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Scope and Future of Proteomics

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Abstract

Economic losses due to parasites in ruminants throughout the world are considerable. Over the past decade considerable advances have been made in the epidemiology of ruminant infections. Researchers worldwide are diligently seeking alternatives or "novel approaches" for control of parasitic infections in ruminants. Almost all the activities in living cells are performed by proteins and to study all these proteins expressed by the genome of an organism, it is necessary to analyse the proteome. Proteomics not only allows us to obtain a quantitative description of protein expression and its changes under the influence of biological perturbations, but it also provides information about the occurrence of post-translational modifications and the distribution of specific proteins within the cell. In nutshell, the proteomic study is expected to multiply the number of known drug targets 100-fold and would certainly open a new area of research for application to livestock industry throughout the globe.

Keywords: Parasite; Proteomics; Proteins, Ruminants; Genome; Proteome

Opinion

The 20th century has seen the introduction of very important innovative research with the introduction and launch of recombinant vaccines against many economically important parasites. Research continues to hold promise with the development of immunological and molecular approaches for control many economically important parasites and in this regard it has already been seen that blood-sucking parasites are susceptible to control by vaccines containing 'novel' or 'concealed' antigens. As for instance, Haemonchus contortus is primarily pathogenic to sheep and its blood-feeding behaviour causes effects ranging from mild anaemia to mortality in young animals [1]. Current means of control which are dependent on repeated treatment with anti helmintics has been responsible for increasing drug resistance in this parasite. Together with the growing concern of residual chemicals in the environment and food chain, this has led to attempts to better understand the biology of the parasite with an aim to develop alternate means of control, including the development of molecular vaccines. More problematic and also important is the formulation and delivery strategy to induce expulsion of the parasites, using vaccines containing recombinant 'conventional' antigens. Tremendous progress has been made in the last decade in identifying several antigens from many different parasites which in their native form stimulate useful levels of protective immunity. Vaccines have been developed against parasites using 'novel' gut antigens from the parasites, but variable responsiveness of the host has resulted in varying degrees of protection which are stimulated by these vaccines. Computer models have also been used to simulate vaccine efficacy in worm control and it has yielded good results.

The rapid and widespread emergence of anthelmintic resistant strains of the highly pathogenic parasites has resulted in the need to develop alternative control strategies such as vaccination [2-4]. Recombinant protein-based vaccines have recently been developed against the cattle tick Boophilus microplus [5] and the sheep cestode Taenia ovis [6] highlighting the importance as well as effectiveness of proteomics in field conditions. In case of H. contortus and O. ostertagi, attention has been focused on the fractionation of protein extracts in an attempt to identify antigens that induce protective immunity and this has led to the identification of a number of promising candidates including the so-called 'hidden' antigens expressed on the microvillar surface of the gut and also the surface antigens present on the cuticle [7,8]. Many parasitic nematodes are developing resistance to chemical treatment and the work in this aspect is on to produce commercially viable molecular vaccines. Much progress has been made with highly protective hidden antigens as well as natural antigens which has yielded promising results [9-12]. Significant progress towards successful vaccination against animal parasites of veterinary importance has been made during the last two decades [13,14].

Veterinary parasitology has witnessed a tremendous boost of recombinant antigens for their use as vaccines against the parasites of veterinary importance. Obviously the biggest single barrier to the commercialisation of a vaccine against infectious parasites is the production of recombinant proteins which will approach the efficacy of the best native antigens that have been used. More field trials are needed to optimise how and when such a vaccine would be administered, bearing in mind the age and reproductive status of the ruminants as well as the likely level of parasite exposure, before the potential benefits and limitations of a vaccine can be defined. Molecular biology has provided the means to identify antigens, to define their function, patterns of expression and most importantly a means to produce them in quantity.

The developments in genomics and proteomics and the definition of patterns of antigen expression will help in the long run in the identification of many more candidate protective antigens. Although vaccines have been successfully produced against many other important parasites, the final product will need to be active against more than one species of parasite. Trials have been very encouraging and work is being done in this aspect but so far there is no field data to assist researchers to find the levels of vaccine efficacy that will be required for cost-effective reduction of parasitism in livestock and the role of vaccines in integrated worm control strategies. Therefore much more still needs to be done.

Conflict of Interest

The authors declare that they have no conflict of interest.

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