Fonds Wetenschappelijk Onderzoek – Vlaanderen
Results Odysseusprogramme 2020
25/03/2021

Results Type I

Projectnummer	Onderzoeker	Titel	Onderzoeksinstelling	Toegekend budget
G0F0421N	Oscar Gelderblom	The Social History of Finance	UAntwerpen	€ 2.990.200
Why was it that in Western economies banks only began to reach deep into society during the 1960s and 1970s? The half century that passed between their creation in the late 19th and early 20th century and the widespread use of their services by households suggests that, for a very long time, many households managed their finances differently. But which services did they use, and when, how and why did the providers of those alternatives make way for banks? What drove this fundamental change in household finance and why did it not come earlier? Current research on financial development has no answers to these questions. THE SOCIAL HISTORY OF FINANCE proposes a new conceptual framework to capture the long-term development of the financial system and the social context in which it took shape. The project analyzes (1) the long-term development of financial services provided by banks and other suppliers, notably governments and the social networks in which households were embedded; (2) continuity and change in the financial demand of households; and (3) the suppliers' adaptation of financial services to changes in both the demand of households and the supply of financial services by other providers. The project develops this new social history of finance through an indepth investigation of household finance in Belgium and The Netherlands in the 19th and 20th centuries. It will serve as a benchmark for future work on the evolution of financial systems.				
G0E9821N	Christina Maria Kreinecker	1Cor – Text, Transmission and Translation of 1 Corinthians in the First Millennium	KU Leuven	€ 3.588.380
The 1Cor-project examines the text, the transmission and the translations of the apostle Paul's first letter to the Corinthians in its earliest attainable textual forms. As one of the oldest writings of the New Testament 1Cor has influenced the development and shape of Christian communities up to the present. Despite its centrality to Christianity, critical editions of the text based on the vast amount of manuscript evidence extant today are still lacking. The project's aim is to produce digital text-critical editions and studies of 1Cor, including the Greek Editio Critica Maior and the Vetus Latina which will replace century-old editions from the 18th and 19th century. With specifically designed digital tools and cutting-edge methodology the project processes and evaluates the manuscript tradition of 1Cor on a larger scale than has ever been possible. The project's studies are based on over 150 biblical manuscripts, over 44.000 quotations of the text in Early Christian writings and translations of the Greek tekst into Latin, Coptic, Syriac, Gothic and Arabic. With its unique and innovative multilingual perspective, the project offers new insights into the transmission and history of 1Cor across languages and cultures. The project will provide the standard scholarly text of 1Cor for generations to come, which will also function as the base text for future translations into modern languages and will thus be read and studied by millions all around the world.				

G0F5621N	NN	NN	UGent	€ 3.153.674
G0F5921N	Fatemeh Mohammadi	Exploiting combinatorial structures for algebraic and geometric decompositions	UGent	€ 2.571.990

We will develop novel tools to solve several important real-world problems: (i) Proving safety of programs (Computer Science), (ii) Computing network reliability (Industrial Engineering), (iii) Causality (Statistics), and (iv) Geometry of particle interactions (Physics). These problems are all traditionally modeled as polynomial systems. However, given that solving a general system is very difficult, they all lack scalable algorithms. The main idea is that our applications' systems tend to have additional structural properties. Our vision is to exploit these specific properties to sidestep the difficulty of solving general systems, and obtain dedicated solution methods for realworld cases.

The most profound impact is in program verification, focusing on proving the presence/absence of bugs or vulnerabilities in code. Given the ever-increasing role of software in safety-critical operations, e.g. avionics and healthcare, it is vital to perform software verification reliably and exactly. Our results will have a huge downstream effect on every aspect of verification, ultimately leading to more secure and trustworthy software in all sorts of applications. Another focus is Network Reliability with significant applications in economics and epidemiology. We will develop novel methods to compute the reliability. Finally, we will study the Amplituhedron: a geometric object that dramatically simplifies calculations of particle interactions in Physics.

G0F4721N	Panagiotis Ntziachristos	Characterizing and targeting aberrant splicing activity in acute leukemia	UGent	€ 3.298.990

Acute leukemia, both of myeloid and lymphoid origin, is a very prevalent cancer in kids and adults. Unfortunately, frontline radiation and chemotherapy causes lasting cognitive problems and can also lead to secondary cancers. Additionally, about one-fourth of children and 50% of adults with acute leukemia develop resistance to therapy or relapse post therapy. Mechanisms of resistance are poorly understood and current research on oncogenesis (the development of cancer) mainly focuses on alterations ("mutations") of gene units in leukemia. Recent studies show that aberrant patterns of transcripts - pieces of RNA stitched together via a process called "splicing" - are critical factors in oncogenesis. I have discovered that proteins controlling transcript stitching are aberrantly stabilized and have identified that this leads to abnormal splicing patterns. This phenomenon creates generations of transcripts not found in normal cells, ultimately leading to resistance to therapy. I aim to define mechanisms of therapy resistance related to transcript stitching and protein stability in high-risk leukemia by directly comparing therapy-responsive or resistant leukemia cases to each other and to healthy samples. I will also suggest therapeutic platforms for patients using relevant models of disease that can translate to clinical trials. This approach is at the heart of personalized medicine, as it takes into consideration protein levels for candidate proteins to target drug resistance.

Results Type II

Projectnummer	Onderzoeker	Titel	Onderzoeksinstelling	Toegekend budget
G0F3121N	Louisa Bogaerts	Readers as statistical learners: an individual differences approach	UGent	€ 729.125
Individual differences in statistical learning (SL), defined as the ability to learn regularities from sensory input, are a promising avenue for understanding why some of us (learn to) read with greater ease than others. This project entertains a novel three-dimensional (3D) approach to individual differences in SL that considers: I. sensitivity to patterns, II. retention of learned patterns, and III. adaptability to changing environments. It breaks new ground by bringing together the scientific domains of language and reading on the one hand, and learning and memory on the other. It integrates evidence from behavioral experiments, the measurement of brain activity, the tracking of eye movements during reading, and monitoring the developmental trajectory of beginning readers. The first work packages map individual differences in the three dimensions of learning regularities from print, and investigate the cognitive and brain mechanisms underlying them. We next take this knowledge to the "real written world" and evaluate how 3D learning profiles may effectively explain and predict the reading behavior of adult and beginning readers. Our findings will provide a precise understanding of how humans learn in structured environments and how SL abilities affect the acquisition and execution of fluent reading. They also hold the promise of informing best practices in literacy instruction and interventions that capitalize on individual differences.			
G0F6421N	Shoubhik Das	From CO2 to Enantiopure Carboxylic Acids: Late Stage C-H bond Functionalization Using Earth-Abundant-Metals and Cooperative Photoredox Catalysis	UAntwerpen	€ 997.520
The synthesis of enantiopure compounds is becoming highly important and the global chiral chemicals market is expected to reach 120 billion USD by 2025 at a Compound Annual Growth Rate (CAGR) of 13.67%. Among these chiral molecules, carboxylic acids and their derivatives are highly important for the synthesis of pharmaceuticals. This proposal will envisage the functionalization of challenging C(sp3)-H bond to achieve chiral carboxylic acids and their derivatives using CO_2 as a sustainable C1 synthon making use of cooperative photoredox catalysis. The mild reaction conditions proposed in combination with the earth abundant catalytic systems used should enable this new reactivity concept to be applicable to the direct C–H bond functionalization of a range of C-H bonds including 'functionally challenging' molecules.			
G0F7321N	Ruben de Groote	A new window on the atomic nucleus through high-precision atomic spectroscopy techniques	KU Leuven	€ 1.000.000
This project will extend the precision frontier for measurements of the atomic structure of radioactive nuclei by a factor of 1000 compared to the current state-of-the art, with the aim of improving our understanding of the motion and distribution of nucleons in radioactive atomic nuclei. By using high-precision quantum optics methods at radioactive beam facilities, combining lasers, ion traps and radiofrequency fields, new nuclear observables can be studied for the first time in radioactive isotopes and molecules. Those observables will be used to challenge modern nuclear and particle physics theories. On the nuclear level, further insight will be gained into the yet not well understood nuclear force that binds protons and neutrons in complex structures forming exotic isotopes. By measuring these new nuclear observables in specific isotopes or molecules that are sensitive to fundamental symmetry violations, new ways to search for physics beyond the standard model will be explored. Technical developments at the home laboratory will be combined with state-of-the art measurements at radioactive beam facilities, to further enhance our understanding of the fundamental forces in nature.			

G0F0621N	Daniela De Simone	Upland societies and forests communities in India: Late Antiquity to Early Modernity	UGent	€ 921.600

Non-literate and non-monumental societies are under threat from resource extraction, agricultural development and de-forestation, as are the material residues of their cultures from past centuries. An understanding of these peoples is thus timely, if not urgent. The aim of the proposed project is to expand our limited knowledge on the past of South Indian upland forest-dwellers in order to move beyond the conventional view of upland forest people as remote and unconnected, and initiate a step-change in our perception of the role that forest-dwelling communities played in the history of civilisation. To achieve the project's aim, research will focus on the forested uplands of the Nilgiri Hills in southern India from the start of the Common Era to the early 19th century. The main outcome of the proposed project will be the development of multidisciplinary methodologies integrating material culture studies, landscape archaeology, historical ethnobotany, and textual analysis for the study of the archaeology of upland forests and the history of upland forest-dwelling communities. Research on the archaeology of Indian forests and the pre-colonial history of Indian forest-dwellers is inadequate therefore the proposed project provides a significant opportunity to advance the study of a neglected topic in South Asian Studies and eventually establish the project team and the South Asia Network Ghent (SANGH) research group as leaders in the field.

G0E9121N	Lynette Lim	Identification of Metabolic States that Drive Interneuron Diversification and Cortical Circuit Assembly	KU Leuven	€ 999.500

Brains are composed of a multitude of neuronal cell types that assemble together into specific functional circuits. Elucidating how a small number of neural progenitors generates the vast diversity of neuronal cell types in the brain remains a major goal in neuroscience, since the different types of neuron — and their specific connectivity — are the basis for information processing. This problem is very challenging in the cerebral cortex, where dozens of different types of neuron come together, during development, to form microcircuits. Importantly, miswiring of microcircuits is often the hallmark of major neurodevelopmental diseases. Recent studies, including my own, have used novel sequencing approaches to classify neocortical neurons and their progenitors based on their gene expression. We found that metabolic genes, which are traditionally associated with housekeeping functions, are among the most differentially expressed in distinct classes of neuronal progenitors. This finding, together with other works describing instructive changes in metabolic states during cell differentiation, points to a probable role for the metabolome in interneuron diversification. Based on these published data, the central goal of this proposal is to identify metabolic states in neuronal progenitors that specify cell fate and lineage diversification, with a long-term goal to design new cell reprogramming and replacement strategies to treat brain disorders.

G0F8421N	Fedor Pakhomov	Recursion, reflection, and second-order arithmetic	UGent	€ 881.000

Hilbert's second problem, posed in 1900, was to prove that there are no contradictions in arithmetic; in modern terms his arithmetic corresponds to second-order arithmetic PA_2. Gentzen in 1939 identified the characteristic ordinal of first-order arithmetic PA, which among many other striking results gave a proof that PA isn't contradictory. The extension of Gentzen's analysis to the case of PA_2 is one of the main open problems in proof theory. The analysis of PA_2 is extremely difficult since PA_2 allows highly non-computable definitions of new sets in terms of the whole universe of sets. In the first part of this project we will develop the connections between PA_2 and higher order recursion on ordinals. The latter is a computational procedure on ordinals, which should open the door to compute the characteristic ordinals of PA_2 and its strong fragments. Beklemishev originated the approach, where the characteristic ordinal of a theory is computed via the investigation of a suitable reflection algebra. A recent result of James Walsh and the proposer demonstrated that this approach should in principle be applicable to very strong theories. In the second part of the project we will develop a reflection algebra suitable for the ordinal analysis of PA_2. Within the framework of the project, the proposer plans to mentor two postdocs and two graduate students, as well as to organize a weekly seminar and an annual meeting.

G0F9421N	Georgios Spyropoulos	Soft integrated ion-based circuits for diagnostics and closed-loop neurological interventions	UGent	€ 1.000.000

Responsive modulation of neural networks is increasingly being used to treat patients with auditory-neurological disorders and neuropsychiatric diseases. Yet, current technology burdens neurostimulation tools with bulky, non-biocompatible electrical components that require rigid encapsulation for long-term implantation in body. Recently, we created a novel transistor architecture (internal ion-gated organic electrochemical transistors; IGT) that can be an efficient building block for integrated bioelectronics. These transistors include all the key features required for safe, efficient, and prolonged use of transistors in biological environments: i) they are made out of biocompatible and stable materials; ii) they are soft and conformable; iii) they show high speed and amplification to detect potentially low-amplitude ionic signals of the body; iv) they can perform certain computations. Based on this emerging technology, I propose to design, develop and test novel fully implantable, contained and responsive neural interface devices that will allow long-term acquisition and closed-loop manipulation of neural circuits with high spatiotemporal resolution over extended period of time.

G0F7621N	Xing Yang	Next generation membrane platform for ultra-fast purification in bio-processing	KU Leuven	€ 935.000

The purification of biopharmaceuticals is an essential step in the biomedical applications such as therapeutics, immunodiagnostics and vaccine development. The large market demand pushes above 10-fold increase in upstream production, shifting the manufacturing bottleneck to downstream processing. Resin columns are currently dominant but face major hurdles in scale-up due to high material cost, ultra-high pressure and mass transfer resistance. Membrane chromatography is an emerging concept due to its many advantages such as easy scale-up, low material cost, high surface area and flowindependent binding capacity, potentially offering 2-3 magnitudes higher production rate. However, its development is still at early stage and major breakthroughs are urgently needed. This research aims to establish the next generation platform for ultrafast purification in bioprocessing. Firstly, limitations in mass transfer and ligand distribution will be overcome by designing 3- dimensional membrane matrix. Secondly, breakthrough in binding kinetics entails the incorporation of stimuli-responsive functionality into the membrane to achieve selective separation with reduced consumption of process materials. Lastly, computational modeling is used to bring mechanistic understanding on mass transport and binding kinetics, facilitating technology scale-up. The obtained results will directly impact efforts in bioprocessing, healthcare and broadly product purification.