

The Perpetuation of Living Beings

Thomas H. Huxley

The Project Gutenberg Etext of The Perpetuation of Living Beings
#14 in our series by Thomas Henry Huxley

Copyright laws are changing all over the world, be sure to check
the laws for your country before redistributing these files!!!

Please take a look at the important information in this header.
We encourage you to keep this file on your own disk, keeping an
electronic path open for the next readers.

Please do not remove this.

This should be the first thing seen when anyone opens the book.
Do not change or edit it without written permission. The words
are carefully chosen to provide users with the information they
need about what they can legally do with the texts.

Welcome To The World of Free Plain Vanilla Electronic Texts

Etexts Readable By Both Humans and By Computers, Since 1971

These Etexts Prepared By Hundreds of Volunteers and Donations

Information on contacting Project Gutenberg to get Etexts, and
further information is included below. We need your donations.

Presently, contributions are only being solicited from people in:
Texas, Nevada, Idaho, Montana, Wyoming, Colorado, South Dakota,
Iowa, Indiana, and Vermont. As the requirements for other states
are met, additions to this list will be made and fund raising will
begin in the additional states. These donations should be made to:

Project Gutenberg Literary Archive Foundation
PMB 113
1739 University Ave.
Oxford, MS 38655

Title: The Perpetuation of Living Beings

Author: Thomas H. Huxley

Release Date: October, 2001 [Etext #XXXX]
[Yes, we are about one year ahead of schedule]

Edition: 10

The Project Gutenberg Etext of The Perpetuation of Living Beings
*****This file should be named thx0410.txt or thx0410.zip*****

Corrected EDITIONS of our etexts get a new NUMBER, thx0411.txt

Livros Grátis

<http://www.livrosgratis.com.br>

Milhares de livros grátis para download.

VERSIONS based on separate sources get new LETTER, thx0410a.txt

This etext was prepared by Amy E. Zelmer.

Project Gutenberg Etexts are usually created from multiple editions, all of which are in the Public Domain in the United States, unless a copyright notice is included. Therefore, we usually do NOT keep any of these books in compliance with any particular paper edition.

We are now trying to release all our books one year in advance of the official release dates, leaving time for better editing. Please be encouraged to send us error messages even years after the official publication date.

Please note: neither this list nor its contents are final till midnight of the last day of the month of any such announcement. The official release date of all Project Gutenberg Etexts is at Midnight, Central Time, of the last day of the stated month. A preliminary version may often be posted for suggestion, comment and editing by those who wish to do so.

Most people start at our sites at:

<http://gutenberg.net>

<http://promo.net/pg>

Those of you who want to download any Etext before announcement can surf to them as follows, and just download by date; this is also a good way to get them instantly upon announcement, as the indexes our cataloguers produce obviously take a while after an announcement goes out in the Project Gutenberg Newsletter.

<http://metalab.unc.edu/pub/docs/books/gutenberg/etext01>

or

<ftp://metalab.unc.edu/pub/docs/books/gutenberg/etext01>

Or /etext00, 99, 98, 97, 96, 95, 94, 93, 92, 92, 91 or 90

Just search by the first five letters of the filename you want, as it appears in our Newsletters.

Information about Project Gutenberg (one page)

We produce about two million dollars for each hour we work. The time it takes us, a rather conservative estimate, is fifty hours to get any etext selected, entered, proofread, edited, copyright searched and analyzed, the copyright letters written, etc. This projected audience is one hundred million readers. If our value per text is nominally estimated at one dollar then we produce \$2 million dollars per hour this year as we release fifty new Etext files per month, or 500 more Etexts in 2000 for a total of 3000+ If they reach just 1-2% of the world's population then the total should reach over 300 billion Etexts given away by year's end.

The Goal of Project Gutenberg is to Give Away One Trillion Etext Files by December 31, 2001. [10,000 x 100,000,000 = 1 Trillion] This is ten thousand titles each to one hundred million readers, which is only about 4% of the present number of computer users.

At our revised rates of production, we will reach only one-third of that goal by the end of 2001, or about 3,333 Etexts unless we manage to get some real funding.

Something is needed to create a future for Project Gutenberg for the next 100 years.

We need your donations more than ever!

Presently, contributions are only being solicited from people in: Texas, Nevada, Idaho, Montana, Wyoming, Colorado, South Dakota, Iowa, Indiana, and Vermont. As the requirements for other states are met, additions to this list will be made and fund raising will begin in the additional states.

All donations should be made to the Project Gutenberg Literary Archive Foundation and will be tax deductible to the extent permitted by law.

Mail to:

Project Gutenberg Literary Archive Foundation
PMB 113
1739 University Avenue
Oxford, MS 38655 [USA]

We are working with the Project Gutenberg Literary Archive Foundation to build more stable support and ensure the future of Project Gutenberg.

We need your donations more than ever!

You can get up to date donation information at:

<http://www.gutenberg.net/donation.html>

You can always email directly to:

Michael S. Hart <hart@pobox.com>

hart@pobox.com forwards to hart@prairienet.org and archive.org
if your mail bounces from archive.org, I will still see it, if
it bounces from prairienet.org, better resend later on. . . .

We would prefer to send you this information by email.

Example command-line FTP session:

```
ftp metalab.unc.edu
login: anonymous
password: your@login
cd pub/docs/books/gutenberg
cd etext90 through etext99 or etext00 through etext01, etc.
dir [to see files]
```

get or mget [to get files. . .set bin for zip files]
GET GUTINDEX.?? [to get a year's listing of books, e.g., GUTINDEX.99]
GET GUTINDEX.ALL [to get a listing of ALL books]

****The Legal Small Print****

(Three Pages)

*****START**THE SMALL PRINT!**FOR PUBLIC DOMAIN ETEXTS**START*****

Why is this "Small Print!" statement here? You know: lawyers. They tell us you might sue us if there is something wrong with your copy of this etext, even if you got it for free from someone other than us, and even if what's wrong is not our fault. So, among other things, this "Small Print!" statement disclaims most of our liability to you. It also tells you how you can distribute copies of this etext if you want to.

***BEFORE!* YOU USE OR READ THIS ETEXT**

By using or reading any part of this PROJECT GUTENBERG-tm etext, you indicate that you understand, agree to and accept this "Small Print!" statement. If you do not, you can receive a refund of the money (if any) you paid for this etext by sending a request within 30 days of receiving it to the person you got it from. If you received this etext on a physical medium (such as a disk), you must return it with your request.

ABOUT PROJECT GUTENBERG-TM ETEXTS

This PROJECT GUTENBERG-tm etext, like most PROJECT GUTENBERG-tm etexts, is a "public domain" work distributed by Professor Michael S. Hart through the Project Gutenberg Association (the "Project"). Among other things, this means that no one owns a United States copyright on or for this work, so the Project (and you!) can copy and distribute it in the United States without permission and without paying copyright royalties. Special rules, set forth below, apply if you wish to copy and distribute this etext under the Project's "PROJECT GUTENBERG" trademark.

To create these etexts, the Project expends considerable efforts to identify, transcribe and proofread public domain works. Despite these efforts, the Project's etexts and any medium they may be on may contain "Defects". Among other things, Defects may take the form of incomplete, inaccurate or corrupt data, transcription errors, a copyright or other intellectual property infringement, a defective or damaged disk or other etext medium, a computer virus, or computer codes that damage or cannot be read by your equipment.

LIMITED WARRANTY; DISCLAIMER OF DAMAGES

But for the "Right of Replacement or Refund" described below, [1] the Project (and any other party you may receive this etext from as a PROJECT GUTENBERG-tm etext) disclaims all liability to you for damages, costs and expenses, including legal fees, and [2] YOU HAVE NO REMEDIES FOR NEGLIGENCE OR UNDER STRICT LIABILITY, OR FOR BREACH OF WARRANTY OR CONTRACT, INCLUDING BUT NOT LIMITED TO INDIRECT, CONSEQUENTIAL, PUNITIVE OR INCIDENTAL DAMAGES, EVEN IF YOU GIVE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

If you discover a Defect in this etext within 90 days of receiving it, you can receive a refund of the money (if any) you paid for it by sending an explanatory note within that time to the person you received it from. If you received it on a physical medium, you must return it with your note, and such person may choose to alternatively give you a replacement copy. If you received it electronically, such person may choose to alternatively give you a second opportunity to receive it electronically.

THIS ETEXT IS OTHERWISE PROVIDED TO YOU "AS-IS". NO OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, ARE MADE TO YOU AS TO THE ETEXT OR ANY MEDIUM IT MAY BE ON, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Some states do not allow disclaimers of implied warranties or the exclusion or limitation of consequential damages, so the above disclaimers and exclusions may not apply to you, and you may have other legal rights.

INDEMNITY

You will indemnify and hold the Project, its directors, officers, members and agents harmless from all liability, cost and expense, including legal fees, that arise directly or indirectly from any of the following that you do or cause: [1] distribution of this etext, [2] alteration, modification, or addition to the etext, or [3] any Defect.

DISTRIBUTION UNDER "PROJECT GUTENBERG-tm"

You may distribute copies of this etext electronically, or by disk, book or any other medium if you either delete this "Small Print!" and all other references to Project Gutenberg, or:

[1] Only give exact copies of it. Among other things, this requires that you do not remove, alter or modify the etext or this "small print!" statement. You may however, if you wish, distribute this etext in machine readable binary, compressed, mark-up, or proprietary form, including any form resulting from conversion by word processing or hypertext software, but only so long as *EITHER*:

[*] The etext, when displayed, is clearly readable, and does *not* contain characters other than those intended by the author of the work, although tilde (~), asterisk (*) and underline (__) characters may be used to convey punctuation intended by the author, and additional characters may be used to indicate hypertext links; OR

[*] The etext may be readily converted by the reader at no expense into plain ASCII, EBCDIC or equivalent form by the program that displays the etext (as is the case, for instance, with most word processors); OR

[*] You provide, or agree to also provide on request at no additional cost, fee or expense, a copy of the etext in its original plain ASCII form (or in EBCDIC or other equivalent proprietary form).

[2] Honor the etext refund and replacement provisions of this "Small Print!" statement.

[3] Pay a trademark license fee to the Project of 20% of the gross profits you derive calculated using the method you already use to calculate your applicable taxes. If you don't derive profits, no royalty is due. Royalties are payable to "Project Gutenberg Literary Archive Foundation" the 60 days following each date you prepare (or were legally required to prepare) your annual (or equivalent periodic) tax return. Please contact us beforehand to let us know your plans and to work out the details.

WHAT IF YOU *WANT* TO SEND MONEY EVEN IF YOU DON'T HAVE TO?

The Project gratefully accepts contributions of money, time, public domain etexts, and royalty free copyright licenses. If you are interested in contributing scanning equipment or software or other items, please contact Michael Hart at: hart@pobox.com

*END THE SMALL PRINT! FOR PUBLIC DOMAIN ETEXTS*Ver.04.07.00*END*

This etext was prepared by Amy E. Zelmer.

THE PERPETUATION OF LIVING BEINGS, HEREDITARY TRANSMISSION AND VARIATION

by Thomas Henry Huxley

The inquiry which we undertook, at our last meeting, into the state of our knowledge of the causes of the phenomena of organic nature,--of the past and of the present,--resolved itself into two subsidiary inquiries: the first was, whether we know anything, either historically or experimentally, of the mode of origin of living beings; the second subsidiary inquiry was, whether, granting the origin, we know anything about the perpetuation and modifications of the forms of organic beings. The reply which I had to give to the first question was altogether negative, and the chief result of my last lecture was, that, neither historically nor experimentally, do we at present know anything whatsoever about the origin of living forms. We saw that, historically, we are not likely to know anything about it, although we may perhaps learn something experimentally; but that at present we are an enormous distance from the goal I indicated.

I now, then, take up the next question, What do we know of the reproduction, the perpetuation, and the modifications of the forms of living beings, supposing that we have put the question as to their origination on one side, and have assumed that at present the causes of their origination are beyond us, and that we know nothing about them? Upon this question the state of our knowledge is extremely different; it is exceedingly large, and, if not complete, our experience is certainly most extensive. It would be impossible to lay it all before you, and the most I can do, or need do to-night, is to take up the principal points and put them before you with such prominence as may subserve the purposes of our present argument.

The method of the perpetuation of organic beings is of two kinds,--the asexual and the sexual. In the first the perpetuation takes place from and by a particular act of an individual organism, which sometimes may not be classed as belonging to any sex at all. In the second case, it is in consequence of the mutual action and interaction of certain portions of the organisms of usually two distinct individuals,--the male and the female. The cases of asexual perpetuation are by no means so common as the cases of sexual perpetuation; and they are by no means so common in the animal as in the vegetable world. You are all probably familiar with the fact, as a matter of experience, that you can propagate plants by means of what are called "cuttings;" for example, that by taking a cutting from a geranium plant, and rearing it properly, by supplying it with light and warmth and nourishment from the earth, it grows up and takes the form of its parent, having all the properties and peculiarities of the original plant.

Sometimes this process, which the gardener performs artificially, takes place naturally; that is to say, a little bulb, or portion of the plant, detaches itself, drops off, and becomes capable of growing as a separate thing. That is the case with many bulbous plants, which throw off in this way secondary bulbs, which are lodged in the ground and become developed into plants. This is an asexual process, and from it results the repetition or reproduction of the form of the original being from which the bulb proceeds.

Among animals the same thing takes place. Among the lower forms of animal life, the infusorial animalculae we have already spoken of throw off certain portions, or break themselves up in various directions, sometimes transversely or sometimes longitudinally; or they may give off buds, which detach themselves and develop into their proper forms. There is the common fresh-water Polype, for instance, which multiplies itself in this way. Just in the same way as the gardener is able to multiply and reproduce the peculiarities and characters of particular plants by means of cuttings, so can the physiological experimentalist--as was shown by the Abbe Trembley many years ago--so can he do the same thing with many of the lower forms of animal life. M. de Trembley showed that you could take a polype and cut it into two, or four, or many pieces, mutilating it in all directions, and the pieces would still grow up and reproduce completely the original form of the animal. These are all cases of asexual multiplication, and there are other instances, and still more extraordinary ones, in which this process takes place naturally, in a more hidden, a more recondite kind of way. You are all of you familiar with those little green insects, the 'Aphis' or blight, as it is called. These little animals, during a very considerable part of their existence, multiply themselves by means of a kind of internal budding, the buds being developed into

essentially asexual animals, which are neither male nor female; they become converted into young 'Aphides', which repeat the process, and their offspring after them, and so on again; you may go on for nine or ten, or even twenty or more successions; and there is no very good reason to say how soon it might terminate, or how long it might not go on if the proper conditions of warmth and nourishment were kept up.

Sexual reproduction is quite a distinct matter. Here, in all these cases, what is required is the detachment of two portions of the parental organisms, which portions we know as the egg and the spermatozoon. In plants it is the ovule and the pollen-grain, as in the flowering plants, or the ovule and the antherozoid, as in the flowerless. Among all forms of animal life, the spermatozoa proceed from the male sex, and the egg is the product of the female. Now, what is remarkable about this mode of reproduction is this, that the egg by itself, or the spermatozoa by themselves, are unable to assume the parental form; but if they be brought into contact with one another, the effect of the mixture of organic substances proceeding from two sources appears to confer an altogether new vigour to the mixed product. This process is brought about, as we all know, by the sexual intercourse of the two sexes, and is called the act of impregnation. The result of this act on the part of the male and female is, that the formation of a new being is set up in the ovule or egg; this ovule or egg soon begins to be divided and subdivided, and to be fashioned into various complex organisms, and eventually to develop into the form of one of its parents, as I explained in the first lecture. These are the processes by which the perpetuation of organic beings is secured. Why there should be the two modes--why this re-invigoration should be required on the part of the female element we do not know; but it is most assuredly the fact, and it is presumable, that, however long the process of asexual multiplication could be continued, I say there is good reason to believe that it would come to an end if a new commencement were not obtained by a conjunction of the two sexual elements.

That character which is common to these two distinct processes is this, that, whether we consider the reproduction, or perpetuation, or modification of organic beings as they take place asexually, or as they may take place sexually,--in either case, I say, the offspring has a constant tendency to assume, speaking generally, the character of the parent. As I said just now, if you take a slip of a plant, and tend it with care, it will eventually grow up and develop into a plant like that from which it had sprung; and this tendency is so strong that, as gardeners know, this mode of multiplying by means of cuttings is the only secure mode of propagating very many varieties of plants; the peculiarity of the primitive stock seems to be better preserved if you propagate it by means of a slip than if you resort to the sexual mode.

Again, in experiments upon the lower animals, such as the polype, to which I have referred, it is most extraordinary that, although cut up into various pieces, each particular piece will grow up into the form of the primitive stock; the head, if separated, will reproduce the body and the tail; and if you cut off the tail, you will find that that will reproduce the body and all the rest of the members, without in any way deviating from the plan of the organism from which these portions have been detached. And so far does this go, that some experimentalists have carefully examined the lower orders of animals,--among them the Abbe Spallanzani, who made a number of experiments upon snails and salamanders,--and have found that they might mutilate them to an

incredible extent; that you might cut off the jaw or the greater part of the head, or the leg or the tail, and repeat the experiment several times, perhaps, cutting off the same member again and again; and yet each of those types would be reproduced according to the primitive type: nature making no mistake, never putting on a fresh kind of leg, or head, or tail, but always tending to repeat and to return to the primitive type.

It is the same in sexual reproduction: it is a matter of perfectly common experience, that the tendency on the part of the offspring always is, speaking broadly, to reproduce the form of the parents. The proverb has it that the thistle does not bring forth grapes; so, among ourselves, there is always a likeness, more or less marked and distinct, between children and their parents. That is a matter of familiar and ordinary observation. We notice the same thing occurring in the cases of the domestic animals--dogs, for instance, and their offspring. In all these cases of propagation and perpetuation, there seems to be a tendency in the offspring to take the characters of the parental organisms. To that tendency a special name is given-- it is called 'Atavism', it expresses this tendency to revert to the ancestral type, and comes from the Latin word 'atavus', ancestor.

Well, this 'Atavism' which I shall speak of, is, as I said before, one of the most marked and striking tendencies of organic beings; but, side by side with this hereditary tendency there is an equally distinct and remarkable tendency to variation. The tendency to reproduce the original stock has, as it were, its limits, and side by side with it there is a tendency to vary in certain directions, as if there were two opposing powers working upon the organic being, one tending to take it in a straight line, and the other tending to make it diverge from that straight line, first to one side and then to the other.

So that you see these two tendencies need not precisely contradict one another, as the ultimate result may not always be very remote from what would have been the case if the line had been quite straight.

This tendency to variation is less marked in that mode of propagation which takes place asexually; it is in that mode that the minor characters of animal and vegetable structures are most completely preserved. Still, it will happen sometimes, that the gardener, when he has planted a cutting of some favourite plant, will find, contrary to his expectation, that the slip grows up a little different from the primitive stock--that it produces flowers of a different colour or make, or some deviation in one way or another. This is what is called the 'sporting' of plants.

In animals the phenomena of asexual propagation are so obscure, that at present we cannot be said to know much about them; but if we turn to that mode of perpetuation which results from the sexual process, then we find variation a perfectly constant occurrence, to a certain extent; and, indeed, I think that a certain amount of variation from the primitive stock is the necessary result of the method of sexual propagation itself; for, inasmuch as the thing propagated proceeds from two organisms of different sexes and different makes and temperaments, and as the offspring is to be either of one sex or the other, it is quite clear that it cannot be an exact diagonal of the two, or it would be of no sex at all; it cannot be an exact intermediate form between that of each of its parents--it must deviate to one side or the other. You do not find that the male follows the precise type of the male

parent, nor does the female always inherit the precise characteristics of the mother,--there is always a proportion of the female character in the male offspring, and of the male character in the female offspring. That must be quite plain to all of you who have looked at all attentively on your own children or those of your neighbours; you will have noticed how very often it may happen that the son shall exhibit the maternal type of character, or the daughter possess the characteristics of the father's family. There are all sorts of intermixtures and intermediate conditions between the two, where complexion, or beauty, or fifty other different peculiarities belonging to either side of the house, are reproduced in other members of the same family. Indeed, it is sometimes to be remarked in this kind of variation, that the variety belongs, strictly speaking, to neither of the immediate parents; you will see a child in a family who is not like either its father or its mother; but some old person who knew its grandfather or grandmother, or, it may be, an uncle, or, perhaps, even a more distant relative, will see a great similarity between the child and one of these. In this way it constantly happens that the characteristic of some previous member of the family comes out and is reproduced and recognised in the most unexpected manner.

But apart from that matter of general experience, there are some cases which put that curious mixture in a very clear light. You are aware that the offspring of the Ass and the Horse, or rather of the he-Ass and the Mare, is what is called a Mule; and, on the other hand, the offspring of the Stallion and the she-Ass is what is called a 'Hinny'. I never saw one myself; but they have been very carefully studied. Now, the curious thing is this, that although you have the same elements in the experiment in each case, the offspring is entirely different in character, according as the male influence comes from the Ass or the Horse. Where the Ass is the male, as in the case of the Mule, you find that the head is like that of the Ass, that the ears are long, the tail is tufted at the end, the feet are small, and the voice is an unmistakable bray; these are all points of similarity to the Ass; but, on the other hand, the barrel of the body and the cut of the neck are much more like those of the Mare. Then, if you look at the Hinny,--the result of the union of the Stallion and the she-Ass, then you find it is the Horse that has the predominance; that the head is more like that of the Horse, the ears are shorter, the legs coarser, and the type is altogether altered; while the voice, instead of being a bray, is the ordinary neigh of the Horse. Here, you see, is a most curious thing: you take exactly the same elements, Ass and Horse, but you combine the sexes in a different manner, and the result is modified accordingly. You have in this case, however, a result which is not general and universal--there is usually an important preponderance, but not always on the same side.

Here, then, is one intelligible, and, perhaps, necessary cause of variation: the fact, that there are two sexes sharing in the production of the offspring, and that the share taken by each is different and variable, not only for each combination, but also for different members of the same family.

Secondly, there is a variation, to a certain extent--though, in all probability, the influence of this cause has been very much exaggerated--but there is no doubt that variation is produced, to a certain extent, by what are commonly known as external conditions,--such as temperature, food, warmth, and moisture. In the long run, every variation depends, in some sense, upon external conditions, seeing that

everything has a cause of its own. I use the term "external conditions" now in the sense in which it is ordinarily employed: certain it is, that external conditions have a definite effect. You may take a plant which has single flowers, and by dealing with the soil, and nourishment, and so on, you may by-and-by convert single flowers into double flowers, and make thorns shoot out into branches. You may thicken or make various modifications in the shape of the fruit. In animals, too, you may produce analogous changes in this way, as in the case of that deep bronze colour which persons rarely lose after having passed any length of time in tropical countries. You may also alter the development of the muscles very much, by dint of training; all the world knows that exercise has a great effect in this way; we always expect to find the arm of a blacksmith hard and wiry, and possessing a large development of the brachial muscles. No doubt training, which is one of the forms of external conditions, converts what are originally only instructions, teachings, into habits, or, in other words, into organizations, to a great extent; but this second cause of variation cannot be considered to be by any means a large one. The third cause that I have to mention, however, is a very extensive one. It is one that, for want of a better name, has been called "spontaneous variation;" which means that when we do not know anything about the cause of phenomena, we call it spontaneous. In the orderly chain of causes and effects in this world, there are very few things of which it can be said with truth that they are spontaneous. Certainly not in these physical matters,--in these there is nothing of the kind,--everything depends on previous conditions. But when we cannot trace the cause of phenomena, we call them spontaneous.

Of these variations, multitudinous as they are, but little is known with perfect accuracy. I will mention to you some two or three cases, because they are very remarkable in themselves, and also because I shall want to use them afterwards. Reaumur, a famous French naturalist, a great many years ago, in an essay which he wrote upon the art of hatching chickens,--which was indeed a very curious essay,--had occasion to speak of variations and monstrosities. One very remarkable case had come under his notice of a variation in the form of a human member, in the person of a Maltese, of the name of Gratio Kelleia, who was born with six fingers upon each hand, and the like number of toes to each of his feet. That was a case of spontaneous variation. Nobody knows why he was born with that number of fingers and toes, and as we don't know, we call it a case of "spontaneous" variation. There is another remarkable case also. I select these, because they happen to have been observed and noted very carefully at the time. It frequently happens that a variation occurs, but the persons who notice it do not take any care in noting down the particulars, until at length, when inquiries come to be made, the exact circumstances are forgotten; and hence, multitudinous as may be such "spontaneous" variations, it is exceedingly difficult to get at the origin of them.

The second case is one of which you may find the whole details in the "Philosophical Transactions" for the year 1813, in a paper communicated by Colonel Humphrey to the President of the Royal Society,--"On a new Variety in the Breed of Sheep," giving an account of a very remarkable breed of sheep, which at one time was well known in the northern states of America, and which went by the name of the Ancon or the Otter breed of sheep. In the year 1791, there was a farmer of the name of Seth Wright in Massachusetts, who had a flock of sheep, consisting of a ram and, I think, of some twelve or thirteen ewes. Of this flock of ewes, one at the breeding-time bore a lamb which was very singularly formed;

it had a very long body, very short legs, and those legs were bowed! I will tell you by-and-by how this singular variation in the breed of sheep came to be noted, and to have the prominence that it now has. For the present, I mention only these two cases; but the extent of variation in the breed of animals is perfectly obvious to any one who has studied natural history with ordinary attention, or to any person who compares animals with others of the same kind. It is strictly true that there are never any two specimens which are exactly alike; however similar, they will always differ in some certain particular.

Now let us go back to Atavism,--to the hereditary tendency I spoke of. What will come of a variation when you breed from it, when Atavism comes, if I may say so, to intersect variation? The two cases of which I have mentioned the history, give a most excellent illustration of what occurs. Gratio Kelleia, the Maltese, married when he was twenty-two years of age, and, as I suppose there were no six-fingered ladies in Malta, he married an ordinary five-fingered person. The result of that marriage was four children; the first, who was christened Salvator, had six fingers and six toes, like his father; the second was George, who had five fingers and toes, but one of them was deformed, showing a tendency to variation; the third was Andre; he had five fingers and five toes, quite perfect; the fourth was a girl, Marie; she had five fingers and five toes, but her thumbs were deformed, showing a tendency toward the sixth.

These children grew up, and when they came to adult years, they all married, and of course it happened that they all married five-fingered and five-toed persons. Now let us see what were the results. Salvator had four children; they were two boys, a girl, and another boy; the first two boys and the girl were six-fingered and six-toed like their grandfather; the fourth boy had only five fingers and five toes. George had only four children; there were two girls with six fingers and six toes; there was one girl with six fingers and five toes on the right side, and five fingers and five toes on the left side, so that she was half and half. The last, a boy, had five fingers and five toes. The third, Andre, you will recollect, was perfectly well-formed, and he had many children whose hands and feet were all regularly developed. Marie, the last, who, of course, married a man who had only five fingers, had four children; the first, a boy, was born with six toes, but the other three were normal.

Now observe what very extraordinary phenomena are presented here. You have an accidental variation arising from what you may call a monstrosity; you have that monstrosity tendency or variation diluted in the first instance by an admixture with a female of normal construction, and you would naturally expect that, in the results of such an union, the monstrosity, if repeated, would be in equal proportion with the normal type; that is to say, that the children would be half and half, some taking the peculiarity of the father, and the others being of the purely normal type of the mother; but you see we have a great preponderance of the abnormal type. Well, this comes to be mixed once more with the pure, the normal type, and the abnormal is again produced in large proportion, notwithstanding the second dilution. Now what would have happened if these abnormal types had intermarried with each other; that is to say, suppose the two boys of Salvator had taken it into their heads to marry their first cousins, the two first girls of George, their uncle? You will remember that these are all of the abnormal type of their grandfather. The result would probably have been, that their offspring would have been in every case a further

development of that abnormal type. You see it is only in the fourth, in the person of Marie, that the tendency, when it appears but slightly in the second generation, is washed out in the third, while the progeny of Andre, who escaped in the first instance, escape altogether.

We have in this case a good example of nature's tendency to the perpetuation of a variation. Here it is certainly a variation which carried with it no use or benefit; and yet you see the tendency to perpetuation may be so strong, that, notwithstanding a great admixture of pure blood, the variety continues itself up to the third generation, which is largely marked with it. In this case, as I have said, there was no means of the second generation intermarrying with any but five-fingered persons, and the question naturally suggests itself, What would have been the result of such marriage? Reaumur narrates this case only as far as the third generation. Certainly it would have been an exceedingly curious thing if we could have traced this matter any further; had the cousins intermarried, a six-fingered variety of the human race might have been set up.

To show you that this supposition is by no means an unreasonable one, let me now point out what took place in the case of Seth Wright's sheep, where it happened to be a matter of moment to him to obtain a breed or raise a flock of sheep like that accidental variety that I have described--and I will tell you why. In that part of Massachusetts where Seth Wright was living, the fields were separated by fences, and the sheep, which were very active and robust, would roam abroad, and without much difficulty jump over these fences into other people's farms. As a matter of course, this exuberant activity on the part of the sheep constantly gave rise to all sorts of quarrels, bickerings, and contentions among the farmers of the neighbourhood; so it occurred to Seth Wright, who was, like his successors, more or less 'cute, that if he could get a stock of sheep like those with the bandy legs, they would not be able to jump over the fences so readily, and he acted upon that idea. He killed his old ram, and as soon as the young one arrived at maturity, he bred altogether from it. The result was even more striking than in the human experiment which I mentioned just now. Colonel Humphreys testifies that it always happened that the offspring were either pure Ancons or pure ordinary sheep; that in no case was there any mixing of the Ancons with the others. In consequence of this, in the course of a very few years, the farmer was able to get a very considerable flock of this variety, and a large number of them were spread throughout Massachusetts. Most unfortunately, however--I suppose it was because they were so common--nobody took enough notice of them to preserve their skeletons; and although Colonel Humphreys states that he sent a skeleton to the President of the Royal Society at the same time that he forwarded his paper, I am afraid that the variety has entirely disappeared; for a short time after these sheep had become prevalent in that district, the Merino sheep were introduced; and as their wool was much more valuable, and as they were a quiet race of sheep, and showed no tendency to trespass or jump over fences, the Otter breed of sheep, the wool of which was inferior to that of the Merino, was gradually allowed to die out.

You see that these facts illustrate perfectly well what may be done if you take care to breed from stocks that are similar to each other. After having got a variation, if, by crossing a variation with the original stock, you multiply that variation, and then take care to keep that variation distinct from the original stock, and make them breed together,--then you may almost certainly produce a race whose tendency

to continue the variation is exceedingly strong.

This is what is called "selection"; and it is by exactly the same process as that by which Seth Wright bred his Ancon sheep, that our breeds of cattle, dogs, and fowls, are obtained. There are some possibilities of exception, but still, speaking broadly, I may say that this is the way in which all our varied races of domestic animals have arisen; and you must understand that it is not one peculiarity or one characteristic alone in which animals may vary. There is not a single peculiarity or characteristic of any kind, bodily or mental, in which offspring may not vary to a certain extent from the parent and other animals.

Among ourselves this is well known. The simplest physical peculiarity is mostly reproduced. I know a case of a man whose wife has the lobe of one of her ears a little flattened. An ordinary observer might scarcely notice it, and yet every one of her children has an approximation to the same peculiarity to some extent. If you look at the other extreme, too, the gravest diseases, such as gout, scrofula, and consumption, may be handed down with just the same certainty and persistence as we noticed in the perpetuation of the bandy legs of the Ancon sheep.

However, these facts are best illustrated in animals, and the extent of the variation, as is well known, is very remarkable in dogs. For example, there are some dogs very much smaller than others; indeed, the variation is so enormous that probably the smallest dog would be about the size of the head of the largest; there are very great variations in the structural forms not only of the skeleton but also in the shape of the skull, and in the proportions of the face and the disposition of the teeth.

The Pointer, the Retriever, Bulldog, and the Terrier, differ very greatly, and yet there is every reason to believe that every one of these races has arisen from the same source,--that all the most important races have arisen by this selective breeding from accidental variation.

A still more striking case of what may be done by selective breeding, and it is a better case, because there is no chance of that partial infusion of error to which I alluded, has been studied very carefully by Mr. Darwin,--the case of the domestic pigeons. I dare say there may be some among you who may be pigeon 'fanciers', and I wish you to understand that in approaching the subject, I would speak with all humility and hesitation, as I regret to say that I am not a pigeon fancier. I know it is a great art and mystery, and a thing upon which a man must not speak lightly; but I shall endeavour, as far as my understanding goes, to give you a summary of the published and unpublished information which I have gained from Mr. Darwin.

Among the enormous variety,--I believe there are somewhere about a hundred and fifty kinds of pigeons,--there are four kinds which may be selected as representing the extremest divergences of one kind from another. Their names are the Carrier, the Pouter, the Fantail, and the Tumbler. In the large diagrams they are each represented in their relative sizes to each other. This first one is the Carrier; you will notice this large excrescence on its beak; it has a comparatively small head; there is a bare space round the eyes; it has a long neck, a very long beak, very strong legs, large feet, long wings, and so on. The

second one is the Pouter, a very large bird, with very long legs and beak. It is called the Pouter because it is in the habit of causing its gullet to swell up by inflating it with air. I should tell you that all pigeons have a tendency to do this at times, but in the Pouter it is carried to an enormous extent. The birds appear to be quite proud of their power of swelling and puffing themselves out in this way; and I think it is about as droll a sight as you can well see to look at a cage full of these pigeons puffing and blowing themselves out in this ridiculous manner.

The third kind I mentioned--the Fantail--is a small bird, with exceedingly small legs and a very small beak. It is most curiously distinguished by the size and extent of its tail, which, instead of containing twelve feathers, may have many more,--say thirty, or even more--I believe there are some with as many as forty-two. This bird has a curious habit of spreading out the feathers of its tail in such a way that they reach forward, and touch its head; and if this can be accomplished, I believe it is looked upon as a point of great beauty.

But here is the last great variety,--the Tumbler; and of that great variety, one of the principal kinds, and one most prized, is the specimen represented here--the short-faced Tumbler. Its beak is reduced to a mere nothing. Just compare the beak of this one and that of the first one, the Carrier--I believe the orthodox comparison of the head and beak of a thoroughly well-bred Tumbler is to stick an oat into a cherry, and that will give you the proper relative proportions of the head and beak. The feet and legs are exceedingly small, and the bird appears to be quite a dwarf when placed side by side with this great Carrier.

These are differences enough in regard to their external appearance; but these differences are by no means the whole or even the most important of the differences which obtain between these birds. There is hardly a single point of their structure which has not become more or less altered; and to give you an idea of how extensive these alterations are, I have here some very good skeletons, for which I am indebted to my friend, Mr. Tegetmeier, a great authority in these matters; by means of which, if you examine them by-and-by, you will be able to see the enormous difference in their bony structures.

I had the privilege, some time ago, of access to some important MSS. of Mr. Darwin, who, I may tell you, has taken very great pains and spent much valuable time and attention on the investigation of these variations, and getting together all the facts that bear upon them. I obtained from these MSS. the following summary of the differences between the domestic breeds of pigeons; that is to say, a notification of the various points in which their organization differs. In the first place, the back of the skull may differ a good deal, and the development of the bones of the face may vary a great deal; the back varies a good deal; the shape of the lower jaw varies; the tongue varies very greatly, not only in correlation to the length and size of the beak, but it seems also to have a kind of independent variation of its own. Then the amount of naked skin round the eyes, and at the base of the beak, may vary enormously; so may the length of the eyelids, the shape of the nostrils, and the length of the neck. I have already noticed the habit of blowing out the gullet, so remarkable in the Pouter, and comparatively so in the others. There are great differences, too, in the size of the female and the male, the shape of the body, the number and width of the processes of the ribs, the

development of the ribs, and the size, shape, and development of the breastbone. We may notice, too,--and I mention the fact because it has been disputed by what is assumed to be high authority,--the variation in the number of the sacral vertebrae. The number of these varies from eleven to fourteen, and that without any diminution in the number of the vertebrae of the back or of the tail. Then the number and position of the tail-feathers may vary enormously, and so may the number of the primary and secondary feathers of the wings. Again, the length of the feet and of the beak,--although they have no relation to each other, yet appear to go together,--that is, you have a long beak wherever you have long feet. There are differences also in the periods of the acquirement of the perfect plumage,--the size and shape of the eggs,--the nature of flight, and the powers of flight,--so-called "homing" birds having enormous flying powers;* while, on the other hand, the little Tumbler is so called because of its extraordinary faculty of turning head over heels in the air, instead of pursuing a direct course. And, lastly, the dispositions and voices of the birds may vary. Thus the case of the pigeons shows you that there is hardly a single particular,--whether of instinct, or habit, or bony structure, or of plumage,--of either the internal economy or the external shape, in which some variation or change may not take place, which, by selective breeding, may become perpetuated, and form the foundation of, and give rise to, a new race.

[footnote: The "Carrier," I learn from Mr. Tegetmeier, does not 'carry'; a high-bred bird of this breed being but a poor flier. The birds which fly long distances, and come home,--"homing" birds,--and are consequently used as carriers, are not "carriers" in the fancy sense.]

If you carry in your mind's eye these four varieties of pigeons, you will bear with you as good a notion as you can have, perhaps, of the enormous extent to which a deviation from a primitive type may be carried by means of this process of selective breeding.

End of The Project Gutenberg Etext of The Perpetuation of Living Beings
by Thomas H. Huxley

Livros Grátis

(<http://www.livrosgratis.com.br>)

Milhares de Livros para Download:

[Baixar livros de Administração](#)

[Baixar livros de Agronomia](#)

[Baixar livros de Arquitetura](#)

[Baixar livros de Artes](#)

[Baixar livros de Astronomia](#)

[Baixar livros de Biologia Geral](#)

[Baixar livros de Ciência da Computação](#)

[Baixar livros de Ciência da Informação](#)

[Baixar livros de Ciência Política](#)

[Baixar livros de Ciências da Saúde](#)

[Baixar livros de Comunicação](#)

[Baixar livros do Conselho Nacional de Educação - CNE](#)

[Baixar livros de Defesa civil](#)

[Baixar livros de Direito](#)

[Baixar livros de Direitos humanos](#)

[Baixar livros de Economia](#)

[Baixar livros de Economia Doméstica](#)

[Baixar livros de Educação](#)

[Baixar livros de Educação - Trânsito](#)

[Baixar livros de Educação Física](#)

[Baixar livros de Engenharia Aeroespacial](#)

[Baixar livros de Farmácia](#)

[Baixar livros de Filosofia](#)

[Baixar livros de Física](#)

[Baixar livros de Geociências](#)

[Baixar livros de Geografia](#)

[Baixar livros de História](#)

[Baixar livros de Línguas](#)

[Baixar livros de Literatura](#)
[Baixar livros de Literatura de Cordel](#)
[Baixar livros de Literatura Infantil](#)
[Baixar livros de Matemática](#)
[Baixar livros de Medicina](#)
[Baixar livros de Medicina Veterinária](#)
[Baixar livros de Meio Ambiente](#)
[Baixar livros de Meteorologia](#)
[Baixar Monografias e TCC](#)
[Baixar livros Multidisciplinar](#)
[Baixar livros de Música](#)
[Baixar livros de Psicologia](#)
[Baixar livros de Química](#)
[Baixar livros de Saúde Coletiva](#)
[Baixar livros de Serviço Social](#)
[Baixar livros de Sociologia](#)
[Baixar livros de Teologia](#)
[Baixar livros de Trabalho](#)
[Baixar livros de Turismo](#)