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**THE ORIGINS OF HUMANKIND:
A SURVEY OF SCHOOL TEXTBOOKS AND TEACHERS' CONCEPTIONS IN 14
COUNTRIES**

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Abstract

To investigate the difficulty teaching human origins, and particularly the possible link between values and taught scientific knowledge, research was carried out in 14 countries, in the context of the project BIOHEAD-Citizen. In eight countries (Cyprus, Estonia, Finland, France, Hungary, Italy, Romania, Senegal), this topic is included in the biology syllabus; in the six other countries (Algeria, Burkina Faso, Lebanon, Morocco, Portugal and Tunisia), it is not.

Analysis of the images of timelines or trees depicting evolution revealed that *Homo sapiens* is never represented by a woman alone, only twice by a couple, and never with ethnic diversity. *Homo sapiens* is generally at the top or end of the evolutionary schemas, indicating a goal-ended conception of evolution. Thus scientific knowledge related to human origins can be mixed with implicit values.

In the 14 countries, 5,706 teachers (primary and secondary school teachers of biology or national language) completed a questionnaire. Conceptions differed greatly among countries. Creationist conceptions were correlated with level of belief in God, as well as with shorter training at university. In the countries where evolution is included in the students' curriculum, the biology teachers' conceptions were less radically creationist than when it was not included in the curriculum.

Keywords: human evolution; implicit values; science syllabuses; science textbooks; teachers' conceptions

1. Introduction

On 21 June 2006, the InterAcademy Panel (IAP), representing 68 national science academies, published a joint statement on the teaching of evolution: *“We, the undersigned Academies of Sciences, have learned that in various parts of the world, within science courses taught in certain public systems of education, scientific evidence, data, and testable theories about the origins and evolution of life on Earth are being concealed, denied, or confused with theories not testable by science”* (IAP, 2006). This collective declaration reflects the difficulties involved in teaching evolution, due to the interactions between scientific knowledge and values concerning the teaching of this topic. In recent years, our knowledge of the evolution of mankind has been significantly modified, with each new discovery immediately popularised in the media. While many people are fascinated by our origin, paradoxically, this precise topic is not taught in some countries. For instance, in Lebanon, evolution was included in the new syllabus following the civil war (Harfouch & Clément, 2001), but today it is no longer compulsory and is taught in only some schools. In other cases, such as Greece (Lakka & Vassilopoulou, 2004), human evolution is in the syllabus but is not always taught. Prinou, Halkia and Skordoulis (2007) specified that, in Greece, from 1983 until 2000 *“the evolution of humankind was only taught to a small percentage of pupils—those who were prospective candidates of medicine.”* Since 2000, human evolution has been included in a chapter on the theory of evolution which is *“omitted from the subject matter of courses in the Upper Secondary School, a practice that reveals at least the underestimation of its importance”* (Prinou et al., 2007, p. 1).

School syllabuses, textbooks and teachers' conceptions can be analysed as one step in didactic transposition. Proposed by Verret (1975) and then by Chevallard (1985), the concept of didactic transposition is used to analyse the way in which some scientific knowledge is chosen and then transformed in order to be taught. Typically, it considers three levels of transposition: the reference knowledge, the knowledge to be taught and the taught knowledge. In fact, there are more than three steps, one of them being related to school textbooks. None of the steps are limited to scientific knowledge and they can be analysed as interactions between scientific knowledge (K), values (V) and social practices (P): the KVP model (Clément, 2006; Clément & Hovart, 2000). Several scientists and philosophers have analysed the interactions between scientific content and socio-cultural context, particularly for the evolution of mankind (Cohen, 1999; Gould, 1981).

Quessada and Clément (2007) introduced the concept of didactic transposition delay (DTD). This is the delay between the date on which a scientific publication appears and the date on which its content is introduced into a syllabus or school textbook. Analysing the history of French science textbooks, Quessada and Clément (2006a, 2006b) measured different DTDs. The DTD for syllabuses could be either shorter or longer than for textbooks. The lengths of these DTDs were correlated to different parameters of the socio-cultural context, such as the importance of the subject matter and the popularisation of the specific topic, as well as concurrent dominant values (ideologies, beliefs, etc.). Social pressure was particularly important with respect to teaching the origins of mankind.

These results, related to current and past French socio-cultural context, led to the development of a larger comparative approach: the European project “BIOHEAD-Citizen” (Biology, Health and Environmental Education for better Citizenship). Participants from 19 countries worked on six topics, one being the origin of humankind (coordinated by M. P. Quessada and P. Clément). The 19 countries were chosen for their socio-cultural, geographical and historical differences in order to test specific hypotheses regarding comparisons among European and non-European countries, among religions (countries which are mostly Catholic, Protestant, Orthodox or Muslim, and having various levels of atheism or agnosticism) and,

within Europe, among the North and South, East and West, etc. The conceptions related to this topic were analysed with the KVP model (Clément, 2006), mainly as possible interactions between taught scientific knowledge (K) and values (V). The results presented here are restricted to the 14 countries for which the questionnaire administered to the teachers included a question about human origins: Algeria, Burkina Faso, Cyprus, Estonia, Finland, France, Hungary, Italy, Lebanon, Morocco, Portugal, Romania, Senegal and Tunisia. This research presents three complementary sets of data: the biology syllabuses of the different countries, the images of *Homo sapiens* in evolutionary trees of biology textbooks, and the teachers' answers on the questionnaire.

What implicit values can be identified in the images of humans in school textbooks? Can we find the same images, the same implicit values, in textbooks from countries that contrast in their historical, geographical, economic, political, cultural or religious contexts? Which implicit values can be identified in the teachers' conceptions? What are the interactions between social practices, concurrent values, and scientific knowledge taught about human evolution in each country?

2. Methodology

The methodology used in the context of the BIOHEAD-Citizen project is presented in detail in Clément and Carvalho (2007) for the six topics of this project; for the topic "human origins", see Quessada (2008), Quessada, Clément, Oerke and Valente (2008), Quessada and Clément (2009), Clément and Quessada (2008, 2009). The information therein is summarized here.

2.1 Analysis of syllabuses in the 14 countries

One research team per country (except for France, with two teams) was involved in this work. We collectively defined the indicators to analyse the national syllabuses for all school levels (primary and secondary schools). The topic "human evolution" was generally taught in the biology course, but in some cases it was taught in the context of history (Cyprus), psychology (Portugal) or philosophy (Algeria, but just suppressed during the time of our research). Here, we only use the indicator "presence or absence" of the topics "evolution" and "human evolution" in the biology syllabuses.

Analysed syllabuses were used in the 2004/5 school year. Since 2005, the syllabuses of some countries have changed. For example, biological evolution was introduced in Morocco in 2008.

2.2 Analysis of the textbooks containing information on human origins

In the BIOHEAD-Citizen Project, the textbooks were analysed using the same grid in each country. The data used in the current work come from only a small part of that grid. We analysed 50 schemas containing representations of *Homo sapiens*. These images were collected from 18 science textbooks, from nine different countries: Cyprus (1), Estonia (2), France (4), Italy (6), Lebanon (1), Portugal (1), Romania (1), Senegal (1), Tunisia (1). Burkina was not included in the project when this part of the work was being performed. In Finland and Hungary (countries which teach human evolution from its own chapter), there was no timeline or tree of evolution with a representation of *Homo sapiens*. In Portugal and Tunisia, we found such a timeline or tree of evolution with a representation of *Homo sapiens* in the chapter on evolution, although no specific part of the textbook dealt with human evolution.

The images of *Homo sapiens* were grouped into several specific categories: nude man without beard, nude man with beard, dressed man with suit, dressed man (other than suit), couple, small group of people, shadow of unidentifiable gender, brain, and skull. The position of *Homo sapiens* in the schema was analysed in relation to a finalistic or non-finalistic conception.

2.3 Analysis of teachers' conceptions

In the 14 countries, teachers filled out a long questionnaire, including 15 questions related to evolution and 17 questions related to their own characteristics (gender, age, level of training, socio-political or religious opinions). In each country, the sample was a balanced set of primary school teachers (P), secondary school teachers who taught biology (B) and secondary school teachers who taught the national language (L). In these three categories, half of the sample consisted of in-service teachers (In-P, In-B and in-L) and the other half of pre-service teachers (Pre-P, Pre-B and Pre-L). For each of these six sub-samples, about 50 teachers were interviewed: about 300 in each country (sometimes more when we tested complementary hypotheses, as in France, Lebanon and Tunisia; sometimes less when the country was small). In total (for the 14 countries), 5,706 teachers filled out the questionnaire. Some of the information gathered to characterize the interviewed teachers is presented in Table 1.

	Country	Total	including biologists	% Atheist. Agnostic	% Catholic	% Protestant	% Orthodox	% Muslim	% Other
BF	Burkina Faso	296	110	2.4	45.6	18.6	0.0	24.7	8.8
CY	Cyprus	322	66	4.0	9.0	1.2	77.3	0.0	8.4
DZ	Algeria	223	88	1.3	0.0	0.0	0.0	91.9	6.7
EE	Estonia	182	108	43.4	7.7	14.8	2.2	0.5	31.3
FI	Finland	306	121	15.0	1.0	66.3	2.9	0.0	14.7
FR	France	732	319	50.5	38.1	1.9	0.3	1.5	7.7
HU	Hungary	334	112	15.3	46.4	16.2	0.0	0.0	22.2
IT	Italy	559	150	12.3	78.7	0.5	0.0	0.0	8.4
LB	Lebanon	722	261	0.4	21.1	0.4	8.3	65.0	4.8
MA	Morocco	330	186	0.6	0.0	0.0	0.0	97.3	2.1
PT	Portugal	350	111	9.4	76.3	7.4	0.0	0.0	6.9
RO	Romania	273	127	7.3	8.1	7.0	71.1	0.0	6.6
SN	Senegal	324	120	0.9	8.3	0.0	0.0	89.2	1.5
TN	Tunisia	753	326	1.9	0.0	0.0	0.0	96.0	2.1

Table 1. Samples from 14 countries (total = 5,706 teachers)

The questionnaire consisted of questions which had been validated by previous research, and submitted to the steps described in Clément and Carvalho (2007) and in Quessada (2008): translation from the reference languages of the project (English and French) to the national language (using parallel independent translations, then a comparison with a back-translation); pilot interviews in most of the countries; the use of a longer pilot test in each country, then analysing the answers, their reliability after one month for the same pre-service teachers, multivariate analyses and finally a selection of the most discriminating questions.

Here we only present the answers from two questions (see below). They are significantly correlated to the data from the other questions related to evolution (Quessada, 2008). Question B48 (God) was one of a list of factors to rate (natural selection, chance, environment, intelligent design, viruses, transposons).

B28. Which of the following four statements do you agree with most? Select ONLY one sentence:

- 1 It is certain that the origin of humankind results from evolutionary processes.
- 2 Human origin can be explained by evolutionary processes without considering the hypothesis that God created humankind.
- 3 Human origin can be explained by evolutionary processes that are governed by God.
- 4 It is certain that God created humankind.

Indicate your evaluation of the importance of the following factors in species evolution (tick only ONE box for each line):

		Great importance	Some importance	Little importance	No importance at all
B48.	God				

3. Results

3.1 Is the topic "origins of humankind" taught in these 14 countries?

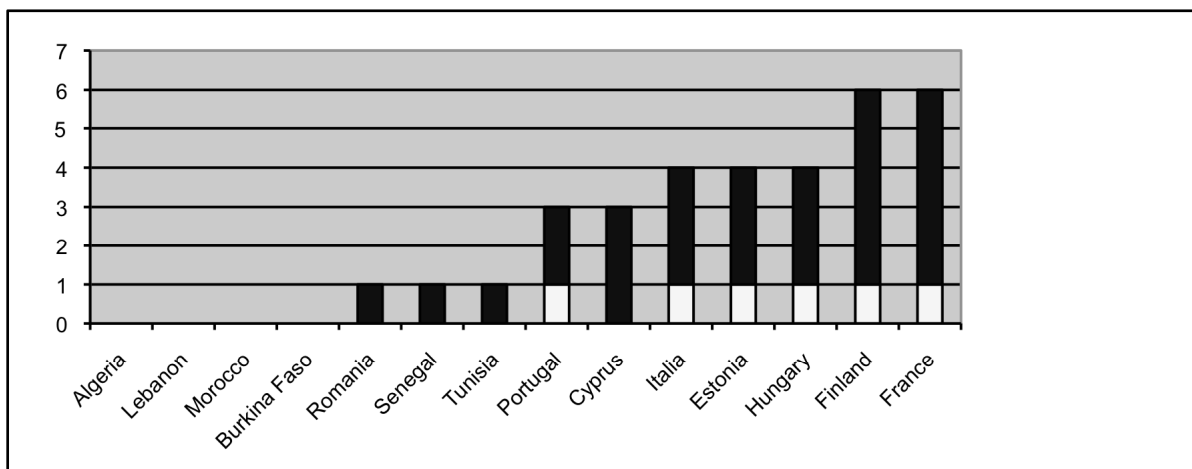


Figure 1. Number of grade levels in which evolution is included in the biology programmes of 14 countries (black = > 12 years old, white = < 12 years old)

In four countries (Algeria, Burkina, Lebanon and Morocco), there was nothing related to biological evolution. This topic has been more recently included in the syllabuses in Morocco (2008) and Lebanon (2009). In Burkina, it is taught only in some schools using the French programme. In three countries (Romania, Senegal, Tunisia), evolution was taught in only one level, the last year of secondary school. In the seven other countries (Cyprus, Estonia, Finland, France, Hungary, Italy, Portugal), evolution was taught in three to six levels and was generally introduced in the primary schools (< 12-year-olds, Figure 1).

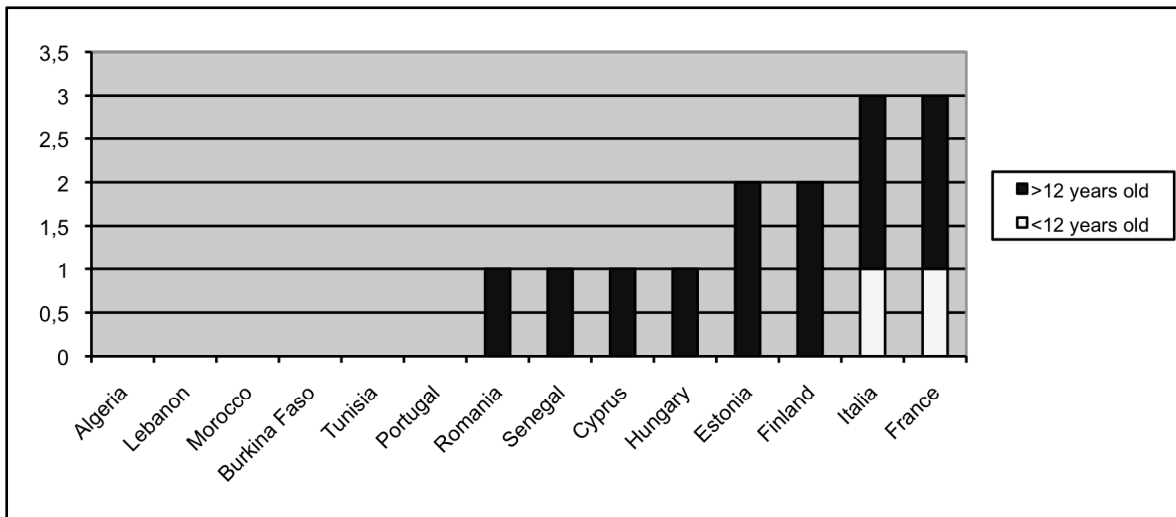


Figure 2. Number of grade levels in which human evolution is included in the biology programmes of 14 countries

In six countries (Algeria, Burkina, Lebanon, Morocco, Portugal and Tunisia), there was nothing on the topic of human evolution. However, in Portugal, human evolution was included in the psychology syllabus. In Tunisia, evolution was taught, but not human origins. In the eight other countries (Cyprus, Estonia, Finland, France, Hungary, Italy, Romania, Senegal), the origins of humankind were taught with evolution (Figure 2).

3.2 The images of human beings illustrating human evolution in school textbooks

In the 18 textbooks analysed, we found 50 images showing human evolutionary trees or timelines (sequences) containing at least one illustration of *Homo sapiens*. These images were classified into nine categories: nude man with beard (14), nude man without beard (9), man dressed in suit (9), skull (9), man dressed in other than suit (5), couple (2), shadow (1), brain (1). *Homo sapiens* was never represented in these textbooks solely by a woman. Only twice (in a French textbook and in an Italian one), was *Homo sapiens* represented by a couple. In the evolution schemas, all representations of humans had white skin; not one image illustrated ethnic diversity.

Most of the textbooks illustrated human biological evolution as linear and finalistic, projecting an image of a white-skinned, male *Homo sapiens*. Figure 3 illustrates the most frequent type of drawing of this linear human evolution. Here, *Homo sapiens* appears as a naked, white-skinned man, resembling the prototypical image of Adam.

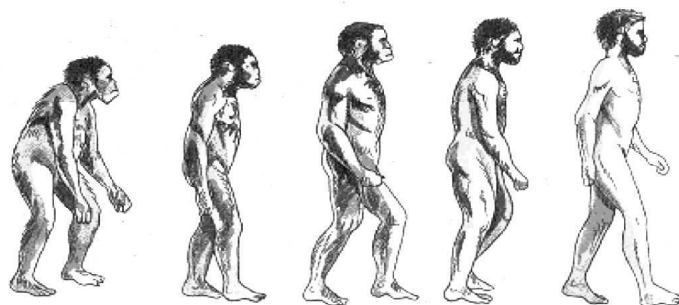
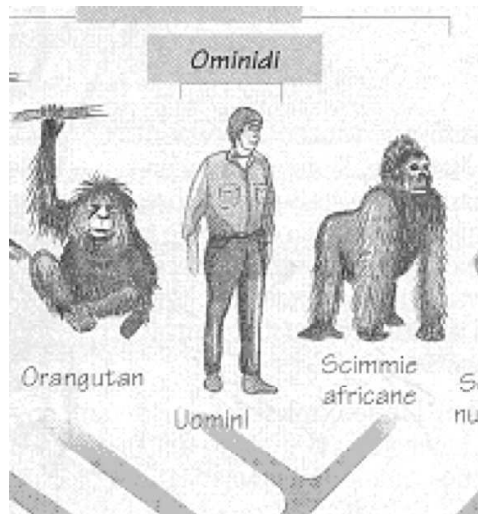
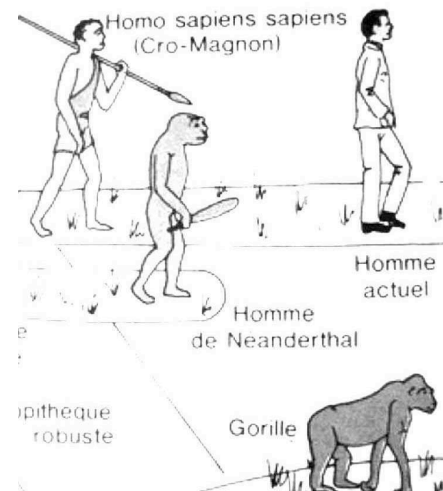


Figure 3. Linear conception of human evolution, ending with a white-skinned and bearded man. Modified from: Colombi, Negrino, & Rondano, 2001, p. 277 (the original is in colour)

Another frequent representation of *Homo sapiens* was as a male human, with characteristics of occidental society (white-skinned, occidental clothing and/or tools and accessories). The images below (Figure 4) show a man wearing modern blue dress in an Italian book, and even in the Senegalese textbook, a white man with a suit.



Miller & Levine, 1998, p.209



Désiré, 1983, p.314.

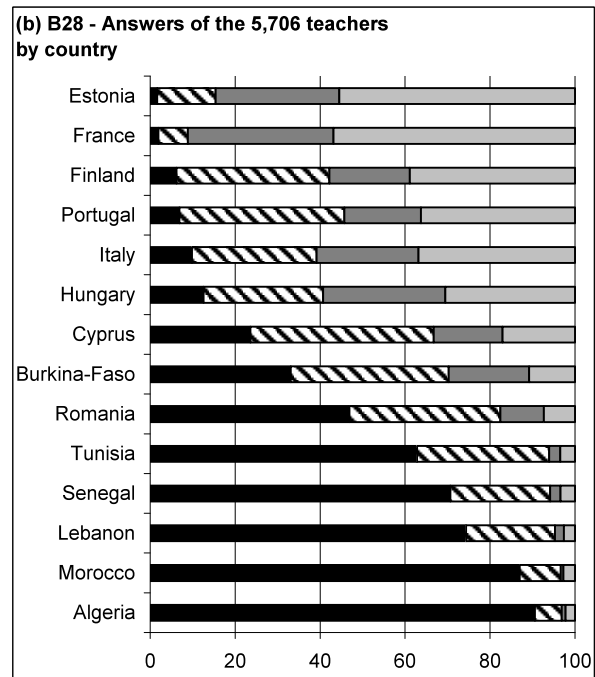
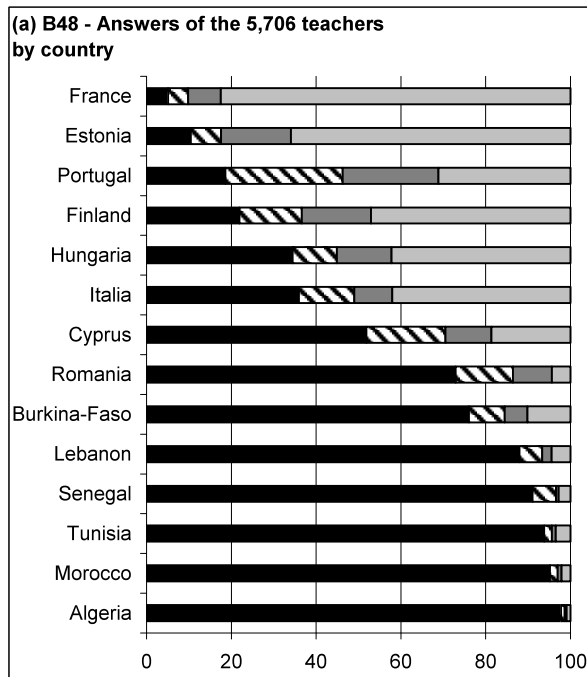
Figure 4. Two representations of an occidental male *Homo sapiens* (modified: the originals are in colour)

Consequently, in the great majority of the textbooks analysed, biological evolution ends with an occidental white male *Homo sapiens*.

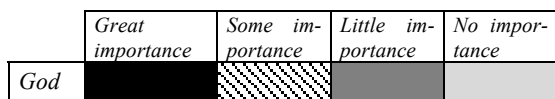
3.3 What are the teachers' conceptions related to human origins?

In answer to question B48 (Figure 5a), related to "the importance of God in species evolution", 8% of the teachers ticked "great importance" or "some importance" in France, while this percentage increased to 95 or more in Lebanon, Senegal, Tunisia, Morocco and Algeria. Nevertheless, some of these teachers were also evolutionists. In answer to question B28 (Figure 5b), 2% of the French teachers ticked the radical creationist item ("It is certain that God created humankind"), whereas 62 to 92% of the teachers ticked it in Tunisia, Lebanon, Senegal, Morocco and Algeria. Other teachers had conceptions that were both creationist and evolutionist, ticking the third item ("Human origin can be explained by evolutionary processes that are governed by God"): 6% of teachers in France and Algeria, to 32% or more in Tunisia, Burkina, Portugal, Finland, Romania and even 43% in Cyprus (Figure 5b).

Further analysis of the answers to question B28 (Figure 6) revealed major differences among the 14 countries. Even when comparing only the Christian teachers' answers (Figure 6, B28 Chr), there were very significant differences among countries, showing a strong influence of national socio-cultural context.



(a) B48. Indicate your evaluation of the importance of God in species evolution (tick only one of the 4 boxes)



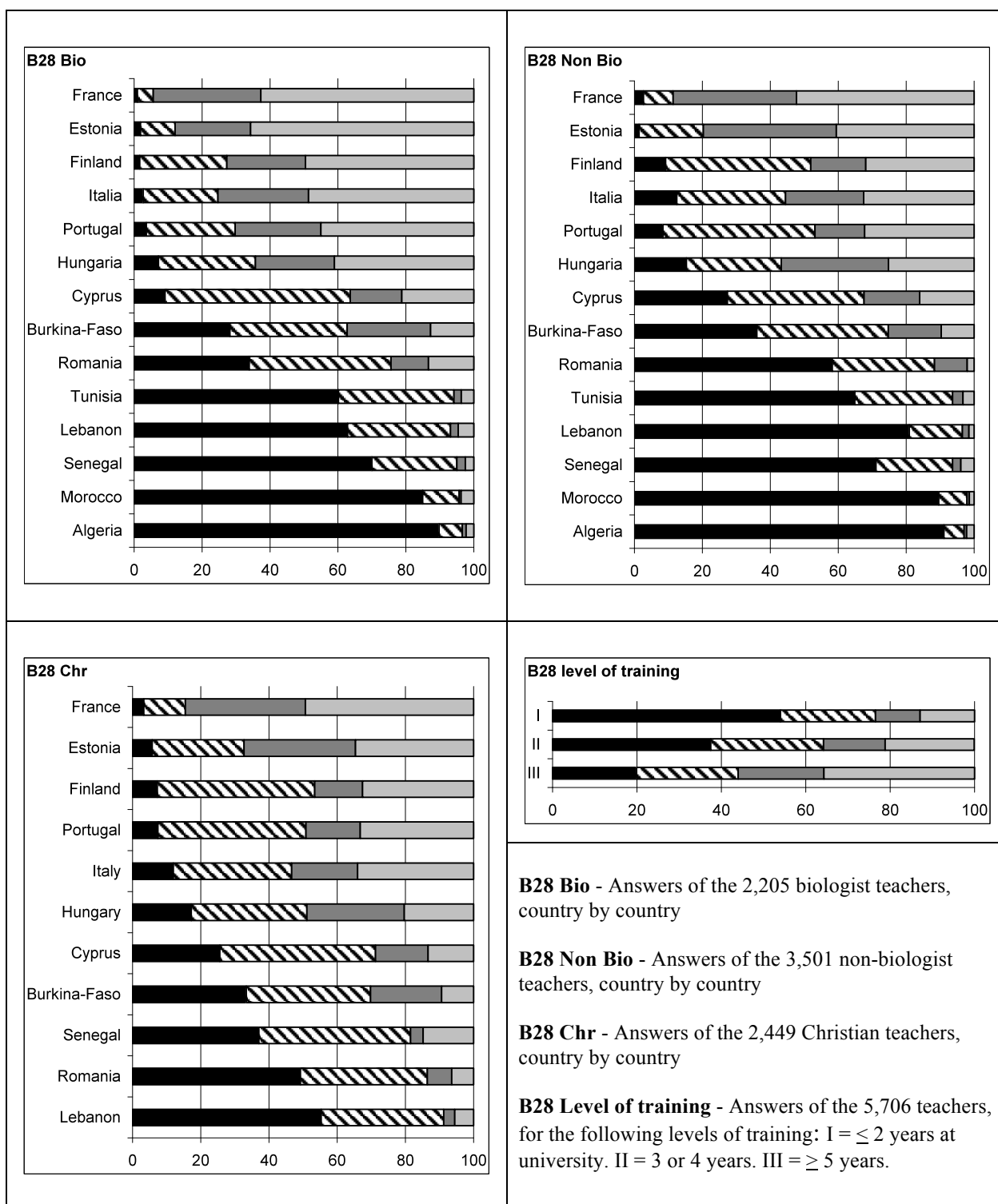
(b) B28. Which of the following four statements do you agree with most? Select ONLY one sentence:

- It is certain that the origin of the humankind results from evolutionary processes.
- Human origin can be explained by evolutionary processes without considering the hypothesis that God created humankind.
- Human origin can be explained by evolutionary processes that are governed by God.
- It is certain that God created humankind.

Figure 5. Teachers' answers to questions B48 and B28 (5,706 teachers in 14 countries)

The answers of the "biologist" teachers (biology teachers in secondary schools + primary school teachers with a diploma in biology; their number is indicated for each country in Table 1) were not so different, within each country, from the answers of their non-biologist colleagues. The difference between biologist teachers and other teachers was nevertheless significant in nine countries (Chi2 with the Bonferroni correction): Cyprus, Estonia, Finland, France, Hungary, Italy, Lebanon, Portugal and Romania. In these countries, biologist teachers were more evolutionist than their colleagues, often with a more important amount of creationist + evolutionist conceptions (item 3 in question B28). In four of the five countries where there was no significant difference, Algeria, Burkina, Morocco and Tunisia, human evolution was not included in the syllabus (Figure 2).

Another important result is shown in Figure 6, graph "B28 Level of training". There was a direct positive correlation between the time a teacher had trained at university and his/her acceptance of evolution: 19% radical creationist conceptions related to the origin of mankind when the level of teachers' training was ≥ 5 years at university; 36% with 3 or 4 years of university; 53% with 2 years or less at university.



B28 - B28. Which of the following four statements do you agree with most? Select ONLY one sentence:





-  It is certain that the origin of the humankind results from evolutionary processes.
-  Human origin can be explained by evolutionary processes without considering the hypothesis that God created humankind.
-  Human origin can be explained by evolutionary processes that are governed by God.
-  It is certain that God created humankind.

Figure 6. Teachers' answers to question B28 (5,706 teachers in 14 countries)

4. Discussion and conclusions

Studies on Evolution teaching have been performed in various countries and often show the great importance of social context with respect to curriculum and textbook contents: Barberá, Beatriz and Pérez-Pla (1999) on Spanish biology curricula; Jiménez Aleixandre (1994, 1996) on Spanish textbooks; Swarts, Anderson and Swetz. (1994) on Chinese, American and Soviet secondary-school biology textbooks; Skoog (1984) and Rosenthal (1985) on US textbooks. We focused our study on human evolution, for which the obstacles and difficulties are exacerbated (Quessada 2008; Quessada & Clément 2006a, 2006b, 2007). Skoog (2005) also studied the coverage of human evolution in 20th century in US high-school biology textbooks and in current science standards. He ascertained that before 1960, human evolution was given little attention in biology textbooks. In the following two decades, the situation with regard to human evolution worsened in that information was minimal. In 1990, human evolution was unrestricted. By 2004, three states included the teaching of human evolution in the state science standards.

Our comparative study shows great differences between countries (with respect to syllabuses and teachers' conceptions): the social context strongly influences the way evolution is (or is not) taught, particularly human evolution. In other articles, we analysed the social factors which are correlated with the teachers' conceptions (Clément & Quessada, 2008, 2009; Quessada, 2008; Quessada, Munoz, & Clément, 2007): the degree of belief in God and in religious practice, the economic status of the country and the teachers' level of training. In the present paper, limited to the evolution of humankind, we also show that the longer the teachers trained at university, the greater is their acceptance of evolutionist ideas. Moreover, in most of the countries where human evolution is taught, the conceptions of teachers who had training in biology are less radically creationist, more creationist-evolutionist than those of their colleagues.

This raises the problem of teachers' training: how can human evolution be introduced in syllabuses when teachers' conceptions are not evolutionist? What training can help effect this change? Our results encourage longer training periods for future teachers in every country, incorporating more biology. They also suggest incorporating an epistemological approach of science in their training, to help teachers differentiate belief from scientific knowledge, to consider religion and science as two non-overlapping domains, i.e. the non-overlapping magisterial (NOMA) proposed by Gould (2000). This could be a first step to introducing the topic "evolution of mankind" in schools of any country.

The present work, along with previous articles (Quessada et al, 2008; Quessada & Clément, 2009), also shows that social representations of human evolution coming from images in textbooks are more or less the same in all countries teaching evolution: *Homo sapiens* is nearly always an archetypal male with white skin, either naked or dressed in occidental clothing. The DTD is important, being more than 15 years: scientific representations with bush-like, non-linear evolution schemas were very rare in 2004 textbooks. These results show that scientific messages related to the origins of humankind are generally mixed with implicit values such as finalism (end-goaled evolution), sexism and occidentalism. Teachers have to identify these epistemological obstacles and try to explain the possible interaction between taught science and values to develop critical attitudes in pupils.

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