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ETHNOBOTANY OF THE HAWAIIANS
By Beatrice H. Krauss

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ETHNOBOTANY OF THE HAWAIIANS

BEATRICE H. KRAUSS*
Research Affiliate, Lyon Arboretum

Ethnobotany as an independent science is relatively new. The subject matter now included in ethnobotanical studies has been, until recently, the concern of the anthropologist and ethnologist.

The term ethnobotany is derived from two other long-established sciences, namely ethnology, the study of man, and botany, the study of plants. Thus ethnobotany can be defined as the study of the interrelation of man and plants, or, to put this another way, the study of the importance of plants to primitive peoples.

I will speak to both meanings but especially to the second. I hope to show how intimately the ancient Hawaiians related to the plants they grew and harvested from the forests, and how important these plants were to them; how skillfully and competently they cultivated them; and how ingeniously and ably they utilized plants in every part of their living. I will be speaking, of course, of the period prior to the advent of foreigners, i.e., up to the time of the arrival of Captain Cook in 1778.

Primarily through ancient chants and legends, but supported by recent scientific research, it appears probable that the people who first settled in these islands came from the Marquesas, or perhaps Tahiti, about 500 A.D.—for certain by 750 A.D. By 1000 A.D., settlements had been established on all islands of the group.

We really do not know how those first Polynesians discovered these islands. Perhaps a canoe travelling to another, known, part of the Pacific, blown off course, sighted the high peaks of Mauna Kea and Mauna Loa. Or, possibly, with the pressure of an increasing population, or the results of war, exploratory parties were sent out deliberately, or set out voluntarily to search for new islands, with one canoe among the many dispatched or embarked finding Hawaii. If this exploratory party had been small, as some of us believe, it almost certainly would very soon have returned to its home island to report this discovery. Then, most probably, a large expedition would have been organized, with tools and an assortment of useful plants, especially those used for food, taken along.

It seems quite natural that these people would bring with them seeds and shoots or cuttings of those plants they used for food and other purposes in their homeland, for it must soon have been obvious to the exploratory party that this new land was lacking especially in food plants, as well as many other useful ones. Thus, the many plants we speak of as "native" in Hawaii today, e.g., *kalo* (taro), *niu* (coconut), *'ulu* (breadfruit), *'uala* (sweet potato), *uhi*

*The author wishes to thank Dr. Yoneo Sagawa and Dr. Donald Mitchell for reading the manuscript. The illustrations are by Mr. Charles Bretz.

(yam), *mai'a* (banana) (Plate I), *wauke* (paper mulberry) (Plate IV), and *kukui* (candlenut), to name but a few, were all brought to Hawaii by these early settlers, and in successive migrations as well. Although there were here already such valuable plants as *koa* (Plate VIII), which became so important to them for building their great canoes; *māmaki* (Plate IV), while not equal to *wauke* yet a substitute for that plant in the making of *kapa* (tapa); and *olonā* (Plate VI), the fiber from which they were to make the finest cordage in the Pacific, the list of such endemic and indigenous plants is short.

The first settlements were most probably established in fishing villages along the seacoast and near fresh water streams, for obvious reasons. Such plants as taro, their staple food, would have been planted along streams and in swampy places, and sweet potato could be planted in the sandy soils near the houses. In time, with almost certainly additional migrations of people from the central Pacific, and an increase in the already-established population, there arose the need to produce more food; it was then that the areas for planting and living were expanded. Thus, gradually, the lower slopes of mountains—the *kula*—and valleys were cleared of their endemic and indigenous vegetation, and put to cultivation, some of it rather intensive, as will be pointed out later.

At first the plants brought by these early Polynesian immigrants were cultivated as on the island(s) from which they came and processed by practiced methods, and with tools brought by these people. With time, however, both practices and tools were modified.

These first settlers came to an environment quite different in some respects from what they had known in their home island(s). There were greater differences in the seasons, especially in respect to the lack of rain in the summer months. Furthermore, on none of the large islands in the area from which these people came were there the extensive flatlands and the type of mountain slopes that they found in Hawaii. The Hawaiians adapted to these differences in climate and terrain with the development of a systematic, extensive irrigation system, and a rather elaborate method of growing taro in flooded banked plots, called *lo'i*. Nowhere else in Polynesia was the cultivation of so-called "water" or "wet" taro practiced with such skill, or, in fact was "dry" or mulched taro (*kalo malo'o*)—cultivated in the drier, lower slopes of mountain sides—grown to such an extent and as successfully as here in Hawaii.

The Hawaiian planter was a horticulturist par excellence; would that the agriculturist in Hawaii today was as skillful a farmer! I have time to touch only briefly on the extent and character of the practical knowledge that the ancient Hawaiians acquired, adopted, and utilized in their farming. They demonstrated great ability in the accuracy of systematic differentiation, identification, and naming of the plants they cultivated and gathered for use. Their knowledge of the morphology of plants, their habits of growth, and the requirements for greatest yields is not excelled by expert agriculturists of

more complicated cultures. They worked out the procedures of cultivation for every locality—for all altitudes, for different weather conditions and exposures, and for soils of all types. In their close observation of the plants they grew, they noted and selected mutants and natural hybrids, and so created subvarieties of their plants. Thus, over the years after their arrival here, the Hawaiians added hundreds of named varieties of taro and sweet potatoes, and less numerous varieties of bananas, sugar cane, and other cultivated plants to those they had brought with them from the central Pacific. There is some evidence that they understood hand pollination, and if this is so, they would have in all probability created new varieties by this means. They recognized the value of green-manuring, incorporating into their cultivated areas such plant materials as weeds growing during fallow periods, or unused leafy portions of food plants.

In the grading and building of terraces for growing “water” or “wet” taro (*kalo wai*), and the construction of a system of aqueducts, flumes, and ditches (*hā wai* and *'auwai*), to bring water from dammed streams or springs to these terraces, the Hawaiians showed greater engineering and building skill, ingenuity, industry, and planning and organizing ability than any other Polynesian people.

And all the many tasks associated with the preparation of the soil, plantings, and often, harvesting, were performed with the use of a simple, crude tool, the *'o'o*, or digging stick, used to turn over the sod, to dig up the soil and make it fine, and to make the holes and trenches for planting various crops. The hands were used for weeding, clearing, raking, and shoveling; the feet, to shovel and push soil around maturing sweet potato and dry taro, to stamp or tramp the bottom soil of the *lo'i*, and to make mounds in which the taro tops (*huli*) or shoots (*pohuli*) were planted in the *lo'i*.

Weather wisdom was of major importance to the planter, not only from season to season, but from day to day. Weather was associated with two seasons: *kau*, i.e., summer, which began in May, and was dry and hot; and *ho'oilo*, beginning in October, when it was rainy and chilly. The seasons were further divided into moon months, and as with many other primitive people, preparing the soil, planting, harvesting, and processing of plant materials were all performed according to the phases of the moon. Even the time of day was supposed to have an influence on such procedures, e.g., the favored time to plant bananas was at noon, when the sucker casts no shadow but “rests” or “retires” within the plant; thus all the strength goes into the trunk and fruit, and so the latter matures rapidly. This particular aspect of the lives of the ancient Hawaiians, i.e., the time for planting and harvesting, and the many rituals associated with those duties, is truly fascinating but could only be mentioned briefly here.

The story of the early Hawaiian planter would not be complete without saying something about the land system. The method of land holding in ancient Hawaii was, in European terms, feudalistic-

tic. I will not go into the intricate ramifications of this land system. Suffice to say that the supreme chief (*mo'i*) of an island did not own the land but only "held" it, serving as a trustee for the nature gods Kane and Lono who made the land fruitful. The *mo'i*, retaining some of his portion for his own use, partitioned the remaining land into districts under the supervision of his high chiefs (*ali'i*). The latter, in turn, divided their allotted portion among their own lesser warrior chiefs (*koa*), dependents, and headsman or land supervisor (*konohiki*). These retainers would, in turn, subdivide their lands among the commoners (*maka'ainana*) who were the planters. Although changes took place in the proprietorship of lands at the higher levels of Hawaiian society, there was, as a rule, a permanency in the occupation by a planter family of land owned by successive overlords. These tenant farmers were not serfs for they could move to the land of another overlord, i.e., *konohiki* or *ali'i*, if they had reason to do so. At the time of the Great *Mahele*, or division of land, in 1848, under the reign of Kauikeaouli (Kamehameha III), these tenant farmers became owners of the land they had been cultivating; the term *kuleana* in the old sense of the word, meaning a portion or share, and also a man's rights, was applied to this piece of land.

Water, which was used to irrigate his staff of life—*kalo*—symbolized bountifulness for the Hawaiian planter; thus, the word for water repeated, *waiwai*, was used to designate something of great value—property, wealth, ownership, prosperity. Because *kalo*—and some other food crops as well—depended primarily upon water for their growth and productivity, the fundamental conception of property and law was based upon water rights rather than land use and possession. Actually there was no conception of ownership of land, as already noted, or of water, but only the use of land and water. The building and maintenance of the *lo'i*, or flooded taro terraces, and the irrigation ditch system (*'auwai*) were communal undertakings; all *kalo* planters took part in this labor, all shared in the use of the water, the amount available to each being determined by the amount of labor contributed. The water rights of planters along the streams themselves were respected in that no *'auwai* was permitted to divert more than half the flow from any stream; each planter took only as much water as he needed, and then closed his inlet so that the planter below could take his share. Thus this way of life was one of taking one's share and looking after the rights of his neighbors as well, without greed or self-interest. Much more could be said here about the complexities associated with the governance of water usage; the intricacies of the irrigation system; the rituals attendant on its construction; and the spiritual connotations of life-giving water, as evidence for the ancient Hawaiians' belief that these were sacred—however, lack of time does not permit this.

With this rather long introduction I hope to have furnished

some background for the following discussion of the use of their plants by the early Hawaiians.

Let us begin with those plants which were used for food; of these, the most important was *kalo*. Because of the importance of this plant in the lives of these people, it became part of their basic culture. It enters into their mythology; terms used to characterize the Hawaiian family are derived from those used to describe *kalo*. These are the reasons for and the results of the intensive cultivation of this plant. Handy believes that there were 300 varieties known and grown by the ancient Hawaiians; he collected 85 of these in 1931, a goodly number of which are being preserved at the Lyon Arboretum. Many of these varieties had specific uses: some were reserved for the *ali'i*, the nobility, e.g., *'api'i* and *pi'i-ali'i*; varieties such as *mākoko* produced beautiful dyes; for medicinal uses there were such varieties as *lau-loa 'ele'ele* and *manini kea*; the many *lehua* types of *kalo*, e.g., *lehua-pala'i'i*, were among the favorite varieties to make red or pink *poi*; and a variety such as *palakea* was used to make the best *kulolo*, a dessert made from taro and grated coconut "meat". Many taros had the names of fish whose coloration or markings they resembled; when fish, the preferred offering to a god was unavailable, taro with the same name, such as *kumu*, *uahi-a-Pele*, or *ha'akea*, was laid on the altar instead.

All parts of the taro plant were eaten: the young leaves and petioles for green vegetables, the flowers as a rare delicacy; of greatest importance, was the so-called "root", i.e., the corm or underground stem. From the last was made *poi*, the most important starchy food in the diet of the Hawaiians. The corm was cooked in the underground oven or cooking pit known as an *imu*. A shallow hole eighteen inches in depth was lined with porous stones (*pōhaku imu*) which were heated to red heat by burning wood upon them. What was left of the latter, after the proper temperature was obtained, was prodded out. Ti and/or banana leaves, or other plant materials were then laid on the hot stones as a base for placing the taro corms and other food to be cooked. Over this food were placed more banana and ti leaves, and sometimes sections of the false trunk of the banana; coarse woven mats placed over all the contents, and a layer of soil over the mats completed the preparation of the *imu*. Note that the *imu* was thus a type of steam rather than a dry oven.

The cooked taro corm was peeled with a shell of a large limpet *'opihi* (Plate V), the back of which had been filed off and sharpened on a stone; with a sharp stone; or a piece of other shell. The taro was then either eaten in this state, or more frequently sliced and dried in the sun; so prepared it would be preserved for a considerable period of time for use on long jounries or in time of famine. The main use of taro was to make *poi*; the steamed peeled corms were broken into pieces and mashed and pounded into a paste. Pounding was done with a stone tool known as *pōhaku ku'i'ai* or

simply *pōhaku ku'i* (stone pounder or poi pounder) on a heavy, slightly hollowed-out board (Plate V). The left hand was dipped into water at intervals and passed under the mass of taro and/or over the bottom of the pounder to make the material more adhesive and keep it from sticking to the board. This product was quite thick or stiff, and in this form (called *'ai pa'a*), wrapped in ti leaves, could be stored, without spoilage, for a fairly long period of time. When freshly pounded, or after storage in the form just mentioned, the *'ai pa'a* was mixed with water to the desired consistency and allowed to ferment to a degree based on personal preference.

The sweet potato (*'uala*) (Plate I) was second in importance to taro as a food staple. In a way, *'uala* was actually more valuable than *kalo* because it could be grown in less favorable localities; it matured in three to six months as against the nine to eighteen months necessary for *kalo*; and it required considerably less labor in planting, and less care in cultivation. Vine-end cuttings were planted on mounds, without irrigation in moist areas, and with some irrigation in those which were drier. The softness of the mound soil permitted the harvest of the largest, mature tubers without disturbing the small, immature ones; these latter were then allowed to remain in the ground until large, making for greater productivity. As with taro, the tubers were baked in the *imu*, and eaten that way, or peeled, mashed and mixed with water to make a *poi* (*poi 'uala*). This was considered to be superior in nutritional value to taro *poi* but was less relished because of its rapid fermentation; this fermentation process was utilized, however, to make a sweet potato beer, *'uala 'awa'awa*. A dessert, *piele 'uala*, was made by mashing cooked sweet potato, combining this with coconut cream, wrapping the mixture in ti leaves and steaming the bundle in the *imu*. The young leaves were used as greens in the same way we use spinach. Although primarily utilized for food, both the tuber and vine of *'uala* were used medicinally. The vine and foliage were fed to hogs, with the peeling of tubers used to fatten them. The tuber of one specific variety, *pu*, was a bait for *'ōpelu* fish. Old vines and leaves were used as padding under floor mats. If time permitted I would have liked to tell of the culture, preparation, and rituals involved with each of the many plants used.

From the forests the Hawaiians obtained products from plants growing wild, e.g., the rolled-up and young fronds (*pepe'e*) of several ferns such as *hō'i'o*, and both such fronds and the roots of the fern *kikawalō*. Other wild food plants included berries: two raspberries, *'ākala* (Plate IV); a relative of the cranberry, *'ōhelo* (Plate I); and the black nightshade, *pōpōlo*—of this last plant both the berries, eaten raw, and the leaves cooked and eaten as greens, were used. From the forests also came the fruit of the *'ōhi'a-'ai*, the mountain apple (Plate I); this was split and dried, since when eaten fresh in quantity this fruit causes stomach ache. There was also the highly-prized fleshy ear-shaped fungus, *pepeiao-akua* (Plate

I) which grew on dead tree trunks. From the streams came the fresh-water algae, and from the ocean the marine forms, both being called *limu* (Plate I); *limu* was eaten primarily as a relish, to "spice" an otherwise rather bland diet. There were several plants, especially ones with roots or tubers, which were used only in time of famine.

Before speaking of the plants cultivated and collected for the making of houses, clothing, canoes, musical instruments, ornaments, and game and sport items, collectively, I would like to single out the coconut, *niu* (Plate I), of which every part was used by the ancient Hawaiian for one or more of the above-mentioned purposes. To list in some detail these uses will point up better than any other way the extensive use the Hawaiians made of plant materials.

The swollen base of the trunk was made into the large hula drum, *pahu hula* (Plate VII), and the food container or calabash (*'umeke*). From the slender main portion of the stem was made the hull of a canoe known as *loloniu*; it was also used for some structural purposes. The heavy base of the leaf or frond stalk, *kū'au*, served as a beater or pounder to firm the banks of the *lo'i*; the fibrous sheath at its base was used for wrappers of food, or fish bait, and to contain the ball of earth when transplanting rooted cuttings and young plants. The whole leaf was a symbol of high rank or divine power; trimmed at the tip and base, it was split along the midrib and plaited to form panels for the roofs of canoe sheds. Interestingly, the ancient Hawaiians did not use the leaflets to plait baskets as did the peoples of other Pacific islands. The last three to four feet at the tip of the frond served as a prod (*pula*) to poke into crevices in the reef and frighten out fish. The softer leaflets at this end were plaited into fans (*pe'ahi*), or a children's ball (*kinipōpō*). Also, the midribs of such leaflets, along with coconut sennit, were fashioned into shrimp snares (*pulu'aha*). The stiffer midribs of the basal leaflets were made into brooms, *nī'au kāhili* or *pūpū nī'au*, by tying the bases together with coconut sennit. These same more rigid midribs furnished the rods on which it was the task of children to string *kukui*-nut kernels (Plate V); these were burned as candles (*lama*). Two games and a musical instrument were also made from the midribs of the leaflets: a snapping or shooting game (*panapana nī'au*) where the midrib was bent like a bow and released so that it sprang away; a loop and ball game, *pala'ie*, where the loop and flexible handle were made of braided midribs (Plate VIII); and a kind of jew's harp, the *nī'au kani*. The old flower cluster, after it had dried, was used as we today use a garden rake.

All parts of the fruit were useful; probably of greatest importance was the husk because of its fibers (Plate VI). Coir, the prepared fibers, i.e., separated, cleaned, and spun, was made into sennit (*'aha*) by twisting or braiding (Plate VI). Dependent upon its

diameter, this cordage was used for many purposes. Because of the absence of metals in Hawaii, and consequently of nails, such parts as gunwale strakes, and pieces, thwarts, and U-shaped braces were lashed to the hulls of the large koa-log canoes with this cordage. The float was lashed to the booms which in turn were lashed to the hull to form the outrigger. In the case of the double canoe, the cross booms connecting the two hulls and the platform resting upon them were lashed together with the same cordage. Only rarely was coir sennit used in the lashing of timbers of houses, or as twine for fish nets. However, this cordage was almost always used to lash stone adzes to their wooden handles.

The elaborate net containers (*kōkō*) made to hold gourd and wooden food bowls; the simpler ones for gourd water bottles (*kōkō pu'alu*) (Plate V); and the one-sided suspensory loops or bails and the more ingenious bilateral cord supports, the *'aha hāwele*, were all made from the coconut-husk-fiber cordage. Fishing hook containers (*ipu lē'i*) were enclosed in net supports usually made of *olonā* cordage but sometimes were made of coir cordage.

Use of coir cordage in preparation of the dead will be discussed later under that subject.

Other uses of sennit were in the repair of cracks in wooden bowls; in making the bottom ring, the tie cords, the side or tautening strings, as well as the beater for the knee drum, *pūniu* (Plate VII); and as the cord to which shark teeth were attached to form a weapon. Thick coir ropes were used for anchor cables. At times, but rarely, sennit was used to make the netting on which were fastened the feathers of the magnificent helmets—*olonā* was the preferred fiber.

From the shells of the nuts were made *'apu*, the cups used to drink only *'awa*, since water was drunk directly from water gourds; small scoops used as spoons (*kī'o'e*) with which sweet-potato *poi* was eaten since this *poi* was not sticky enough to be eaten with fingers as was taro *poi* (Plate V). The shell was also used to make several musical instruments: the knee drum, already mentioned; the single rattle, *'ulī'ulī* when coconut was a substitute for the preferred gourd; the triple rattle, *'ūlili*; and the bull-roarer, *oeoe*—the last actually a toy (Plate VII). In fishing, the shell was sometimes used as the cover for line containers instead of gourds, and as bait mortars instead of the more usual stone.

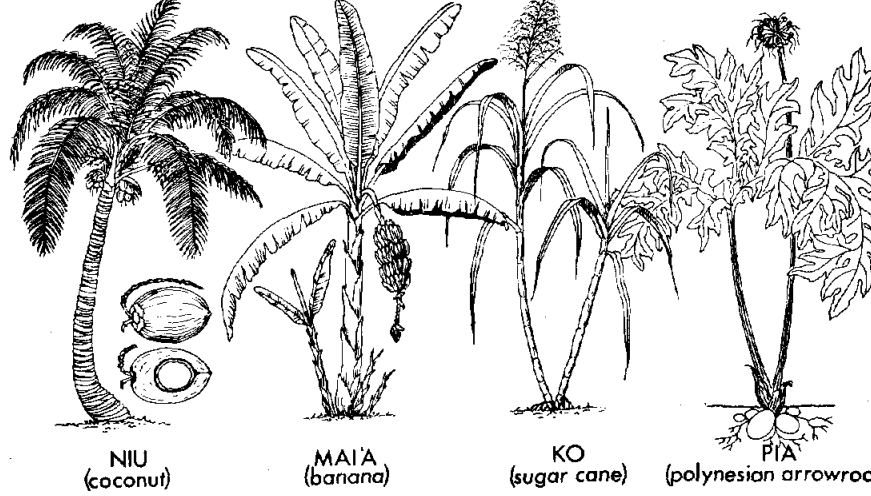
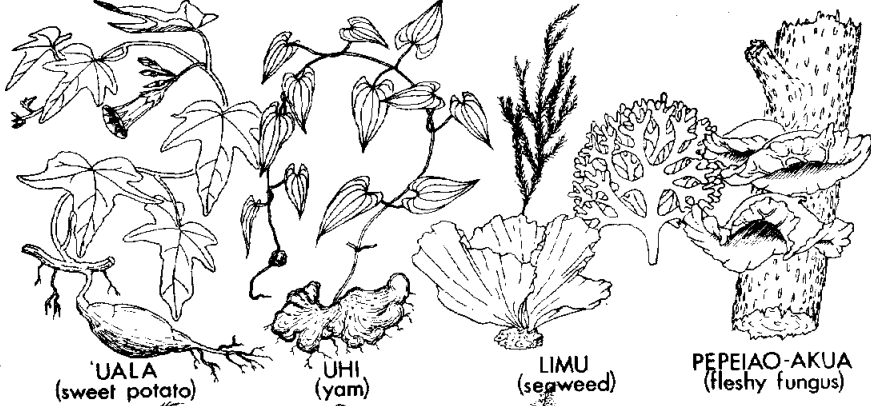
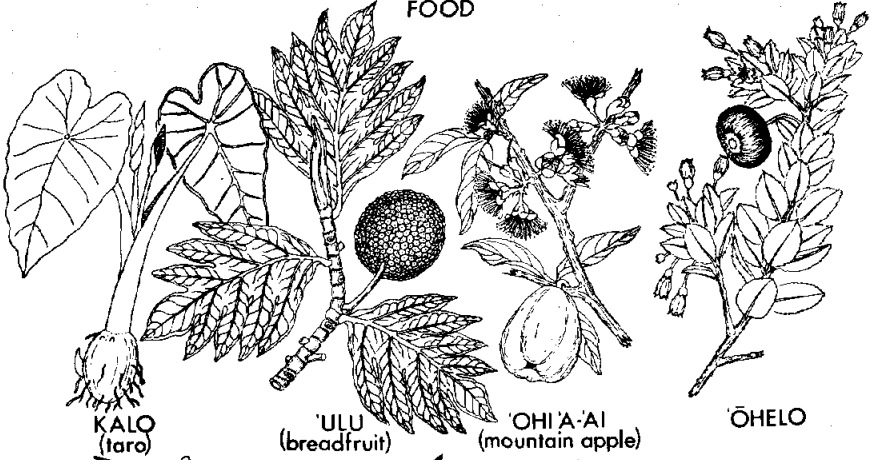
The coconut did not play a very important role as drink and food to the ancient Hawaiian. On coral atolls of Polynesia, coconut water, *wai niu*, was important for drinking but on high islands such as those that make up Hawaii, water for drinking came from springs and streams. Although cream or milk was expressed from the grated coconut flesh there is some question as to whether the Hawaiians used this until post-Cook times. They did, however, use the grated flesh in the preparation of such desserts as *kūlolo*, mixed with raw grated taro and baked in the *imu*; and *piele 'uala*, made

with mashed, cooked sweet potatoes. Such desserts as *haupia* and *piele'ulu*, made with *pia*, the Polynesian arrowroot, and breadfruit, respectively, and coconut cream are perhaps of later origin as are the use of this cream in the making of *kūlolo* and *piele'uāla*. The scraper used to grate the flesh was most frequently a large 'opihi shell (Plate V). An oil for anointing the body and hair was obtained by placing grated coconut flesh, along with some such odoriferous plant as *maile*, in a wooden vessel in the sun. When the oil had separated from the flesh the mass was squeezed through 'ahu'awa, a sedge, and the residue discarded. In one area, Ka'u, oily mature coconut meat, or flesh, was chewed, and the combined saliva and oil squeezed on the head and rubbed into the scalp, before plunging into the sea where the flesh residue was washed away. One report says that when the ocean was rough in a fishing area, chewed oily flesh was spit into the water to calm it.

I would like to speak in the same detail about bamboo, banana, *hau*, *hala*, ti, and many other plants, all of which played important roles in the culture of the old Hawaiians; however, there is not time. Before going on to other aspects of old Hawaii's culture, I do want, however, to mention the gourds which served so many uses. These were especially valuable as vessels, i.e., calabashes for the serving and storage of food; for water containers; for receptacles for all kinds of valuable and utilitarian objects, such as feather capes and fishing gear, respectively; for many of the musical instruments; and for canoe balers—just to mention some of these many uses. It is of interest to note that when the Hawaiians eventually made food and storage containers out of wood from the indigenous and endemic forest trees they found here, these were fashioned in the original shapes of their gourd calabashes.

The Polynesian immigrants who settled in Hawaii had full knowledge of how to build houses with upright walls and roofs; houses of simpler construction had stone walls with thatched roofs, while in those of more advanced structure both walls and roofs were thatched (Plate III). Although caves were used for temporary shelter, and very simple house structures, e.g., without walls, were erected for one purpose or another, the permanent house that was built was a work of great skill, varying only in shape and size depending upon the social status of the occupant(s), and its use. They were of both the hipped-and gabled-roof types. I cannot go into any detail about the construction of these houses but I would like to speak a little about the plant products that went into their construction. The main and gable posts were made of hard, chiefly forest woods such as *uhiuhi*, a leguminous tree; *naio*, the bastard sandalwood; *a'ali'i*, the dodonaeas; *māmane*, another leguminous tree; *olopua*, belonging to the olive family—all species endemic to Hawaii; and others. The rafters were made from straight lengths of other hard woods: 'ohi'a-lehua (or just *lehua*); *lama*, an ebony; or *hā'a* (sometimes called *hame*), a member of the euphorbia family—

FOOD



PLANTS USED IN CONSTRUCTION OF HOUSES



NAIO
(false sandalwood)



'A'ALI'i



MĀMANE

UHIUHI



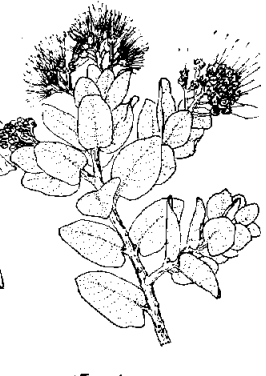
OLOPUA



LAMA



HA'Ā or HAME



'ŌHI'A-LEHUA



KI
(ti)



'AMA'U
(sadleria fern)

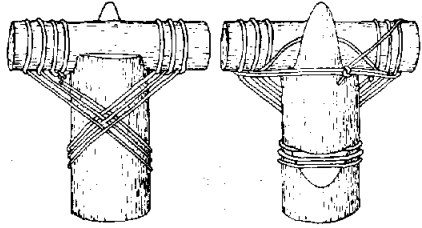
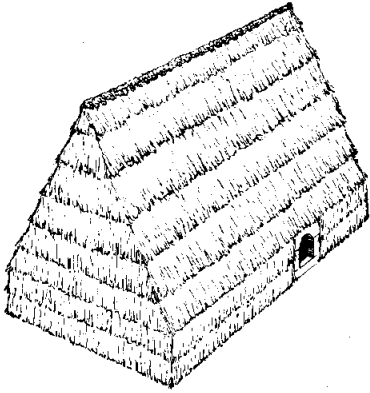


'IE'IE
(climbing pandanus)



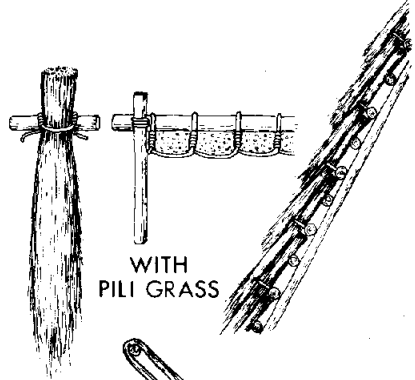
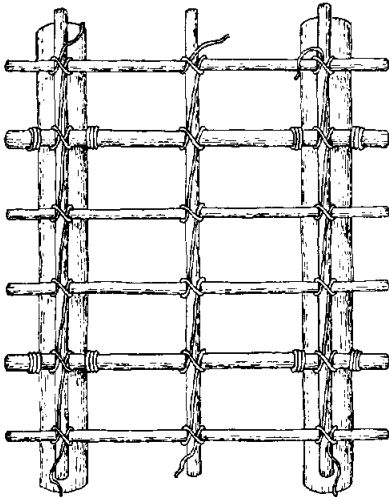
PILI

HOUSES



HOUSE THATCHED WITH PILI GRASS,
GABLE ROOF WITH STRAIGHT RAFTERS

DETAIL OF NOTCHING OF UPPER
END OF WALL POST, AND LASHING
OF WALL PLATE TO POST



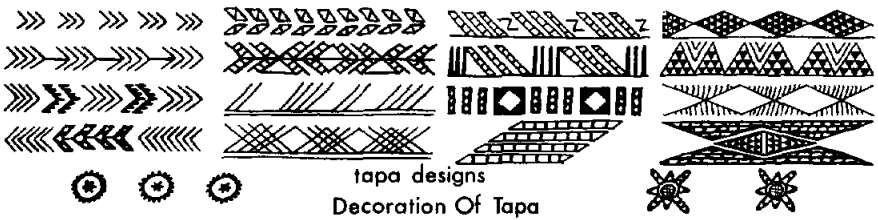
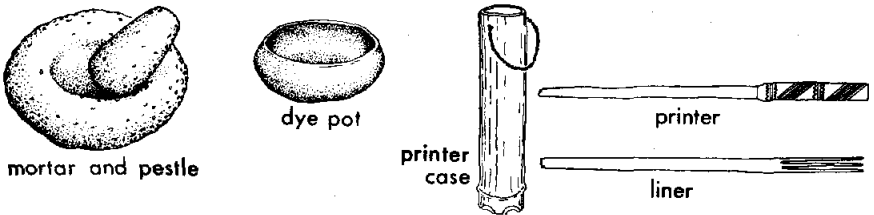
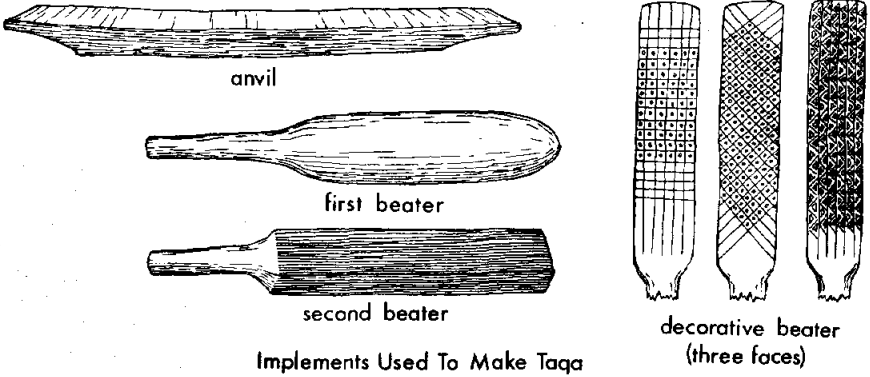
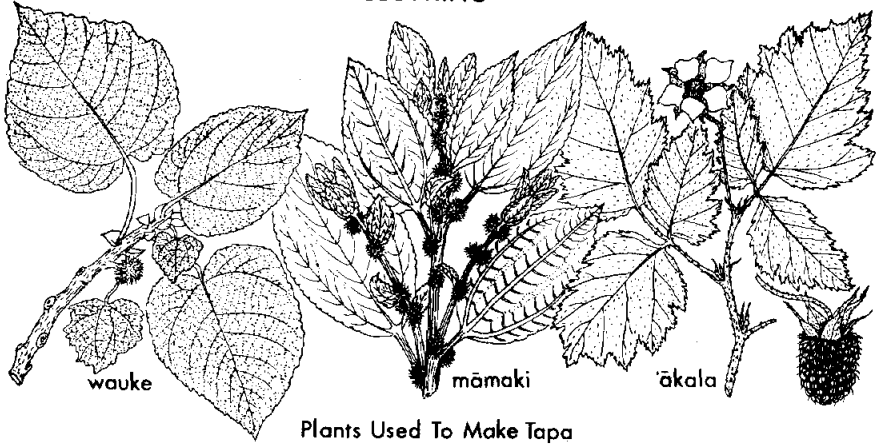
WITH
PILI GRASS

WITH
TI LEAVES

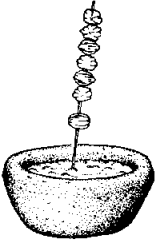
FRAMEWORK FOR THATCHING WALL POSTS
WITH FIXED AND FLOATING PURLINS

THATCHING TECHNIQUES

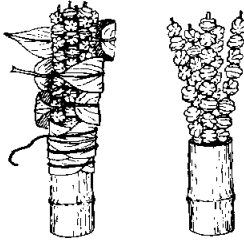
CLOTHING



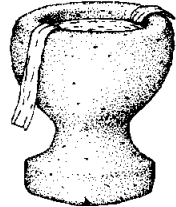
HOUSEHOLD EQUIPMENT AND UTENSILS



IHOIHO KUKUI
(kukui-nut candle)



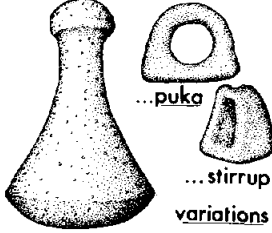
LAMAKŪ
(kukui-nut torch)



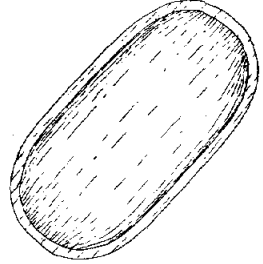
POHO KUKUI
(stone lamp)



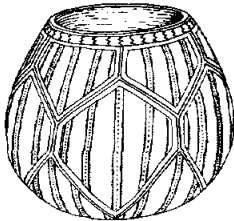
ŌPIHI WA'U
(limpet-shell scraper)



PŌHAKU KU'I 'AI
(stone poi pounder)



PAPA KU'I POI
(poi-pounding board)



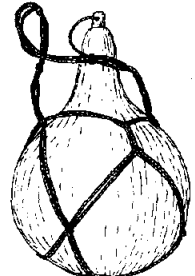
'umeke pāwehe
(decorated gourd bowl)



'umeke pākākā
(low wooden bowl)

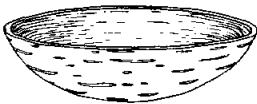


'umeke 'ōpaka
(vertical-panneled wooden bowl)

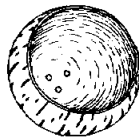


(IPU) HUI WAI
(gourd water container with handle support)

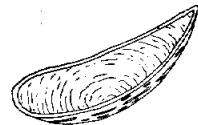
'UMEKE



'APU 'AWA
(coconut-shell 'awa cup)



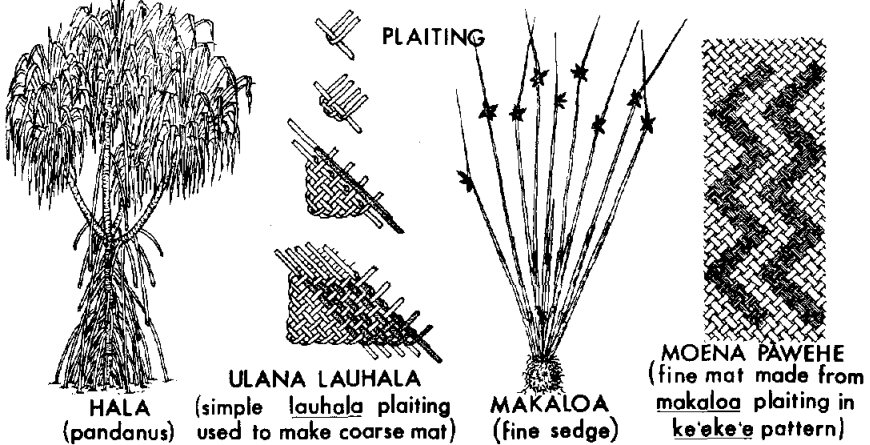
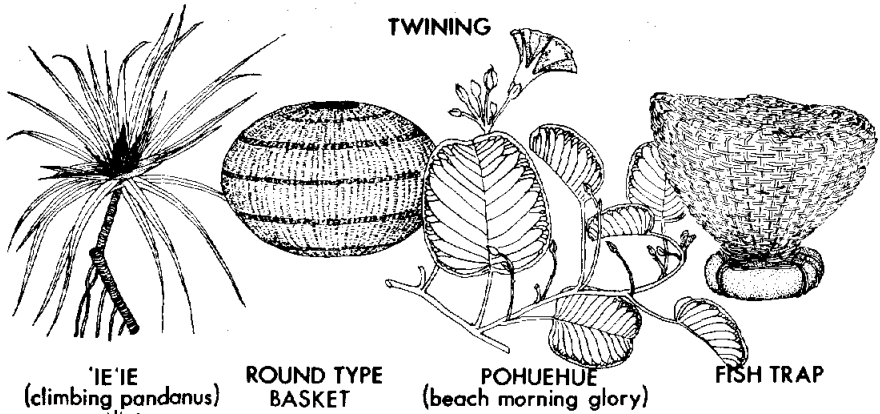
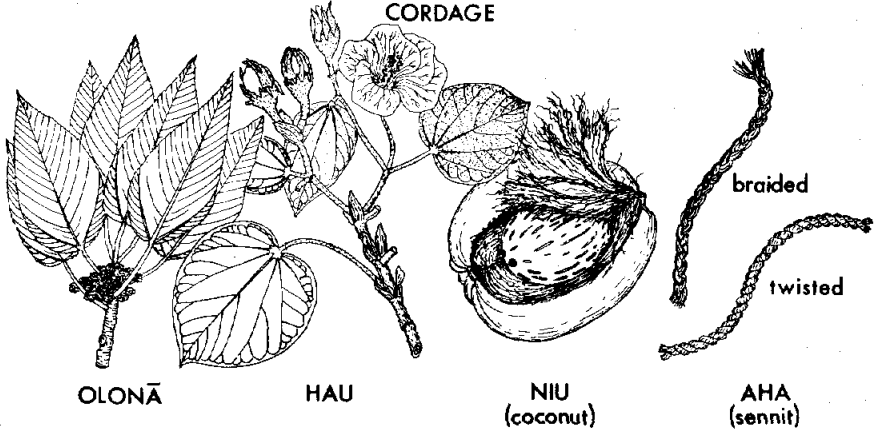
HOKA 'AWA
(coconut-shell 'awa strainer)



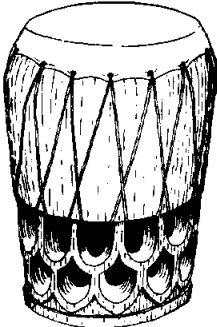
KĪO'E
(coconut-shell spoon)

**CORDAGE, TWINED BASKETS, AND PLAITING
WITH PLANTS USED TO MAKE THEM**

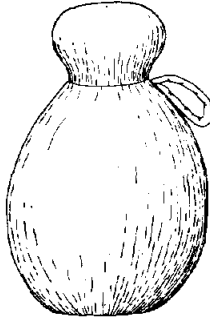
CORDAGE



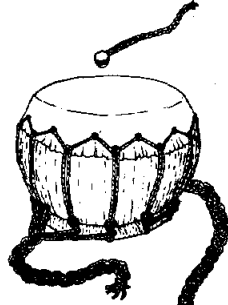
MUSICAL INSTRUMENTS



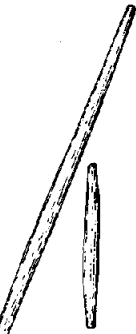
PAHU HULA
[hula (coconut stem) drum]



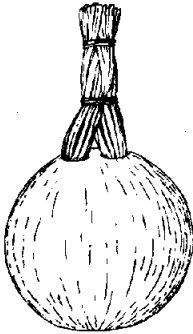
IPU HULA
[hula (gourd) drum]



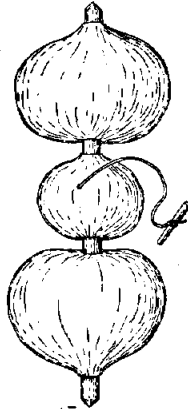
PŪNIU and KĀHĀ
(coconut shell knee
drum and beater)



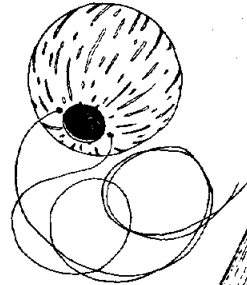
KĀLA 'AU
(hula sticks)



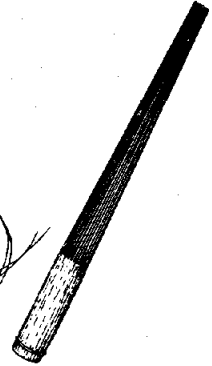
ŪL'ULĪ
(single gourd, rattle
original type)



ŪLĪLĪ
(triple gourd rattle)



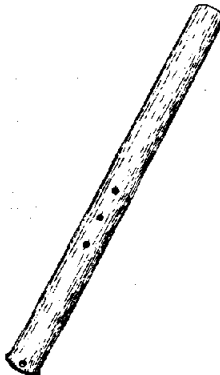
OEOE
(bull-roarer)



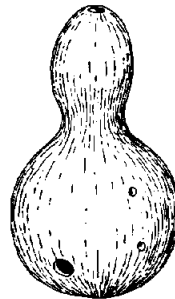
PŪ'ILI
(bamboo rattle)



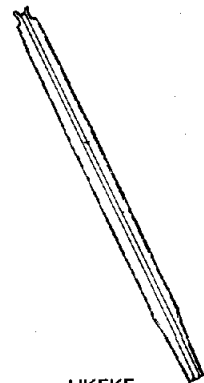
KĀ'EKE'EKE
(bamboo pipe or tube)



OHE-HANO-IHU
(bamboo nose flute)

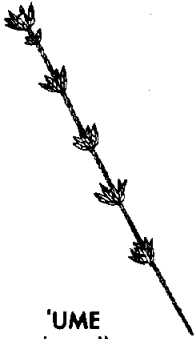


IPU HŌKIOKIO
[gourd (nose) whistle]

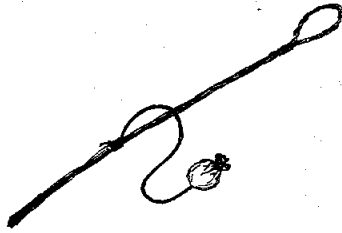


UKEKE
(musical bow)

GAMES AND SPORTS



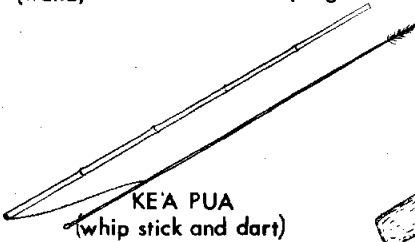
'UME
(wand)



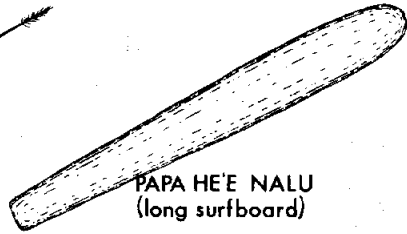
PALA'IE
(ring and ball)



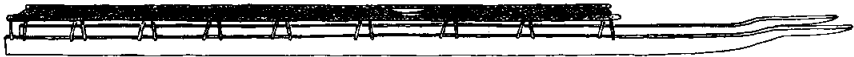
PANA 'IOLE
(bow and arrow)



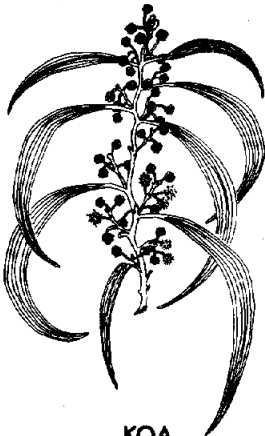
KE'A PUA
(whip stick and dart)



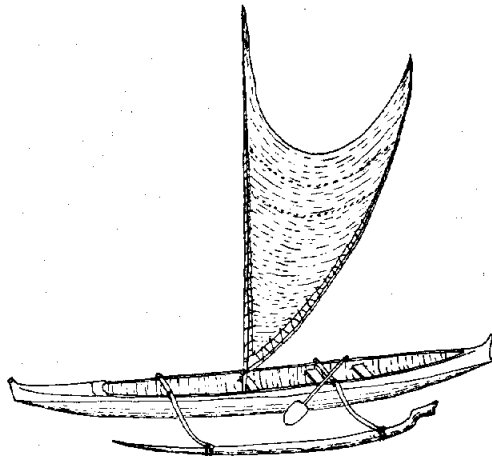
PAPA HE'E NALU
(long surfboard)



PAPA HOLUA
(sled or sledge)



KOA
(used to make wa'a)



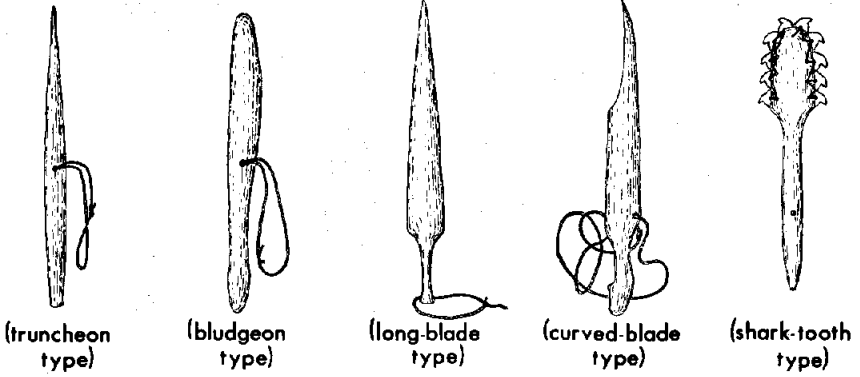
WA'A
[outrigger (single) canoe]

WEAPONS AND CASKET

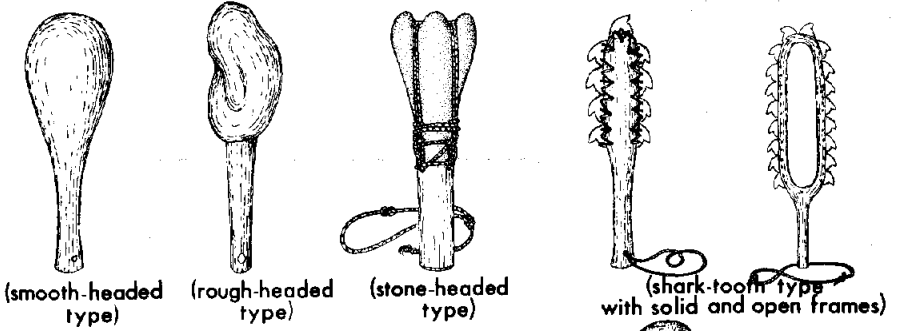
IHE (SPEARS)



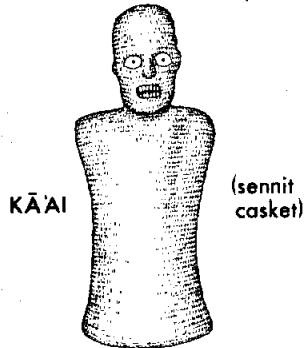
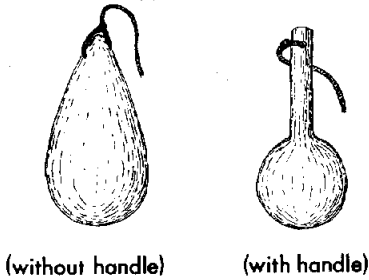
PĀHOA (DAGGER)



LĀ'AU PĀLAU (CLUB)



PIKOI
(tripping club or cord)



these, also, all native species (Plate II). Bamboo was used only for light construction, as for sheds.

All parts of the framework were lashed with braid made from 'uki "grass", actually a member of the sedge family, or the fibers of the aerial roots of 'ie'ie, the climbing *hala* (Plate II). Rarely was coconut-husk-fiber cordage used. The method of lashing varied with the members being joined, and was determined by the unique Hawaiian method of notching. Then came the main purlins, the horizontal framework for the sides and roof. On the thatch purlins, fastened to the main purlins, was tied the thatching material; *pili* grass was the most favored, but other grasses and sedges were also used in the same manner. When other thatch material such as the leaves of pandanus (*lau hala*); ti (*ki*), and sugar cane (*ko*) was used, the method of thatching differed (Plates II, III). Houses were made with a single door, *puka*, and no windows. The doors were usually only high enough to crawl through; this helped to keep out the cold. The living house was very sparsely furnished; mats underlaid with dried grass or old sweet-potato vines, covered the floor, and at one end there was a bench which held utensils, water gourds, and baskets to hold food and other items. Needless to say, the cutting and shaping, i.e., trimming, of house timbers, as well as the cutting of notches by which posts and rafters were lashed together, were done with adzes (*ko'i*) made from special fine-grained basalt stone, i.e., lava, taken from quarries (*lua 'eli pōhaku*).

The common garments of the Hawaiians were the loin-cloth, *malo*, for men; skirts, *pā'ū*, for women; and a type of mantle, *kīhei*, worn by both sexes in cooler weather. These were all made of bark cloth, *kapa* or *tapa*. Bark cloth is a non-woven fabric of felted plant fibers. For Hawaiians, the preferred fiber was from the inner bark of the stem of *wauke*, the so-called paper mulberry; in the opinion of these people, this fiber made the finest, softest, and most durable *kapa*. Although they also made *kapa* from the inner bark of other plants such as *māmaki*, related to *wauke* (Plate IV); bread-fruit (Plate I); *hau* (Plate VI); 'ākala, an endemic raspberry (Plate IV); and 'oloa, or *ma'aloa*, related to *māmaki*, all of these were considered inferior to *wauke*, in some way or another, e.g., *kapa* made from *māmaki* could not be washed, or the others were used for special purposes.

Wauke was a crop cultivated and harvested almost exclusively for the making of *tapa*. The preparation of the inner bark (bast) of this plant, and the beating itself involved considerable labor and much skill. The decoration of Hawaiian *kapa* consisted of water-marking, i.e., in the last stage of beating using a special four-sided wooden beater, each face of which was carved with a different geometric design; dyeing by immersion in plant infusions; overlaying, i.e., "bonding", by beating together two previously dyed or one dyed and one white pieces of *tapa*; and block printing with stamps. These stamps or printers were made from narrow strips

of bamboo on which designs were carved in relief, or excised, with a shark tooth mounted on a wooden handle. A favorite pattern was one of chevrons; these were of different sizes and spacing, either simple or elaborate, and were used alone or in combination with other designs. Other patterns consisted of vertical, horizontal, and oblique bars; elaborate triangles, lozenges, and rhombs; groups of rhombs, squares, lozenges, and ellipses; and infrequently, circles and variants of these. It would be interesting to speak in detail about the making of tapa, and more about its decoration but a lack of time precludes this. Suffice to say, the Hawaiians, among all Polynesians, excelled in the varieties of *kapa* they made, from one which was rather thick to one so thin it was gauze-like, looking almost like lace. The Hawaiian's original skill in the making of *kapa* and its decoration made them renowned throughout the Pacific (Plate IV).

Other garments worn by the Hawaiians were plaited from the fiber obtained from the outer covering of the false banana trunk (Plate I), from *ki* (ti) stalks (Plate II), and from the leaves of certain grasses and the finer sedges.

Capes (*kui lā'i*), used primarily by fowlers who caught birds in the mountains, were made from ti leaves. As originally made, the softened leaf stems were used as wefts, with the leafy portion forming a thatch on the outer surface of the plaited stems. Later, instead of plaiting these stems, they were tied to a fish net, with the leafy portion still forming a thatch which shed the rain and kept out the cold.

Although Hawaiians went barefoot most of the time, on occasion, as when having to pass over a rough 'a'a flow or across sharp coral, they would quickly weave temporary sandals (*kāma'a*) out of whatever tough plant material was at hand: *lau hala* (Plate VI), banana leaves (Plate I), *hau* (Plate VI) or *wauke* bark (Plate IV), or ti (Plate II), the last being the most commonly or frequently used.

Considered as regalia rather than clothing were the magnificent capes and cloaks (*'ahu'ula*) of the ancient Hawaiians; these were worn only by the higher chiefs to designate their social status and rank. These cloaks are in a class by themselves, different from the feather cloaks and capes made by the Maoris and Tahitians, in sheer grandeur, and in technique and materials used in making them. To a shaped-netting foundation, made from cordage prepared from the bast, or inner bark of the endemic *olonā* were attached, i.e., tied, small bunches of bright-colored feathers, the most prized being those of the indigenous honey creepers: 'ō'ō, *mamo*, 'i'iwi, 'apapane, and 'amakihi, because of the special value attached to their red and yellow colors.

At this point a little more should be said about the fiber used for the netting mentioned above—*olonā* (Plate VI). The cordage made from this fiber was one of the finest if not the finest in Poly-

nesia. Because of its great tensile strength (reported to be greater than that of hemp); its lasting quality (longer than for any other cordage); the fact that it did not kink; and because it was resistant against long exposure to water, this cordage was used for fish lines and nets; for lashings of house timber; for some of the lashings in canoe construction; and for the net base of capes and cloaks, as already noted.

The feather helmets (*mahiolo*) were uniquely Hawaiian. They were made in a variety of styles; the crested one, which so naturally complemented the feather capes and cloaks, was worn only by high chiefs and kings. The frame for both the cap and crest portions of these helmets was woven of the split aerial roots of *'ie'ie*, the climbing *hala*, or pandanus (Plates II, VI). The feathers were fastened to a net cut to shape; this net was made of the same material and in the same manner as the net used as the foundation for the capes and cloaks. The feathers were tied onto the net in the same way they were in making the capes and cloaks; whether this was done before or after the attachment of the net to the framework is not known.

Nowhere else in Polynesia was there a greater and richer variety of ornaments for adorning the body than was made in Hawaii. Most of these were of a permanent nature, and made of materials other than from plants. The only permanent ornaments made from plant materials were the seed leis of which those made from *kukui* nuts were the most popular. In an ethnobotanical survey such as this, the fresh flower, leaf, and fern leis are of special interest; they are placed in the so-called "temporary" ornament category. These "fresh" leis were made in a variety of ways which we have come to think of as "typically Hawaiian".

The first settlers who came from the Marquesas or Tahiti arrived in canoes made of planks. The great canoes of the Hawaiians, made from single giant *koa* (Plate VIII) trees (one of the few endemic trees of importance found by the people who settled here), are world-renowned. These were vital to them for transport between the islands of this group, for both peaceful purposes and in wars, and for the longer journeys back to what was once their homeland. Smaller versions were used for fishing, sport, and other purposes. Canoe designing and shaping were practiced by skilled craftsmen, the canoe builders, or *kahuna k̄alai wa'a*. Perhaps in no other performance was greater skill shown by the Hawaiians than in the making of the many kinds of canoes, the best known being the outrigger and double-hulled types. In the *koa* they found growing here, they had the wood par excellence for the hulls, fittings, and paddles of their great canoes. For the lashing together of parts there was coconut sennit, already mentioned. For the hulls of smaller canoes and for parts of all canoes there were other tree and plant materials utilized. The outrigger booms and floats were made of wood poles from *hau* and *wiliwili*, respectively. Gourds were used

for bailers (*ka wa'a*), and *lau hala* for the peculiar three-sided sails (Plate VIII). I wish I had the time to describe the rituals observed at each stage of work: from choosing and felling the tree, during the actual shaping and finishing, to the final launching of the canoes; also, to tell in detail all the aspects of this truly awe-inspiring story.

The hull, shaped with adzes and polished with stone rubbers, was painted on the outside with a mixture of the sap of certain euphorbia plants, the inner bark of *kukui* roots, and the buds of banana blossoms; these were pounded and mixed with charcoal made by burning *lau hala*. The painted hull was dressed with *kukui* nut oil which gave it a finish resembling lacquer.

Plaiting (*ulana*) in ancient Hawaii was restricted primarily to common (i.e., floor) and sleeping mats, made from *lau hala*, the leaf of the pandanus (Plate VI). The story of the selection of these leaves, their preparation, and the various techniques involved in the plaiting itself would require a book. Although mats and pillows were almost the only household articles plaited from *lau hala*, the Hawaiians also made a unique round container with a long narrow neck and cover to hold fish lines and hooks.

Plaiting in Hawaii reached its highest skill in the making of the sleeping mats from a sedge called *makaloa*. There was much variety in the working of different patterns, the finishing of borders, etc., and in color decoration (Plate VI). Strangely, as already noted, the Hawaiians did not plait baskets out of coconut leaves as was common throughout Polynesia.

The twined baskets (*hīna'i*) made by the Hawaiians surpassed any twine work using similar material in all Polynesia. The material used almost exclusively was the stripped pliable whole or split aerial root of the *'ie'ie*, a plant already mentioned in the making of the framework of the feathered helmets. There was great versatility in the types and varieties of baskets made, all showing beautiful craftsmanship (Plate VI). It is impossible to go into detail here about the actual making of them; mention will be made only of the general types and uses. Baskets were twined to cover gourds and the wooden bowls later made to simulate the former. Such twine coverings were especially important for gourds since these become brittle with age. Baskets were also twined in great variety without containers, with and without covers, and with and without decoration. The twined baskets with containers were used to hold poi and other food; those without, to serve for storage of tapa and other valuables. The coarser types of baskets were used to hold fish. Fish traps of many types also consisted of twined baskets; these will be described later.

Netting was the most diversified and productive method of catching fish. The netting twine made of *olonā* fiber was best for this purpose because it was both strong and light. The most useful substitute was twine made from *hau* fiber. Other substitutes, much

less desirable, were twine made from *wauke* and coconut-husk fiber. Special nets called for special cordage, e.g., undressed *hau* bark was used for shark nets, and *ahu'awa*, a sedge, was used to make the large-mesh turtle nets.

Hawaiians used a variety of nets: gill, seine, hand scoop, including a two-handled type; dip; and many types of bag nets. The mesh differed with the use of the net; mesh gauges (*hāha ka 'upe-na*) were made of various materials, including ones of *naio* wood and bamboo. Most netting needles or shuttles (*hi'a*) and net menders (*kī'o'e*) were made of some wood, usually *kauila* or *naio*. Net floats (*pīkoi*) were made of a light wood such as *hau*, and less frequently of *wiliwili*; *kukui* wood was also used at times.

It has been mentioned that twined baskets were used for fish traps. The permanent traps made of the 'ie'ie aerial roots, were of three distinct types: low, circular traps with the entrance above; long, cylindrical traps with openings at the ends; and funnel-shaped traps with the small end closed. Each type was used to catch a different fish, from large sea fish to fresh-water stream fish and shrimps. Temporary twined fish traps were made of the *po-huehue*, the beach morning glory vine (Plate VI).

Although other materials such as pearl shell, human and dog bones, and turtle shell were much preferred for fishhooks, wood was also used. For the large shark hooks a combination of a hard wood and bone, or such a wood alone was used, the woods being those of *uhiuhi*, *alahe'e*, *koai'e*, and 'āweoweo. The bone points of shark hooks were lashed to the point limb (shank) and the snood fibers were fixed to the shank with *olonā* cordage or strips. To hide the coarse appearance of the above lashings, and to give a finished look to the hook, these were hidden with a cover woven of *olonā* fiber.

In Hawaii, contrary to the rest of Polynesia, hooks and lines were kept in gourd or *kou* containers fitted with covers.

As with most other primitive peoples, the Hawaiians used hundreds of plants as medicinal herbs; more often than not these were used in combination rather than alone. The art of compounding remedies in the practice of medicine (*lapa'au*) was performed by the medicinal experts known as *kahuna lapa'au*. Among the many prescriptions for internal use were the infusions of plant parts prepared for "general debility", or the teas used to "purge the blood". One of the most common diseases of children was 'ea, known to us as thrush, for which there were many cures, using the parts of several different plants. The Hawaiians seem to have suffered frequently from respiratory ailments since there are many cures recorded for these. For cuts, sores, skin irritation, and eruptions, leaves of numerous plants were macerated and applied as poultices. Young leaves and flower buds of various plants were used as laxatives; others, including the starch made from the tuber of the Polynesian arrowroot, *pia* (Plate I), served as an anti-diar-

rheal medicine.

Sugar cane (Plate I) was generally used in a prescription simply for sweetening but was sometimes used because of its own therapeutic properties. Plant material was measured in several ways. A dose, or *mahele la'au*, was measured in a cup made from a half shell of a coconut. Leaves and stems were either counted, i.e., determining the number of leaves which could be fitted into the hole formed by arching the forefinger against the thumb of one hand, or measured by handfuls.

I have already mentioned the large hula drum, the knee drum, and the rattles made from the coconut tree. Other musical instruments (Plate VII) were the nose flute, *'ohe hano ihu*; the pipes, *'ohe ka'eke'eke* used for beating time for a particular hula; and the rattle, *pū'ili*, also used to accompany another hula—all three made from bamboo. Made from the beautiful wood of the *kauila* tree (an endemic plant related to the buckthorn family) were the hula sticks termed *kā-la'au*, made in pairs and beaten together to give time for a special hula. These sticks were either long, up to five or six feet, or short, seven to ten inches. The *ipu hula* or *pāipu* drums, also used to beat the rhythm for the dancers of the *hula kuolo*, were made from gourds, i.e., two joined together; these were peculiar to Hawaii, being found nowhere else in Polynesia. Also made from gourds were nose flutes, *ipu hōkiokio*; these were small and usually pear-shaped and unique to Hawaii. They were referred to as lovers' whistles since they were used to entertain one another, especially in the evening. The *'ulī'ulī*, probably the best known of the hula rattles, was preferably made of gourds but sometimes of coconut shells. Hawaiians had a musical bow, or *'ūkēkē*, made of a long, narrow, thin piece of *kauila* wood. It had two or commonly three strings. One end of the bow was placed in the mouth which acted as a resonance chamber when the strings were strummed.

Other devices made from plant materials and designated as musical instruments should rather be classed as toys. These include bull-roarers, *oeroe* (Plate VII), made from a coconut, as already mentioned, or a *kamani* nut; the ti-leaf whistle, *pū lā'i*; and a type of Jew's-harp, *ni'au kani*. The sounding part, or vibrator of this last instrument was made of a piece of the midrib of a coconut leaflet, with a thin piece of bamboo serving as the reed.

The ancient Hawaiians had a large number of games for both adults and children in which they used such articles as whistles, bull roarers and rattles; these have already been treated under musical instruments.

Children's games involving plant material included swinging morning-glory vine (*lele koali*); walking on stilts (*kukuluāe'o*); flying kites (*ho'olele lupe*) made of a *hau* framework covered with *kapa* or plaited *lau hala*; spinning tops (*hū*) made of *kukui* nuts with bamboo splinters for stems; and playing with balls (*kinipōpō*) made of plaited coconut leaflets, or of *lau hala*.

Adult recreation included two games which today are played primarily by children around the world, i.e., the loop and ball game (*pala'ie*) (with the loop and handle braided of the mid-ribs of coconut leaflets and the ball made of *kapa*), and the making of string figures (*hei*). Probably the string used for both these games was banana fiber cordage (Plate VIII).

The adult Hawaiian enjoyed guessing games such as *no'a* and *pūhenehene*, where a small piece of wood or stone was hidden under one of individual bundles of tapa placed beside each of two groups of facing players, or momentarily, in the case of *pūhenehene*, under one sheet of tapa spread between the two rows. *'Ume* was an indoor sitting game similar to some of our present-day games. It was played by commoners and chiefs of lower degree who arranged themselves in a circle, with participants consisting of both sexes. A man called the *mau*, standing within the circle, would tap the "it" man and woman with a wand made of *kauila* wood. *Kilu* was an aristocratic form of *'ume*, played only by the *ali'i*, i.e., the nobility, of both sexes, who were seated at opposite ends of the recreation house. A kind of quoit, *kilu*, made of an obliquely-cut gourd or coconut shell was cast with a sliding motion across the matted floor in an effort to strike the *kilu* of an opponent.

In a type of game of darts or javelins, these were thrown underhand along the ground; either a long dart, *pahe'e*, or a short one, *moa*, both made of a "heavy wood" (probably *kauila*), was used (Plate VIII).

Shooting mice with a bow and arrow (*pana 'iole*) was a sport practiced by the *ali'i*, in a place somewhat like a cock pit; the bow was made of some "pale hard wood", probably *'ūlei*, and the bow string, usually of 3-ply *olonā* cordage. The arrows were made from sugar-cane flower stalks, pointed with hard *kauila* wood or bone (Plate VIII).

A pastime (*ke'a pua*) engaged in by men, women and children when sugar cane was in flower was the throwing of a dart made of a dried cane-flower stalk. The dart was so thrown as to ricochet off the throwing mound, so causing the former to soar gracefully away. In a variant of this game, a whip stick made of a rod of thin bamboo and fitted with a cord (probably *olonā*) was used to cast the dart (Plate VIII).

Sports included spear throwing with a lightweight *hau* spear, called *kāhau*, and with a heavier spear, *lono-maka-ihe*. Fencing with spears was called *kākā lā'āu*. A type of sham fighting, *kaua kio*, was done with blunted spears. Such training prepared young men to become warriors.

The simplest form of sled, used by boys, was the leaf-head cluster of the *ti* plant with part of the stalk; the latter, held between the legs, was used to guide the sled as it sped down a wet grassy slope. Adults used a highly specialized wooden sled (*papa hōlua*); this sport (*hōlua*) was limited to the male *ali'i*. The sled was long and

unusually narrow. Materials used included bamboo, used as cross pieces; *lau hala* matting for the cover; tapa from *wauke*; cordage, probably made of *olonā*; and the hard woods *māmane* and *uhiuhi* for the runners (Plate VIII). The sledding track (*holo hōlua*) was made on the slope of a hill and consisted of a rock foundation, surfaced with soil; at the time of use, the rocks were covered with grass oiled with *kukui*-nut oil to make it slippery.

From time immemorial, Polynesians have ridden waves no matter how high or how rough. Body surfing, *kaha nalu*, was a great sport, but it was with the surfboards (*papa he'e nalu*) the Hawaiians made and used that surfing here reached its highest development in Polynesia. The Hawaiians had a shorter thinner board, *alaia*, made of *koa* or breadfruit wood and used for waves near to shore, as well as the longer one, made of the light *wiliwili* wood (Plate VIII).

In Hawaii, unlike the rest of Polynesia, the most popular weapon of war was the spear of which there were two types, both made of such a hard wood as *kauila*. The long spear, nine to eighteen feet in length, with a circular cross-section of the shaft of 1.5-2.0 inches in diameter, was called *pololū*. It had a blade point formed by trimming down one end of the round shaft into four planes which formed cutting edges; the actual point was formed by curving these edges into a medial point. The butt end of the *pololū* was thicker than the shaft and was shaped in one of a number of forms. These were usually four-sided, making a rectangular cross section, or remained circular. These butt enlargements were either plain or trimmed to make for a smooth grip, or to create unique types (Plate IX).

The short spears (*ihe*), also all-wood, were used for both thrusting and throwing, with the point either barbed or unbarbed. *Ihe* were five to eight feet in length, and had an average diameter of 1.3 inches (Plate IX).

The Hawaiians were unique among Polynesians in having a dagger (*pāhoa*) as a distinct weapon; these also were all-wood. There were five types: the truncheon, the bludgeon, the long-bladed, and the curve-bladed daggers of *olonā*, some of which were fitted with wrist loops. Hawaiian clubs (*lā'au pālau*) were rather crude, probably because of the Hawaiians' preference for spears and daggers. Clubs were of three types, dependent upon the form of the head: smooth, rough, and stone-headed. The whole club of the first two, and the handle of the third were made of the hard woods *kauila* and *uhiuhi*. Other clubs used as weapons had handles made of *kauila* wood on which were fastened shark teeth by one of five methods. In another weapon utilizing shark teeth, these were lashed to cordage made of coconut husk or *hau* fibers (Plate IX).

A peculiar weapon of the Hawaiians was the weighted rope thrown at an opponent's leg to trip him. This tripping weapon (*pī-koi*) consisted of a wooden weight, with or without handle, to

which a long cord was attached. The wooden portion was made of *olo pua* or *kauila* wood while the cord was made of *olonā* fiber (Plate IX).

Treatment of bodies at death and in burials involved such plant materials as *tapa* for wrapping the whole body or cleaned bones (this bundle was, in turn, sometimes wrapped in a *lau hala* or sedge mat), and cordage made from the inner bark of *hau* for holding the bundle in place. This cordage was also used to tie the body in a flexed position, which was the method most frequently used for the common people. The wrapped body was simply carried in a sling made of bands of *tapa* or *hau* fiber cordage attached to the middle of a carrying pole, or in a stretcher (*mānele*) made of two carrying poles with short cross pieces tied to them. Occasionally the bier was a half canoe in which the body, flexed and wrapped in *tapa*, was laid with a pillow of moss beneath the head.

The burial of a chief was carried out in secrecy to avoid the desecration of the bones through stealing and making of fish hooks by an enemy. When the bearers who took part in the burial (at night) returned from their task a priest sprinkled them with water containing some seaweed. Since the *kapu* of death infected all the belongings of the deceased, the *tapa* cover-sheets, clothing, and *lau hala* pillows were buried with him. Burial was in caves, in the sand or earth, in stone cists, and in platform tombs.

Of special interest are the sennit caskets (*kā'ai*) woven to hold the bones (primarily of royalty), peculiar to Hawaii. The material used was well-made, five-ply braid of coconut-husk fiber, woven by a peculiar technique. The casket, in the form of a truncated human form, had a head, neck, and a somewhat cylindrical body without arms or legs (Plate IX).

This, then, is the story, rather sketchily related, of the importance of plants in the lives of one primitive people, the Hawaiians. It is hoped that as you leave off listening, you will have much appreciation for a people who have left us *all*, not only their "blood" descendants, such a rich heritage.

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