

## **Asst. Prof. İsmail BOLAT**

### **Personal Information**

**Office Phone:** [+90 442 241](tel:+90442241) Extension: 7094

**Email:** ismail.bolat@atauni.edu.tr

**Web:** <https://avesis.atauni.edu.tr/ismail.bolat>

**Address:** ismailbolat0525@gmail.com

### **International Researcher IDs**

ScholarID: k\_6OKFQAAAAJ

ORCID: 0000-0003-1398-7046

Publons / Web Of Science ResearcherID: AAU-9698-2021

ScopusID: 57202731935

Yoksis Researcher ID: 302571

### **Biography**

I finished my undergraduate education in 2017 as the top student of the 13th Term of Ataturk University Faculty of Veterinary Medicine. In 2018, I started my doctoral education at Ataturk University, Faculty of Veterinary Medicine, Department of Pathology, and received my doctor's title in 2022. Since that year, I have been working as a faculty member at Ataturk University, Faculty of Veterinary Medicine, Department of Pathology.

### **Education Information**

Doctorate, Ataturk University, Sağlık Bilimleri Enstitüsü, Veteriner Patoloji Anabilim Dalı Başkanlığı, Turkey 2017 - 2022  
Undergraduate, Ataturk University, Veteriner Fakültesi, Turkey 2012 - 2017

### **Foreign Languages**

English, B2 Upper Intermediate

### **Certificates, Courses and Trainings**

Occupational Health and Safety, İş Sağlığı Güvenliği, Ataturk Üniversitesi, 2023

Occupational Health and Safety, İLK YARDIM, Ataturk Üniversitesi, 2020

### **Dissertations**

Doctorate, Doğal Enfekte Köpek Uteruslarında Leptospiral Antijenlerin İmmunohistokimyasal ve Moleküler Yöntemlerle Belirlenmesi, Ataturk University, Sağlık Bilimleri Enstitüsü, Veteriner Patoloji Anabilim Dalı Başkanlığı, 2019

## **Research Areas**

Veterinary Sciences, Pre-Clinical Sciences, Veterinary Pathology, Health Sciences

## **Academic Titles / Tasks**

Assistant Professor, Ataturk University, Veteriner Fakültesi, Klinik Öncesi Bilimleri, 2022 - Continues

Research Assistant, Ataturk University, Veteriner Fakültesi, Klinik Öncesi Bilimleri, 2019 - 2022

## **Academic and Administrative Experience**

Deputy Head of Department, Ataturk University, Veteriner Fakültesi, Klinik Öncesi Bilimleri, 2023 - Continues

Birim Kalite Komisyonu Üyesi, Ataturk University, Veteriner Fakültesi, Klinik Öncesi Bilimleri, 2023 - Continues

Assistant Coordinator, Ataturk University, Veteriner Fakültesi, Klinik Öncesi Bilimleri, 2023 - Continues

Eğitim ve Müfredat Kurulu üyesi, Ataturk University, Veteriner Fakültesi, Klinik Öncesi Bilimleri, 2023 - Continues

Anabilim Dalı Akademik Kurul Üyesi, Ataturk University, Veteriner Fakültesi, Klinik Öncesi Bilimleri, 2022 - Continues

Akreditasyon, Sürekli Gelişim ve Yenilenme Kurulu Üyesi, Ataturk University, Veteriner Fakültesi, Klinik Öncesi Bilimleri, 2021 - Continues

## **Courses**

Genel Patoloji, Undergraduate, 2023 - 2024, 2022 - 2023

Mezuniyet Tezi II, Undergraduate, 2023 - 2024, 2022 - 2023

Hemopoietik Sistem Patolojisi, Doctorate, 2023 - 2024

Olgunlaşma Eğitimi, Undergraduate, 2023 - 2024, 2022 - 2023

Özel Patoloji II, Undergraduate, 2023 - 2024, 2022 - 2023

Temel Patoloji, Postgraduate, 2023 - 2024, 2022 - 2023

Sindirim ve Solunum Sistemi Hastalıkları Patolojisi, Postgraduate, 2023 - 2024, 2022 - 2023

Tümör Bilimi, Postgraduate, 2022 - 2023

Sinir ve Kas Sistemi Hastalıkları Patolojisi, Postgraduate, 2023 - 2024

Patolojik Tanı Teknikleri, Undergraduate, 2023 - 2024

Nekropsi, Undergraduate, 2023 - 2024, 2022 - 2023

Özel Patoloji I, Undergraduate, 2023 - 2024, 2022 - 2023

Mezuniyet Tezi I, Undergraduate, 2023 - 2024, 2022 - 2023

Kan ve Dolaşım Sistemleri Patolojisi, Postgraduate, 2022 - 2023

## **Jury Memberships**

Doctoral Examination, Doctoral Examination, Atatürk Üniversitesi, December, 2023

## **Published journal articles indexed by SCI, SSCI, and AHCI**

- I. **Investigation of the protective effect of chitosan against arsenic-induced nephrotoxicity and oxidative damage in rat kidney tissue**

Irak K., Çelik Ö., Bolacalı M., Tufan T., Özcan S., Yıldırım S., Bolat İ.

Polish journal of veterinary sciences, vol.27, no.1, pp.95-105, 2024 (SCI-Expanded)

- II. **Molecular insights into the antioxidative and anti-inflammatory effects of P-coumaric acid against bisphenol A-induced testicular injury: In vivo and in silico studies.**

Tekin S., Sengul E., Yildirim S., Aksu E. H., Bolat İ., Çınar B., Shadidizaji A., Çelebi F., Warda M.

- Reproductive toxicology (Elmsford, N.Y.), vol.125, pp.108579, 2024 (SCI-Expanded)
- III. Effect of fentanyl and remifentanil on neuron damage and oxidative stress during induction neurotoxicity**
- Taghizadehghalehjoughi A., Naldan M. E., YENİ Y., Genc S., Hacimuoglu A., Isik M., Necip A., BOLAT İ., YILDIRIM S., Beydemir S., et al.
- JOURNAL OF CELLULAR AND MOLECULAR MEDICINE, vol.28, no.4, 2024 (SCI-Expanded)
- IV. Quinacrine, a PLA2 inhibitor, alleviates LPS-induced acute kidney injury in rats: Involvement of TLR4/NF- $\kappa$ B/TNF  $\alpha$ -mediated signaling**
- Çomaklı S., Küçükler S., Değirmençay Ş., Bolat İ., Özdemir S.
- International immunopharmacology, vol.126, pp.111264, 2024 (SCI-Expanded)
- V. Analyzing the impact of synthetic and natural steroids: a study of cytochrome P450 metabolism, morphological alterations through metabolomics, and histopathological Examination**
- KOCAMAN E. M., ŞENOL O., YILDIRIM S., ATAMANALP M., ÖZCAN S., BOLAT İ., UÇAR A., KILIÇLIOĞLU M., PARLAK V., TAKKAÇ M., et al.
- Toxicology Mechanisms and Methods, 2024 (SCI-Expanded)
- VI. Investigation of the effects of pulmonary adenomatosis on oxidative dna damage, inflammation, apoptosis, and autophagy in lung tissues in sheep**
- Bolat İ., Yıldırım S., Sağlam Y. S., Çomaklı S., Kılıçlioğlu M., Dereli E.
- Small Ruminant Research, vol.230, 2024 (SCI-Expanded)
- VII. Self-healing demonstration in imidacloprid toxicity with multibiomarkers and biologic pathways**
- Alak G., Yıldırım S., Yeltekin A. Ç., Uçar A., Bolat İ., Kılıçlioğlu M., Parlak V., Kocaman E. M., Atamanalp M.
- Process Safety and Environmental Protection, vol.178, pp.121-134, 2023 (SCI-Expanded)
- VIII. Flavonoid-Rich Sambucus nigra Berry Extract Enhances Nrf2/HO-1 Signaling Pathway Activation and Exerts Antiulcerative Effects In Vivo**
- ÇİÇEK B., DANIŞMAN B., YILDIRIM S., YÜCE N., Nikitovic D., BOLAT İ., KUZUCU M., Ceyran E., Bardas E., Golokhvast K. S., et al.
- International Journal of Molecular Sciences, vol.24, no.20, 2023 (SCI-Expanded)
- IX. Global warming and nanoplastic toxicity; small temperature increases can make gill and liver toxicity more dramatic, which affects fillet quality caused by polystyrene nanoplastics in the adult zebrafish model**
- ŞENOL O., Sulukan E., BARAN A., BOLAT İ., TORAMAN E., ALAK G., YILDIRIM S., Bilgin G., CEYHUN S. B.
- SCIENCE OF THE TOTAL ENVIRONMENT, vol.892, 2023 (SCI-Expanded)
- X. The anxiolytic and circadian regulatory effect of agarwood water extract and its effects on the next generation; zebrafish modelling**
- Kankaynar M., Ceyhun H. A., Baran A., Sulukan E., Yıldırım S., Bolat İ., Toraman E., Nadaroğlu H., Arslan M., Ceyhun S. B.
- COMPARATIVE BIOCHEMISTRY AND PHYSIOLOGY C-TOXICOLOGY & PHARMACOLOGY, vol.269, 2023 (SCI-Expanded)
- XI. Glioblastoma cell-derived exosomes induce cell death and oxidative stress in primary cultures of olfactory neurons. Role of redox stress**
- Yeni Y., TAGHIZADEHGHALEHJOUGHİ A., GENÇ S., HACİMÜFTÜOĞLU A., YILDIRIM S., BOLAT İ.
- Molecular Biology Reports, vol.50, no.5, pp.3999-4009, 2023 (SCI-Expanded)
- XII. Effects of oleanolic acid administration on renal NF- $\kappa$ B, IL-18, IL-6, YKL-40, and KIM-1 in experimental diabetic rats**
- İskender H., Dokumacıoğlu E., Hayırlı A., Terim Kapakin K. A., Bolat İ., Manavoğlu Kirman E.
- IRANIAN JOURNAL OF BASIC MEDICAL SCIENCES, vol.26, no.10, pp.1188-1193, 2023 (SCI-Expanded)
- XIII. Carnosic Acid Ameliorates Indomethacin-Induced Gastric Ulceration in Rats by Alleviating Oxidative Stress and Inflammation**
- DANIŞMAN B., ÇİÇEK B., YILDIRIM S., BOLAT İ., KANTAR GÜL D., Golokhvast K. S., Nikitovic D., Tsatsakis A., TAGHIZADEHGHALEHJOUGHİ A.
- BIOMEDICINES, vol.11, no.3, 2023 (SCI-Expanded)

- XIV. **Investigation of the subchronic effects of low-dose pesticide mixture on rat testes**  
ÖMÜR A. D., Sevim C., SAĞLAM Y. S., BOLAT İ., GENÇ S., YENİ Y., Aydin M. A., Sunar S., Kocak G., AKARSU S. A.  
JAPANESE JOURNAL OF VETERINARY RESEARCH, vol.15, no.3, pp.82-94, 2023 (SCI-Expanded)
- XV. **Combined metabolic activators improve metabolic functions in the animal models of neurodegenerative diseases**  
TÜRKEL H., Altay O., YILDIRIM S., Li X., Yang H., BAYRAM C., BOLAT İ., Oner S., Tozlu O. O., Arslan M. E., et al.  
Life Sciences, vol.314, 2023 (SCI-Expanded)
- XVI. **Global warming and glyphosate toxicity (I): Adult zebrafish modelling with behavioural, immunohistochemical and metabolomic approaches**  
Sulukan E., Baran A., Şenol O., Kankaynar M., Yıldırım S., Bolat İ., Ceyhun H. A., Toraman E., Ceyhun S. B.  
SCIENCE OF THE TOTAL ENVIRONMENT, vol.858, 2023 (SCI-Expanded)
- XVII. **Ellagic Acid and Its Metabolites as Potent and Selective Allosteric Inhibitors of Liver Pyruvate Kinase**  
Battisti U. M., Gao C., Akladios F., Kim W., Yang H., BAYRAM C., BOLAT İ., KILIÇLİOĞLU M., Yuksel N., Tozlu O. O., et al.  
NUTRIENTS, vol.15, no.3, 2023 (SCI-Expanded)
- XVIII. **Sorafenib Alleviates Inflammatory Signaling of Tumor Microenvironment in Precancerous Lung Injuries**  
Çiçek B., Hacımüftüoğlu A., Kuzucu M., Cetin A., Yeni Y., Genç S., Yıldırım S., Bolat İ., Kantarci M., Gül M., et al.  
PHARMACEUTICALS, vol.16, no.2, 2023 (SCI-Expanded)
- XIX. **Reproductive Effects of *S. boulardii* on Sub-Chronic Acetamiprid and Imidacloprid Toxicity in Male Rats**  
Sevim Ç., AKPINAR E., Aksu E. H., ÖMÜR A. D., YILDIRIM S., KARA M., BOLAT İ., Tsatsakis A., Mesnage R., Golokhvast K. S., et al.  
Toxics, vol.11, no.2, 2023 (SCI-Expanded)
- XX. **Global warming and glyphosate toxicity (II): Offspring zebrafish modelling with behavioral, morphological and immunohistochemical approaches**  
Sulukan E., Baran A., Kankaynar M., Kızıltan T., Bolat İ., Yıldırım S., Ceyhun H. A., Ceyhun S. B.  
SCIENCE OF THE TOTAL ENVIRONMENT, vol.856, 2023 (SCI-Expanded)
- XXI. **Effects of emodin and metformin on biochemical, histological and oxidative stress parameters in streptozotocin-induced diabetic rats**  
Bati B., YILDIRIM S., Celik I., Kaptaner B., Huyut Z., Yenilmez A., BOLAT İ., Zirek A. K., Demir A.  
JOURNAL OF ELEMENTOLOGY, vol.28, no.2, pp.319-335, 2023 (SCI-Expanded)
- XXII. **Fluoride exposure causes behavioral, molecular and physiological changes in adult zebrafish< i> (*Danio*< /i>< i> rerio)< /i> and their offspring**  
Karaman M., Toraman E., Sulukan E., Baran A., Bolat İ., Yıldırım S., Kankaynar M., Ghosigharehagaji A., Budak H., Ceyhun S. B.  
ENVIRONMENTAL TOXICOLOGY AND PHARMACOLOGY, vol.97, 2023 (SCI-Expanded)
- XXIII. **Combined metabolic activators improve cognitive functions in Alzheimer's disease patients: a randomised, double-blinded, placebo-controlled phase-II trial**  
Yulug B., Altay O., Li X., Hanoglu L., Cankaya S., Lam S., Velioglu H. A., Yang H., Coskun E., Idil E., et al.  
TRANSLATIONAL NEURODEGENERATION, vol.12, no.1, 2023 (SCI-Expanded)
- XXIV. **Suberosin Alleviates Sepsis-Induced Lung Injury in A Rat Model of Cecal Ligation and Puncture**  
Uzuncakmak S. K., HALICI Z., KARAKAYA S., KUTLU Z., SAĞLAM Y. S., BOLAT İ., Aydin P., KILIÇ C. S.  
JOURNAL OF INVESTIGATIVE SURGERY, vol.36, no.1, pp.1-9, 2023 (SCI-Expanded)
- XXV. **Determination of < i> Leptospiral< /i> antigens in naturally infected canine uterus by immunohistochemical immunofluorescence and ELISA methods**  
BOLAT İ., SAĞLAM Y. S., Cengiz S., Yildirim S.  
JAPANESE JOURNAL OF VETERINARY RESEARCH, vol.15, no.1, 2022 (SCI-Expanded)
- XXVI. **Artichoke (*Cynara Scolymus*) Methanolic Leaf Extract Alleviates Diethylnitrosamine-Induced Toxicity in BALB/c Mouse Brain: Involvement of Oxidative Stress and Apoptotically Related Klotho/PPAR $\gamma$  Signaling**  
ÇİÇEK B., GENÇ S., YENİ Y., KUZUCU M., Cetin A., YILDIRIM S., BOLAT İ., Kantarci M., HACİMÜFTÜOĞLU A.,

- Lazopoulos G., et al.  
Journal of Personalized Medicine, vol.12, no.12, 2022 (SCI-Expanded)
- XXVII. **What is the eco-toxicological level and effects of graphene oxide-boramidic acid (GO-ED-BA NP) ?: In vivo study on Zebrafish embryo/larvae**  
Köktürk M., Yıldırım S., Yigit A., Özhan H. G., Bolat İ., Alma M. H., Mengeş N., Alak G., Atamanalp M.  
Journal of Environmental Chemical Engineering, vol.10, no.5, 2022 (SCI-Expanded)
- XXVIII. **Nano-sized polystyrene plastic particles affect many cancer-related biological processes even in the next generations; zebrafish modeling**  
Sulukan E., ŞENOL O., BARAN A., Kankaynar M., Yıldırım S., Kızıltan T., BOLAT İ., CEYHUN S. B.  
SCIENCE OF THE TOTAL ENVIRONMENT, vol.838, 2022 (SCI-Expanded)
- XXIX. **Discovery of therapeutic agents targeting PKLR for NAFLD using drug repositioning**  
Zhang C., Shi M., Kim W., Arif M., Klevstig M., Li X., Yang H., Bayram C., Bolat İ., Tozlu Ö. Ö., et al.  
EBIOMEDICINE, vol.83, 2022 (SCI-Expanded)
- XXX. **Effects of boric acid and potassium metaborate on cytokine levels and redox stress parameters in a wound model infected with methicillin-resistant *Staphylococcus aureus***  
Çelebi D., Taghizadehghalehjoughi A., Baser S., Genc S., Yilmaz A., Yeni Y., Yesilyurt F., Yıldırım S., Bolat İ., Kordali S., et al.  
MOLECULAR MEDICINE REPORTS, vol.26, no.3, 2022 (SCI-Expanded)
- XXXI. **Assessment of oxidative DNA damage, apoptosis and histopathological alterations on zebrafish exposed with green silver nanoparticle**  
Kokturk M., Yildirim S., Atamanalp M., Çalimli M. H., Nas M. S., Bolat İ., Ozhan G., Alak G.  
CHEMISTRY AND ECOLOGY, vol.38, no.7, pp.655-670, 2022 (SCI-Expanded)
- XXXII. **Potential Neurotoxic Effects of Glioblastoma-Derived Exosomes in Primary Cultures of Cerebellar Neurons via Oxidant Stress and Glutathione Depletion**  
Genc S., Pennisi M., Yeni Y., Yıldırım S., Gattuso G., Altinoz M. A., Taghizadehghalehjoughi A., Bolat İ., Tsatsakis A., Hacımüftüoğlu A., et al.  
ANTIOXIDANTS, vol.11, no.7, 2022 (SCI-Expanded)
- XXXIII. **Investigation of the Oxidative Stress Response of a Green Synthesis Nanoparticle (RP-Ag/ACNPs) in Zebrafish**  
Kokturk M., Yıldırım S., Nas M. S., Ozhan G., Atamanalp M., Bolat İ., Calimli M. H., Alak G.  
Biological Trace Element Research, vol.200, no.6, pp.2897-2907, 2022 (SCI-Expanded)
- XXXIV. **The potential effect mechanism of high-fat and high-carbohydrate diet-induced obesity on anxiety and offspring of zebrafish**  
Turkoglu M., Baran A., Sulukan E., Ghosigharehagaji A., Yıldırım S., Ceyhun H. A., Bolat İ., Arslan M., Ceyhun S. B.  
EATING AND WEIGHT DISORDERS-STUDIES ON ANOREXIA BULIMIA AND OBESITY, vol.27, no.1, pp.163-177, 2022 (SCI-Expanded)
- XXXV. **Effects of oleanolic acid on inflammation and metabolism in diabetic rats**  
Iskender H., Dokumacioglu E., Kapakin K. A. T., YENİCE G., Mohtare B., BOLAT İ., HAYIRLI A.  
Biotechnic and Histochemistry, vol.97, no.4, pp.269-276, 2022 (SCI-Expanded)
- XXXVI. **A versatile toxicity evaluation of ethyl carbamate (urethane) on zebrafish embryos: Morphological, physiological, histopathological, immunohistochemical, transcriptional and behavioral approaches**  
Sulukan E., Ghosigharehagaji A., BARAN A., YILDIRIM S., BOLAT İ., CEYHUN S. B.  
TOXICOLOGY LETTERS, pp.71-78, 2021 (SCI-Expanded)
- XXXVII. **An approach to evaluating the potential teratogenic and neurotoxic mechanism of BHA based on apoptosis induced by oxidative stress in zebrafish embryo (<i>Danio rerio</i>)**  
Baran A., Yıldırım S., Ghosigharehaghaji A., Bolat İ., Sulukan E., Ceyhun S. B.  
HUMAN & EXPERIMENTAL TOXICOLOGY, no.3, pp.425-438, 2021 (SCI-Expanded)
- XXXVIII. **Effect of betulinic acid administration on TLR-9/NF-kappa B /IL-18 levels in experimental liver injury**  
Dokumacioglu E., Iskender H., Terim Kapakin K. A., Yenice G., Mokthare B., Bolat İ., Hayirli A.  
TURKISH JOURNAL OF MEDICAL SCIENCES, vol.51, no.3, pp.1544-1553, 2021 (SCI-Expanded)

- XXXIX. Is sodium carboxymethyl cellulose (CMC) really completely innocent? It may be triggering obesity  
 Baran A., Sulukan E., Türkoğlu M., Ghosigharehagaji A., Yıldırım S., Kankaynar M., Bolat İ., Kaya M., Topal A., Ceyhun S. B.  
 INTERNATIONAL JOURNAL OF BIOLOGICAL MACROMOLECULES, pp.2465-2473, 2020 (SCI-Expanded)
- XL. Neuroprotective effects of dietary borax in the brain tissue of rainbow trout (*Oncorhynchus mykiss*) exposed to copper-induced toxicity  
 Alak G., Ucar A., Yeltekin A., Çomaklı S., Parlak V., Tas I., Özkaraca M., Topal A., Kirman E., Bolat İ., et al.  
 Fish Physiology and Biochemistry, vol.44, no.5, pp.1409-1420, 2018 (SCI-Expanded)

## Articles Published in Other Journals

- I. A Case of Feline Infectious Peritonitis in Erzurum Province: Macroscopic and Microscopic Findings  
 GÖZEGİR B., KILIÇLİOĞLU M., BOLAT İ., BAYSAL S., ÇOMAKLI S.  
 Journal of Veterinary Case Reports, vol.3, no.2, pp.12-16, 2023 (Peer-Reviewed Journal)
- II. Investigation of the Effects of Boric Acid Used in the Treatment of Rat Models with Knee Osteoarthritis Induced by Monosodium Iodoacetate on Liver Tissue  
 Bolat İ., Terim Kapakin K. A., Esra M. K., Gündoğdu G., Gündoğdu K., Demirkaya Miloğlu F., Yılmaz Taşçı Ş.  
 Harran Üniversitesi Veteriner Fakültesi Dergisi, vol.12, no.2, pp.202-208, 2023 (Peer-Reviewed Journal)
- III. Effect of Oleanolic acid administration on hepatic AMPK, SIRT-1, IL-6 and NF-κB levels in experimental diabetes  
 İskender H., Dokumacioglu E., TERİM KAPAKİN K. A., BOLAT İ., Mokhtare B., HAYIRLI A., YENİCE G.  
 Journal of Diabetes and Metabolic Disorders, vol.22, no.1, pp.581-590, 2023 (ESCI)
- IV. Protective Effect of Betulinic Acid Administration on Kidney Damage in Acetaminophen-Induced Nephrotoxicity Model  
 Dokumacioglu E., İskender H., Hayırli A., Yenice G., Terim Kapakin K. A., Bolat İ., Manavoğlu Kirman E.  
 MAKARA JOURNAL OF HEALTH RESEARCH, vol.27, no.1, pp.59-67, 2023 (ESCI)
- V. Gastroprotective effects of bromelain on indomethacin-induced gastric ulcer in rats  
 DANIŞMAN B., ÇİÇEK B., YILDIRIM S., YÜCE N., BOLAT İ.  
 GSC Online Press, vol.23, 2023 (Peer-Reviewed Journal)
- VI. Investigation of Neurotoxicity Oxidative Stress and Oxidative DNA Damage in Cadmium-Induced Brain Injury in Rats  
 BOLAT İ., YILDIRIM S., CEYLAN N., SAĞLAM Y. S., ÖRNEK F. K., BOLAT M., KILIÇLİOĞLU M.  
 Veterinary sciences and practices (Online), vol.18, pp.19-24, 2023 (Scopus)
- VII. Doğal Enfekte Köpek Testislerinde Leptospiral Antijenlerin İmmunohistokimyasal Olarak Araştırılması  
 BOLAT İ., SAĞLAM Y. S., YILDIRIM S.  
 Ataturk Üniversitesi Veteriner Bilimleri Dergisi, vol.16, no.3, pp.236-242, 2021 (Scopus)

## Books & Book Chapters

- I. LEPTOSPIROZİS: SİSTEMATİK BİR İNCELEME  
 Bolat İ., Sağlam Y. S., Yıldırım S.  
 in: VETERİNERLİK ALANINDA AKADEMİK ANALİZLER, Prof. Dr. Mehmet Şükrü GÜLAY, Editor, Yaz Yayımları,  
 Afyonkarahisar, pp.1-10, 2024

## Refereed Congress / Symposium Publications in Proceedings

- I. Investigation of the Effects of Rutin Hydrate Against Diabetic Pancreatic Damage in Rats

- Bolat İ., Yıldırım S.  
4TH INTERNATIONAL CONFERENCE ON INNOVATIVE ACADEMIC STUDIES, Konya, Turkey, 12 - 13 March 2024,  
pp.1-7
- II. **A CASE OF SARCOMA DEVELOPING DUE TO INJECTION IN A DOG**  
Bolat İ.  
11. ULUSLARARASI ZEUGMA BİLİMSEL ARAŞTIRMALAR KONGRESİ, Gaziantep, Turkey, 18 - 20 March 2024, pp.1-5
- III. **Doğal Enfekte Köpek Uterus Dokularında Leptospiral Antijenlerin İmmünohistokimyasal İmmünofloresan ve ELISA Yöntemleriyle Belirlenmesi**  
Bolat İ., Sağlam Y. S., Cengiz S., Yıldırım S.  
XI. ULUSAL / II. ULUSLARASI VETERİNER PATOLOJİ KONGRESİ, Erzurum, Turkey, 4 - 08 September 2023, pp.16-17
- IV. **Quinacrine'in Ratlarda LPS'nin Neden Olduğu Akut Pulmoner Enflamasyon Üzerine Etkileri**  
Çomaklı S., Küçükler S., Değirmençay Ş., Bolat İ.  
XI. ULUSAL / II. ULUSLARASI VETERİNER PATOLOJİ KONGRESİ, Erzurum, Turkey, 4 - 08 September 2023, pp.20-22
- V. **Pulmoner Adenomatozis Enfeksiyonlarının Akciğer Dokularında İnflamasyon, Oksidatif DNA Hasarı ve Apoptozis Üzerine Etkilerinin Araştırılması**  
Bolat İ., Kılıçlıoğlu M., Yıldırım S., Sağlam Y. S., Çomaklı S., Dereli E.  
XI. ULUSAL / II. ULUSLARASI VETERİNER PATOLOJİ KONGRESİ, Erzurum, Turkey, 4 - 08 September 2023, pp.40-42
- VI. **Sıçanlara Valproik Asit Uygulaması ile Çeşitli Dokularda Oluşturulan Hasarlara Karşı Kurkumin'in Koruyucu Etkisinin İmmunohistokimyasal Yöntemlerle Araştırılması**  
Terim Kapakin K. A., Manavoğlu Kirman E., Bolat İ., İskender H., Dokumacıoğlu E., Güll M.  
XI. ULUSAL / II. ULUSLARASI VETERİNER PATOLOJİ KONGRESİ, Erzurum, Turkey, 4 - 08 September 2023, pp.24-26
- VII. **Ratlarda Deneysel Olarak Oluşturulan Diyabetik Nefropatide Morin Hidratın Koruyucu ve Destekleyici Etkilerinin Araştırılması**  
Yıldırım S., Dereli E., Yıldırım H. E., Şengül E., Sağlam Y. S., Bolat M., Kılıçlıoğlu M., Bolat İ.  
II. Uluslararası XI. Ulusal Veteriner Patoloji Kongresi, Erzurum, Turkey, 4 - 09 September 2023, pp.36-37
- VIII. **EFFECTS OF MILK FAT GLOBULES ON WOUND HEALING**  
Mokresh M. Y., Yıldırım S., Sağlam Y. S., Bolat İ., Kılıçlıoğlu M.  
ATAVET II. ULUSLARASI III. ULUSAL ÖĞRENCİ KONGRESİ, Erzurum, Turkey, 15 - 16 December 2021
- IX. **INVESTIGATION OF THE PROTECTIVE EFFECT OF MORIN HYDRATE AGAINST ACRYLAMIDE TOXICATION IN RAT BRAIN TISSUES BY HISTOPATHOLOGICAL AND IMMUNOHISTOCHEMICAL METHODS**  
Bolat İ., Yıldırım S., Sağlam Y. S., Terim Kapakin K. A., Kılıçlıoğlu M.  
ATAVET II. ULUSLARARASI III. ULUSAL ÖĞRENCİ KONGRESİ, Erzurum, Turkey, 15 - 16 December 2021
- X. **INVESTIGATION OF OXTATIVE STRESS EFFECTS ON EXPERIMENTALLY GENERATED DIABETIC AND NON-DIABETIC WOUNDS**  
Mokhtare B., Sağlam Y. S., Yıldırım S., Bolat İ., Kılıçlıoğlu M.  
ATAVET II. ULUSLARARASI III. ULUSAL ÖĞRENCİ KONGRESİ, Erzurum, Turkey, 15 - 16 December 2021
- XI. **Effects of replacing soybean meal with dietary wheat gluten meal and corn gluten meal on histopathological and immunohistochemical parameters in the liver of rats**  
Gümüş R., Terim Kapakin K. A., Esra M. K., Bolat İ., Ercan N.  
ATAVET II. ULUSLARARASI III. ULUSAL ÖĞRENCİ KONGRESİ, Erzurum, Turkey, 15 December 2021
- XII. **ZEBRA BALIĞI MİKROENJEKSİYON YÖNTEMİ İLE GIDA KATKI MADDESİ OLARAK PEKTİN VE AMİDİYE PEKTİNİN ETKİLERİNİN ARAŞTIRILMASI**  
Baran A., Sulukan E., Türkoğlu M., Ghosigharehagaji A., Yıldırım S., Kankaynar M., Bolat İ., Kaya M., Ceyhun S. B.  
9. VETERİNER GIDA HİJYENİ KONGRESİ, Antalya, Turkey, 04 November 2021
- XIII. **ENZOOTİK ATAKSİ'Lİ BİR KUZUNUN KLİNİK, HEMATOLOJİK, TOMOGRAFİK VE PATOLOJİK BULGULARININ DEĞERLENDİRİLMESİ**  
ULAŞ N., TERİM KAPAKİN K. A., EREN E., YANAR K. E., BOLAT İ., EROĞLU M. S.  
ATAVET 1. ULUSLARARASI (2. ULUSLARARASI KATILIMLI) ÖĞRENCİ KONGRESİ, Erzurum, Turkey, 4 - 06 December 2019
- XIV. **BİR KÖPEKTE DEV HÜCRELİ TÜMÖR OLGUSU**

- TERİM KAPAKİN K. A., BOLAT İ., ŞENOCAK M. G.  
 1. ULUSLARARASI (2. ULUSLARARASI KATILIMLI) ÖĞRENCİ KONGRESİ, Erzurum, Turkey, 4 - 06 December 2019
- XV. RATLarda UTERUS DOKUSU ÜZERİNE BUĞDAY VE MISIR GLÜTENİNİN HİSTOPATOLOJİK ETKİLERİNİN BELİRLENMESİ  
 İMİK H., GÜMÜŞ R., TERİM KAPAKİN K. A., BOLAT İ.  
 GANUD INTERNATIONAL CONFERENCE ON GASTRONOMY, NUTRITION AND DIETETICS, 22 November 2019 - 24 January 2020
- XVI. PATHOLOGICAL DIAGNOSIS OF LEPTOSPIROSIS  
 SAĞLAM Y. S., BOLAT İ., YILDIRIM S.  
 ATAVET 1. International(2. International Participants) Student Congress, 4 - 06 December 2019
- XVII. Purulent meningoencephalitis and acute coenurosis in a Morkaraman lamb  
 DEĞIRMENÇAY Ş., AYDIN Ö., YILDIRIM S., ADIGÜZEL M. C., EREN E., BOLAT İ.  
 4th International Congress on Advances of Veterinary Sciences and Techniques (ICAVST), KIEV, Ukraine, 10 - 14 July 2019
- XVIII. The Combination Effect of Pycgenol and Momardica charantia on Inflammatory Cytokines Expressions Induced by Sepsis in Mice  
 SEVİM Ç., SAĞLAM Y. S., BOLAT İ., mokhtare b., ÇOMAKLI S., ÖZKARACA M., DOĞAN E., aristides t.  
 International Eurasian Conference on Biological and Chemical Sciences(EurasianBioChem 2018), 26 - 27 April 2018
- XIX. Çekal Ligasyon Modeliyle Sepsis Oluşturulmuş Farelerin Karaciğerinde Pycnogenol ve Momordica Charantia'ının Apoptotik Hücre Ölümü Üzerine Etkisinin İmmunohistokimyasal Olarak İncelenmesi  
 SEVİM Ç., SAĞLAM Y. S., BOLAT İ., ÇOMAKLI S., ÖZKARACA M., DOĞAN E.  
 Atatürk Üniversitesi Veteriner Fakültesi (ATAVET) I. Uluslararası Katılımlı Öğrenci Kongresi, 18 - 20 October 2017, vol.1, pp.25-26
- XX. Bir tavşanda meme tümörü olgusu  
 BOYACI D. T., CHACHER M. F. A., CANNAZIK O., CEBECİ A. İ., ÇOMAKLI S., BOLAT İ.  
 TÜRK VETERİNER JİNEKOLOJİ DERNEĞİ VII. ULUSAL I. ULUSLARASI KONGRESİ, MARMARİS, 12 - 15 October 2017

## Supported Projects

- YILDIRIM S., BOLAT İ., KILIÇLİOĞLU M., NIŞANCI B., ÜNVER Y., GÖZEGİR B., Project Supported by Higher Education Institutions, Ratlarda Deneysel Kolon Kanserinde Kimyasal Aktif Maddeler ve Bor Bileşiklerinin Antikanser Etkilerinin Biyokimyasal Histopatolojik İmmunohistokimyasal İmmünlloresan ve Moleküler Yöntemlerle Araştırılması, 2024 - Continues
- Bolat İ., Sağlam Y. S., Yıldırım S., Çomaklı S., Bolat M., Project Supported by Higher Education Institutions, Ratlarda Kadmiyum ile İndüklenen Nörotoksiste Üzerine Beta Karyofillenin Etkilerinin Araştırılması, 2024 - 2025
- YILDIRIM S., SAĞLAM Y. S., BOLAT İ., KILIÇLİOĞLU M., ALTUN S., TERİM KAPAKİN K. A., ÇOMAKLI S., Project Supported by Higher Education Institutions, Atatürk Üniversitesi Veteriner Fakültesi Patoloji Anabilim Dalı Laboratuvarlarının Araştırma Altyapısının Geliştirilmesi, 2023 - 2024
- Bolat İ., Sağlam Y. S., Yıldırım S., Çomaklı S., Bolat M., Kılıçlioğlu M., TUBITAK Project, Doğal Enfekte Köpek Uterus Dokularında Leptospira interrogans'ın Yangışal Reaksiyonlar ve Apoptozis Üzerindeki Etkinliğinin Araştırılması, 2023 - 2024
- Okur S., Gölgeli Bedir A., Okur D. T., Apaydın Yıldırım B., Yıldırım S., Tozlu Ö. Ö., Turgut F., Bolat İ., Şenocak M. G., Yanmaz L. E., TUBITAK Project, Ratlarda Deneysel Olarak Oluşturulan Postoperatif İntaabdominal Adezyonların Önlenmesinde Borik Asit, Düşük Enerjili Lazer ve Terapötik Ultrasonun Etkinliğinin Araştırılması, 2023 - 2024
- Bolat İ., Okur S., Kılıçlioğlu M., Okur D. T., Project Supported by Higher Education Institutions, Deneysel olarak ratlarda postoperatif intraabdominal adezyonların şiddetinin belirlenmesinde termografinin etkinliğinin araştırılması, 2023 - 2024
- Bolat İ., Boyacı F., TUBITAK Project, Pnömonili Sığır Akciğer Dokularında Parainfluenza-3 Enfeksiyon Varlığının Araştırılması, 2023 - 2024

Polat B., Çolak A., Özkar E., Sevinç Özkar R., Çomaklı S., Bolat İ., Polat N., Özgen E. K., Erdoğan Y., Sağlam Y. S., TUBITAK Project, 1001 - İneklerde Subklinik Endometritisin Tedavisinde İnter Uterin Bor Kullanımının Etkinliğinin Araştırılması, 2022 - 2024

ALTUN S., BOLAT İ., KILIÇLİOĞLU M., ARSLAN H., Project Supported by Higher Education Institutions, "Pestisit Kaynaklı (Ratlarda) Beyin ve Sinir Sistemi Hasarlarının Alzheimer, Amyotrofik Lateral Skleroz, Demans, Multipl Skleroz (MS), Parkinson Hastalığı gibi Hastalıkların Patogenezine Etkisinin Araştırılması", 2021 - 2024

YILDIRIM S., KILIÇLİOĞLU M., ALTUN S., BOLAT İ., Project Supported by Higher Education Institutions, XI Veteriner Patoloji Ulusal II. uluslararası katılımlı Kongresi, 2023 - 2023

Bolat İ., Sağlam Y. S., Kılıçlıoğlu M., Project Supported by Higher Education Institutions, Koyun Akciğerlerinde Pulmoner Adenomatozis Enfeksiyonunun Oksidatif Stres İnflamasyon Apoptozis ve Otofaji Üzerine Etkilerinin Araştırılması, 2022 - 2023

TERİM KAPAKİN K. A., BOLAT İ., Project Supported by Higher Education Institutions, Sıçanlara Valproik Asit Uygulaması ile Çeşitli Dokularda Oluşturulan Hasarlara Karşı Kurkuminin Koruyucu Etkisinin Biyokimyasal ve İmmunflöresan Yöntemlerle Araştırılması, 2022 - 2023

Bolat İ., Çomaklı S., Küçükler S., Değirmençay Ş., Project Supported by Higher Education Institutions, LPS'ye bağlı şekillenen akut organ hasarları üzerine Quinacrinein etkisinin araştırılması, 2022 - 2023

Bolat İ., Terim Kapakin K. A., Dokumacıoğlu E., İskender H., Ömeroğlu M., Project Supported by Higher Education Institutions, Sıçanlara Valproik Asit Uygulaması ile Çeşitli Dokularda Oluşturulan Hasarlara Karşı Kurkuminin Koruyucu Etkisinin Biyokimyasal ve İmmunflöresan Yöntemlerle Araştırılması, 2021 - 2023

YENİCE G., YILDIRIM S., BOLAT İ., ÖZKANLAR S., Project Supported by Higher Education Institutions, Betulinik asidin sıçanlarda deneysel olarak oluşturulan akut pankreatite karşı koruyucu etkilerinin araştırılması, 2021 - 2022

SAĞLAM Y. S., BOLAT İ., Project Supported by Higher Education Institutions, Doğal Enfekte Köpek Uteruslarında Leptospiral Antijenlerin İmmunohistokimyasal ve Moleküler Yöntemlerle Belirlenmesi, 2020 - 2022

Bolat İ., Sağlam Y. S., Yıldırım S., Adığuzel M. C., Project Supported by Higher Education Institutions, Zoonoz ve Salgın Hastalıklar Sempozyumu, 2021 - 2021

TERİM KAPAKİN K. A., ORUÇ H., YILDIRIM S., BOLAT İ., MANAVOĞLU KIRMAN E., Project Supported by Higher Education Institutions, ÇOCUK GELİŞİMİNDE SPOR ve BİNİCİLİK, 2019 - 2020

## Activities in Scientific Journals

CMJ Open Journal , Committee Member, 2024 - Continues

Academy Journal of Clinical and Medical Case Reports, Committee Member, 2024 - Continues

## Scientific Refereeing

Archives of Surgery and Clinical Research, Other Indexed Journal, March 2024

CURRENT PHARMACEUTICAL DESIGN, SCI Journal, March 2024

Archives of Pulmonology and Respiratory Care, Other Indexed Journal, March 2024

Clinical Journal of Obstetrics and Gynecology, Other Indexed Journal, March 2024

Forensic Science Today, Other Indexed Journal, March 2024

Journal of Oral Health and Craniofacial Science, Other Indexed Journal, March 2024

Archives of Pharmacy and Pharmaceutical Sciences, Other Indexed Journal, March 2024

Annals of Clinical Gastroenterology and Hepatology, Other Indexed Journal, March 2024

CURRENT CANCER THERAPY REVIEWS, Journal Indexed in ESCI, March 2024

Archives of Renal Diseases and Management, Other Indexed Journal, March 2024

SM Journal of Nursing, Other Indexed Journal, February 2024

Annals of Dermatological Research, Other Indexed Journal, February 2024

Journal of Sports Medicine and Therapy, Other Indexed Journal, February 2024

Journal of Oral Health and Craniofacial Science, Other Indexed Journal, February 2024

Journal of Radiology and Oncology, Other Indexed Journal, February 2024  
Journal of Forensic Science and Research, Other Indexed Journal, February 2024  
Journal of Pulmonology and Respiratory Research, Other Indexed Journal, January 2024  
IgMin Research: Advancing knowledge and innovation in STEM, Other Indexed Journal, January 2024  
Journal of Clinical Nephrology , Other Indexed Journal, January 2024  
HISTOLOGY AND HISTOPATHOLOGY, SCI Journal, January 2024  
JSM Clinical Oncology and Research, Other Indexed Journal, January 2024  
Insights in Veterinary Science, Other Indexed Journal, January 2024  
Journal of Genetic Medicine and Gene Therapy, Other Indexed Journal, December 2023  
Heighpubs Otolaryngology and Rhinology, Other Indexed Journal, December 2023  
Journal of Advanced Pediatrics and Child Health, Other Indexed Journal, December 2023  
Archives of Pharmacy and Pharmaceutical Sciences, Other Indexed Journal, November 2023  
HELIYON, SCI Journal, November 2023  
Journal of Surgery and Surgical Research, Other Indexed Journal, November 2023  
Journal of Surgery and Surgical Research, Other Indexed Journal, November 2023  
Necmettin Erbakan Üniversitesi Sağlık Bilimleri Fakültesi Dergisi, National Scientific Refreed Journal, November 2023  
Open Journal of Tropical Medicine, Other Indexed Journal, November 2023  
Open Journal of Pain Medicine, Other Indexed Journal, November 2023  
Archives of Pathology and Clinical Research, Other Indexed Journal, November 2023  
Archives of Case Reports, Other Indexed Journal, October 2023  
Archives of Pathology and Clinical Research, Other Indexed Journal, October 2023  
Archives of Pharmacy and Pharmaceutical Sciences, Other Indexed Journal, October 2023  
Annals of Proteomics and Bioinformatics , Other Indexed Journal, September 2023  
INTERNATIONAL JOURNAL OF VETERINARY AND ANIMAL RESEARCH, Other Indexed Journal, July 2023  
The Trout Journal of Atatürk University, National Scientific Refreed Journal, May 2023  
Open Journal of Parkinson's Disease and Treatment, Other Indexed Journal, April 2023  
Ukrainian Journal of Radiology and Oncology, Other Indexed Journal, March 2023  
Afyon Kocatepe Üniversitesi Fen ve Mühendislik Bilimleri Dergisi, National Scientific Refreed Journal, October 2022

## Tasks In Event Organizations

Bolat İ., Yıldırım S., Çomaklı S., SAĞLAM Y. S., XI. Ulusal II. Uluslararası Veteriner Patoloji Kongresi, Scientific Congress, Erzurum, Turkey, Eylül 2023  
Bolat İ., ATAVET II. ULUSLARASI III. ULUSAL ÖĞRENCİ KONGRESİ, Scientific Congress, Erzurum, Turkey, Aralık 2021  
Bolat İ., Yıldırım S., Balkaya İ., Zoonoz ve Salgın Hastalıklar Sempozyumu, Scientific Congress, Erzurum, Turkey, Ekim 2021

## Metrics

Publication: 68  
Citation (WoS): 251  
Citation (Scopus): 278  
H-Index (WoS): 10  
H-Index (Scopus): 10

## Congress and Symposium Activities

XI Ulusal II Uluslararası veteriner patoloji kongresi, Attendee, Erzurum, Turkey, 2023

Prulent meningoencephalitis and acute coenurosis in a Morkaraman lamb, Attendee, Ukraine, 2019

The Combination Effect of Pycgenol and Momardica charantia on Inflammatory Cytokines Expressions Induced by Sepsis in Mice, Attendee, Ankara, Turkey, 2018

Bir Tavşanda Meme Tümörü Olgusu, Attendee, Muğla, Turkey, 2017

Çekal Ligasyon Modeliyle Sepsis Oluşturulmuş Farelerin Karaciğerinde Pycnogenol ve Momardica Charantia'nın Apoptotik Hücre Ölümü Üzerine Etkisinin İmmunohistokimyasal Olarak İncelenmesi, Attendee, Erzurum, Turkey, 2017

## Awards

Bolat İ., Quinacrine, a PLA2 inhibitor, alleviates LPS-induced acute kidney injury in rats: Involvement of TLR4/NF- $\kappa$ B/TNF  $\alpha$ -mediated signaling, Tübitak, February 2024

Bolat İ., Self-healing demonstration in imidacloprid toxicity with multibiomarkers and biologic pathways, Tübitak, February 2024

Bolat İ., Global warming and nanoplastic toxicity; small temperature increases can make gill and liver toxicity more dramatic, which affects fillet quality caused by polystyrene nanoplastics in the adult zebrafish mode, Tübitak, November 2023

Bolat İ., Carnosic Acid Ameliorates Indomethacin-Induced Gastric Ulceration in Rats by Alleviating Oxidative Stress and Inflammation, Tübitak, November 2023

Bolat İ., The anxiolytic and circadian regulatory effect of agarwood water extract and its effects on the next generation; zebrafish modelling, Tübitak, November 2023

Bolat İ., Flavonoid-Rich Sambucus nigra Berry Extract Enhances Nrf2/HO-1 Signaling Pathway Activation and Exerts Antiulcerative Effects In Vivo, Tübitak, November 2023

Bolat İ., Self-healing demonstration in imidacloprid toxicity with multibiomarkers and biologic pathways, Tübitak, November 2023

Bolat İ., Sorafenib Alleviates Inflammatory Signaling of Tumor Microenvironment in Precancerous Lung Injuries, Tübitak, April 2023

Bolat İ., Fluoride exposure causes behavioral, molecular and physiological changes in adult zebrafish (*Danio rerio*) and their offspring, Tübitak, April 2023

Bolat İ., Global warming and glyphosate toxicity (II): Offspring zebrafish modelling with behavioral, morphological and immunohistochemical approaches, Tübitak, April 2023

Bolat İ., Global warming and glyphosate toxicity (I): Adult zebrafish modelling with behavioural, immunohistochemical and metabolomic approaches, Tübitak, April 2023

Bolat İ., Ellagic Acid and Its Metabolites as Potent and Selective Allosteric Inhibitors of Liver Pyruvate Kinase, Tübitak, April 2023

Bolat İ., Combined metabolic activators improve metabolic functions in the animal models of neurodegenerative diseases, Tübitak, April 2023

Bolat İ., Combined metabolic activators improve cognitive functions in Alzheimer's disease patients: a randomised, double-blinded, placebo-controlled phase-II trial, Tübitak, April 2023

Bolat İ., Reproductive Effects of *S. boulardii* on Sub-Chronic Acetamiprid and Imidacloprid Toxicity in Male Rats, Tübitak, April 2023

Bolat İ., Discovery of therapeutic agents targeting PKLR for NAFLD using drug repositioning, Tübitak, October 2022

Bolat İ., What is the eco-toxicological level and effects of graphene oxide-boramidic acid (GO-ED-BA NP) ?: In vivo study on Zebrafish embryo/larvae, Tübitak, October 2022

Bolat İ., A versatile toxicity evaluation of ethyl carbamate (urethane) on zebrafish embryos: Morphological, physiological, histopathological, immunohistochemical, transcriptional and behavioral approaches, Tübitak, September 2022

Bolat İ., Potential Neurotoxic Effects of Glioblastoma-Derived Exosomes in Primary Cultures of Cerebellar Neurons via Oxidant Stress and Glutathione Depletion, Tübitak, September 2022

Bolat İ., Nano-sized polystyrene plastic particles affect many cancer-related biological processes even in the next generations; zebrafish modeling, Tübitak, September 2022

Bolat İ., The potential effect mechanism of high-fat and high-carbohydrate diet-induced obesity on anxiety and offspring of zebrafish, TÜBİTAK, May 2022

Bolat İ., Effect of betulinic acid administration on TLR-9/NF-κB/IL-18 levels in experimental liver injury, TÜBİTAK, December 2021

Bolat İ., Is sodium carboxymethyl cellulose (CMC) really completely innocent? It may be triggering obesity, TÜBİTAK, March 2021

### **Artistic Activity**

Bolat İ., Yıldırım S., Nörobilim: Geleneksel ve İleri Düzey Nöron Sergisi, Personal Exhibition, December 2021