whether some fail and some succeed in its proper navigation, the port of Destiny is there and toward the journey's end appears faintly visible in the distance. I am afraid we too often make the sad mistake of fearing to embark, clinging apprehensively to our little patch of earth as if the relative security of our private lives could shield us from the omnipresent reach of fate. That fear alone is worse than the merely human impotence which, when in mid-voyage our ship runs into the storm of Avarice and Intolerance, puts us on the weaker side and we go down in dismal failure to our death. There

is an argument of defense for failure while courageously trying to pull through with faith and honor, but there is no excuse whatever for not even trying, forgetting faith and honor in the cowardly fear that anything but idle ease is rash.

What a delight it is to meet a man or woman who is not set on realizing any of the common passions of the day. It shows that they are free of at least some of the ephemeral worldliness which so engrosses our modern life. Such acquaintances are a veritable nourishment to the soul. They quench our famishing thirst for the cooling waters of friendship, and they allay the gnawing hunger of our hearts for something good to cherish. It is indeed an item of rare good fortune to be temporarily lost in the desert of worldly desolation and have someone to come along with a camel-load of provisions and take us to the oasis of an inexhaustible relish and delight. It is in this world a most rare thing to have a friend in need who does not barter his friendship for what it will bring in material or even more tangible returns. A palm tree at the equator or a stove in the arctic are feeble comforts to the various lives of men when compared with the occasional but undeniable necessity of generosity and friendship in the prosecution of their daily affairs. They both depend upon purity in one's personal desires and this is a trait of character more noble and enduring than ambition or love because it is less personal in its attentions and more free-hearted in its conventional "rights." It is a token of Heaven's own tranquility and clear infallible perception that we are even capable of having friends, for true friends are never jealous or envious, they never covet what we have nor take umbrage over things they cannot understand.

VI. LIFE'S NOBLER DUTIES

Much as we cherish the little personal tokens of kindness and affection they very often are elected our best means of nobler sacrifice and security. The feeling of sure faith and the counsel of pure comradeship have higher demands upon our time and treasure than the simple relish of their innocent pleasure. And where the circumstance is one of trouble or distressed relationship, it is still sometimes a manner of good fortune to be not so crude of soul that what we hold most dear cannot be given up. Grief and sorrow may well attend, but the nobler function is to make our sacrifices freely and

magnanimously, for nothing aggravates a strained condition of life more than the obstinate refusal or the ignoble disinclination to act agreeably or serve humbly in time of need. It is the one sure sign of sober souls to use this coign of commonsense for it is the only adequate piece of evidence we have in proof of a person's innate kindness of spirit.

In a way it is not so much our attention to big things which makes us great, but our diligence and sincerity in properly disposing the small things, the daily affairs of life. Here is the domain of our habitual practices far oftener than that less immediate world wherein we seek some colossal pursuit of fame, wealth, power or social position. Therefore, with this thoroughness in attending the personal and particular, we can closely approach the happiness of those who are wise and content with life. For life at its best is only a place to work faithfully and well, a period of spiritual analysis and cultural decision, a sort of mystic grotto full of trash and trees, bricks and buttercups, moor-wort and mullen-weed, where we must grope our way toward the light. With us as we are at present constituted, the chief and proper idea is how to get away from the mean, the sordid and ignoble, choosing rather to house our souls among the dreamy surroundings of peace and goodwill, or at least as near to such a rarely found congenial neighborhood as our poor crooked natures will allow us to get. Sir Humphrey Davy very nicely summed up the proposition when he once remarked that "Life is made up, not of great sacrifices or duties, but of little things in which smiles and kindnesses and small personal obligations, given habitually and above all generously, are what win and preserve the heart and secure comfort to us."

In the first place we seldom find ourselves able to either understand or acknowledge our proper duties to each other; we are conscientious enough in regard to conventional things but little concerned to take a spontaneous interest in any of those many *informal* opportunities for altruism and benevolence which present themselves to us every day. And in the second place, provided we do possess this primary credential, we are equally seldom capable of giving to our daily practice that element of calm and benign generosity which is balm to the slow hours of sorrow and myrrh to the fleeting moments of joy. In order to be whole, life's nobler duties always require both a thorough understanding and an honest exercise of the daily obligations to which all of us are or should be subject as intelligent social beings.

VII. MASQUE-FIGURES, ALL

So few of this old mottled world's masque-figures really know the proper way to act their chosen parts. The play is constantly being interrupted and misread by someone unmindful of his lines or downright negligent of his appropriate makeup; and still, if we but take the drama seriously, we will also notice here and there a misplaced 'scutcheon or some lying gonfalon, a privy-counsellor with milady's boudoir-cap on, or a plodding hostler-boy with poorly promised mimicry of the cunning jester's whimsical foils. The whole effect is sprawling and bestrewn with clumsy scenes which grate the finer tastes of the elect. No wonder the critics are so fulsome, so incorrigibly amazed at the false exotics, and so implacably opposed to all the vast array of namby-pamby ironies. And when the critics disagree, how much less can the galleries be expected to know aught of the stage proprieties? Nay, whether they are witnessing the least essential form of tragedy or burlesque! Only this winter have practically all the preparations and efforts of Melchoir Vischer been in vain when he produced his somewhat farfetched drama at the Lubeck Theatre in Berlin trying to show that Charley Chaplin's antics fundamentally present, not comedy, but grotesque tragedy and hence compose a problem in the philosophy of social relations. And we American movie-patrons have recently had some few demonstrations that Charley himself thought something along this line, and had been devoting considerable time to dramatic aspirations.

Any dramatic experiment requires more than a lot of scenery and the adjuncts of the costumer's art; all these flourishes only make up the atmosphere, the setting of the play. The most inadequate production on the stage of life is still a masterpiece compared with that pitiful but not yet altogether hopeless attempt of the histrionic gau-chereux who try to "put it over" on what they think is a foolish if not unsophisticated public. They should, by some rare art of counter-suggestion, be made to recall Ringling's amendment to old P. T.'s shrewd conceit: "The circus game is not for private boodle but public amusement: your fool requires to be entertained not swindled."

But alas, so long as the false conception of life's purpose is maintained and given unscrupulous application, the all-suffering public

will be the helpless victim, and the cunning knave will continue to be the avidious spoliator. I often think that it takes both fools and knaves to keep the ball of evil rolling, for if the world had no morbid appetites to serve, its selfish panderers would soon die of inanition, or at least be forced to turn to more honest industry. But to be a member to the mischief of helping pander, be it ever so commercially shrewd and daring, to the depraved appetites of fools—this is the only shameless offense against our better hopes for this bickering and often blasphemous world. Whatever be the special privilege or device that serves to effect the putrid aim which invariably looks toward some sort of culpable denouement, it is indeed a direct support to the already despotic power of our moral dilemma, that *froissement honleur* of our worldly finitude and selfishness. Most all ages are about the same in moral stamina and heroism, so I often wonder if our raucous age has any more real heroes than Talleyrand thought could be found in his when he told Napoleon's young son that if he killed off all the rogues there would be no one but fools left.

The only really disheartening feature of all our mad wrangling for contentious gain is that both sides of every public dispute and private debate *want to win*. That is their first and foremost aim, consequently each thinks and claims to be in the right. While they are so closely concerned with presenting and justifying their own view of life, little opportunity is given any disinterested philosopher to bring conciliation into their controversy. About the only encouraging feature is that some few people here and there expect that these disputes and debates will somehow and someday be the means of discovering the proper estimate and utility of the beautifully good and true. Let us sincerely hope so; but we somehow remind ourselves that the judges of combat are always placed *outside* the dust and gore of the arena. At any rate we will do well to be of open mind and good cheer, taking humble sides with those who make courageous emprise toward the Future.

VIII. YE OLDEN PASTIME

One of the oldtime substitutes for the reckless and extravagant wasting of life's raremost treasures on vain profits and fickle pleasures was the love of Nature, of books, art, music, friends. And it was a goodly substitute too, as beneficial and uplifting as it was

ingenuous and fascinating. To do one's daily duty to the best and sincerest advantage to all concerned was the law of honest livelihood. And at evening to lie oneself with joyous expectation to "the blessed bosom of Nature where rest and sweet caresses would restore the soul's spent force." Or else quite meekly, but with no less of keen anticipation, to seek the path of constancy leading home to "that unbroken circle of one's books and friends, few and choice" around a genial fireside where could be had the amiable discussion of things both in and beyond this present world, where soft-played chords of melody would wrap the mind and soothe the weary heart away from petty cares and fears. Then was a time of personal restraint; then was the heyday of men's sincerity and simple industry, of love and faith and benediction, although indeed an age as finely nerved and full of sorrow as our own. Where are those beautiful *slow* days of serenity and contemplation in this mad age of bungling and billingsgate, these speedy days of strategems and spoils broken here and there with passing penny-plays for risque delight?

The *old* has lost vast playgrounds to the cramped mechanical pastimes of the *new*. But those who still delight in simple aims and pleasures find no relish in loose repetitions of this Modern Muse's mad resort to folly. No comfort is afforded them by this fevered age of syncopated jazz and easy virtue, this Nature-less world with all its female cigarettes, pocket-flasks and urban artifice, its calculating friends and irresponsible scandal-mongers. True friends devote no time to idle prospects of some private exploit or requital, for they are bound by faith and amiable converse, not that vulgar creed of modern days which has no conscience and no loyalty. Good measure is always *given*, not calculated in return. Gentle converse with Nature is the mystic hospice of the soul which knows no base conciliation with depravity or fear seeks no destruction nor malicious intervention, but has purpose only to aspire toward the goodly things of life. Surely no strategems or spoils can figure in the hearts of those who love the concord of sweet sounds. Nor can there be any element of literary *nerf férure* in the minds of those who love good books. Life is a gorgeous fabric patterned after the Divine Handiwork, but if we crumple or reverse its proper design how can its soft harmonies of line or its fascinating balance of colors be in any adequate measure appreciated?

It is always with sad regret that I look upon this modern disaffection for amiable discussion, good books, Nature-love, music-with-meaning, resurgent art and constant friendship. It does not

now portend anything of encouraging promise to a world already half infernal, or to an age two-thirds submerged in the bog of profit-slime and growing ever more burdened and weary with the oppression of unequal toil and care. Still it is not a sufficient label to my mood to say that total failure shall swallow up this poor crude thing called modern civilization, for my argument is that anyone holding such a brief for man's disaster cannot be considered a pejorist. The simple but quite sufficient reason being found in that subtle scheme of Providence that some things, by their own very sterility, are doomed to end in some manner of delinquency and despair. And we who only mention this fate for things inane and fickle, even though insatiably pursued and unreasoningly valued by the modern world, are yet well established on the way to optimism and regeneration if we but reflect sensibly on the issues of the day and take no umbrage to cloud the morrow's dawn. Change from bad to worse is pejorism: but change from bad to better is no true revolt except as all allegiance to sin is flatly repudiated and joyously expunged from Life's itinerary. I tis just such revolt as this which should alone be ever welcome to our house of pain by all who seek to be in sensible accord with any code of betterment which can be made to affect this vacillating age. All hope and godspeed to those few happy souls who brave the stormy tides to bring back luscious fruits from foreign lands!

Modern civilization, as Bertrand Russell has shown, is apparently on the brink of disaster as a cultural achievement because it is being fast corrupted and enslaved by the tricky procurations of industrialism and the insane race after financial hegemony and power. In nations whose majority of individuals have sacrificed the culture of spiritual energy and expression to the insistent exploits of mechanism and material expansion we do not have to look very closely in order to see signs and omens of deterioration. And when this worldly sacrifice has gone so far that practically every activity of the citizenry becomes warped and vulgarized with the same diabolical tendency we can be quite sure that the demoralization is complete and that the nation presenting such a corrupt condition is well started on the road to decay and death. No sham psychologism will save it, no hypocritical veneer of paternalism or democratic propaganda will for long successfully cover up the fact that it is internally rotten and cankered. The only hope for redemption is for the leaders of such a nation to catch the ominous prospect in time for melioristic action, change the spiritual horizon and lay down patterns of activity

which aspire to have eternal value rather than ephemeral utility and profit. I believe America to be at just this stage of her career today, and think with some anxiety that if she does not turn back to those olden pastimes of philosophy and art, religion and Nature-love, her future will not be worth a two-cent mortgage in another century.

IX. Two DESTINIES AWAITS US

Anyone who makes the least pretense to an intelligent and generous conduct of life will sooner or later in his career adopt those items of wisdom and virtue which have an immortal prestige in the minds and hearts of honest men. Saints and sages the world over have copied these precepts and practices from their genial predecessors, and we can only accept the advice which they invariably give (if our own failur and misfortune do not offer such counsel) : that mere policy of honor is hypocritical and hopelessly inadequate to effect any durable degree of personal integrity. One must be *made whole*, reborn and regenerated from inner frame to outward countenance before these spiritual functions can be given their full unhampered exercise. And yet in the first few stages of this subtle transformation we find both fascination and regret, both pleasure in gradual progress and remorse over occasional relapses. But withal it is a pursuit bordering on the magnificent to have the intelligence, the courage and the energy to make such noble awards to one's better nature. It is an exertion requiring perennial attention, hope, faith, diligence and discretion, else we know not whether our labors be more a comfort to the Devil than a supplication to the Grace of God.

No one should say his life is spent in vain who still has mind to think and heart to feel, who still is warm with the fire divine and has some feeble far-off dream of good-deeds-seldom-done. That is the first foundation stone of his redemption, that is the open sesame to his occult world of personal choice and public usefulness. The only vice and tragic decision is to constantly desert this dream-born world, repudiating its soft insistence as a voice of no material worth, no tangible personal reward, and lay one's soul at the vulgar altar of worldliness and material ambition. Surely he who lives for Matter's sordid sake, valuing no effort which is not of transient sense or fickle recompense, is already a prize candidate for Failure's gloomy office. He has not even started to have a soul, and such a one

would be poor prospect for any other service to his age than that of selfish exploits after private satisfaction and enlargement. The proper thing for him is to be set adrift with nought but gold and finery to feed and clothe his flabby flesh. But even then the fates would soon grow lenient, and we would all turn beachcombers in the vague hope of some day finding an old derelict raft washed ashore bearing a naked carcass with the mottled bones engraved: *Tardif je repentir!*

That is the pattern of one sort of destiny, and I can't see how anyone with the least spark of spiritual power (not to say of commonsense or self-respect) can drive madly through a whole lifetime of such degenerate vulgar days and not once feel the tug of conscience or at least disgust and disaffection. Another and more noble pattern, far removed from the Mammon-worshipper's wicked creed, is that which Maeterlinck has tried to vision in that vast destiny which is eternal as the stars. He sees man's life as passing beyond this petty world of personal programs and desires, reaching out into the Universe where his little selfish measures will not fit, and where he will be forced to grow more generous and just, more worthy, wakeful and wise. The general condition of such a life begins right now if we will only try to see that "it is very possible that our loftiest wishes of today will become the law of our future development. It is very possible that our best thoughts will welcome us on the other shore and that the quality of our intellect will determine that of the infinite which crystallizes around it." But no man can see even this much until he has taken some preliminary surveys of his own nature, his own loves and fears, his own motives, aims, theories and ambitions. With these well in hand some intelligent prospect may be had looking forward to that memorable day when he will choose wisdom and Life instead of worldliness and Death. At least he will understand that there are *only two sorts of destiny*, and knowing something about what each has to offer he will certainly choose the one that saves him from disaster and destruction.

PLATO, PRINCE OF THINKERS

BY Z. S. FINK

PLATO is perhaps the best known of all the philosophers, both ancient and modern. Those who know little or nothing of philosophical systems can usually associate him with the geometry lesson in the *Meno*; and nearly everyone can recall him as the pupil of Socrates. There are many reasons why this is so. The clarity and brilliance of style with which Plato succeeded in setting forth his theories have rarely been equalled. Many who find the works of other writers difficult and obscure, discover in the great Athenian an author on an intricate subject, who is not only interesting and understandable, but even entertaining. The highly dramatic qualities of the Platonic style have created in some of the dialogues scenes which rank with the masterpieces of all time. The scene in the *Phaedo*, depicting the death of Socrates, possesses force and power and emotion such as could be produced only by one with supreme dramatic talent.

A second circumstance which has focused attention on Plato for ages is the fact that he was both a culmination of all in philosophy that had gone before him, and a starting point for nearly everything that came after. It would be inaccurate to regard him either as the founder or perfector of Greek philosophy. Living as he did, about four hundred years before Christ, there had been great philosophers before him and were to be great ones after him. But the particular work of Plato was to examine and purify the work of the thinkers before him, rejecting all that was unessential, and to recognize clearly for the first time, many of the great philosophical problems which have engaged the attention of the human mind ever since.

Plato lived and wrote at a critical period in Greek history. Faith in the old religion was rapidly breaking up. Even the great body of the people had begun to follow the lead of the educated in doubt ing, ridiculing and denying the gods who had served the simple

faith of an earlier generation. Greece was faced with a situation but rarely paralleled in history. While the national religion disintegrated, no new one appeared to take its place. Four centuries were yet to elapse before the birth of Christ, and Athens bade fair to soon become a city without a faith. The philosophy of Plato might have been substituted for the old religion had it not been for its highly intellectual quality. In Plato the appeal is never primarily to the emotion, but rather to the reason; the great Athenian is always coldly, if sometimes fallaciously, logical. The Platonic philosophy never made a wide appeal or a serious bid for acceptance as the religion of the people, but among the learned it exerted a profound influence in Plato's day and for centuries afterward.

The theories of Plato are found in a series of dialogues, of which the *Republic* is the most widely known and the one most generally read. No one dialogue, however, is sufficient to give one even the most superficial conception of Plato. Like the plays of Shakespeare, the dialogues are a constant source of revelation—always pregnant with some new meaning, no matter how frequently they are read.

One of the first things which impresses a reader of the dialogues is the characteristic Socratic question method. Apparently it is always primarily Plato's object to criticize and destroy the beliefs of others. This has been sometimes criticized as being purely destructive criticism. It is true that Plato rarely arrived at truth after demolishing the theories of an opponent; but he performed nevertheless a genuine constructive function by detecting and destroying false methods and bases in the thinking of others. Plato was always the enemy of error; wherever he found it he sought it out and destroyed it, without ever making any claims of having arrived at absolute truth himself.

If it can be said that any one thing is dominant in Plato's writings, most authorities would probably agree that it is dualism, the division of things into the spiritual and the material. The spiritual world is an abstract one of absolute truths which give form and meaning to the objects of the material world. Correspondingly, though man lives in the material world, there is a spiritual side to his nature, which it should be his constant object to cultivate in preparation for the life to come. This side of the Platonic philosophy is a constantly reoccurring note in the dialogues.

The insistence on the cultivation of the spiritual, naturally led Plato into a consideration of the nature of good and evil. In the *Gorgias* he rejects pain and pleasure as criteria on the ground that

a thing can be both pleasurable and painful at the same time, but that it cannot be both good and evil. He then tells us that those things are good which have the good as their ultimate object and which tend to promote harmony and order in the world. Plato viewed the world as one thing made up of many parts existing together in harmonious relationships to one another. Hence, whatever tends to keep the harmony of things perfect is good, while that which introduces disorder is evil.

Plato also speculated in a number of the dialogues on the immortality of the soul. The ancient Greeks regarded life after death as a miserable sort of semi-existence in Hades. Plato, going centuries ahead of his time, believed that the evil of this world were punished, in proportion to their offenses, in the next; while the good, who had constantly endeavored to cultivate and purify the spiritual side of their nature, were received into the Isles of the Blest. The similarities and points of comparison between Platonism and Christianity, particularly in the matter of immortality and in the emphasis of both on things spiritual, rather than material, have been frequently remarked.

Taken all in all, it would be difficult to estimate the extent of Plato's influence on the course of human thought. Many things in his writings impress a reader, even today, as strikingly modern. The wide range of his speculations led him into the most diverse fields. The economic cause of war, the science of education and speculations which anticipated the great geographical discoveries by several hundred years, were only a few of the fields explored by this extraordinary man.

BOOK REVIEW AND NOTES

HOMER AND THE PROPHETS or HOMER AND NOW. By Cornelia Steketee Hulst. Published by Open Court Publishing Co., Chicago, Ill.

A wonderful book, a book that marks a new epoch in the study of Homer and Greek culture and civilization. The author has proved herself a profound scholar and has produced a monumental work. It is not too much to say that no book of recent years does greater credit to American scholarship or is deserving of more pronounced success. The author shows that the mythology of Homer was on a much higher level than that of the time of Plato, the latter being a degeneration, and that Roman mythology shows a still greater departure from that of the age of Homer.

The myth is the oldest form of truth, and mythology presents to us the knowledge which the ancients had of the source of all things, that is to say, of the Divine. The object of mythology is to find God and come to him. Out of the mythology comes the epic in which the gods and goddesses are associated with human actors. Thus, we find the story of the Volsungs and Niblungs among the ancient Nordics, the Kalevala among the Finns, the Mahabharata and Ramayana among the Hindoos; and, what now is of special interest in connection with Mrs. Hulst's book, the Iliad and Odyssey among the ancient Greeks. As I conceive it, the Iliad and Odyssey are two parts of an original, much larger epic. There doubtless was a city like Troy, a war between the Greeks and the Trojans and a Greek victory, as a nucleus of the epics, but in the story we find the gods and goddesses taking part in events, and so presenting the highest Greek conception of wisdom, justice, culture, chastity, and of all personal, social and political problems and morals. That this is so is proved conclusively in Mrs. Hulst's book by her interpretation of the names given by Homer to the various heroes and heroines. The vicious characters have corresponding names while the good characters have names that are equally fitting. It is utterly impossible that these names should fit the characters by mere accident, and it is also impossible to conceive that these names should have been given to the children by their parents, for, as Mrs. Hulst shows:

- (1) Some of them are not affectionate, as that of Antinous (without mind, fool, idiot)
- (2) Some fit the events which took place in mature life, as that of Paris (the adulterer), and

(3) That of Agamemnon can have been given to him only after his death. It means "remember a fatal marriage."

This latter refers to the scene in Hades when Agamemnon told Odysseus how his wife had killed him. The name of Helen is from an Arian root, meaning to shine, to beam, cognate with the root in Helios (the sun); and this is appropriate to this queen, because of her exceeding beauty. The character of Helen of Troy is pathetic because there is so much good in her and so little ignoble, because her husband was so unworthy and she supposed that Paris was as good as he looked and claimed to be. Menelaus (*I stay behind*), Agamemnon, and Aegisthus (a goat), are accursed with the accursed house, visited with the sins of their fathers in the fourth generation, and visited with doom. Especially the analysis of Menelaus is of interest and value for scholars, for all have taken it for granted that he became immortal as he hoped. Under Egyptian influence, later Greeks seemed to have thought that perhaps Helen was in Egypt, but as Mrs. Hulst shows, every fact from early tradition points to the victory of his people over Menelaus and the merciless death of Helen in Rhodes.

As was said by Schiller, "Man depicts himself in his gods"; or as Ingersoll almost blasphemously expressed it, "An honest god is the noblest work of man." Should we not say that the influence of the religion upon the people and that of the national character upon the religion are reciprocal? Mythology doubtless fundamentally is a deification of the forces of nature. Seeking to know the origin and destiny of themselves and the world about them, the people created their mythology, but the mythology in turn moulded the national character; and then the two, the mythology and the national character, acted and reacted upon each other.

Of absorbing interest in the volume before us are the parallels drawn by the author between Homer and the Prophets of the Old Testament. The parallels are most startling and show that there must have been much intercourse between the Greeks of Homer's time and the biblical epoch of the Prophets. The parallels, astonishing and conclusive, do not indicate whether the Greeks or the Hebrews obtained their ideas from each other. It is barely possible that they arrived at similar conclusions spontaneously. This question is left for future scholars to settle. The Israelites did not heed the warnings of their prophets, and so they degenerated and became a by-word among nations. The spirit of Homer culminated in the wise and humane laws of Solon, but in the course of time, the Greeks too degenerated. "Athens passed from the spirit of Homer to that of degenerate Rome of the Caesar's and Vergil. The imperial gods of devotion were now Ares, who was Roman Mars, and Aphrodite, Roman Venus. In turn, Athens became soon another perfect example of a nation so unwise as to permit injustice—a warning which others may heed—which they disregard at their peril. Like uncorrupted Israel of Moses and the Prophets, the uncorrupted Athens of Homer's wisdom and justice is an inspiration and hope to the world; like Israel in her decay she became a shaking of the head to the nations" (page 89).

And have not we of the twentieth century after Christ also degenerated? Do we not need to make a new study of Homer, of the Prophets, and of the laws of Solon? Do we not need to get back to the principles of wisdom, justice, and fundamental ethics? To help us in doing so, what a wonderful thing it would be for our people if we could have Homer's epics, both "The Iliad" and "The Odyssey," for our movies, with interpretations on the screen, to spread the goodness, the truth and the beauty shown in this wonderful volume, **Homer and the Prophets**, and also to be used in the education of the coming generations!

Let me here call attention to another parallel to Homer and the Prophets, a third source of inspiration for the betterment of our degenerate world, that should be used in the same way. By the side of the streams coming down to us from the Greek and the Hebrew we have our Nordic Eddas and Sagas, our Odinic religion, and our Nordic epic of Sigurd the Volsung and the fall of the Niblungs. Here, also, the names fit the characters; Sigurd is the victorious, and the Niblungs are the nebulous. The code and the religious tenets of the old Nordics were, like those of Homer and of the Prophets, wisdom, justice, chastity, and all the virtues, perhaps greatest among these, courage. We must never forget that it was Nordic heroes and heroines who gave the death blow to the oppressive and corrupted ancient Roman Empire. What a vicious thing Roman literature was, reflecting that oppression and corruption and not condemning it! The products of the Roman authors, especially those of their poets and philosophers, are either a feeble imitation or absolutely worthless. Roman literature did not—like the Hindooic, the Hebrew, the Homeric and the Nordic, spring from the life of the people, by whom it had been nourished and cherished for centuries, but it was produced for pay and as an ornamental accomplishment, during the reign of that polished tyrant, Augustus, to please his ear. We may well call the literature of the Augustan period, "the golden age" in Roman literature, for it served to gild over those chains of Caesarism that were artfully forged to fetter the peoples living around the Mediterranean Sea, but which, by an inevitable decree of the Norns, the Romans were themselves destined to wear. When we think of this fact, is it not strange that the schools of all nations have clung so tenaciously to Roman literature, even after it had become nothing more than the remains of a dead language? H. A. Taine, the foremost critic of his generation, who was himself a disciple of Guizot, the historian of civilization, in speaking of the Romans, says: "If man, reduced to narrow conceptions and deprived of all speculative refinement, is at the same time altogether absorbed and straightened by practical occupations, you will find, as in Rome, rudimentary deities, mere hollow names serving to designate the trivial details of agriculture, generation, household concerns, etiquettes in fact of marriage, of the farm, producing a mythology, a philosophy, a poetry, either worth nothing or borrowed. Among the ancients the Latin literature is nothing more, at the outset, than borrowed and imitative."

After this sweeping condemnation of the Romans from the scholarly pen of Taine, the reader may accept more calmly a few additional strokes from the hammer of Thor. Romanism has presented itself in history in

three distinct forms: first, as a chain forged by the Roman Caesars; second, as a crozier in the grasp of the Roman popes; third, as a rod in the hands of the Roman schoolmaster.

The Nordics were thoroughly successful in severing the political fetters forged by the Roman Caesars, and Nordic principles of individual liberty are engrafted more or less visibly into nearly all modern governmental systems. The second form of Romanism the Nordics have ever delighted in breaking, thanks to Wickliffe, to Luther and to every hero of religious progress and reform. What they instinctively abhor is slavery of conscience. Their profound, inexplicable mind cannot endure those transparent souls who claim to be in possession of infallible truth. But the third form of Romanism is the rod in the hands of the Roman schoolmaster, and this the Nordics have not yet broken, but every branch of the race, from North Cape to the Alps, from the Baltic to the Pacific, has more or less submissively kissed it, although it is really the most dangerous of the three forms of Romanism. It is nothing less than the murderous weapon concealed in the hand of an assassin. It has overawed our mothers and whipped the life out of our children, so that they could not command strength to break it. The great mistake that the Nordics have made is in short this: After having severed the fetters of the Roman emperors and subverted Roman despotism and corruption, after having broken the Roman crozier, they quietly submitted to the rod of the Roman schoolmaster, that is to say, they made the Latin language and literature, the very thing that had been at once the cause and the offspring of these evils, the basis of all education and culture. They adopted Roman principles of scholastic submission, they nourished and brought up the minds and hearts of Nordic lads and lasses on Roman thought. Like Romulus and Remus, Nordic infants have been exposed and left to be caressed and fondled and nursed by a wolf, instead of being nourished with the milk from the breasts of their own mothers. The Nordics have persisted in doing this for centuries, at a well-nigh complete sacrifice and disregard of their own records of the northern past, and at a most deplorable neglect of the Greek language, which is the great representative of South European thought and feeling. The North is brimful of artists and tale-tellers, like Homer, who give us a theology of well-defined gods, full of beauty and significance, who give us a close and delicate philosophy, and who present to us art and poetry remarkable for clearness, spirit, scope, truth and beauty. How foolishly we have acted as a race. While drinking from the Roman muddy stream we have suffered the Greek language and literature to be neglected, although it is a crystal clear stream flowing unadulterated from the Castalian fountains of Parnassus, indigenous and original, refreshing, with the purest poetry, history and philosophy. The Greek comes to us from a people who did not, like the Romans, employ slaves as their teachers, but who made teaching the highest position that a free man could attain—and I may add, it was selected by the wise Norns to be the means of bringing to us the gospel of the Galilean.

And what is worst of all in this connection is that we have wholly neglected our own old Nordic literature. We have, in fact, conducted

our schools, from the lowest to the highest, on the basis that our own forefathers were barbarians, who neither could nor did bequeath to us holy books that are to be studied and learned by child and grandchild so long as the race endures. We have holy books, a literary heirloom, bequeathed to us by our Nordic forebears, and they are as profound in thought and as sublime in sentiment as are the sacred scriptures of other peoples, nowhere equalled in tempestuous strength, in primitive vigor, in body of muscle. These books of the north we must study. We must study them more carefully and more zealously than any others, for they are the Bifrost bridge, the heavenly bridge of the gods, connecting our present with our past. They are, too, a mirror in which are reflected the prophetic, poetic and imaginative childhood of our race. If in order to properly understand the man we must study the life of the child, for "as the twig is bent the tree is inclined," so we must know what those old Nordics thought and felt and did in all directions, those Berserks and Vikings, who crushed Rome, introduced a new order of things and infused new blood and new spirit into the world.

Here we have a new parallel to Mrs. Hulst's remarkable book, from our own immediate forebears. With her splendid work, Mrs. Hulst has given her readers a mighty impetus to the study and reading and re-reading of Homer's great epics. She has helped to emancipate us from the shackles of Romanism in all its hideous forms; and incidentally her work will develop a deeper interest in other epics and in the sacred books of our Nordic ancestors, the Eddas and the Sagas.

RASMUS B. ANDERSON.

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