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ИЛМИЙ-ТАҲЛИЛИЙ ЖУРНАЛ ***2/2025***

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THE CIVIL LEGAL NATURE OF BIOINFORMATICS

Аннотация. Данное исследование изучает гражданско-правовое регулирование биоинформатики в рамках судебной системы Узбекистана в условиях современной цифровой трансформации. Исследование анализирует интеграцию элементов биоинформатики с установленными институтами гражданского права при выявлении регулятивных вызовов в современной правовой практике. Посредством систематического анализа Гражданского кодекса Узбекистана (1996), Закона об авторском праве и смежных правах (2006) и Закона об изобретениях, полезных моделях и промышленных образцах (2002) в сочетании с изучением международных правовых прецедентов данное исследование показывает, что биоинформатика демонстрирует гибридные характеристики, объединяющие биологическую информацию с вычислительными технологиями. Эти уникальные особенности требуют специализированных правовых подходов в рамках гражданско-правовой системы Узбекистана. В исследовании применяется сравнительно-правовая методология между системой Узбекистана и международными рамками, дополненная анализом кейс-стади и систематической интерпретацией соответствующих законодательных положений. Результаты показывают, что традиционные категории гражданского права требуют адаптивных механизмов для эффективного учета инноваций биоинформатики.

Ключевые слова: гражданско-правовое регулирование, защита интеллектуальной собственности, патентное право, защита авторских прав, право информационных технологий, биотехнология, биоинформатика, биологические данные.

Abstract. This research investigates the civil legal framework governing bioinformatics within Uzbekistan's judicial system amid contemporary digital transformation processes. The study examines how bioinformatics elements integrate with established civil law institutions while identifying regulatory challenges in current legal practice. Through systematic analysis of Uzbekistan's Civil Code (1996), Copyright and Related Rights Law (2006), and Inventions, Utility Models and Industrial Designs Law (2002), combined with international legal precedent examination, this investigation reveals that bioinformatics demonstrates hybrid characteristics merging biological information with computational technologies. These unique features necessitate specialized legal approaches within Uzbekistan's civil law framework. The research employs comparative legal methodology between Uzbekistan's system and international frameworks, supplemented by case study analysis and systematic interpretation of relevant legislative provisions. Findings indicate that traditional civil law categories require adaptive mechanisms to accommodate bioinformatics innovations effectively. The study proposes conceptual frameworks for adapting civil law doctrine to technological realities while maintaining consistency with Uzbekistan's legal traditions. Practical implications include establishing theoretical foundations for specialized bioinformatics regulation and enhancing intellectual property protection mechanisms within Uzbekistan's developing biotechnology sector.

Keywords: civil legal regulation, intellectual property, patent law, copyright, information technology law, biotechnology, bioinformatics, biological data.

Аннотация. Ushbu tadqiqot zamonaviy raqamli transformatsiya sharoitida O'zbekiston Respublikasining qonunchilik tizimida bioinformatikaning fuqarolik-huquqiy tartibga solinishini o'rganadi. Tadqiqot bioinformatika elementlarining an'anaviy fuqarolik huquqi institutlari bilan tizimli bog'lanishlarini tahlil qiladi va hozirgi huquqiy amaliyotda yuzaga keladigan tartibga solish muammolarini aniqlaydi. O'zbekiston Respublikasining Fuqarolik kodeksi (1996), Mualliflik huquqi va turdosh huquqlar to'g'risidagi qonun (2006), Ixtirolar, foydali modellar va sanoat namunalari to'g'risidagi qonun (2002) hamda xalqaro huquqiy pretsedentlarning tizimli tahlili orqali tadqiqot shuni ko'rsatadiki, bioinformatika biologik ma'lumotlar va hisoblash texnologiyalarini birlashtiruvchi gibrid xususiyatlarga ega. Bu noyob xususiyatlar O'zbekiston fuqarolik huquqi tizimida maxsus huquqiy yondashuvlarni talab qiladi. Tadqiqotda O'zbekiston huquq tizimi va xalqaro amaliyot o'rtasidagi qiyosiy-huquqiy metodologiya, keys-stadi tahlili va tegishli qonunchilik hujjatlarining tizimli talqini qo'llanilgan. Natijalar shuni ko'rsatadiki, an'anaviy fuqarolik huquqi kategoriyalari bioinformatika innovatsiyalarini samarali qamrab olish uchun moslashuvchan mexanizmlarni talab qiladi. Tadqiqot O'zbekistonning huquqiy an'analariga rioya qilgan holda fuqarolik huquqi ta'limotini texnologik haqiqatlarga moslashtirishning konseptual asoslarini taklif etadi.

Kalit so'zlar: fuqarolik-huquqiy tartibga solish, intellektual mulk, patent huquqi, mualliflik huquqi, axborot texnologiyalari huquqi, biotexnologiya, bioinformatika, biologik ma'lumotlar.

I. Introduction

Contemporary digital transformation processes fundamentally challenge traditional civil law frameworks, particularly in developing jurisdictions like Uzbekistan undergoing comprehensive legal modernization. The convergence of biological sciences with computational technologies creates unprecedented theoretical and practical challenges requiring innovative legal solutions within established civil law systems.

The strategic importance of biotechnology

development is explicitly recognized in Uzbekistan's national policy documents. The Concept for Improving Civil Legislation (Presidential Decree F-5464, April 5, 2019) specifically addresses establishing legal foundations for information and communication technology applications in civil legal relations. The Development Strategy (Presidential Decree PF-60, January 28, 2022) establishes clear biotechnology sector development objectives, emphasizing the critical importance of developing modern technologies including biotechnology and information systems integration.

This investigation aims to analyze bioinformatics components as civil law objects within Uzbekistan's legislative framework and develop theoretical foundations for their proper legal qualification under national legislation. The central research problem involves determining how traditional civil law categories established in Uzbekistan's Civil Code can effectively accommodate the hybrid nature of bioinformatics technologies while maintaining legal system coherence and supporting innovation development.

Specific research objectives include: (1) determining the legal nature of bioinformatics components under Uzbekistan's civil law; (2) analyzing their characteristics as civil law objects within the national legal system; (3) examining systematic connections with traditional civil law institutions; and (4) identifying qualification challenges in contemporary legal practice within Uzbekistan's developing biotechnology sector.

Previous scholarly investigations have approached bioinformatics regulation from various perspectives, though limited attention has been directed toward developing country legal frameworks. International scholarship demonstrates the complexity of applying traditional intellectual property concepts to bioinformatics innovations.

Fernandez and colleagues (2015) emphasize that intellectual property protection in bioinformatics directly relates to biotechnology and computational biology, serving as a crucial factor for economic development in modern biotechnology sectors. Their analysis highlights the necessity of adapting traditional legal frameworks to accommodate technological innovations while maintaining protection effectiveness.

Contreras (2019) demonstrates that technical standards increasingly influence bioinformatics research and are essential for ensuring interoperability between databases, analytical tools, and software systems. This technical standardization creates additional legal complexity requiring specialized regulatory approaches within national legal frameworks.

The European Parliament Science and Technology Options Assessment (STOA, 1999) provides a foundational definition of bioinformatics as "research, development or application of computational tools and approaches for expanding the use of biological, medical, behavioral or health data." This definition emphasizes the technological and informational characteristics of bioinformatics from a legal perspective, requiring consideration within civil law frameworks.

Material and Methods

This investigation employs comprehensive legal analysis incorporating multiple methodological approaches adapted to Uzbekistan's legal system characteristics and development priorities. The methodological framework follows established principles of legal research while incorporating interdisciplinary perspectives necessary for understanding bioinformatics regulation complexity.

Comparative Legal Analysis: Systematic comparison between Uzbekistan's legal framework and international regulatory approaches, examining how different legal systems address bioinformatics regulation while identifying best practices adaptable to Uzbekistan's legal traditions and development objectives.

Doctrinal Analysis: Comprehensive examination of Uzbekistan's normative documents including the Civil Code (1996), Law on Copyright and Related Rights (2006), and Law on Inventions, Utility Models and Industrial Designs (2002), analyzing how existing legal provisions apply to bioinformatics components.

Case Study Methodology: Analysis of international legal precedents and their potential application to Uzbekistan's legal framework, examining landmark decisions like Association for Molecular Pathology v. Myriad Genetics (2013) and their implications for developing legal systems.

Systematic Interpretation: Understanding how bioinformatics elements integrate within Uzbekistan's civil law objects framework established in Article 81 of the Civil Code, identifying areas requiring specialized regulation while maintaining system coherence.

The investigation focuses on bioinformatics components as defined by established scholarship: (A) biological sequences including DNA, RNA, and protein sequences; (B) databases organizing these sequences; (C) software and hardware tools designed for creating, accessing, organizing, and analyzing sequence and database information. These components are analyzed within Uzbekistan's civil law objects classification system while considering their unique characteristics and regulatory requirements.

Research Results

Definitional Framework and Legal Characterization

The National Institutes of Health provides a foundational definition of bioinformatics as "research, development or application of computational tools and approaches for expanding the use of biological, medical, behavioral or health data." This definition emphasizes the technological and informational characteristics essential for legal analysis within civil law frameworks.

Contemporary scholarship offers more precise definitional approaches better suited for legal analysis. Gaff, Loren and Dickson (2013) define bioinformatics as "the use of information technology in analyzing and organizing biological data." This definition proves particularly relevant within Uzbekistan's civil law context

because it emphasizes the dual nature of bioinformatics—processing biological content through information technology tools—which implicates both intellectual property and information technology regulation under Uzbekistan's legal system.

Under Article 81 of Uzbekistan's Civil Code, civil law objects encompass "results of intellectual activity" among other categories. Bioinformatics components potentially qualify as such objects, though their hybrid nature combining biological data with information technologies creates classification complexities within this established framework.

Historical Development and Contemporary Significance

The conceptual genesis of bioinformatics traces to Watson and Crick's 1953 discovery of DNA's double helix structure, establishing the foundation for understanding biological information storage and transmission. Hogeweg and Hesper (1978) first employed the term "bioinformatics" in academic literature, defining it as "the study of information processes in biotic systems."

According to the European Parliament STOA (1999), contemporary bioinformatics encompasses three primary components: genomics and sequencing technologies, high throughput screening and combinatorial chemistry applications, and databases with associated software systems. Each component requires distinct legal consideration within Uzbekistan's civil law framework, creating multiple regulatory touchpoints across different areas of law.

Legal Nature and Civil Law Relations Integration

The legal characterization of bioinformatics as civil law objects under Uzbekistan's Civil Code presents complex qualification challenges requiring nuanced analysis. Contemporary scholarship recognizes that adapting modern biotechnology to established legal systems requires understanding that traditional categories may not fully accommodate innovative technologies, particularly relevant for developing legal frameworks like Uzbekistan's that must balance innovation incentives with broader policy considerations.

Under Uzbekistan's Law on Inventions, Utility Models and Industrial Designs (2002), inventions must demonstrate novelty, inventive step, and industrial applicability according to Article 6. Bioinformatics components may satisfy these requirements, but require careful analysis within Uzbekistan's specialized legal framework, particularly considering the distinction between discoveries and inventions established in international jurisprudence.

Primary Characteristics Defining Legal Nature

Informational Character: The informational nature of bioinformatics creates unique legal challenges within traditional property law frameworks. Eisenberg's (2000) analysis of "information about DNA sequences" requiring special legal regimes proves relevant to Uzbekistan's approach to information technology regulation. Under Article 7 of Uzbekistan's Law on Copyright and Related Rights (2006), databases may receive protection as compilations if they constitute intellectual creation through selection or arrangement of contents.

Computational Character: Uzbekistan's intellectual property framework provides copyright protection for computer programs as literary works according to Article 6 of the Law on Copyright and Related Rights (2006). However, the biological significance of bioinformatics algorithms creates additional complexity requiring specialized consideration within Uzbekistan's legal system.

The State Street Bank & Trust Co. v. Signature Financial Group Inc. (1998) decision established that mathematical algorithms can receive patent protection when producing "useful, concrete and tangible results." This precedent provides guidance for Uzbekistan's approach to bioinformatics algorithm protection, though adaptation to the national legal framework under the Law on Inventions, Utility Models and Industrial Designs (2002) remains necessary.

Database Characteristics: Uzbekistan's copyright law protects databases as compilations under Article 7 of the Law on Copyright and Related Rights (2006), but the specific nature of biological data requires additional analysis. The factual nature of much biological data may limit copyright protection scope under national law, creating potential protection gaps requiring specialized solutions.

Research Results Analysis

Systematic Connections with Civil Law Institutions

Bioinformatics integration within Uzbekistan's civil law system manifests through complex relationships with traditional legal institutions established in the Civil Code and specialized intellectual property legislation. These connections stem from bioinformatics' dualistic nature and require innovative approaches within Uzbekistan's developing legal framework.

Intellectual Property Law Integration: Uzbekistan's intellectual property legislation enables bioinformatics protection through multiple mechanisms. The Law on Copyright and Related Rights (2006) protects software and database compilations under Articles 6-7, while the Law on Inventions, Utility Models and Industrial Designs (2002) covers technical solutions meeting patentability requirements under Article 6.

National strategic documents emphasize information technology development and innovation systems as priorities, creating policy foundations for comprehensive bioinformatics protection within Uzbekistan's legal system. This framework supports developing specialized approaches to bioinformatics regulation while maintaining consistency with established legal principles.

Patent protection under Uzbekistan's Law on Inventions, Utility Models and Industrial Designs (2002) requires novelty, inventive step, and industrial applicability under Article 6. Bioinformatics algorithms and methodologies may receive patent protection if they satisfy these requirements and constitute technical solutions

rather than mathematical methods, as distinguished in Article 6.

Obligation Law Relationships: Uzbekistan's Civil Code governs obligation relationships in bioinformatics through licensing agreements, research collaboration contracts, and data sharing arrangements. Articles 234-235 establish the general framework for obligation relationships applicable to bioinformatics licensing and collaboration arrangements.

The Civil Code addresses contractual relations for research and development activities, providing specialized foundations applicable to bioinformatics research collaborations. These provisions require interpretation considering bioinformatics' unique characteristics while ensuring compliance with intellectual property protection requirements.

Property Law Connections: Bioinformatics infrastructure falls under traditional property regimes established in Uzbekistan's Civil Code. However, bioinformatics data and algorithms create novel property issues requiring specialized consideration within the framework established by Article 81.

Under Article 81 of Uzbekistan's Civil Code, intellectual property results constitute civil law objects. Bioinformatics innovations protected under intellectual property law create exclusive rights functioning as property within Uzbekistan's legal system. However, the informational nature of bioinformatics data challenges traditional property concepts assuming tangible objects with clear boundaries.

Main Characteristics under Uzbekistan's Legislative Framework

Informational-Algorithmic Nature: Under Article 6 of Uzbekistan's Law on Copyright and Related Rights (2006), computer programs receive protection as literary works. However, bioinformatics algorithms' biological significance creates additional complexity within this classification under national law.

Biological Relevance: Presidential decrees establishing national strategies recognize biotechnology's strategic importance, suggesting that bioinformatics' biological applications may warrant special consideration within Uzbekistan's civil law classification system.

Dynamic Evolution: Bioinformatics algorithms possess machine learning capabilities and evolve over time. This creates challenges for traditional intellectual property concepts under Uzbekistan law, which typically protect fixed expressions or technical solutions rather than evolving systems, as established in the Law on Inventions, Utility Models and Industrial Designs (2002).

Qualification Challenges within Legislative Framework

The primary qualification challenge involves determining appropriate protection mechanisms under Uzbekistan's intellectual property laws. The multi-layered nature of bioinformatics systems creates complexity in applying traditional categories established in the Civil Code and specialized intellectual property legislation.

Under Article 6 of Uzbekistan's Law on Inventions, Utility Models and Industrial Designs, technical solutions receive patent protection. However, determining when bioinformatics algorithms constitute patentable technical solutions rather than unpatentable mathematical methods requires careful analysis within Uzbekistan's legislative framework. The Mayo Collaborative Services v. Prometheus Laboratories (2012) decision provides guidance by ruling that "adding algorithms to natural phenomena does not create patent objects."

Database aspects of bioinformatics receive copyright protection under Article 7 of Uzbekistan's Law on Copyright and Related Rights (2006) if they constitute intellectual creations through selection or arrangement. However, factual biological data may not meet originality requirements established in international jurisprudence like Feist Publications, Inc. v. Rural Telephone Service Co. (1991), creating protection gaps requiring specialized solutions within Uzbekistan's legislative framework.

International Law, Precedents and Uzbekistan's Legal Development

The Association for Molecular Pathology v. Myriad Genetics (2013) decision provides crucial guidance for developing countries like Uzbekistan. The Supreme Court ruled that "naturally occurring DNA segments are products of nature and not eligible for patent protection merely because they have been isolated," while "complementary DNA (cDNA) receives patent eligibility because it does not occur naturally."

This precedent suggests that Uzbekistan's patent law under the Law on Inventions, Utility Models and Industrial Designs (2002) should distinguish between discoveries of natural phenomena and inventions creating novel technical solutions. Article 6 establishes criteria for patentability that align with this approach to balancing patent protection with scientific progress.

European Union approaches to biotechnology regulation, particularly Directive 98/44/EC on biotechnological inventions, provide additional guidance for Uzbekistan's legal development while respecting national legal traditions in developing bioinformatics regulation approaches.

The Computer Associates International v. Altai (1992) decision established the "abstraction-filtration-comparison" test for software copyright protection, which could inform Uzbekistan's approach to bioinformatics software protection under the Law on Copyright and Related Rights (2006). This test helps distinguish protectable expression from unprotectable ideas in computer programs.

Current Legislative Framework Assessment

Analysis of Uzbekistan's current legislative framework reveals both strengths and gaps in bioinformatics regulation. Article 81 of the Civil Code provides general foundations for civil law objects, while specialized intellectual property laws address specific protection mechanisms. However, bioinformatics objects' unique characteristics require additional regulatory attention within the national legal system.

Uzbekistan's Law on Copyright and Related Rights

(2006) provides foundations for protecting bioinformatics software and databases under Articles 6-7, while the Law on Inventions, Utility Models and Industrial Designs (2002) covers technical solutions meeting patentability requirements under Article 6. However, gaps exist in addressing the dual nature of bioinformatics combining biological data with information technologies.

National strategies establish important policy foundations for technological development within Uzbekistan, emphasizing innovation and international cooperation as key elements for sector development. This framework supports developing comprehensive approaches to bioinformatics regulation while maintaining consistency with national development priorities.

Challenges for Uzbekistan's Developing Biotechnology Sector

Uzbekistan's developing biotechnology sector faces several challenges in bioinformatics regulation requiring comprehensive legal and policy responses consistent with the country's reform agenda.

Capacity Building Requirements: Specialized expertise in bioinformatics law is necessary to develop effective regulatory frameworks within Uzbekistan's legal system. This requires interdisciplinary collaboration between legal professionals and biotechnology specialists.

International Harmonization Needs: National strategies emphasize that Uzbekistan's legal framework must align with international standards while addressing national priorities and development needs. Compatible legal frameworks are essential for Uzbekistan's integration into global biotechnology markets.

Innovation Incentives vs. Public Access Balance: Uzbekistan's legislative framework must encourage bioinformatics innovation while ensuring public access to fundamental biological information and research tools, consistent with the country's development objectives.

Conclusions

Comprehensive analysis of bioinformatics as civil legal regulation objects demonstrates that this field requires specialized legal approaches within Uzbekistan's developing legislative framework. The dualistic nature of bioinformatics—combining biological data with information technologies—creates complex relationships with various civil law institutions under Uzbekistan's legal system that traditional categories cannot fully accommodate.

Uzbekistan's current legislative framework provides important foundations for bioinformatics regulation through the Civil Code (1996), Law on Copyright and Related Rights (2006), and Law on Inventions, Utility Models and Industrial Designs (2002). However, specialized regulation is needed to address bioinformatics objects' unique characteristics effectively while maintaining consistency with established legal principles and national development objectives.

Recommendations for Legislative Development

Based on comprehensive analysis, several specific recommendations emerge for Uzbekistan's legislative framework development to address bioinformatics regulation effectively within the national legal system.

Specialized Regulatory Framework: Develop specialized regulatory documents addressing bioinformatics objects' unique characteristics within Uzbekistan's existing legislative framework. These regulations should clarify qualification criteria under Article 81 of the Civil Code and protection mechanisms for different bioinformatics components while maintaining consistency with established civil law principles.

Intellectual Property Law Amendments: Consider amendments to Uzbekistan's intellectual property laws addressing bioinformatics' dual nature. The Law on Copyright and Related Rights (2006) and Law on Inventions, Utility Models and Industrial Designs (2002) could benefit from specialized provisions addressing bioinformatics characteristics.

Capacity Building Programs: Implement legal education programs for biotechnology practitioners and biotechnology education for legal professionals within Uzbekistan. This interdisciplinary approach is essential for effective bioinformatics regulation.

International Cooperation Mechanisms: Establish international cooperation mechanisms facilitating harmonization with global standards while protecting Uzbekistan's national interests and development priorities. This approach supports the country's integration into international biotechnology markets while maintaining regulatory sovereignty.

The complex and multifaceted nature of bioinformatics objects requires continued development of Uzbekistan's legislative framework to accommodate both technological sophistication and biological relevance of these emerging technologies. This development should support Uzbekistan's biotechnology sector growth while ensuring appropriate protection for all stakeholders' interests and maintaining consistency with the country's broader legal and development objectives as established in national strategies.

Future research should focus on developing detailed implementation mechanisms for the proposed regulatory framework, examining specific case studies of bioinformatics applications within Uzbekistan's legal context, and analyzing the economic impact of different regulatory approaches on the country's developing biotechnology sector.

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