agence d'évaluation de la recherche
et de l'enseignement supérieur

Department for the evaluation of research units

AERES report on unit:

Equine Biomechanics and Locomotor Pathology

BPLC

Under the supervision of the following institutions and research bodies:

National Veterinary School of Alfort

January 2014

agence d'évaluation de la recherche
et de l'enseignement supérieur

Department for the evaluation of research units

On behalf of AERES, pursuant to the Decree of 3 november 2006[1]*,*

- Mr. Didier HOUSSIN, president
- Mr. Pierre GLAUDES, head of the evaluation of research units department

On behalf of the expert committee,

- Mr. Hans GEYER, chair of the committee

[1] The AERES President "signs [...], the evaluation reports, [...] countersigned for each department by the director concerned" (Article 9, paragraph 3 of the Decree n ° 2006-1334 of 3 November 2006, as amended).

Evaluation report

This report is the result of the evaluation by the experts committee,the composition of which is specified below.

The assessment contained herein are the expression of independent and collegial deliberation of the committee.

Unit name:	Equine Biomechanics and Locomotor Pathology
Unit acronym:	BPLC
Label requested:	UPR/UC
Present no.:	UC 957
Name of Director (2013-2014):	Ms Nathalie CREVIER-DENOIX
Name of Project Leader (2015-2019):	Ms Nathalie CREVIER-DENOIX

Expert committee members

Chair: Mr Hans GEYER, Zurich Veterinary Faculty, Switzerland

Experts:

Mr Francis DESBROSSE, Clinique Desbrosse

Mr François-Xavier LEPOUTRE, University of Valenciennes and Hainaut-Cambrésis

Ms Ann MARTENS, Ghent University, Faculty of Veterinary Medicine, Belgium

Mr Serge POIRAUDEAU, Paris-Descartes University

Scientific delegate representing the AERES:

Mr Hubert LEVÉZIEL

Representative(s) of the unit's supervising institutions and bodies:

Mr Cyril KAO (representative of Doctoral School n°435)

Mr Alain OURRY (representative of Doctoral School n°497)

Mr Thierry PINEAU, INRA

Mr Renaud TISSIER, ENVA

1 • Introduction

History and geographical location of the unit

The research unit was created in 1991 in the context of the collaboration between the "Ecole Nationale Vétérinaire d'Alfort" (ENVA) and of the Institut National de la Recherche Agronomique (INRA) and was then entitled "Biomécanique du Cheval".

Since 1999, the unit is organized in two teams which have two locations. One team « Biomécanique articulaire et tendineuse » (BAT), directed by Pr Nathalie CREVIER-DENOIX, is at ENVA, in Maison-Alfort. The other team, directed by Pr Jean-Marie DENOIX and named « Imagerie et pathologie osteoarticulaires »(IPOA), is located at Goustranville (Calvados). In the recent past, since 2009, the unit has the status of an own unit, « unité propre » attached to DGER (Direction Générale en Enseignement et Recherche), but the BAT team is also attached to INRA as an under contract unit (USC 957).

The IPOA team was set up when in 1999 the « Centre d'Imagerie et de Recherche sur les Affections Locomotrices Equines » (CIRALE), located in Calvados and founded with the support of the "Basse-Normandie" Region, started its work. Horse breeding is very important In this area and has major impact on the economy as well as on the social and cultural life. Research about all factors inducing pathologies of the locomotor system in the equine species and especially research in preventing such pathologies is of a very high value for all people whose income is based on breeding or the use of horses because these pathologies are the most important causes of premature ending of the sportive career of horses.

Management team

Pr Nathalie CREVIER-DENOIX is director of the unit and Pr Jean-Marie DENOIX is co-director.

AERES nomenclature

Domaine scientifique : SVE2_LS9

Unit workforce

Unit workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	6	6
N2: Permanent researchers from Institutions and similar positions	1	1
N3: Other permanent staff (without research duties)	1	
N4: Other professors (Emeritus Professor, on-contract Professor, etc.)		
N5: Other researchers from Institutions (Emeritus Research Director, Postdoctoral students, visitors, etc.)		
N6: Other contractual staff (without research duties)	6	4
TOTAL N1 to N6	14	11

Unit workforce	Number as at 30/06/2013	Number as at 01/01/2015

Doctoral students	2	
Theses defended	3	
Postdoctoral students having spent at least 12 months in the unit*		
Number of Research Supervisor Qualifications (HDR) taken	1	
Qualified research supervisors (with an HDR) or similar positions	4	5

2 • Assessment of the unit

The unit "Equine Biomechanics and Locomotor Pathology" ("Biomécanique et Pathologie Locomotrice du cheval" or "BPLC") has two main objectives:

a) To find and document the site of different lesions in the locomotor system, and to use this as a base for treating and preventing those pathologies;

b) To acquire knowledge in the biomechanical factors which induce the pathologies related to the sportive use of the horses.

With their small teams, the unit was able to establish diagnostic methods and a precise documentation of results, especially concerning the juvenile joint lesions and tendon lesions of horses. The knowledge of the forces and the kinematics of the horses limbs provides a solid basis for research on the prevention of the numerous orthopaedic pathologies which frequently induce lameness.

Strengths and opportunities related to the context

The unit is very innovative and established excellent new methods and concepts in diagnostic, prophylaxis and treatment of the equine locomotor apparatus and its pathologies. The high standard of the technical equipment and the very creative approach in diagnostic and in kinematic of horses is a special and outstanding strength of the unit.

In growing up, training and working on different tracks, the unit succeeded to transform the new results for the benefit of the horses and their users. The numerous papers and presentations of the members are responsible that the scientific results are world-wide recognized. Therefore the unit has an outstanding national and international reputation and its experts are highly estimated world-wide.

The perspectives for continuing the development of the research carried out in excellent conditions in Calvados are favorable because the extension of the CIRALE in Goustranville (as stage III of the expansion of the center) is ensured by the region Basse-Normandie.

During the visit, the Director of the ENVA states that he knows and appraises the outstanding quality of the research in the unit and that he will give all his support for a successful future of this unit.

Weaknesses and threats related to the context

The small number of long-time employees (only 3 per team) is a big disadvantage. In all the investigations of the unit, an intense and long-lasting collaboration between veterinarians and engineers is absolutely necessary; however, the positions of the engineers are in the rule only limited contracts of two years.

The long distance between the two sites (Maisons Alfort and the CIRALE) renders that the exchange between both groups is more difficult. Teaching or assisting in the daily work between one team and the other can not be realized spontaneously and has to be scheduled long-time ahead.

Recommendations

With the superb methods it developed, the unit is able to do long-time follow-ups of the locomotor apparatus of many horses, which have been trained or treated under defined conditions. The research unit has the unique possibility to draw conclusions regarding how the pathologies develop or how they can be treated or even better can be avoided. Therefore it is very important, that the unit can continue with the long time research program, because it uses many years until you get reliable results in horses. As mentioned above, the prophylaxis of pathologies, based on very numerous measurements and documentations of the clinical state, are of an enormous value for all users of the horses.

In order to contribute to the long-term existence and the further success of the research unit, which already has done a highly estimated work for the health and the well being of horses and their users, the committee considers that the renovation and enlargement of rooms and laboratories in Maison-Alfort appear as an absolute necessity.

The committee also considers that the unit is still highly fragile and suggests that a very strong attention should be paid in recruting collaborators on more long-time positions in order to maintain and to ensure its productivity and its attractiveness for young researchers.

3 • Detailed assessments

Assessment of scientific quality and outputs

The small unit had a big number of publications in peer-reviewed journals of a high standard. The total number of 73 papers in 5 years means an average of 15 papers per year. Besides many articles in the veterinary sciences journals, the fact that the unit published some of their main results in more general journals has to be pointed out. More than 70 communications at national or international congresses have also been given. Team members wrote also several books or chapters in books.

Assessment of the unit's academic reputation and appeal

The unit is the only one in France dealing with the physiology and pathology of the locomotion apparatus in horses. Besides the national reputation the work of this unit is well known and estimated over the whole world, not only by veterinary and equine specialists, but also by non-veterinary researchers in the disciplines of comparative medicine and biomechanics. Many collaborations already exist between the unit and research groups of biomechanics in Paris, Uppsala (Sweden) and Davies (California, USA).

The activities of the unit members as experts for equine sportive events or for problems related to equine locomotion show how the knowledge and the expertise of the unit is demanded and estimated in the national environment and world-wide. The numerous invitations of the teams leaders at conferences in Europe and other continents are indicators of their outstanding reputation in the scientific world. In the 5-year period, 111 conferences were given as invited speakers (77 by the IOAP and 34 by the BAT-team respectively).

Apart from this the unit received 4 research prizes for its work and organized 2 international congresses: the international congress on locomotion and the 23rd Congress of the European Association of Veterinary-Anatomists in 2010.

Assessment of the unit's interaction with the social, economic and cultural environment

The unit succeeded to bring their results of basic sciences to a wide public, who can apply the results for the benefit of the horses and their users. In this sense the unit created an optimal transfer from basic research to applied sciences. The research of both teamss is complementary and clearly defined. The unit achieved a patent in France for measuring the tension in tendons and another in USA for producing a model of fibrous structure of fibrous tissue.

The contracts with companies and public institutions for research projects provided with more than 2.2 Million € during the five years period and it is a strong proof of the good examplary interactions with the environment and a sign of a very high confidence of all partners in the research unit.

Assessment of the unit's organisation and life

Based on the documents and the interviews with unit members, the committee had the impression of a very good and harmonic team life within and between both teams of the unit. The meetings and scientific exchanges occur on a very regular base in the CIRALE and daily in Maisons-Alfort (because the members of that team live closer together). The two teams have an excellent complementarity and synergy. The long distance between the two locations is a disadvantage, which is however overruled by the great advantage to have a field-station at the best conditions and an environment where horses are bred and trained.

Assessment of the unit's involvement in training through research

The unit is intensely involved in training through research and their members have many responsibilities in teaching and in daily clinical diagnostic work and care for equine patients. The success of both groups is only due to an enormous engagement and idealism of all members, whose leaders are well estimated over the whole world. During the period, there were 110 people welcomed for practice in the CIRALE, from whose 18 were residents or veterinarians of foreign countries; in addition, 2 seminaries with 40 participants in diagnostic were performed as well as trainings for farriers.

In the unit, 3 theses were finished and 5 theses are in progress; 11 Master diplomas were finished. Sixteen theses de Doctorat vétérinaire were completed and 4 diplomas within the DESV (Diplôme d'études spécialisées Vétérinaires) were obtained.

During the thesis the doctoral students have a great opportunity to realize experiments with methods of engineering or natural sciences to answer questions of biomechanics or veterinary medicine in equine locomotion. In this way it was possible to get results concerning tension of the superficial flexor tendon of the horse in motion or detecting biomarkers for tendon lesions in horses. Such theses are of very good reputations for the further career of the candidates.

During the visit, the committee members had a short exchange with the Directors of the Doctoral Schools 435 and 497 (telephone call) to which the teams are respectively attached. Both of them confirmed that the theses submitted by the unit are regularly of a high standard and they hope that the good collaboration will continue. However, the foreign members of the committee were astonished to hear that French Veterinarians are only admitted for a doctoral thesis after supplemental master degrees in other sciences like engineers or natural sciences as pharmacist, chemist etc.. The veterinarians of the committee think that young veterinarians would be more encouraged for scientific work if they could participate in research for a doctoral thesis after their veterinarian diploma without preliminary studies of other disciplines and they altogether consider that a Diploma in Veterinary Medicine of France is accepted in Europe as a very good qualification.

Assessment of the strategy and the five-year plan

The strategy and the five year plan for the next period was presented in a clear manner and includes both continuation of the former projects and the start of new projects.

These projects are all very ambitious, but realistic, and can be well performed with the existing equipment and in collaboration with other units.

The expected results will give very important impacts for therapy and prevention of pathologies in equine locomotion and are therefore of a high economic value.

The projects will be mentioned in the chapter for each team. For the realisation of research of such a high quality in future, the conditions should give a certain relief of the daily duties for the team leaders. A wider distribution of the work to long-time experienced collaborators should be attempted. Moreover the environment and the laboratories could be improved in Maisons-Alfort.

4 • Team-by-team analysis

Team 1 : Osteoarticular Imaging and Pathology « Imagerie et pathologie osteoarticulaires » (IPOA)

Name of team leader: Mr Jean-Marie DENOIX

Workforce

Team workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	3	3
N2: Permanent EPST or EPIC researchers and similar positions		
N3: Other permanent staff (without research duties)		
N4: Other professors (PREM, ECC, etc.)		
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)		
N6: Other contractual staff (without research duties)	3	3
TOTAL N1 to N6	6	6

Team workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	1	
Theses defended	2	
Postdoctoral students having spent at least 12 months in the unit		
Number of Research Supervisor Qualifications (HDR) taken		
Qualified research supervisors (with an HDR) or similar positions	2	2

• Detailed assessments

Assessment of scientific quality and outputs

In Goustranville (Calvados) an excellent possibility exists for investigations in horses of three disciplines (Warmbloods,Trotters and Thoroughbreds) and the team has very strong connections to the horse breeders of the environment. Together with new buildings and a very modern equipment in Radiology, Ultrasonography, Scintigraphy and Magnetic Resonance Imaging (MRI), optimal conditions exist for clinically based research. The diagnostic work on 1'000-1'200 horses per year, suffering from lameness or other locomotor disorders, is a big effort for the relatively small research team, but forms a solid base for clinical research.

The IPOA team is working in the context of CIRALE which is financing itself since 1999 and is able to pay the expenses of a large part of the crew and the maintenance costs of the centre and its machines by the income of the diagnostic work. The personal consists of 14 veterinarians and 7 non veterinarians; 4 persons are employed by the ENVA, the rest of salaries are self-financed for an amount of 450.000 € per year.

The documentation and follow-up of a wide range of locomotory pathologies allows IPOA to draw conclusions on the development and the causes of the lesions. The study of 392 foals of the breeds Trotters, Thoroughbreds and Selle Français showed that the hind fetlock joint was in 28.3 % of the foals the most common location for osteochondrosis, and that this condition was most frequently seen in Selle Français horses. An evolution of radiological findings between 6 and 18 month was also possible. The follow-up study in 328 yearlings was of special interest and showed that horses with few or mild radiological findings as yearlings were later better positioned in races than those with higher grades of radiological changes. The cited examples indicate how important the IPOA/CIRALE-research is in favour of improvement of the health condition of horses and the income in the horse industry. No other research unit in the world has such facilities and would be able to do such a widely disposed research with horses as it has been performed in the CIRALE.

IPOA published 50 articles in peer-reviewed journals of a high standard (impact factors of more than 2, a high standing in veterinary medicine), which during the period corresponds to an average of 3.3 papers per year per scientist. The team gave 34 communications at national or international congresses. The highlight of the team publication was the special issue in "The Veterinary Journal" (Nr. 197, 1, 2013) to the difficult and very important subject on juvenile osteochondral conditions in horses, which comprised the follow-up of 392 foals in the breeds Selle Francais, French trotters and Thoroughbreds.

The authorship of chapters in books (radiology of the tarsus and stifle joint) by a team member and of the book entitled "Biomechanics and physical training of the horse" by the team leader give also a clear view of the deep knowledge and experience of the IPOA team.

As a whole, the scientific production of IPOA is more than excellent and of the highest interest in term of quality and innovation, especially because it is based on the use of the more moderm imaging methodologies and the collection of many observations on a large population of horses which have beenvestigated together with information on their environmental conditions.

Assessment of the unit's academic reputation and appeal

The team-leader and his crew are worldwide estimated as experts in all disciplines of equine locomotion. In the academic world their experience and their didactic skills are well known, which is reflected by the very high number of invitations to national and international congresses and conferences as invited speakers.

In addition, the team leader has become Diplomate of the American College of Veterinary Sport Medicine and Rehabilitation (2013) and a team member is Vice-president of the European Large Animal Diagnostic Imaging Society (2011).

Assessment of the unit's interaction with the social, economic and cultural environment

The interaction with the environment is extremely intense in this team. As particular examples, it can be mentioned that the team leader was expert of the FEI (Fédération Equestre Internationale) in the Equine World Championship in Lexington (Kentucky, USA) and that the CIRALE will assure the veterinarian activities concerning imaging and diagnosis of sport injuries in the World Equestrian Championship in 2014.

The numerous contracts for collaboration and financial contracts prove the high confidence of many public institutions and companies in the work of the team. There was an amount near 800.000 € assured for this 5-year period (Projects: Hippocart, Tendimage and Equitend). A great success for the team is that a further stage (stage III) of the extension of the CIRALE, which includes the installation of a new and very powerful MRI for a total of about 4 millions €, is assured.

The results concerning osteochondrosis and other locomotor pathologies mean that this knowledge should be considered by the professionals and change some strategies. This should occur in the selection of sound animals for breeding and in avoiding too intense nutrition and the very ambitious and strong training programs of the young horses.

Assessment of the unit's organisation and life

In order to complete what has already been mentioned with regard to the whole unit, the IPOA team appeared very well organised. Meetings for all duties with the patients, journal-clubs, discussions of research projects and the state of affairs are held on a regular basis with the members of the staff.

Assessment of the unit's involvement in training through research

The CIRALE is accredited for the education of European residents since 2010.

Many veterinarians are trained in equine practice and research. A great number of pre- and postgraduate students were accepted and trained (masters, engineers and veterinarians), with very good success.

In the context of the doctoral school, the CIRALE acquired an excellent reputation.

Assessment of the strategy and the five-year plan

In the strategy and the 5-year plan IPOA has presented, the following projects were discussed, which for some of them are partially already started:

1. The project “Tendimage” identified markers, which are sensitive and specific for tendinopathies. The new project “Equitend” will evaluate the compatibility and therapeutic effect of the application of the biopolymer RGTA in tendon lesions;

2. The project “Tendolyse” tries to induce the fibrinolysis of the intratendinous clot at early stage of lesions, so that the regeneration can be studied afterwards by imaging methods and histology;

3. The project “Trotter races without shoes” – a project with high relevance for animal welfare, aims to assess the lesions that occur when horses race without shoes, and to give recommendations on what is tolerable for the horse’s feet;

4. “Radiculopathies cervicales” is a project on the diagnosis and management of compressive cervical neuropathies in the horse. Identification of clinical cases with irritations of the spinal cord and its nerves increased during the last years together with the pathologies of the cervical articulations, which are near to the spinal nerves. The project aims to developp the present knowledge on the inflammations and compressions of the nerves and the spinal cord which may induce pain and ataxies;

5. The project “Hippocart” shall develop new diagnostic approaches and stem cell therapies for arthropathies in the horse. A model of fetlock osteoarthritis has been developed and by means of cell engineering it shall be tried to obtain cartilage matrix regeneration;

6. A project “Physiotherapy” wants to evaluate the effects of physiotherapy and training in the swimming pool and the functional effect and therapeutic indications of electro-stimulation in the horse.

The mentioned projects have partially connections among them. They all consider the urgent questions of equine practice. Despite it will represent a very high effort for a small team to conduce the projects, the committee note that it has already been the case with outstanding results in the last decades. All the projects are ambitious, contain creative orginality, and they have a high relevance for the welfare of horses and for the equine practitioners. The material equipment and the location of the CIRALE are optimal conditions for the realization of the projects.

Conclusion

- **Strengths and opportunities:**

The IPOA team has well known experts in the field of equine locomotion and there is a very good synergy between veterinary clinicians and engineer or practioners.

The CIRALE centre which has a wide recruitment of horses for clinical diagnosis of locomotor disorders, is the optimal environment for equine diagnostic research.

The stage III of the expansion of the CIRALE has been decided and is ensured by the region Basse-Normandie and this opens very positive perspectives for continuing the development of the research carried out.

- **Weaknesses and threats:**

The personal, who is only connected to contracts is a problem for the continuity of the research.

The daily duties to run a large equine diagnostic centre with a great part of teaching diminish, for this relatively small team, the time available for research.

- **Recommendations:**

The IPOA-team should have more experienced leaders, dealing with the daily diagnostic work and attending the research projects.

The committee considers that in the future, the immense work in publishing and in education with conferences, workshops etc. should rely on several team members instead of mainly one today.

Among the various actions expected to support this successful research team, a specific attention should be given to recruit more long-time positions in order to maintain its very attractive position and its reputation in the whole world.

4 • Team-by-team analysis

Team 2 : Articular and tendon Biomechanics

« Biomécanique articulaire et tendineuse » (BAT)

Name of team leader: Ms Nathalie CREVIER-DENOIX

Workforce

Team workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	3	3
N2: Permanent EPST or EPIC researchers and similar positions	1	1
N3: Other permanent staff (without research duties)	1	
N4: Other professors (PREM, ECC, etc.)		
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)		
N6: Other contractual staff (without research duties)	3	1
TOTAL N1 to N6	8	5

Team workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	1	
Theses defended	1	
Postdoctoral students having spent at least 12 months in the unit		
Number of Research Supervisor Qualifications (HDR) taken	1	
Qualified research supervisors (with an HDR) or similar positions	2	3

• Detailed assessments

Assessment of scientific quality and outputs

The BAT team in Maisons-Alfort consists of 7-8 members and only 4 of them are permanent teachers and researchers. At first, the team members have a great deal of work in teaching Anatomy to the students of the École Nationale Vétérinaire de Maisons-Alfort. It is admirable that this team could achieve so successful results in their biomechanical research in the horse, a species with a complex dynamic locomotor system, which brings many difficulties in the measurement of forces.

BAT succeeded in establishing non-invasive methods for measuring the forces working on the different components of the equine distal limb in horses moving in their natural environment. The methods were first tested under laboratory conditions in an intense collaboration between veterinarians and engineers.

The forces of the superficial flexor tendon were measured at first in tension tests with tendons of slaughtered horses and a sonographic sensor, and it could be demonstrated that with increasing tension the speed of ultrasounds linearly increased. Next, the team also succeeded to measure the tendon tension in the superficial digital flexor tendon at the level of the Metacarpus and Metatarsus in the life horse in movement.

For measurement of the forces and the accelerations in the hooves, BAT developed a new dynamometric horseshoe with pressure receptors at the level of the sole and a receptor for accelerations at the dorsal hoof wall. The dynamic horseshoe allows to measure the forces and movements in different circumstances of work (e.g. on different race tracks). This is a field where up to now only rough assessments could be made. The project “Sequisol” was performed with trotters, which run with a sulky. Large differences in forces acting on the distal limb between hard sandtracks and tracks containing waxed fibres were seen; the track with waxed fibres resulted in much lower vertical forces to the hooves. In the subsequent project “Safetrack” the dynamic horseshoe and the sonographic measurements of tendon tension are combined and adapted for the ridden horse.

The developped experimental methods of the BAT-team are up to now unique in the world. It is a great success of the team that they could adapt the results of laboratory studies to field conditions, where measurements of the life animal in motion are possible. The development of these methods was a very time consuming process, but now it enables to get correct informations about the forces induced on the limbs and the influence of the tracks. The excellent kinematic methods allow to study in the slow motion modus, how the mouvements proceed in the different positions. This gives realistic informations for all people who want to learn more about equine locomotion.

BAT published 23 articles in peer-reviewed journals of a high standard, which correponds to an average of 1.2 papers per year per scientist during the five years period. Besides the articles in the Equine Veterinary Journal, the team could publish their results on tendon loads and the force measurements in hooves and limb kinematics of horses in the Journal of Biomechanics. This is a fact, which must be pointed out as a sign of an intense and very effective collaboration of veterinarians and engineers.

The team gave 40 communications at national or international congresses. The publication of scientific and technical reports, as the “rapport technique sur le project Sequisol” also attests of the skills and experience of the BAT-team.

The intense collaboration between veterinarians and engineers created outstanding methods to realize measurements in equine locomotion, which seemed to be impossible for years. The knowledge of the immense forces, and the big influence of the different race tracks, which can now be measured as well in the ridden horse, gives exact informations about the various impacts on the locomotor apparatus in motion. This is only due to the outstanding and unique productive work of the BAT-team.

Assessment of the unit's academic reputation and appeal

The excellent reputation of the research of the BAT team resulted in an increasing number of invitations as speakers in national and international conferences world wide and in requests for collaborations. In this respect, a collaboration with a research group in Davies (California, USA), whose work is complementary to the BAT-activities, is on the way.

Assessment of the unit's interaction with the social, economic and cultural environment

The increased knowledge on equine locomotion which is obtained by the results of the BAT team constitutes a sound scientific base in the development of strategies to prevent musculoskeletal injuries in the horse. This is very important in a field where many "facts" were up to now speculative. A first practical application would be a good scientific advice for the choice of race-tracks based on the results of the studies performed.

The measuring devices developed are very well adapted for practical use, as they allow to obtain objective data on the stress and strain to the equine locomotor system in different circumstances "on the field". Therefore different equestrian organizations are enthusiastic for a good collaboration with the team, because they realize that studies on the measurement of load to the limbs and the influence of the different soils serve for the health and the well being of the horses and for their own benefit.

The BTA team had contracts of more than 1 400 000 € (Projects: Sequisol, SIM, Safe Track and one thesis) over the last five years, and that situation can be seen as a sign of high confidence and estimation to the outstanding work of the group.

The applied biomechanics of equine locomotion is a new field, which gives realistic informations about the forces and the influences of different tracks to the horses in motion. This is a very good chance for the industry and the users of the horses to improve the conditions and to do profitable investments for the welfare of the horses and their users.

Assessment of the unit's organisation and life

The organisation and life of the team seemed to be very well and harmonic. In Maisons-Alfort, the research team has good facilities for *in vitro*-tests and dissections and all the research work is done next to a wide duty in teaching anatomy to Veterinary Medicine students. The committee also noted that the research work in the field has a very distinct long-term plan.

Assessment of the unit's involvement in training through research

BAT participates in continuous training through research. One thesis is accepted, one is ongoing, and, during the period, 3 persons reached a Masters degree and in addition 8 reports of engineers were accepted thanks to their practice in the research team. Furthermore, one colleague received the diploma HDR.

Assessment of the strategy and the five-year plan

The research program shall continue with intense field studies planned in the context of the project Safe-track will be very important, because it is essential for equine sports to get more data on the wide field of influences of the different tracks and work of the horses (different disciplines) on their locomotor system. In this context the team wants to get information about the pathologies induced to the musculoskeletal system by tracks of inferior quality or by certain trainings – this in collaboration with the IPOA-group.

Another great and ambitious perspective is the project "Biomechanics of the back and the interactions with the saddle". In this project pressure-measurements of different saddles shall be performed combined with kinematic studies of the motion in the region of the spinal column. The painful pathologies in the back as well as in the cervical region indeed became serious hot item in the last decades.

The projects for the five-year period depend to the needs of the equine practice. They are ambitious, based on excellent self-developped methods and let expect, like in the last period, results of a high relevance for the benefit of the horses. It is of special interest to get further informations about the severe mechanical influences on the locomotor apparatus in motion. The need of the projects is evident, and the high motivation and the wide knowledge of the team should bring again new and outstanding results. These results about equine locomotion under field conditions will be the base for many improvements in equine health and will have as well a benefit for the equine users.

Conclusion

- **Strengths and opportunities:**

This team has developed very sophisticated methods for measuring forces and motions to the hooves and tendons of the distal limbs. These newly developed experimental methods are world-wide unique and give the opportunity to measure the various influences of tracks and working conditions of horses under field circumstances. The results have high relevance to the practice of veterinarians, horsemen and for the well-being of sport horses.

- **Weaknesses and threats:**

In Maisons-Alfort, the buildings and rooms are suboptimal, although the deficiency in rooms induces a good interactions within the members of the team.

All experiments and measurements with life horses occur outside Maisons-Alfort at different locations under defined conditions. They need to be planned a long time before they can be realized and these experiments also require the participation of the entire team. The high costs for maintaining the technical instruments is a further difficulty.

A weak point in this team is the small size and the always existing problem of a loss of qualified personal. A great part of the personal is employed with contracts only for a certain time and the presence of a colleague in charge of the administrative work should not be prolonged in the plan of 2015. This is a continuous menace to the group.

- **Recommendations:**

The BAT-team should have in future a constant supply for creating the technical equipment and its modifications, which are continuously needed in the difficult field of measurements in equine locomotion under field conditions.

Similar to the IPOA-team the staff should have in future more long-time experienced specialists, for fulfilling the large duties in research and in the wide field of publishing and teaching for the different users of its experimental work.

The narrowness in old rooms instead of new laboratories and offices could constitute a real disadvantage for the development of the team in the future. The absence of reinforcement in permanent positions for continuous research could also constitute another limiting element.

The team should be encouraged to continue with its excellent work in future and with the same enthusiasm and success as up to now.

5 • Conduct of the visit

Visit date :	14/01/2014
Start :	Tuesday January 14th 2014, at 8 am
End :	Tuesday January 14th 2014, at 18 pm
Visit site(s):	ENVA, Alfort
Institution :	ENVA
Address :	7 avenue du Général de gaulle, 94704 Maisons-Alfort

Conduct or programme of visit:

8:00 am	Welcome & Closed-door Meeting of Visiting Committee with AERES Scientific Advisor
8:45 am	Introduction of Plenary Session: AERES Role & Procedures: AERES Scientific Advisor
9:00	General Presentation of the Unit & Discussion; Ms Nathalie CREVIER-DENOIX and Mr Jean-Marie DENOIX (presentation of CIRALE)
10:15 am	Presentations of Research Teams & Discussion: Team 1: Osteoarticular Imaging and Pathology; Mr Jean-Marie DENOIX and Mr Fabrice AUDIGIÉ Team 2: Articular and Tendon Biomechanics); Ms Nathalie CREVIER-DENOIX and Mr Henry CHATEAU
12:15 am	Discussion of the Strategies and Perspectives of the Unit
12:30 am	Closed-door Discussion with the Director(s) of the Doctoral School(s)
12:45 Lunch	
13:45 pm	Closed-door Discussion with Representatives of the Managing Bodies
14:15	Meeting of the Committee with personnel: Discussion with engineers, technicians, administrative staff Discussion with staff scientists Discussion with students and post-docs
15:00 pm	Closed-door Discussion with the Direction of the Unit (if necessary)
15:30 pm	Closed-door meeting of the Visiting Committee (in presence of AERES Scientific Advisor)
18:00 pm	End of the visit Departure of Committee members

6 • Supervising bodies' general comments

EnvA
École nationale vétérinaire d'Alfort

Ministère de l'Agriculture, de l'Agroalimentaire et de la Forêt

Pr Marc Gogny
Directeur
Tel : 33 (0)1 43 96 71 80
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direction@vet-alfort.fr

n° MG/CF/101-2014

AERES
Section des Unités
20, rue Vivienne

75002 PARIS

Maisons-Alfort, le 16 avril 2014

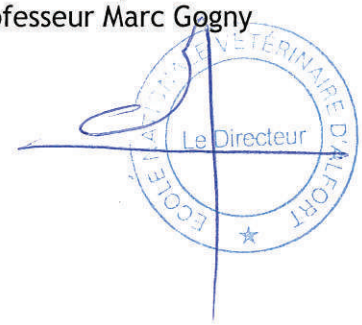
Objet : **S2PUR150008852 - Biomécanique et pathologie locomotrice du cheval - 0940608A**

Madame, Monsieur,

En tant que directeur de l'EnvA, je souhaite vous transmettre les éléments suivants concernant le rapport d'évaluation de l'Unité "Biomécanique et pathologie locomotrice du cheval".

En vous remerciant, je vous prie de croire, Madame, Monsieur, en l'expression de mes salutations très distinguées.

Le Directeur,
Professeur Marc Gogny



Ecole Nationale Vétérinaire d'Alfort

Professeur N. Crevier-Denoix
Unité INRA-ENVA 957 BPLC
Biomécanique et Pathologie Locomotrice du Cheval
Ecole Nationale Vétérinaire d'Alfort
7 avenue du Général de Gaulle
94704 Maisons-Alfort cedex, France
☎ 01 43 96 71 06
01 43 96 70 87
ncrevier@vet-alfort.fr

Professor Hans GEYER
Chair of the experts committee

Maisons-Alfort, le 7 mai 2014

As regards AERES Evaluation :
S2PUR150008852 - Unité INRA-ENVA *Biomécanique et Pathologie Locomotrice du Cheval* - 0940608A

Dear Sir,

On behalf of the BPLC Unit I would like to express our thanks to you and the other members of the AERES experts committee for your evaluation report.
We appreciate that the committee acknowledges our achievements and encourages us to continue. Besides we fully agree with the strengths and weaknesses of the BPLC unit identified by the experts. In particular both teams of the BPLC unit feel specially concerned by the fragility coming from the lack of long-time positions for maintaining a high level production in research in the future.

Kind regards

Pr Nathalie Crevier-Denoix
Directrice de l'Unité INRA-ENVA 957 BPLC