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TEACHING BIOLOGY BY VIDEO IMAGES ASSISTED BY COMPUTER : EMBRYOLOGICAL LABORATORIES

Valdiodio NDIAYE

Département de Sciences Naturelles, Ecole Normale Supérieure, B.P. 5036, Université Cheikh Anta Diop, Dakar-Fann, Sénégal

ABSTRACT

Observing microscopie embryonic slides in university laboratories is improved thanks to video recorders which allow us to project slide-images on TV screens. The video recorder helps teachers to contact students about observed microscopie slides. It helps to overcome some difficulties linked to the microscopie observing slides, favoring discussion between teachers and students about the same observed microscopie slide. However, some difficulties continue to exist for a not insignificant number of students: changing plans of slides, going from 2 dimensional sight (2D) to 3 dimensional sight (3D) and vice versa, as well as identification of various embryonic areas. Using computers allows putting digital images in place of analogical ones on the same slides. This allows a significantly more important number of students to overcome all the difficulties previously enumerated

RESUME

L'observation de coupes d'embryons au microscope en T.P.. à l'Université est améliorée grâce à l'utilisation de la vidéo qui permet d'envoyer des images de ces coupes sur des écrans. La vidéo aide à établir la communication entre enseignants et étudiants à propos des coupes observées. Elle aide à surmonter certains obstacles liés à l'observation de coupes microscopiques en favorisant la discussion entre enseignants et étudiants à propos de la même préparation observée. Cependant des difficultés subsistent pour un nombre non négligeable d'étudiants: le changement de plans de coupes, le passage de la vision en 2 dimensions (2 D) à la vision en 3 dimensions (3 D) et vice versa ainsi que l'identification des différentes zone embryonnaires. L'utilisation de l'ordinateur permet de remplacer les images analogues par des images numérisées des mêmes coupes. L'aide didactique apportée par l'ordinateur permet à un nombre d'étudiants significativement plus important de surmonter tous les obstacles précédemment énumérés.

1 INTRODUCTION

In teaching biology, observation takes up a great deal of time. Some biologists consider this activity so important (BRICAGE and NABVERA, 1987) that they do not hesitate to

insist that, more than teaching and use of some techniques, objective and intellectual observation is the beginning of all scientific training. Although this thinking is exaggerated and positivist, the problem of observation in Biology is indeed essential. To improve the students' faculty of observation, biologists use various didactic aids (GIORDAN, 1988; ASTOLFI, 1988). Thus, many biologists use machines to improve observation : telescopes, magnifying grasses, microscopes and various media, as the diapo projector, the film, and, more often nowadays, the analogical video image or the digital image.

As part of this programme, we were led to carry out research on using video images in laboratory teaching at university level (CLEMENT et LE GUELTE, 1986; CLEMENT et NDIAYE, 1997; CLEMENT et NDIAYE, 1989; NDIAYE et CLEMENT, 1988 a et b, NDIAYE et CLEMENT, 1989, NDIAYE, 1990)..

2 MATERIAL AND METHOD

In embryology laboratories, for instance, the students' classic work consists in observing, analyzing and interpreting microscopie embryonic slides (Figures 1, 2, 3a, 3b, 4a, 4b). The difficulties they meet in leading students to aim at objectives of laboratories forced teachers (in Lyon, in Dakar) to introduce video in the teaching of embryology, through a system of microscopes with a tritube connected to a videocamera which can project the slide image to be observed onto TV screens appropriately arranged in the laboratory. In Embryology, the great difficulty many students meet concerns changing slide plans and consequently, the problems of directing, of going from 2D images (2 dimensional vision) to 3D images (3 dimensional vision), of going past the vision from the plan to the space and vice versa. This must be done to understand and correctly interpret the microscope slides or their video images.

One of the various aids offered to students for this purpose is to use the possibilities of the video images and those of computer digital images. In that way, the images to be observed, transferred in a computer connected to a video recorder are shown to students in the plan and in the space. It might be even better if the images came with their interpreted diagrams and with the insertion of a cursor to plot the transition from 2D vision to the 3D vision and to their interpreted diagrams.

Teachers responsible for these laboratories, in second year university science, and students of these courses were questioned.

3 RESULTS

3.1 Observing slides only with microscopes

Some students succeeded in aiming objectives and observing slides of embryos with microscopes al one, accompanied by some explanations. However, our experience

(NDIAYE, 1990) showed there are significant numbers of students who do not see at all, whatever the explanations may be. These are among the difficulties to which teachers drew attention and which they pointed out during the interviews (NDIAYE, 1990):

" If you have such a situation with embryo slides and with this kind of equipment, even when you really describe something to the students, you notice that a few of them immediately "see"; there is no problem. But some of them do not see anything and have no representation. As a matter of fact, they have in front of them many structures they are not able to order in space. Therefore, our goal is to "create limits" in the structures they see, so that they can be correctly coordinated; that is more or less, our work. Describing things verbally may be good but is not sufficient. Even if you tell the student " look above, on your right in the scope of your microscqpe, round about "3, 5, 11 o'clock", OK, he sees or doesn't see. If there is a cell, he will see a cell; but if there is a structure to be eventually identified, - and it should be taken into account the fact that sometimes, these structures are broken - so if there is such a structure to be identified, the student doesn't necessarily see it. "

The students also express their difficulties.

A.N " Yes, I agree that it is not easy to observe everything in one's first year. It's true that it is not obvious without saying that the teacher's explanations are not so clear.

It's hard because it's our first year...If we had been taught from the beginning to...yes, it is not obvious, we don't have enough time. But we are directly in year 2, overcharged, and four hours in front of a microscope; it is not obvious."

A.R " Furthermore, it is something totally new since we have never done laboratory work before. So it is not so easy to be in front of a microscope and to do what is to be done and to see what we are asked to see"

3.2 With the help of a video

With the help of a video, contact with the students is significantly improved, the quality of work is really better when the video images of the same embryo's slides are projected. The teachers give further testimony:

" So, the fact that we can present it (the microscopic structure to be observed) in advance on standard slides which are not selected, present it on a screen, comment and describe its structures, direct them, subdivide them..., all this gives the students an opportunity to have a better understanding of what they have before their eyes.

The second fact is that it contributes to partially solve the problem of the lack of teachers; four T.V sets take the place of three or four teachers. It 's not ideal... but it can help.

Therefore, there are two advantages in proceeding thus:

- One gives the students a "structure" and helps him to "structure" by himself what he sees;

- One partially solves the problem of lack of teachers.

... "When the student - individually, doesn't really understand. In Embryology, for instance, things are happening in space, and if the student doesn't really understand what is going on before his eyes, he can take his slide, his own slide which is in his microscope and bring it to the video, and there, we can comment on it together (teacher and student). It is his equipment, not only an equipment with which he can compare his slide which is, however, like the one he has to compare to his own. It is his own slide".

3.3 But difficulties remain. And it is to solve them that we must resort to the resources of the computer.

This experiment which just started seems to be of great help to teachers and students in achieving the objectives set in these laboratories, such as observing embryo slides at different ages, knowing how to identify the embryonic organs and tissues, orienting the slides in space, proposing an interpretation of the microscope preparations or video images viewed in correct diagrams. Since the setting up of such a system, more and more students successfully observe slides. This is the official statement of teachers:

" Therefore there are no more problems; understanding is generally very, very swift..

Then, in the descriptive part, the coupling of video and computer together is absolutely necessary. And, if the first stage, that is to say, the understanding of plans of slides given, is not good, we obtain nothing at all by training exercises, i.e., we cannot hope to obtain an understanding of other plans of slides. Therefore, this system of images may be considered as the means to good understanding. That is my opinion.

OK., there, we compensate for an absolutely scandalous inefficiency. I think that we succeeded in almost correct teaching inspite of this reduced number of teachers, thanks to this system. Because without that, teaching is, let us call a spade a spade, foolish, and I think it should be suppressed; if not, it would be swindling students.

Let us say that it should be a help, to both student and teacher, but it is not a means to get rid of teachers" .

How to assess this help ?

"It is difficult to give a very unbiased assessment, but we can make a comparison, i.e., the few situations in which we did not have this system, (neither computer, nor video) and there we realize that it is very difficult: the students have

great difficulty in understanding and this is well shown by their diagrams; they are bad. It's very difficult, but it can be tested through the students' understanding when we meet them again in training exercises. If we don't have this kind of equipment (the system) or when for any material excuse, i.e. lack of classroom when, as usual, we were told to get out, it is enough to drive you absolutely mad, because you have students who always hang on to your jacket, or to your overalls, who question you "what is this, what is this...". And, practically, you can show we are significantly below the number of teachers required, as the standard number is one (teacher) for nine (students) as planned in agreement with the State, and in fact, we are two (teachers) for 52 (students), as on the last day, when you came with me. It is enough to drive you mad. Result, teaching is impossible or of bad quality".

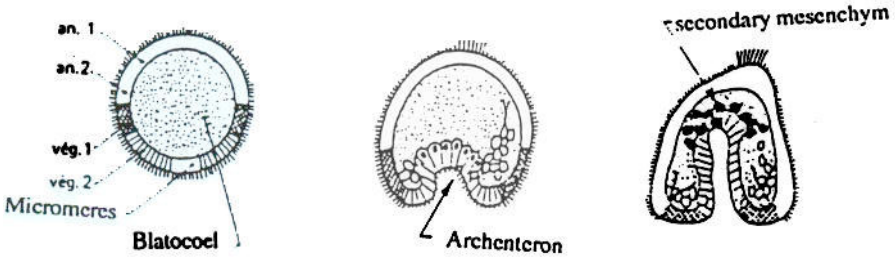

Figure 1 : Sea-urchin's embryogenesis
Diagrams of blastula, young grastula, old grastula (LE MOIGNE, 1979 modified)

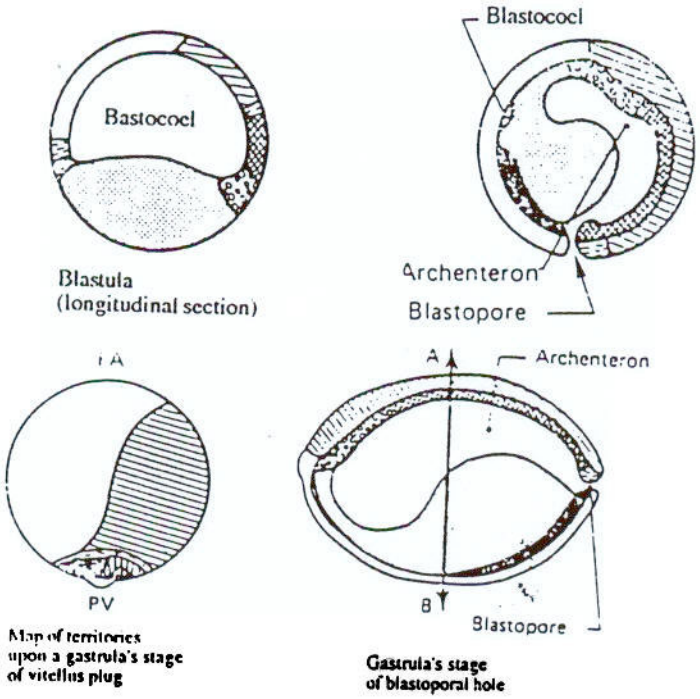

Figure 2 : An amphibian's development
Diagrams of a slide of blastula and various slides of grastula (LE MOIGNE, 1979, modified).

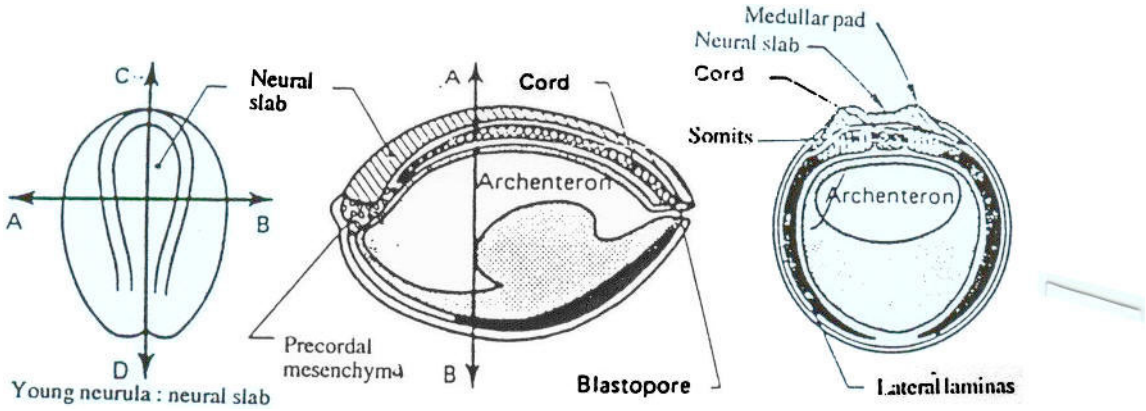

Figure 3 : An amphibian's development
Diagrams of a young neurula's slab, and showing two perpendicular plans of slides of neural slab (LE MOIGNE, 1979, modified).

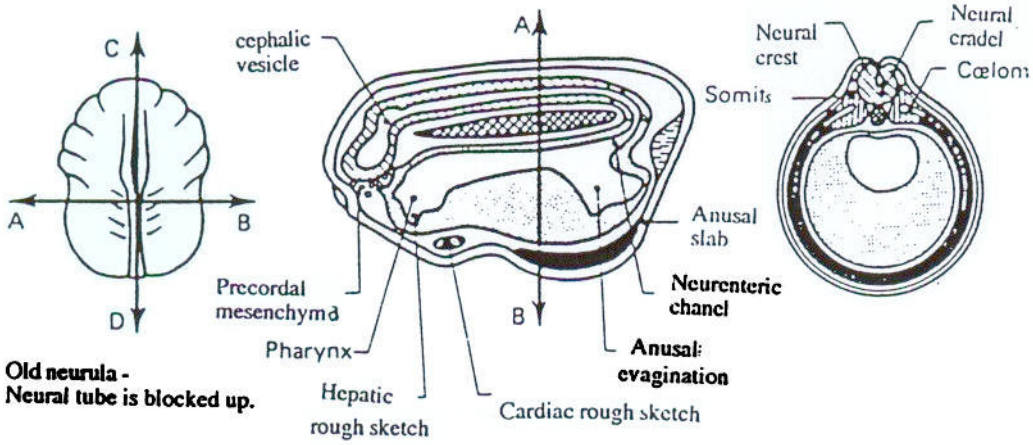

Figure 4 : An amphibian's development
Diagrams of a old neurola (the neural tube is blocked up), and showing two perpendicular plans of slides (LE MOIGNE, 1979, modified).

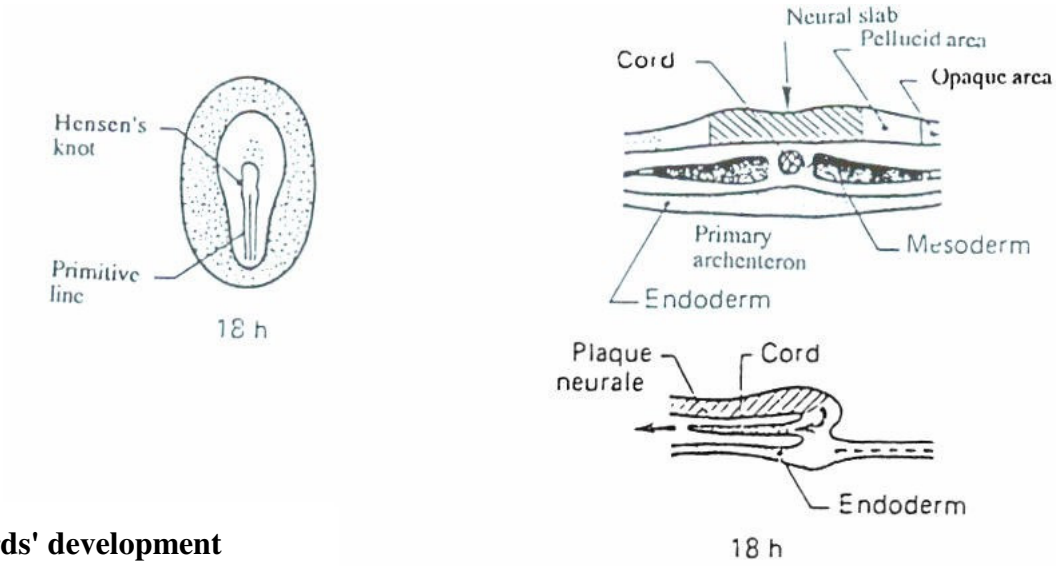

Figure 4a : Birds' development
Diagrams of an external view. of longitudinal and cross sections of 18 hours old blastodisc through Hensen's knot of chiken's embryo (HOUILLON, 1967, modified)

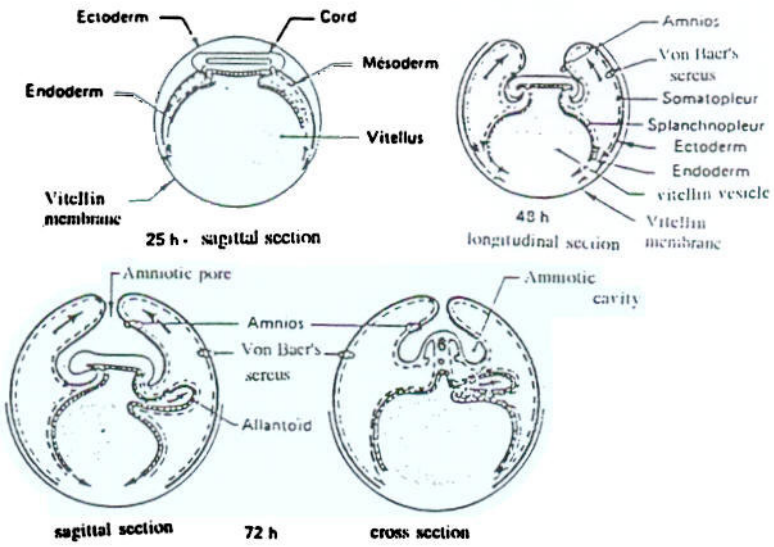

Figure 4b : Birds' development
Growth of birds' embryonic annexes of 25 hours, 48 hours, 72 hours old. Embryo's dimension and the annexes' one was systematically exaggerated in comparison with the vitellus one. The arrows point out the direction of growing of annexes (LE MOINGNE, 1979, modified).

4 DISCUSSION AND CONCLUSIONS

Before the advent of new technologies, the teachers and their students went on doing Embryology in their laboratories. And in spite of difficu1ties, they succeeded in realizing the observations of the embryo slides. Yes indeed ! the efforts of teachers and students were considerable, and for all that, results were poor. Many students did not succeed. But the knowledge was present, given by the microscope. It is not created by introducing new technologies (video and computer). They help (ASTOLFI, 1988) students to appropriate it more easily and teachers to improve

significantly their contact with their students. At the very most, presentation of knowledge was considerably improved by digital images. This technology of digital images, in introducing motion thanks to the computer, brings a new dimension to slide observation. It brings dynamics to observation which makes it easier to understand hanging plans, dimensions and consequently directing slides.

Thus, video coupled 10 computer system is a didactic aid (GIORDAN 1988; ASTOLFI, 1988; NDIAYE, 1990) for teachers to improve contact with students, and for students themselves to improve the quality of observing. Introducing motion makes it easier to understand changing plans.

KEYWORDS

Didactic, embryological laboratories, laboratory observation, video-images, computer, computer-images.

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