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SCIENCE AND EDUCATION: SYNERGY OF INNOVATION

PROCEEDINGS OF IV INTERNATIONAL SCIENTIFIC AND PRACTICAL CONFERENCE NOVEMBER 24-26, 2025

BERLIN 2025

SCIENCE AND EDUCATION: SYNERGY OF INNOVATION

Proceedings of IV International Scientific and Practical Conference

Berlin, Germany

24-26 November 2025

Berlin, Germany

2025

UDC 001.1

The 4th International scientific and practical conference "Science and education: synergy of innovation" (November 24-26, 2025) MDPC Publishing, Berlin, Germany. 2025. 647 p.

ISBN 978-3-954753-01-7

The recommended citation for this publication is:
Ivanov I. Analysis of the phaunistic composition of Ukraine // Science and education: synergy of innovation. Proceedings of the 4th International scientific and practical conference. MDPC Publishing. Berlin, Germany. 2025. Pp. 21-27. URL: https://sci-conf.com.ua/iv-mizhnarodna-naukovo-praktichna-konferentsiya-science-and-education-synergy-of-innovation-24-26-11-2025-berlin-nimechchina-arhiv/.

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TABLE OF CONTENTS

AGRICULTURAL SCIENCES

VETERINARY SCIENCES

BIOLOGICAL SCIENCES

MEDICAL SCIENCES

REPOSITIONING OF MEDICINES AS A MODERN DIRECTION OF INNOVATIVE PHARMACOTHERAPY AND ITS REFLECTION IN THE TEACHING OF PHARMACOLOGY

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Introduction. The development of new medicinal products is a lengthy and high-cost process associated with a substantial risk of failure at both preclinical and clinical stages. Against this background, the strategy of drug repurposing, which involves identifying new therapeutic indications for already known molecules with a well-characterised safety profile, is gaining importance. Drug repurposing enables the shortening of the time required to introduce new clinical options, reduces costs, and realises the potential of pleiotropic pharmacodynamic effects. In recent years, SGLT2 inhibitors (dapagliflozin, empagliflozin), initially approved as oral glucose-lowering agents, have gained attention in clinical pharmacology. They are now recommended for the treatment of heart failure and chronic kidney disease, including in patients without diabetes mellitus, owing to their demonstrated cardio-renal protective effects. Similarly, GLP-1 receptor agonists (such as semaglutide) have evolved from drugs for treating type 2 diabetes mellitus into agents for long-term body weight control and reduction of cardiovascular risk in patients with overweight or obesity, including individuals without diabetes. Clinically relevant examples of repurposing also include the use of topiramate as a first-line drug for migraine prophylaxis and for body weight reduction in a subset of patients; the use of propranolol as a first-line agent in infantile haemangiomas; and the investigation of pentoxifylline and other so-called “metabolic” drugs as anti-inflammatory and nephroprotective agents in common chronic diseases.

For pharmacology education, examples of drug repurposing provide a clear tool to demonstrate the dynamic nature of pharmacotherapy, the link between

mechanism of action and new indications, and the need to develop in students the skills of critically appraising evidence and being prepared to revise established therapeutic approaches.

Aim. To analyse drug repurposing as a contemporary trend in innovative pharmacotherapy using a series of clinically significant medicinal products, and to substantiate the potential of integrating the concept of drug repurposing into pharmacology teaching for students enrolled in the educational and professional programme “Medicine”.

Materials and methods. A targeted literature review was conducted in the PubMed, Web of Science, and Google Scholar databases using the keywords: “drug repurposing”, “drug repositioning”, “SGLT2 inhibitors”, “GLP-1 receptor agonists”, “propranolol infantile hemangioma”, “topiramate migraine”, and “pharmacology education” (2020–2025). Priority was given to review articles, meta-analyses, and reports of randomised clinical trials that described changes in indications or an expanded spectrum of use for already known drugs. In parallel, national educational standards for training specialists in Field I “Health and Social Welfare” and the program of the academic discipline “Pharmacology” for speciality 222 “Medicine” were analysed to determine the extent to which the topic of drug repurposing is reflected in these documents. Analytical, comparative, and systematisation approaches were employed.

Results and discussion. The review of current sources confirms that drug repurposing has gained the status of an independent strategy in innovative pharmacotherapy, combining clinical-pharmacological analysis, bioinformatic methods, the use of large registry datasets, and artificial intelligence approaches to identify new therapeutic niches for existing molecules. SGLT2 inhibitors are among the most prominent examples of repurposing. Initially introduced as glucose-lowering agents for type 2 diabetes mellitus, subsequent randomised trials demonstrated a marked reduction in the risk of hospitalisations for heart failure, cardiovascular mortality, and progression of chronic kidney disease, including in non-diabetic cohorts. This prompted a revision of clinical guidelines and the inclusion of SGLT2

inhibitors in treatment regimens for heart failure and chronic kidney disease as agents with a proven cardio-renal protective potential. GLP-1 receptor agonists illustrate another repurposing trajectory: from glucose-lowering drugs to agents for long-term pharmacotherapy of obesity and cardiovascular risk reduction. Data from the SELECT programme in patients with overweight and obesity have confirmed a decrease in the incidence of major adverse cardiovascular events during semaglutide therapy, including in individuals without manifest type 2 diabetes. Thus, the class of GLP-1 receptor agonists is now positioned not only in endocrinology but also in cardiology and lifestyle medicine. Topiramate, developed initially as an antiepileptic drug, has become a first-line agent for migraine prophylaxis and shows clinically relevant weight-reducing effects in a proportion of patients, which has led to its incorporation into specific obesity treatment regimens (including fixed-dose combinations in international guidelines). Propranolol, a classical non-selective β-adrenoceptor blocker used for the treatment of arterial hypertension and tachyarrhythmias, is currently regarded as a drug of choice for infantile haemangiomas and a potential candidate for the treatment of rare vasculopathies due to its effects on angiogenesis, vascular tone, and endothelial cell apoptosis.

These examples illustrate that effective drug repurposing relies on a profound understanding of mechanisms of action, pleiotropic effects, and the systemic consequences of modulating specific molecular targets. For the pharmacology educator, this provides substantial didactic opportunities. Analysing a drug from its initial indication through to newly established areas of use allows to illustrate the relationship between pharmacodynamics and clinical effects, foster in students an appreciation of the evolutionary nature of the evidence base, and emphasise the need for a critical attitude towards established treatment regimens. The analysis of programs revealed that the topic of drug repurposing is not structured as a separate section and is mentioned only fragmentarily, predominantly in brief comments (for example, regarding SGLT2 inhibitors or GLP-1 receptor agonists). This does not fully align with the current stage of development in innovative pharmacotherapy. It appears reasonable to: integrate dedicated blocks on drug repurposing into the

sections “Drugs acting on the cardiovascular system”, “Preparations regulating metabolic processes”, and the topic “Pharmacology of anticancer drugs”; employ problem-based learning and case-based teaching in which students analyse the stages of repurposing of specific drugs; and engage learners in mini-reviews of recent literature and discussion of clinical trial results during practical classes. Such an approach aligns with the competency-based model of medical training, strengthens the connection between fundamental pharmacology and clinical practice, and promotes readiness for continuous professional development.

Conclusions. Drug repurposing is a crucial direction in innovative pharmacotherapy that enables the expansion of the clinical indications spectrum through the use of molecules with a known safety profile and pleiotropic pharmacodynamic effects. Contemporary examples of drug repurposing, such as SGLT2 inhibitors, GLP-1 receptor agonists, topiramate, and propranolol, among others, have high potential for demonstrating the relationship between mechanism of action, clinical effects, and the evolution of the evidence base. The integration of drug repurposing into the pharmacology program, utilising problem-based, case-based, and analytical teaching methods, fosters the development of clinically oriented pharmacological thinking in students, grounded in evidence-based medicine. A promising direction for further scholarly and methodological work is the development and piloting of structured educational modules focused on drug repurposing, followed by their integration into the interdisciplinary medical training system.