

THE MULE

This man-made animal is nearing extinction under the impact of mechanization. Its biology goes considerably beyond the mere fact that it is the result of a cross between a donkey and a horse.

by Theodore H. Savory

Late in the 19th century the American Populist leader Ignatius Donnelly said of his Democratic opposition: "The Democratic party is like a mule—without pride of ancestry or hope of posterity." The phrase is memorable, but it is both unfair and inaccurate. It is unfair because, although a mule is the result of a cross between a male donkey and a female horse, the care with which the breeder chooses both parents is quite enough to afford the offspring a genuine pride of ancestry. It is inaccurate because, although male mules are sterile and indeed without hope of posterity female mules can and do successfully produce foals. Donnelly was also gratuitously unkind: few of the hybrids created by man have been economically more valuable or biologically more interesting than the mule.

The origin of the mule is difficult to determine, but the practice of breeding the animals is at least 3,000 years old. So is the breeding of the hinny: the offspring of the reciprocal cross, between a female donkey and a male horse. Mules were known in the Holy Land before the time of King David, replacing the donkey as the royal beast. We read in II Sam. (13:29): "Then all the king's sons arose, and every man gat him up upon his mule, and fled." The animal was well known to Homer; not only does a famous line in the *Iliad* conjure up the animals in motion but also the poet records the arrival of mules from Henetia in Asia Minor, where breeding them was a local specialty. Mules were also bred in Homeric Greece and were widely used as draft animals and in farming. In later days they were raised in many areas of the Peloponnesus, particularly in Arcadia, and harness races for mules, started at Olympia in 500 B.C., continued to be run for more than 50 years. The Greek word for mule was *hemionus*, that is, "half-ass," and the word for a female donkey was *muchlos*, whence came the Latin *mulus* and the English *mule*.

Mules were cosmopolitan animals long before the Renaissance; as early as A.D. 1274 Marco Polo praised the Turkoman mules he encountered in central Asia. By the 18th century the breeding of mules was a flourishing industry in Italy, Spain and France. For many years the chief European center was the French province of Poitou, where every year some 50,000 animals were bred. Heavydraft mules were in demand for farm work, and a local breed of stud donkey, which had unusually large legs and hooves, was in high favor. The French distinguish between the masculine mule (*le mulet*) and the feminine (*la mule*). Two other phrases have been contributed to that language by the mule industry. The hinny is known as *le bardot*, and the phrases are *etre le bardot*, which we might render as "to be a laughing-stock," and *passer pour bardot*, meaning "to crash the gate."

In America and Britain the mule was not much appreciated until late in the 18th century. In Britain the chief demand for mules was for service in the army in India and elsewhere abroad. Among the first in America to encourage the use of mules was George Washington, who had been given a large Spanish ass, named "Compound," by the king of Spain. In 1786 Washington advertised the animal's services in a Philadelphia journal. Compound's stud fee for serving horses was a third less than it was for serving donkeys; the father of his country, foreseeing the value of mules to the American farmer, chose this practical means of making his opinion known.

A large number of donkeys were subsequently brought to America from Spain. In the decade between 1850 and 1860 alone the number of mules in the country increased 100 percent. More than 150,000 mules were foaled in the year 1889; by then the animals had most entirely replaced horses for farm work in many areas.

In the years before Mendel's discoveries made known the principles of heredity, experimental hybridists failed to grasp the essentials of their results because they were described in broad, overall terms rather than being focused on some single pair of contrasting characteristics. Hence the mule was the subject of a number of vague and even inaccurate generalizations. For example, it was said, as it still is today by a few dog-fanciers, that the contribution of the female to its offspring was negligible and that the male parent was the one that must be critically selected. In contrast, the mule breeders of Kentucky always brought the best cart-horse mares to stud and found that this practice consistently gave the best results.

A generality with somewhat more truth to it is the dictum that the mule resembles its male parent at its extremities, namely in the ears, the legs and the tail. Spanish donkeys, frequently used as studs, are notable for their rather delicate legs and feet, which may account for another general comment: that the mule has the appearance of a horse's body mounted on the legs of an ass. The grain of truth in the first dictum led, as we have seen, to the use of a line of donkeys with unusually large legs and hooves as the studs in Poitou. Another descriptive comment, once common among British troops, is that mules look like asses in front and like horses behind. Underlying all such remarks is the fact that by selective breeding the mule can to some extent be tailored to suit whatever purpose is intended.

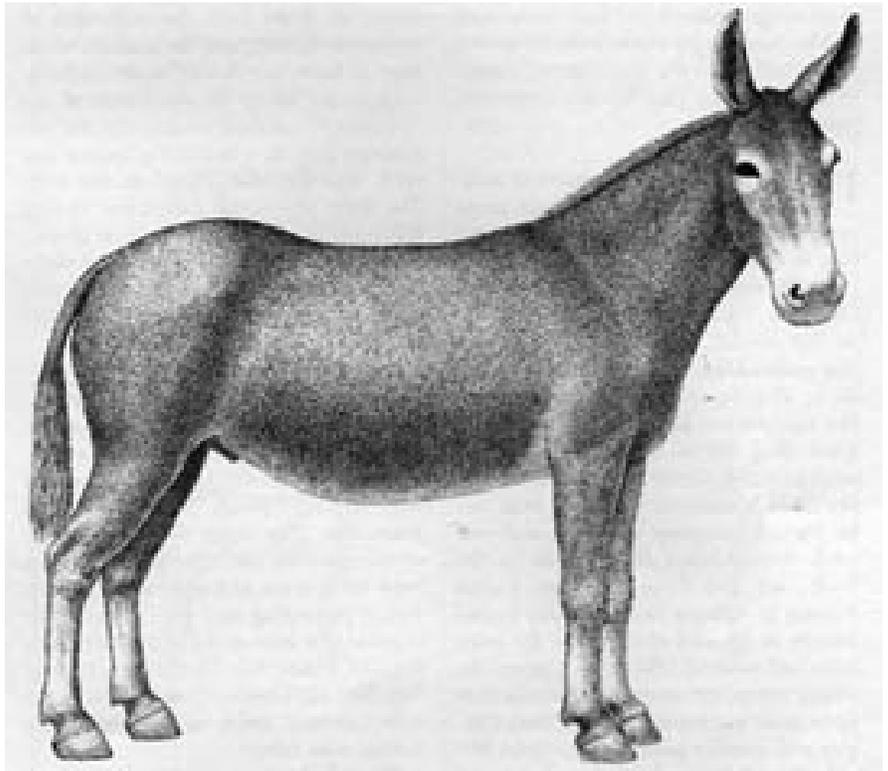
In height at the withers mules range between 12 and 17.5; hands (between four feet and five feet 10 inches). The coat is uniformly colored, without "stockings" or blazes, and the neck and croup are shaped like those of a horse. The head, the ears, the tail and the short mane all resemble a donkey's. Like the legs of the donkey, the mule's legs do not show on their inner surface the growths of callus at knee and hock, called

“chestnuts,” that are characteristic of horses. The mule brays like a donkey.

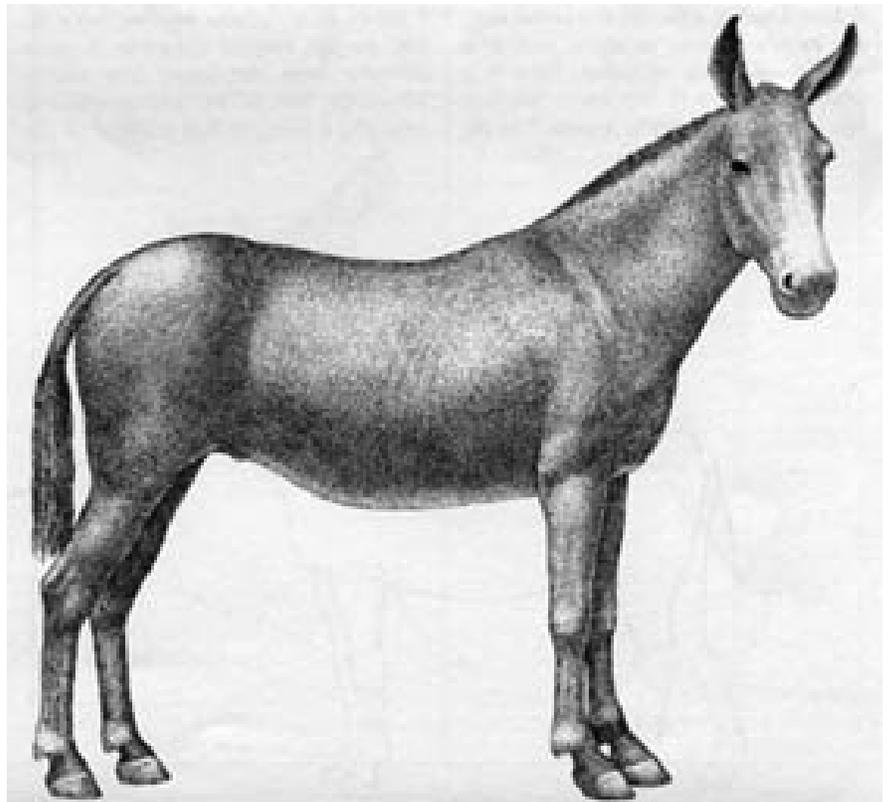
The mule has more than its share of admirable qualities. It is courageous and intelligent, hard of hide, sure of foot, sound of constitution and able to resist changes in climate and withstand thirst and hunger better than the horse. Such perfection must necessarily be marred by a few minor drawbacks. The mule is markedly sensitive around the head and does not enjoy having its ears fondled in this respect it differs from the horse and resembles its male parent. It will not accept injustice or irrational treatment but meets them with instant rebuff. The common phrase “a kick like a mule” shows how well known is the animal’s major means of protest. The mule can also be self-willed to the point of unreasonableness, as is attested by “stubborn as a mule.” Like their masters, however, mules acquire the unattractive traits of stubbornness and ill temper only when they have been badly brought up. They are essentially sensitive spirits in robust bodies, and when their early training has been sympathetically carried out, their behavior is incomparable.

The hinny, the hybrid of a female donkey and a male horse, grows in a smaller uterus, which may in part account for its lesser value. Its distinctive character was known to Pliny, who described it as *effrentis et tarditatis*, meaning “unrestrained and slow of movement.” The animal is more like a horse in general appearance, just as the mule is more like its male parent. Never as popular as the mule, the hinny has been bred in Ireland more than elsewhere. It has great stamina, trots well and is long-lived; owners of a first-class hinny are always enthusiastic about it.

Mules are bred for three basic tasks pack work, draft work and riding. The amount of work the animal can do varies with each role. The largest mules bred, certain crosses between dray mares and Poitou donkeys, stood between 17 and 17.5 hands high; they were favored for riding. Harnessed for draft work, the mule is not at its best before the plow, and the slow labor of agriculture in hot countries is more satisfactorily done by oxen. Teams of mules, however, are efficient wagon animals and have been used to haul loads everywhere from the snows of Antarctica to the superheated desert of Death Valley.

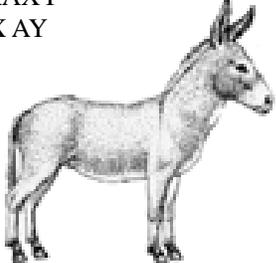
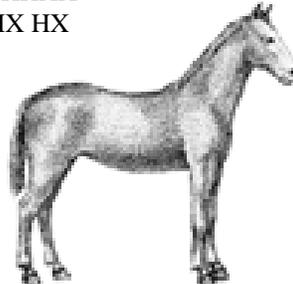
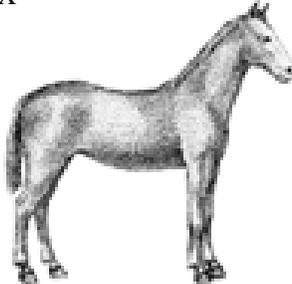
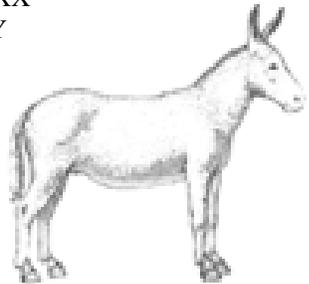
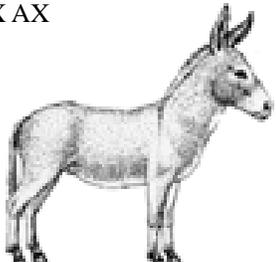
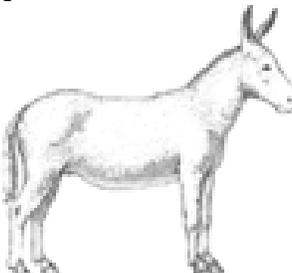
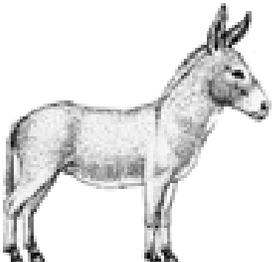
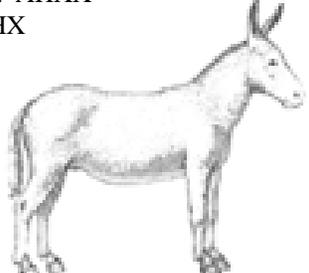
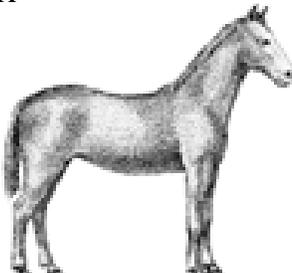
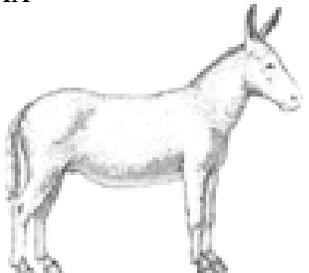
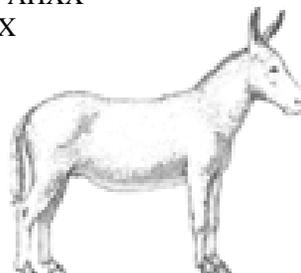
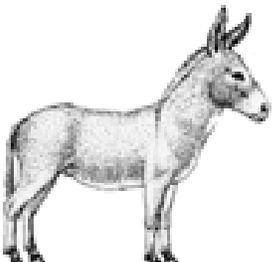


FAMILIAR HYBRID, the mule is the offspring of a female horse that has been mated with a male donkey. Mules resemble their male parent in size and shape of ears, legs and hooves, shape of tail and shortness of mane. Mules can range between 12 and 17.5 hands in height.



LESS FAMILIAR HYBRID, the hinny is the offspring of the reciprocal cross, the mating of a female donkey with a male horse. Hinnies are more horselike in appearance than mules. Far less frequently bred than mules, they are long-lived animals and noted for stamina.

PARENT

<p>MALE HORSE GENOTYPE: HHXY GAMETES: HX HY</p> 	<p>MALE DONKEY GENOTYPE: AAXY GAMETES: AX AY</p> 	
<p>FEMALE HORSE GENOTYPE: HHXX GAMETES: HX HX</p> 	<p>HORSES Female: HHXX Male: HHXY</p> 	<p>MULES Female: AHXX Male: AHXY</p> 
<p>FEMALE DONKEY GENOTYPE: AAXX GAMETES: AX AX</p> 	<p>HINNIES Female: AHXX Male: AHXY</p> 	<p>DONKEYS Females: AAXX Males: AHXY</p> 
<p>FEMALE MULE GENOTYPE: AHXX GAMETE: HX</p> 	<p>HORSES Female: HHXX Male: HHXY</p> 	<p>MULES Female: AHXX Male: AJHY</p> 
<p>FEMALE HINNY GENOTYPE: AHXX GAMETE: AX</p> 	<p>(UNKNOWN)</p>	<p>DONKEYS Female: AAXX Male: AAXY</p> 

PARENT

POSSIBLE CROSSES between horses and donkeys are indicated in this diagram, along with the natural (black) or hybrid (color) offspring to be expected from each cross. The genotypes and gametes of the parents are also shown. In addition to the sex-determining X and Y chromosomes, the nonsex chromosomes are indicated by the letter *H* for the horse and the letter *A* for the donkey. Male mules and hinnies have been omitted because both are sterile. Issue from the cross between hinny and horse is unknown.

It is as pack animals that mules of ordinary size, from 13 to 14.5 hands, come into their own. Starting when they are four or five years old, they will continue, to work well until they are 18 or 20. Carefully loaded, a mule can carry 300 to 350 pounds, including the weight of the packsaddle, and it normally covers 20 to 25 miles in a day's march. When the animals are pressed, they can do a good deal better. During the Indian wars in the American Southwest a number of mule endurance records were set. In 1882 a company of scouts and one pack train, loaded 200 pounds to the mule, set out from the San Carlos Agency in Arizona on a three-day forced march; at the end of that time the pack train had covered 280 miles. During the Garza campaign on the Rio Grande that same year, a company of the Third Cavalry and another pack train covered 108 miles in 16 hours, bettering the record for a day's march set the year before in New Mexico by a pack train that had traveled 85 miles under the desert sun in 12 hours.

As pack animals mules can be led or driven. Driving is usually the better way; the mule's hearing is acute, and it is readily controlled by voice. Thus it is said, "You can talk to a horse, but you can chat and whisper to a mule." In the American West both the acuteness of the mules' hearing and the

animals' tendency to form into "herds" under a dominant leader led to the perfection of the "bell mare" method of driving. An experienced mare, a bell slung around her neck, was the lead animal on the trail. The mare dominated the mules, so that following her was a natural herd action. Even when the mare was out of sight ahead, the mules farthest to the rear could follow the sound of the bell, moving contentedly behind in single file.

The mule's small hooves give it a sure-footedness that is invaluable in mountainous terrain. This was one reason for the large number of mules with the British forces in India. As readers familiar with Kipling's poem "Screw-guns" will remember, they were the usual means of transport for the light artillery. They were often shod as horses are. The custom of protecting their feet in some way or other is at least as old as Shakespeare's day. In *Henry VI: Part II* he writes of "my foot-cloth mule," a reference to the contemporary habit of wrapping the hooves with fabric.

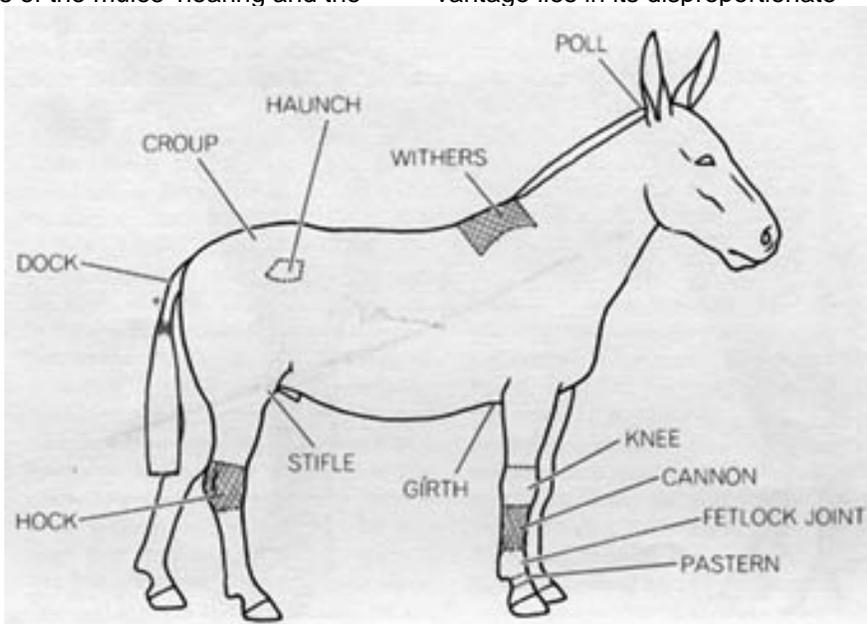
One of the favorable qualities characteristic of the mule is its quick power of recovery after strenuous effort. If a day's work has pushed it close to the limit of its strength, a night's rest seems to restore it completely and morning finds it ready to undertake another day's labor. In this respect the mule is quite different from the horse. The mule's advantage lies in its disproportionate

strength, a strength that is found in the anatomy of its hindquarters. This muscular development of the mule is of much greater practical value than show-ring conformation of shoulders and withers.

Manuals of animal management point out that mules and horses fundamentally need the same care. Although they say that mules can endure hunger and thirst better than horses can, and that mules are commonly supposed to eat less, they should receive the same rations as horses when subjected to the rigors of active service. A heavy-draft mule, for example, might be given 12 pounds of oats, 16 pounds of hay and eight pounds of straw a day; these quantities may be varied considerably for mules of a different type and in different circumstances.

As recently as 1966 British army instructions devoted six pages to the mule. Among other things, the reader was informed that in selecting a mule one should look for those with straight backs. The pages included information on feeding, watering, general care on the march or in fording or swimming rivers, and proper procedures in other emergencies of service. Perhaps with inspirational intent a statement is included that the Chinese have a reputation for taking great care of their mules. Nor is the humanitarian touch omitted: "When unsaddled," the instructions state, "mules should be allowed to roll, a proceeding they thoroughly enjoy."

Everyone who is interested in the history of Antarctic exploration is familiar with the tragic end of Robert Falcon Scott and his party, but few remember that the sledges of the relief expedition that reached Scott's tent were drawn by mules as an alternative to Manchurian ponies seven mules had been sent from India to Ross Island in 1912. They were brought to first-rate condition, and on October 30 they set out on their journey, each mule pulling a sledge load of 700 pounds. They soon showed the mulish characteristic of refusing to eat when disturbed. It is recorded that they neglected their rations of corn but at times ate sugar, tea leaves and tobacco ash. On one occasion two of them devoured a headrope between them. For 30 days the mules virtually starved themselves, two reaching the limit of



SELECTED FEATURES of equid anatomy are indicated on this outline drawing of a mule. The mule differs from the horse in its donkey-like appearance and in lacking the growths of callus, known as "chestnuts," found on the inner surface of horses' legs at hock and knee.

their endurance and dying. The other five returned safely to Cape Evans, where sad to relate they were shot in January, 1913.

During World War I many men made the acquaintance of mules for the first time, and many mules had their first encounter with partially trained drivers. The consequences were inevitable: only the more fortunate animals were given

the expert and kindly treatment to which they always respond. Their services were well appreciated and ended only too often in events belying the tradition that "one never sees a dead mule." The others responded to their amateur stablemen with their teeth and heels, a form of reprisal the British soldier accepted with good humor. Such encounters were the inspiration for a *Punch* cartoon in 1916 showing a group of tethered mules. The animals are depicted in escalating stages of mirth as one of their number takes vengeance first on a corporal, then on a veterinarian, then on a staff officer and finally on the regimental commander.

A lasting example of how mules have impressed their character on the minds of the men who have known them is a monument that stands in the Swiss town of Sion. Mules have long been the mainstay of agriculture in that region. The time came not long ago when the last mule was superseded by machine, whereupon the farmers of the neighborhood joined together and erected the memorial that will for years to come testify to the debt they and their forebears owed to generations of hardworking mules.

I have not yet forgotten the circumstances that required me to hear three times the same lecture on the care of mules that was given to each section of a Royal Field Artillery battery many years ago. On each occasion the veterinary officer, emphasizing his advice with more than a little eloquence, had the following to say about watering a mixed body of horses and mules:

"Horses are more
Particular about their food and less
Particular about their water than
mules;
Mules are less
Particular about their food and more

Particular about their water than
horses;
Hence,
If you have to water
A mixed force
Of horses and mules,
Water your mules first."

Perhaps the officer did not notice that his advice, if it is printed as it is above, comes near to being poetry. It is said that "poetry is memorable speech," and this speech was memorable. I have often wondered who wrote it.

A more conscious poetic effort involving the mule appears, as I have noted, in the *Iliad*. The scene comes as a party from the Greek camp ascends the mountains to gather wood for the fallen Patroclus' funeral pyre. The lines, as rendered by A. T. Murray, run:

". . . and before them went the
mules; And ever upward, downward,
sideward and aslant they fared."

Here is the sound in Greek of the second line, the stress of the meter (dactylic hexameter) indicated by the accents: *Polla d'ananta katanta paranta te dochmia t'elthon*. It is an almost perfect onomatopoeic reproduction of the clatter of mules' hooves on a mountain trail.

What is the exact reason for the sterility of the male mule? In 1913 H. Federley showed that this condition results from a failure of sperm production by meiosis, the type of cell division that gives rise to germ cells. Specifically the failure occurs at the stage of synapsis, when the chromosomes of maternal and paternal origin come together. Male mules and male hinnies will readily mount female mules, hinnies, horses or donkeys, but there is no record that such mating has ever resulted in offspring. As a matter of fact, male mules and male hinnies are usually gelded early in life, since such mating behavior is pointless and a nuisance in the stable and the pasture. This guarantees that the animals are without hope of posterity.

Female mules, however, are less consistently sterile than males, and when they are served by male horses

or donkeys, they may sometimes conceive. Conception is usually followed by a slipping, or miscarriage, of the fetus, but very occasionally a foal is carried to its full term of 10.5 months. The rarity of this accomplishment is recognized in the old Latin phrase *cum mula peperit* ("when a mule foals"), which might be rendered today as "once in a blue moon." Such occasional foals are of two kinds. If the sire was a donkey, they are mules like their mother; if it was a horse, they are horses like their father.

Fertility is even rarer among female hinnies than among mules, or perhaps records of hinny foals are scarcer because there have always been fewer hinnies in existence. Served by a horse, a female hinny produces nothing. Served by a donkey, she bears a typical donkey.

The instances of fertility among female hybrids of both crosses between the donkey and the horse are so few that it is impossible to be certain that they represent a general truth. If one accepts the risks of arguing from the particular to the general and the few facts are taken at their face value, however, the reproductive pattern can be interpreted in terms of simple genetics, as follows.

Let the nonsex chromosomes of the horse be represented by H and those of the donkey by A. When the sex chromosomes X and Y are added, a genetic formula for male and female horses will respectively be HHXY and HHXX, and the formula for male and female donkeys will be AAXY and AAXX. The breeding of mules can then be written: AAXYX HHXX=AHXX (female) or AHXY (male). The breeding of hinnies would be written: AAXXX HHXY=AHXX (female) or AHXY (male).

The subsequent mating between a male horse and a female mule should therefore follow the pattern HHXYX AHXX, with the offspring either AHXX, AHXY, HHXX or HHXY, which is to say both sexes of mules and horses. The failure of such matings to produce either AHXX or AHXY, that is, either of the mule sexes, can be explained by assuming that true mule ova (AX) are not present in female mules. This leads to the conclusion that the ova of the mule carry only horse chromosomes.

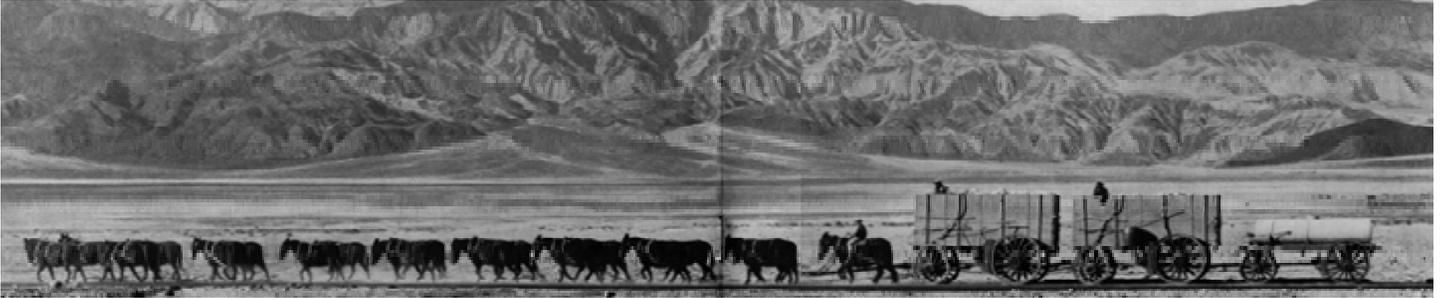
Similarly, the absence of horses from crosses between a donkey and a hinny is understandable if the ova of a hinny contain only donkey chromosomes. All the possible matings between horses, donkeys, mules and hinnies of both sexes are summarized in the attached illustration.

All of this does not, however, explain why the cross between a male horse and a female hinny yields no foals (which in theory would be mulelike). The probable truth is that opportunities to try this mating have arisen too seldom. Unlike fruit flies or mice, horses and donkeys are not suitable animals for experiments in genetics. They breed too slowly, they produce only one offspring at a time even when the breeding is successful, and they are too expensive to keep merely for research purposes. These considerations underlie the reason for each individual mule or hinny's being the offspring of a specially contrived mating. To complicate matters further, it is a curious fact that once a male donkey has served a female donkey, it is often reluctant to transfer its attentions to a female horse.

Under the impact of mechanization the mule has been steadily disappearing from agriculture, industry and transportation. This trend will undoubtedly continue. Worldwide mule-breeding statistics are not readily accessible, but the following figures for the U.S. are indicative. In 1920 the mule population was about 5.43 million. By 1931 the number had fallen to 5.13 million, by 1948 to 2.54 million and by 1954 to 1.6 million. A graph of these figures shows that the last three points lie on a straight line, indicating the complete extinction of mules in the U.S. sometime around 1958. This has not yet come to pass, but the outcome is unmistakable. In many ways it will be regrettable. Mules have played a worthy role in human affairs over much of the world for a considerable period, and they deserve a fate better than such an obscure drift toward oblivion.



UNITED STATES BORAX & CHEMICAL CORPORATION TWENTY-MULE TEAM



TWENTY-MULE TEAM hauls two freight wagons and a tank wagon in train through the forbidding terrain of Death Valley in California. The freight wagons are 16 feet long; their rear wheels are seven feet in diameter. Each weighs nearly four tons and can carry 10 tons of cargo. The water tank holds 1,200 gallons. The 20-mule teams were used in the 1880's to carry borax from Death Valley to the railroad at Mojave, 165 miles away. The United States Borax & Chemical Corporation uses the team as its trademark..