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Questions about the Breeding of Animals

[1840]

By

CHARLES DARWIN

With an Introduction by

SIR GAVIN DE BEER, F.R.S.

SOCIETY FOR THE BIBLIOGRAPHY OF NATURAL HISTORY
c/o British Museum (Natural History), Cromwell Road, London, S.W.7

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CHARLES DARWIN

Questions about the Breeding of Animals

[1840]

Facsimile

With an Introduction by

SIR GAVIN DE BEER, F.R.S.

lately Director, British Museum
(Natural History)

1968

LONDON

SOCIETY FOR THE BIBLIOGRAPHY OF NATURAL HISTORY

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INTRODUCTION

By Sir Gavin de Beer, F.R.S.

In his invaluable Darwin Bibliography,[1] R. B. Freeman describes the pamphlet *Questions about the Breeding of Animals* as the only one of Darwin's printed works which "in any form of its text, can surely be described as rare". He has not seen it reprinted, described, or mentioned in any work relating to Darwin, and the present occasion is therefore a fitting one for rescuing it from oblivion, especially as it is of great interest in itself.[2]

The pamphlet raises a number of problems. First, there is the date of its production. Next, it introduces a method of obtaining information of which Darwin made great use. Thirdly, it is an eloquent authentic document reflecting the state of ignorance of genetics at that date. Lastly, it serves as a round-up of the myriad questions which Darwin asked himself in his Notebooks on Transmutation of Species,[3] questions the answers to which should have been reflected in his Essay[4] of 1844 if he received any.

The Date of the Pamphlet

The date of the production of the pamphlet falls within a known time-bracket from the fact that it was issued from the address 12 Upper Gower Street. This was Darwin's

[1] R. B. Freeman, *The Works of Charles Darwin. An annotated bibliographical Handlist*, London: Dawsons of Pall Mall, 1965.

[2] The pamphlet consists of eight pages containing twenty-one numbered paragraphs in which there are forty-four queries. The type is set in one column on the inner side of each page, so that the inner margin is narrow and the outer margin wide, presumably to take the answers to the questions. There is no indication of printer, date, or place. The copy in the Zoological Library of the British Museum (Natural History) is the only one known, and is reproduced here in exact facsimile by kind permission of the Trustees.

[3] "Darwin's Notebooks on Transmutation of Species. Parts I to IV", edited by Sir Gavin de Beer, *Bull. Brit. Mus.* (*Nat. Hist.*) Historical Series, **2**, 1960, pp. 23–183; "Addenda and Corrigenda", edited by Sir Gavin de Beer and M. J. Rowlands, *op. cit.*, **2**, 1961, pp. 185–200; "Part VI. Pages excised by Darwin", edited by Sir Gavin de Beer, M. J. Rowlands, and B. M. Skramovsky, *op. cit.*, **3**, 1967, pp. 129–176. Hereafter referred to as "Notebooks".

[4] Darwin's Essay of 1844, reprinted in *Evolution by Natural Selection*, with a foreword by Sir Gavin de Beer, Cambridge at the University Press, 1958. Hereafter referred to as "Essay".

address from 1 January 1839 until 17 September 1842 when he went to live in the country at Down House in the village of Downe [*sic*], Kent. In the printed *Catalogue of the Books, Manuscripts, Maps and Drawings in the British Museum (Natural History)*, (Vol. VI. Supplement A–I. 1922) the pamphlet is dated "1840?". A search through Darwin's letters during this period tends to confirm this date.

In a letter[5] to his cousin William Darwin Fox, who was well informed on general matters relating to natural history, quoted by Francis Darwin as "written in June", without specifying the year, but printed on a page bearing 1838 in its heading, Darwin wrote: "I am delighted to hear you are such a good man as not to have forgotten my questions about the crossing of animals. It is my prime hobby, and I really think some day I shall be able to do something in that most intricate subject, species and varieties."

As it was only on 28 September 1838 that Darwin, on reading Malthus's *Essay on the Principle of Population*, saw how natural selection works,[6] before which time he refused to hazard his arm on this subject or speak to anyone about it at all, this letter to Fox cannot have been written in June 1838. While he started his Notebooks on Transmutation of Species in July 1837, his Journal shows that during that year, 1838, and during 1839 he was mostly engaged in geological work, preparing his books for publication, visiting and meditating on the Parallel Roads of Glen Roy, and editing the *Zoology of the Voyage of H.M.S. Beagle*. . . . There was also his marriage and the establishment of his home in Upper Gower Street. The letter must probably be dated June 1840, which agrees with the entry in the Journal[7]: "During the summer when well enough did a good deal of Species work."

In January 1841 Darwin[8] wrote again to Fox, saying, "I continue to collect all kinds of facts about 'Varieties and Species', for my some-day work to be so entitled; the smallest contributions thankfully accepted; descriptions of offspring between all domestic birds and animals, dogs, cats, &c., &c., very valuable." This is exactly what the pamphlet is about, and this letter to Fox was clearly a reminder—"I send you this P.S. as a memento"—of his former letter.

The Notebooks on Transmutation of Species, scribbled between July 1837 and July 1839, are riddled with queries about problems of breeding and crossing in plants and animals, hybridism, and inheritance. The pamphlet represents a consolidated questionnaire as regards the animal kingdom.

[5] *Life and Letters of Charles Darwin*, edited by Francis Darwin [hereafter referred to as *Life & Letters*], London: John Murray, 1887, **1**, p. 298.

[6] "Notebook III", MS p. 135; *op. cit.*, **3**, 1967, p. 162.

[7] "Darwin's Journal", edited by Sir Gavin de Beer, *Bull. Brit. Mus. (Nat. Hist.)* Historical Series, **2**, 1959, pp. 1–21; reference on p. 9.

[8] *Life & Letters*, **1**, p. 301.

The Questionnaire Method

In the Introduction to *Variation in Animals and Plants under Domestication*,[9] Darwin described his method: "In treating the several subjects included in the present and my other works, I have continually been led to ask for information from many zoologists, botanists, geologists, breeders of animals, and horticulturists, and I have invariably received from them the most generous assistance. Without such aid I could have effected little. . . . I cannot express too strongly my obligations to the many persons who have assisted me, and who, I am convinced, would be equally willing to assist others in any scientific investigation."

So it was a deliberate method, and Darwin might well be grateful to his correspondents for the information which they gave him, because he pursued them unmercifully with cataracts of questions. One of his most profitable quarries was William Bernhard Tegetmeier[10] who, for over twenty years, was continually bombarded with questions about breeds of fowls, Turkish fowls, Indian jungle fowls, rumpless fowls, eggs with chicks just hatching, down in young birds, owls' eggs, laughing pigeons, runts, carriers, skanderoons, rabbits, length of cats' teeth, bees, sex-ratios at birth, racehorse records, and what not besides.

The pressure which Darwin maintained was unrelenting, and must be regarded as a measure of that with which he attacked his subject, which occupied the entire focus of his mind to the exclusion of everything else. 21 November 1857: "Will you keep in mind Malay eggs?" 5 February 1860: "Have you quite thrown me over as too troublesome?" Next, he gets impatient, and on 27 February 1864 he asks for the return of a manuscript which Tegetmeier "has kept so long for him". 7 April 1865, Tegetmeier is asked to get Mr L. Wells to draw some fowls and to submit the drawings to Tegetmeier for his approval: this for the book on *Variation*. 16 January 1866, will Tegetmeier please ask Wells to hurry up with his drawings. 21 February 1868: "I suppose you are too busy a man to try whether a magenta-coloured pigeon would please or disgust his associates." The pigeon was to be stained. 18 April 1869, Darwin wants more information "if it would not cause you too much trouble"; he is ready to receive the eggs which Tegetmeier is to send him, "and the sooner the better". 14 May 1872: "Pray add to your kindness by hereafter telling me the sex of the single bird." 8 August 1875: "You have helped me, and can you do so again?"

Tegetmeier was far from the only quarry. Lawrence Edmondstone,[11] in the Shetland Islands, was asked, 11 September 1856, "Is the Rabbit wild in the Shetlands?. . . . A

[9] 1st ed., 1868, p. 14; popular ed., p. 16.

[10] Darwin's letters to W. B. Tegetmeier are preserved in the Library of the New York Botanic Gardens. A microfilm, obtained by Dr Sydney Smith, is in the Cambridge University Library, to the authorities of which I am grateful for communicating it to me.

[11] "Some unpublished letters of Charles Darwin", edited by Sir Gavin de Beer, *Notes & Records of the Royal Society*, **14**, 1959 [hereafter referred to as *Notes & Records*]; the reference is on p. 30.

Shetland specimen put in a jar with lots of salt would be a treasure to me. . . . I fear that you will think that you have fallen on a most troublesome petitioner." He got his rabbit. On 2 August 1857, the barrage continues,[12] introduced in a disarming way: "I thought I had already trespassed to a *quite* unreasonable extent on your kindness: but as you offer with so much good nature to assist me further, I will ask you my question, as I do not think that it can cost very much trouble." It was whether dun-coloured Shetland ponies have a black stripe along the spine.

Henry Tibbats Stainton[13] was at the receiving end of a barrage of questions about insects to which Darwin wanted answers for his work on sexual selection. 18 February 1858: "I am going to be very unreasonable and beg from you any little information which you can give me on some points, which can hardly fail to be very doubtful. I must trust to your kindness to excuse me." There follow seven questions. "Now you will think me, I fear, the most unreasonable and troublesome man in Great Britain; and I can hardly expect you to go seriatim through my queries. But I should be truly obliged for any hints, with permission to quote you."

So it went on, in one subject after another, with Darwin clinging like a leech to the problem on which he was at work. Nothing was allowed to stand in his way, and he realised this himself, as when he wrote[14] to Hooker: "It is an accursed evil to a man to become so absorbed in any subject as I am in mine." For a man as kind as he was, it was this absorption in his subject which blinded him to the probability that some of his correspondents must have shuddered when they received a letter bearing the Downe postmark.

Occasionally in his letters there is evidence of the insertion of questions in periodical journals. On 11 June and 20 June, he sends questions to the long-suffering Stainton[15] with the request that they be inserted and printed in *The Intelligencer*. On 20 December 1862, he tells Tegetmeier that he has published a query on the running powers of the penguin duck. While reaching a wider public, this method of publishing printed questions reduced the pressure on the recipient of a letter.

Apart from these insertions of isolated questions (a collection of which would be of great interest), there is evidence of two questionnaires, additional to the present pamphlet, printed in leaflet or pamphlet form. One of these relates to the expression of the emotions. On page fifteen of the book bearing this title,[16] Darwin reprinted sixteen questions which he said that he had circulated in 1867 to persons who had been in touch

[12] *Notes & Records*, p. 32.

[13] *ibid.*, p. 56.

[14] *Life & Letters*, **2**, p. 139.

[15] "Further unpublished letters of Charles Darwin", edited by Sir Gavin de Beer, *Annals of Science*, **14**, 1958, p. 107.

[16] *The expression of the Emotions in Man and Animals* . . ., London: John Murray, 1872.

with non-European peoples. The questions, with differences and an additional question, were reprinted by the Smithsonian Institution of Washington.[17]

The second questionnaire related to sexual selection in man. To David Forbes, Darwin wrote[18] in March 1868; "I forgot to remind you that any notes on the idea of human beauty by natives who have associated little with Europeans would be very interesting to me. Also if by any strange chance you should have observed any facts leading you to believe that the women of savage tribes have influence in determining which man shall steal them or buy them or run away with them I should much like to hear such facts. I have lately been sending the enclosed queries to all parts of the world and I send a copy to you." It would be pleasant to think that it was from this questionnaire that Darwin's attention was drawn to Captain Burton's observation, which Darwin included in *The Descent of Man*[19] with the words "The Somal men 'are said to choose their wives by ranging them in a line, and by picking her out who projects farthest *a tergo*.' " One wonders if this was the passage which, in a letter[20] to John Murray of 29 September 1870, Darwin agreed to a change in the text to make it less coarse. It does not appear that this questionnaire, or that on the expression of the emotions, has been found.

The Questions about the Breeding of Animals and their Answers

In the first edition of the *Origin of Species*, published in 1859, Darwin was still obliged to say[21] that "The laws governing inheritance are quite unknown", as, indeed, they were to remain, not only until Mendel's discoveries were rediscovered, but until their significance was appreciated,[22] in 1930. Darwin's statement means, in effect, that whatever replies he may have received to his questions about the breeding of animals (which will never be known, except, perhaps, for some references in his books, because all letters received by him before 1862 were destroyed by him), they failed to provide him with any valid theory. Here, all that can be attempted is to point out some passages in Darwin's Essay of 1844, his first round-up of information after broadcasting his questions about the breeding of animals, which reflect some of the questions asked in that pamphlet.

[17] *Annual Report of the Smithsonian Institution for 1867*, 1868, p. 324.

[18] *Notes & Records*, p. 33.

[19] 2nd ed., 1874 (and reprinted) p. 882.

[20] John Murray Archives, Darwin Letters, 212–213.

[21] p. 13. In the 6th ed. (1872, reprinted in World's Classics, p. 13) the sentence runs: "The laws governing inheritance are for the most part unknown." It is not clear what had been learnt during the interval.

[22] Appreciation of the significance of Mendel's discoveries and of the importance of the particulate nature of inheritance dates from Sir Ronald Fisher's *The Genetical Theory of Natural Selection*, Oxford at the Clarendon Press, 1930.

Question 1 is echoed by the section on "Crossing Breeds" in the Essay, but the answer eludes his correspondents (if any) and him: "When two well marked races are crossed the offspring in the first generation take more or less after either parent or are quite intermediate between them, or rarely assume characters in some degree new."[23] In other words, no answer.

Question 2 fares better in the Essay, though not in modern terms. "Although intermediate and new races may be formed by the mingling of others, yet if the two races are allowed to mingle quite freely, so that none of either parent race remains pure, then, especially if the parent races are not widely different, they will slowly blend together, and the two races will be destroyed, and one mongrel race left in its place. This will of course happen in a shorter time, if one of the parent races exists in greater number than the other."[24] This passage serves to show the impenetrability of the fog which the theory of blending inheritance imposed on biologists before Mendel's demonstration of particulate inheritance and Sir Ronald Fisher's equally important demonstration that variance in populations is conserved, subject to natural selection.

Question 3 relates to the efficacy in practice of artificial selection of variants. It is reflected in the "Summary of First Chapter" of the Essay[25]: "Races are made under domestication . . . by man's selecting and separately breeding certain individuals, or introducing into his stock selected males, or often preserving with care the life of the individuals best adapted to his purpose." This was the basis from which Darwin's whole system stemmed.

Question 4 brings up the subject of what Darwin called "Yarrell's Law". In his First Notebook on Transmutation of Species, Darwin wrote[26]: "Mr Yarrell[27] says that old races when mingled with newer, hybrid variety partakes chiefly of former."

"Yarrell's Law" underwent vicissitudes in Darwin's mind, even in the years 1838 and 1839. For instance, in the Second Notebook: "I am sorry to find Mr Yarrell's evidence about old varieties is reduced to scarcely anything—almost all imagination."[28] But in the Fourth Notebook: "Yarrell's Law must be partly true, as enunciated by him to me, for otherwise breeders who care only for first generations, as in horses, would not care so much about breed."[29]

It would be tedious to go through all the questions, which started from a false basis; but numbers 13 and 14 are worth a mention. They refer to telegony, the supposed

[23] Essay, p. 100.

[24] *ibid.*, p. 101.

[25] *ibid.*, p. 110.

[26] Notebook I, MS p. 138; *op. cit.*, **2**, 1960, p. 57.

[27] William Yarrell (1784–1856), zoologist, one of Darwin's oldest friends; he helped him to buy his kit for the voyage of the *Beagle*.

[28] Notebook II, MS p. 121; *op. cit.*, **2**, 1960, p. 94.

[29] Notebook IV, MS p. 112; *op. cit.*, **2**, 1960, p. 173.

appearance in offspring from a second mating of the characters of a first sire. The classical case of this error was that of "Lord Morton's mare", which, when crossed first with a quagga and later with a horse, produced by the horse a foal with striped legs. It was really bad luck on Lord Morton that in a certain percentage of cases, foals which have never had any quagga history in the dams out of which they were foaled by horses, have striped legs. Lord Morton's "Law" figures frequently in the Notebooks on Transmutation of Species.[30] It also appears in the Essay[31] of 1844, in all six editions[32] of the *Origin of Species*, and in *Variation in Animals and Plants*.[33] Some superstitions die very hard.[34]

The Recipients of the Pamphlet

There remains only one problem to consider: to whom did Darwin distribute this questionnaire, in 1840, when his circle of correspondents was still not very large, and most of his friends, not being breeders or farmers, would have been unable to answer them? What can they have thought of the questions, some of which are decidedly imperious, as, for instance, number 4 which ends like an examination paper with the words: "Please to mention in detail any instances you may be acquainted with." How did he distribute the pamphlet; was it through the post to selected addressees, or with the publications of the Zoological Society?

Darwin was not the only man to issue questionnaires. Francis Galton sent one[35] to men of science in 1873, asking for personal details of their lives, physical characters, and mental traits. There have been recent revivals of the practice, trying to arrive at the truth by the method of majority opinion.[36] Darwin's questions had at least the merit of objectivity.

[30] Notebook II, MS p. 98; Notebook III, MS p. 8, 152, 165, 168; Notebook IV, MS p. 79.

[31] Essay, p. 133.

[32] 1st ed., p. 165; 2nd ed., p. 165; 3rd ed., p. 183; 4th ed., p. 193; 5th ed., p. 201; 6th ed., p. 129; World's Classics ed., p. 168.

[33] 2nd ed., **1**, p. 435; popular ed., p. 518.

[34] Professor F. A. E. Crew, F.R.S., told me that when he was Head of the Animal Breeding Research Department at Edinburgh, he was consulted by the owner of a bull which had served a pedigree heifer whose owner sued him for damages on the grounds that the heifer was ruined for pedigree breeding. Professor Crew advised the owner of the bull to enter a counter-claim for contamination of the male.

[35] *Life & Letters*, **3**, p. 177.

[36] The questionnaire method has been used for grave abuses. Henri Corbières, of Paris, circularised men of science and asked them to contribute a letter, for him to print and publish, on whether science was compatible with morality. I replied declining to supply him with any such letter, because I rejected the method of aiming at truth by referendum. This did not prevent him from printing and publishing the letter in which I said this. A Belgian biochemist has sought to advance science by asking zoologists all over the world (on a basis of selection which is not clear) who, in their opinion, was the greatest living zoologist. I was fascinated to find myself listed in forty-first place in this non-competition.

QUESTIONS

ABOUT THE

BREEDING OF ANIMALS.

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1. If the cross offspring of any two races of birds or animals, be interbred, will the progeny keep as constant, as that of any established breed; or will it tend to return in appearance to either parent? Thus if a cross from the Chinese and common pig be interbred, will the offspring have a uniform character during successive generations, that is, as uniform a character, as the pure-bred English or Chinese ordinarily retains? Thus, again, if two mongrels, (for instance of shepherd dog and pointer) which are like each other, be crossed, will the progeny, during the succeeding generations retain the same degree of constancy and similarity, which might have been expected from pure-bred animals? Is it known by experience, that when an attempt has been made to improve any breed by a cross with another, that the offspring are apt to be uncertain in character, and that *unusual* care is required in matching the descendants of the half-bred among themselves, in order to keep the character of the first cross?—Always please to give as many examples as possible, to illustrate these *and the following* questions.

2. If by care, the character of half-bred animals (mongrels or hybrids) be pre-

served through some two, three, or more generations, is it then generally found, that the character becomes more permanent, and less care is required in matching the offspring? If this be so, how many generations do you suppose is requisite to form a mixed race, into what is ordinarily termed a permanent variety or well-bred race?

3. Supposing some new character to appear in a male and female animal, not present in the breed before, will it become more permanent, and less likely to disappear, after it shall have been made to pass through some successive generations, by picking out and crossing those of the offspring, which happened to possess the character in question?

4. In crossing between an old-established breed, or local variety, which from time immemorial has been characterized by certain peculiarities, or the animal in its aboriginal state, with some new breed, does the progeny in the first generation take more after one than the other? or if not so, is the character of one more indelibly impressed on the successive generations, than that of the other? Or, which is the same question, is the *breed* of the parents of more consequence, when a *breeding* animal is wanted, than when merely a fine animal is wanted in the *first* generation? The effect should be observed both in a female of the old race crossed by the new, and a female of the new crossed by a male of the old; for otherwise the greater or less preponderance of the peculiarities in the progeny might be attributed to the power of the sex, thus characterized in transmitting them; and not to the length of

time the breed had been so characterized. Thus to take an extreme example, we may *presume* that an Australian Dingo is an older breed than a pug-dog: if both were crossed with Spaniel bitches, would the litter in the one case more resemble the Australian, than in the other case the pug: and however this may be, would the pug, or Australian character be most persistent under similar circumstances in successive generations? How would this be in the various breeds of cattle? Thus if a Bull (or cow) of a breed which had long been known to have been white with short horns, were crossed with a black cow with long horns, (or Bull, if the first were a cow) which had accidentally sprung from some breed, not thus characterized, would there be any marked leaning in the character of the calves to either side; or would *successive* generations have a stronger tendency to revert to one than the other side? Please to mention in detail any instances you may be acquainted with.

5. What would the result be, in the foregoing respects, in crossing a wild animal with a highly domesticated one of another species, supposing the half cross to be fertile? Thus if a fox and hound were crossed with pointer-bitches, what would the effect be both in the first litter and in the successive ones of the half-bred animals? To form a judgment on this latter point, the subsequent crosses in each case should be relatively the same; thus the half-bred fox and half-bred hound should be recrossed with the pointer, or with some other, but the same breed.

6. Where *very* different breeds of the

same species are crossed, does the progeny generally take after the father or mother?

7. When two breeds of dogs are crossed, the puppies of the same litter occasionally differ very much from each other, some resembling the bitch and some the dog. In the mule between the ass and horse, this great variation does not appear commonly to occur. Do you know any cases, where two *varieties* have been often crossed, and *mongrels* have been uniformly produced similar to each other within small limits, and intermediate between their parents? And on the other hand, do you know of *hybrids*, between such animals as are generally considered distinct *species*, varying in this manner?

8. When breeds extremely different (as the grey-hound and bull-dog, the pouter and fantail-pigeon,) are crossed, are *their offspring* equally prolific, as those from between nearer varieties (such as from the grey-hound and shepherd-dog). Is the half-bred Chinese pig as prolific as the full-bred animal? Does a slight cross increase the prolifickness of animals?

9. Do you know of instances of any character in the external appearance, constitution, temper, or instinct, appearing in half-bred animals, whether mongrels or hybrids, which would not be expected, from what is observable in the parents?

10. In those rare cases, where hybrids *inter se* have been productive; have the parent hybrids resembled each other; or have they been somewhat dissimilar, partaking unequally of the appearance of their

pure-bred parents. Also, what has been the character of the progeny of such hybrids?

11. When wild animals in captivity, cross with domesticated ones, is it most frequently effected by means of the male or female of the wild one?

12. Amongst animals (especially if in a free, or nearly free condition,) do the males show any preference, to the young, healthy, or handsome females? or is their desire quite blind?

13. Where a female has borne young to two different breeds or kinds of animals, do you know of any instances, of the last born partaking of any part of the character of the first born, and to what extent?

14. When a female of one breed has been crossed by a male of another breed *several times*, do the last-born offspring resemble the breed of the father, more than the first-born, and therefore are they more valuable in those cases, where the peculiarity of the father is desired?

15. Do you know instances of any peculiarities in structure, present for the first time in an animal of any breed, being inherited by the grand-children, and *not by the children?* It cannot be said to be *inherited* without it appear in more than one of the grand-children, or without it be of an extremely singular nature; for otherwise it ought to be considered as the effect of the same circumstances, which caused it to appear in the first case.

16. What are the effects of breeding in-and-in, very closely, on the males of either quadrupeds or birds? Does it weaken their passion, or virility? Does it injure the secondary male characters,—the masculine form and defensive weapons in quadrupeds, or the plumage of birds? In the female does it lessen her fertility? does it weaken her passion? By carefully picking out the individuals most different from each other, without regard to their beauty or utility, in every generation from the first, and crossing them, could the ill effects of inter-breeding be prevented or lessened?

17. Where any animal whatever (even man) has been trained to some particular way of life, which has given peculiarity of form to its body by stunting some parts and developing others, can you give any instances of the offspring inheriting it? Do you know any such case in the instincts or dispositions of animals? If an animal's temper is spoilt by constant ill usage, or its courage cowed, do you believe the effect is transmitted to its offspring? Have any cases fallen under your observation, of quadrupeds (as cats or pigs, &c.) or birds (fowls, pigeons, &c.) born in this country, from a foreign stock, which *inherited* habits or disposition, somewhat different from those of the same variety in this country? If removed early from their parents, there are many habits, which we should be almost compelled to believe were inherited, and not learnt from them; and if transmitted to any half-breed we should feel sure of this.

18. Can you give any detailed account of the effects on the mind, instincts or dis-

position of the progeny, either in the first or in the succeeding generations from crossing different breeds, (for instance carrier and tumbler pigeons, grey-hounds and spaniels) or different species, (as fox and dog.) Do they show an aptness to acquire the habits of both parents? Or do they partake strongly of the habits of one side, (if so, which side?) with some peculiarity showing their hybrid origin? Or do they entirely follow one side?

19. Can you give the history of the production in any country of any new but now permanent variety, in quadrupeds or birds, which was not simply intermediate between two established kinds?

20. Do you know any cases of different breeds of the same species, (as of dogs &c.) being differently affected by contagious or epidemic diseases, and which difference cannot be attributed merely to a greater vigour in the one breed than in the other? In countries inhabited by two races of men, facts of this kind have been observed.

21. All information is valuable, regarding any crosses whatever, between different wild animals, either free or in confinement, or between them and the domesticated kinds; *equally so* between any different *breeds* of the same species, especially the less known kinds, as Indian with common cattle, different races of Camels, &c. Please to state all or any particulars, for what object the cross was made and whether it is habitually made; whether the female had offspring before; whether she produced as many of the half-breed at one birth, (if more than one be produced) as she probably would have done of the pure

breed; whether the progeny were fertile *inter se,* or with their parents whether they resembled one stock more than the other and in what respects, and which; and whether the favoured side was the male or female. State, if known, whether the progeny differ when stock (A) is the father and (B) the mother, and from what it does where (A) is the father and (B) mother. If the half-bred are fertile, *inter se* or with the parent stock, describe the offspring whether like their parents and all like each other, or whether they revert to either original stock, or whether they assume any new character?

C. DARWIN.

12, *Upper Gower Street, London.*