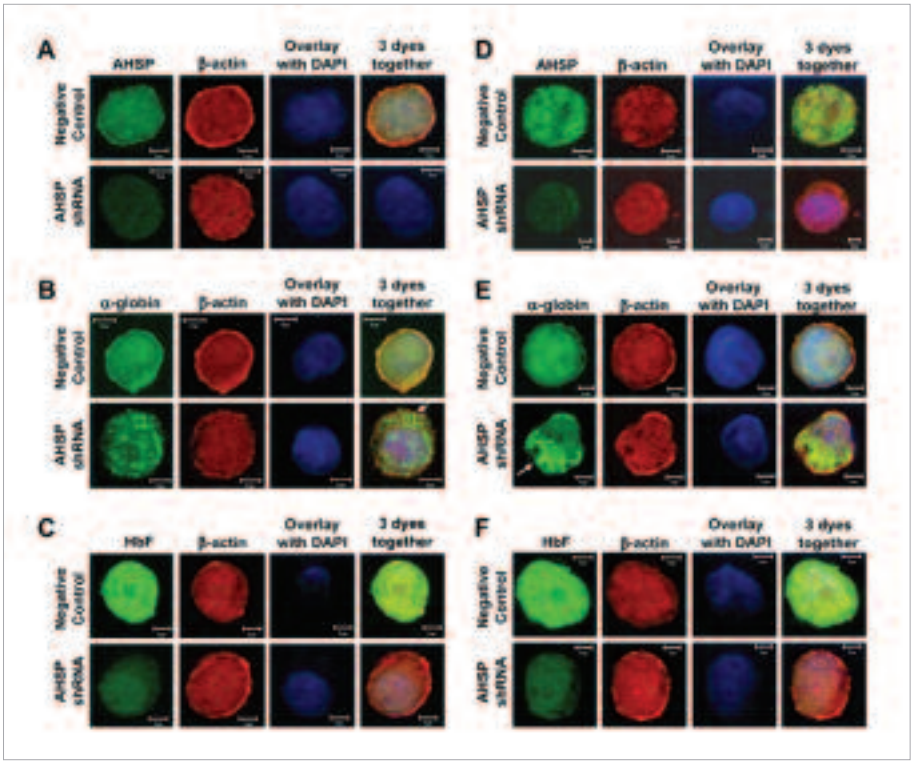
HEREDITARY HEMOGLOBIN DISORDERS: MOLECULAR GENETICS, CLINICAL FEATURES AND ANIMAL MODELS WITH THE PRODUCTION OF TRANSGENIC ANIMALS

Fernando Ferreira COSTA

School of Medical Sciences / State University of Campinas (Unicamp)



Immunofluorescence of hemin-induced K562 (A–C) and (D–F) represent immunofluorescence of hemin-induced K562 cells collected at 168 hours after hemin addition transfected by electroporation and Effectene, respectively. Bars: 5 µm. (A, D) Reduction of α-hemoglobin stabilizing protein (AHSP) production in AHSP–short-hairpin RNA (shRNA) cells (bottom and left) in relation to negative control cells (top and left). (B, E) α-Hemoglobin chain precipitation in AHSP-shRNA cells (bottom and left) in relation to negative control cells (top and left); the inclusion bodies are clearly identifiable (white arrows). (C, F) Reduction of fetal hemoglobin (HbF) production in AHSP-shRNA cells (bottom and left) in relation to negative control cells (top and left). Controls for immunofluorescence assays wereβ-actin–labeled cells and 4′-6′-Diamidino-2-phenylindole (DAPI) was used to stain the nuclear DNA

The Hemoglobinopathy Research Group of the Hemocentro and of the Department of Clinical Pathology, Unicamp, have, for nearly two decades, regularly investigated the hereditary hemoglobinopathies present in the Brazilian population. The environment of the State University of Campinas facilitates this type of study, since in addition to laboratory investigations, including the analysis of proteins and nucleic acids, the clinical evolution of patients is accompanied by the same group of clinicians and researchers, thus allowing for a large number of studies involving the association of both of these clinical and laboratory aspects.

The project consists of the study of gene expression in hematopoietic cells in hemoglobinopathies and hereditary anemias, the production of transgenic animals carrying genes that are important for the study of the hemoglobinopathies, and the analysis of the diverse pathophysiological and therapeutic aspects of the hemoglobinopathies, principally those involving vascular occlusion in sickle cell anemia and the mechanisms of action of nitric oxide.

Taken together, the project proposed herein focuses particularly on the study of the hereditary alterations of the hemoglobins. Despite the fact that it employs a large variety of methodological approaches along with clinical studies conducted in patients attended in four hospitals of the State of São Paulo, this project is expected to potentially produce important results for a better understanding of the pathophysiological mechanisms in the hemoglobinopathies. In addition, it is hoped to contribute to new therapeutic perspectives in these diseases.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

The results of the project were extremely relevant for the achievement of a better understanding of the multiple mechanisms of action of hydroxyurea on the erythropoietic cells of humans. In addition, the studies regarding cell adhesion in sickle cell disease provide important results concerning the beneficial action of hydroxyurea and nitric oxide donors. Furthermore, data suggestive of the action of nitric oxide in the production of fetal hemoglobin were obtained.

The investigations of ASHP permitted the acquisition of original data regarding the importance of this protein in normal human erythropoiesis. Our findings on the actions of the GATA-1 factor in erythropoiesis, obtained by the study of a family that carried an extremely rare mutation, deserve particular emphasis. These data permit the formation of new hypotheses regarding the functions of the GATA-1 and GATA-1s proteins.

In fact, our group currently represents one of the most active groups in this area. As an example of this activity, we have published, in the last 3 years, approximately 42 articles in specialized journals with an international circulation, with various unedited contributions to the identification of mutations in structural hemoglobinopathies and thalessemias, molecular alterations of the blood groups in sickle cell disease, methods for the study of the flexibility of the red blood cells, identification of the genetic polymorphisms that modify the severity of sickle cell disease and the description of specific clinical aspects of the disease.

MAIN PUBLICATIONS

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Fernando Ferreira COSTA

Faculdade de Ciências Médicas
Universidade Estadual de Campinas (Unicamp)
Departamento de Clínica Médica
Rua Carlos Chagas, 480 – Barão Geraldo
CEP 13083-970 – Campinas, SP – Brasil

+55-19-3521-8734 ext. 18734
ferreira@unicamp.br