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The Nature of Man Professor Jerome Lejeune

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The transmission of life is quite paradoxical. We know with certainty that the link which relates parents to children is at every moment a material link, for we know it is from the encounter of the female cell (the ovum) and the male cell (the spermatozoon), that a new individual life will emerge. But we know with the same degree of certitude that no molecule, no individual particle of matter enclosed in the fertilized egg, has the slightest chance of being transmitted to the next generation. Hence, what is really transmitted is not the matter as such, but a specified conformation of the matter, or more precisely, an 'information'.

Without reviewing the complex machinery of coded molecules like DNA, RNA, proteins, and so on, which are the vehicle of heredity, we can see that this paradox is common to all the processes of reproduction, whether natural or man-made. For example, a statue must be built out of some material, and could not exist if made of pure void. During the casting process, there exists at every moment a contiguity of molecules between the statue and the cast, and later, between the cast and the replica. But, obviously, no matter is reproduced, for the replica could be plaster or bronze, or anything else. What is indeed reproduced is not the matter of the statue, but the form imprinted in the matter by the genius of the sculptor.

Indeed, the reproduction of living beings is infinitely more delicate than the reproduction of an inanimate form, but the process follows a very similar path, as we will see by another familiar example. On the magnetic tape of a tape recorder, it is possible to inscribe by minute alterations of local magnetism, a series of signals corresponding, for example, to the execution of a symphony. Such a tape, if in-

roduced in the appropriate machine will play the symphony, although there are no musicians in the machine and no notes, even, written on the tape. That's the way existence is played!

In this analogy, the magnetic tape is incredibly thin, for it is reduced to the size of a DNA molecule, the miniaturization of which is bewildering. To give an idea of this minuteness, we should remember that in this thread every character of each of us is exactly described. Thou shalt have blond hair, hazel eyes, thou shalt be six feet tall, and thou shalt live some eighty years, if no road accidents intervene! All these instructions giving a full description of a man, are written in a thread one yard long. But the thread is so thin and so carefully packed inside the nucleus of the cell, that it would stay at ease on the point of a needle.

To give another impression, if we were to reassemble on this table all these threads which will specify each and every quality of the next three thousand million men who will replace us on the surface of the planet, this quantity of matter would fit nicely in an aspirin tablet. The fertilized egg is comparable to a tape recorder loaded. As soon as the mechanism is triggered, the human work is lived, in strict conformity to its program.

The very fact that we have to develop ourselves during nine months inside the bodily protection of our mother does not change anything, as you can easily observe by looking at the egg of a hen, from which the chicken will emerge. It makes no difference whether he was incubated by the fowl, or by an electrical heating device. The chicken is still a chicken. If one day a child can be entirely grown in a test tube, the test tube will never believe that the child is its property.

Such a reduction of the human being to its very nature may

not be very palatable, or intuitively satisfactory, but it accurately reflects the present state of our scientific knowledge. When a new student hears for the first time a symphony, let us say the Little Night Music by Mozart, he must listen to the whole in order to know it. But if he is a music lover, he will recognize Mozart at the first bars, and could tell the title at the second or third bar. It's the same with the human symphony. The specialist can recognize it at its first accents, even if a great number of various movements are required so that its general form may become evident to everyone.

The infinitesimal threads of the genetic information are carefully coiled in little rods, the chromosomes, easily visible with an ordinary microscope. They are something like the magnetic tape inside the cartridge of a mini-cassette. Some twenty years ago, nobody could have told the cell of a man from the cell of a chimpanzee. Ten years ago, a simple counting of the chromosomes would have given the answer, 46 if a man, 48 if a chimp. Since last year, if a student looking at a dividing fertilized egg or at the dividing cell of a blastocyst, could not tell them apart saying, 'This one is a chimpanzee being, this one I is a human being', he would fail his medical examination.

However, can we say that the early human being is an individual just after fecundation? Does he have the two qualities of an individual: its unity and its uniqueness? Exceptions to unity are known: maybe once in every million births, some subjects carry, side by side, male cells (recognized by their X and Y chromosomes) and female cells (recognized by their two X chromosomes). Thus, these subjects are simultaneously provided with the masculine attributes of Hennes and those feminine of Aphrodite, hence the name hermaphroditism. One would believe that two fertilized eggs, one bound to be a boy, and the other bound to be a girl, have united together intimately, and it is quite the case. In the hermaphrodite, the mistake is extremely precocious and seems to happen at the second division of maturation of the egg. Two reciprocal cells are produced, the ovum and its polar body, which would be here just as voluminous as the ovum. Both of them are simultaneously fertilized, each one by a different spermatozoa. Hence exceptions to unity can happen very rarely at the time of fecundation.

Exception to uniqueness is more common: the identical twins, coming from the same fertilized egg, share exactly the same genetic patrimony, but each of them is obviously an individual by itself. From embryological knowledge, it seems impossible to separate one nature into two (or more) persons after the neural crest; that is, the first appearance of the nervous system, has differentiated. Hence, after the 13th day, no twins could occur. But, by inference, for the experimentation is not at hand at this time, it seems that the splitting must be extremely precocious, probably at the moment of the division of the first few cells of the embryo, that is, at the first encounter

of the paternal and maternal sets of chromosomes.

These remarks on the exception of the individual 'one and unique' corroborate the notion that every man begins at his very beginning. These theoretical and experimental notions can sometimes be directly felt by the persons themselves in exceptional situations. A very rare accident can occur at the moment the identical twins are formed. From an XY fertilized egg, bound to be a boy, two cells are produced: one XY will continue its masculine destiny, the other having received only the X chromosome (the Y being lost during the separation process) will develop itself as an imperfect girl. Two X chromosomes are required for a complete and harmonious femininity. Hence the identical twins will be different: one normal boy and one frail and sterile girl.

In the first case we observed of such a young girl, she was some 18 years old and complained of a strange trouble. She feared to look at herself in a mirror because she pretended she was seeing her brother. Such an impression, far from anomalous, was an extraordinary intuition, very feminine indeed, of a very complex situation entirely undetected at that time. Due to the loss of a Y chromosome, she was effectively a piece of her brother, from whom she issued.

These facts of human genetics can appear a little too theoretical, and the question must be asked whether common sense can recognize as such a tiny human being. If very early, only the scientist aided by refined techniques, can tell. If, let us say, at two months, everybody knows and has known for thousands of years.

At two months of age, the human being is less than one thumb's length from the head to the rump. He would fit neatly into a nutshell, but everything is there hands, feet, head, organs, brain - all are in place. If you look very closely, you would see the palm creases, and if you were a fortune-teller, you could read the good adventure of that person. Looking still closer with a microscope, you could detect the finger prints like Sherlock Holmes - every document is available to give him his national identity card.

The incredible Tom Thumb really does exist. Not the one of the fairy-tale, but the one each of us has been. For it is from the true story that fairy-tales were invented. If Tom Thumb's adventures have already enchanted the children, if they can still evoke emotion in grown-ups, it is because all the children of the world, all the grown-ups they have turned into, were one day a Tom Thumb in their mother's womb.

But can we scientists accept these fairy-tales? The truth is indeed that Nature itself does. For instance, abortion is a normal process in imperfect mammals called marsupials. They have a special pouch on the abdomen, conveniently accommodated to nurture the little. In the giant kangaroo, the abortion occurs at the same stage as the

little Tom Thumb in man, and is roughly the same size. The aborted foetus then climbs into the fur of its mother to reach the pouch. The bewildering fact is that the kangaroo mother will let him do so, although she would not allow any other kind of animal to drop in. If the poor brain of a female kangaroo can recognize the tiny creature as a kangaroo being, there is no wonder that geneticists can safely assure you that Tom Thumb is indeed a true human being.

Now the question can be raised whether a developing human being should be protected even if he is affected by a disease.

To take a clear-cut example let us study the case of mongolism. By puncture of the amniotic cavity in which the foetus is swimming, some cells can be taken so that chromosomal examination can be performed. If the extra chromosome is found, surely enough the child is affected by mongolism. Hence it has been proposed to eliminate him.

To be precise, such investigation can be made after the sixteenth week of pregnancy. In the United States, for example, foetuses aborted for that reason have been aged from eighteen to twenty-four weeks or sometimes up to thirty weeks.

However, it should be kept in mind that looking at the chromosomes of a mongoloid foetus gives us two certainties, (1) he is affected by the disease, for he has an extra chromosome, and (2) he is a human being as all the rest of his chromosomes demonstrate.

Hence, the case is not to decide whether to eliminate a disease, but whether we eliminate a human being affected by the disease.

There is no difference whether the mental retardation is caused by a chromosomal accident, a virus infection, or a road accident.

We do our best to keep alive, assist and, if possible, cure patients suffering from the sequelae of a traffic accident, including the sequelae of brain damage. We have to remember that the road of life is long and dangerous, and from its beginning to its old-age end, in every case the duty of medicine is to strive towards healing and not towards killing.

From molecular genetics to comparative reproduction, Nature has taught us that from its very beginning the 'thing' we started with is a member of our kin. As such, human by its nature, never a tumour, never an amoeba, fish or quadruped, it is the same human being from fecundation to death. He will develop himself, if the surrounding world is not too hostile. And the sole role of medicine is to protect the individual from accidents as much as possible during the long and dangerous road of life.