

Prof. Dr. Cut Fatimah Zuhra, S.Si., M.Si.

Dosen Program Studi S2 Kimia
Fakultas Matematika Dan Ilmu Pengetahuan Alam
Universitas Sumatera Utara

✉ cutfatimah@usu.ac.id

🏢 Kantor Wakil Dekan I, Fakultas Matematika dan Ilmu Pengetahuan Alam, USU

🌐 fmipa.usu.ac.id/id/dosen/cut-fatimah-zuhra

Dr. Cut Fatimah Zuhra, S.Si., M.Si. dilahirkan di R. Panjang pada tanggal 05 April 1974 dan merupakan seorang dosen Kimia di Universitas Sumatera Utara. Beliau menyelesaikan pendidikan terakhirnya, yakni S3 Kimia, di USU pada tahun 2012.

Publications

2026

Jurnal internasional bereputasi

Development of Noodles from Heat-moisture-treated Jackfruit Seed Starch and Mocaf: Physicochemical Properties and Glucose-lowering Effects in STZ-induced Diabetic Rats

RINI HARDIYANTI , CUT FATIMAH ZUHRA , SOVIA LENNY , Anisa Lutfia , Tia Aviza , Zabdan Ahmad Arrazi , Maratul Fadhilah Lubis , Natasia Mangatur Reta Ezra Sinaga

2026

Jurnal internasional bereputasi

Nutrient composition and antioxidant properties of fish protein hydrolysate from bullet tuna (*Auxis rochei*)

MUHAMMAD ZULHAM EFENDI SINAGA , CUT FATIMAH ZUHRA , SOVIA LENNY , RINI HARDIYANTI , WIRDA ARIYANTI

2025

Jurnal internasional bereputasi

Modification starch of breadfruit (*Artocarpus altilis*) through esterification reaction with fatty acid as pesticides in controlled-release formulation

MUHAMMAD ZULHAM EFENDI SINAGA , RINI HARDIYANTI , CUT FATIMAH ZUHRA

2025

Prosiding seminar internasional

Development of antibacterial biofoam from *Eucalyptus grandis*, cassava, and synthetic plastic as an effort to increase storage time of *Citrus sinensis*

MUHAMMAD TAUFIK , SOVIA LENNY , BOBY CAHYADY , RINI HARDIYANTI , CUT FATIMAH ZUHRA

2025

Prosiding seminar internasional

Synthesis and physicochemical properties of cationic starch from the etherification of cassava (*Manihot utilissima*)

SAHARMAN GEA , CUT FATIMAH ZUHRA , SRI RAHAYU , REKA MUSTIKA SARI , NOR AZZURA , Ronn Goei , Eva Oktavini

2025

Prosiding seminar internasional

Modification of breadfruit starch (*Artocarpus altilis*) using sodium acetate as a cross-linking agent

CUT FATIMAH ZUHRA

2025

Prosiding seminar internasional

Development of antibacterial biofoam from *Eucalyptus grandis*, cassava, and synthetic plastic as an effort to increase storage time of *Citrus sinensis*

2025
Prosiding seminar internasional

Activated carbon adsorbents for cadmium ion removal from pulp and paper mill sludge

BOBY CAHYADY , MUHAMMAD TAUFIK , CUT FATIMAH ZUHRA , SOVIA LENNY

2025
Prosiding seminar internasional

Dual modified breadfruit starch (Artocarpus altilis) from oxidated starch and cross-linked using trisodium trimetaphosphate

CUT FATIMAH ZUHRA , MUHAMMAD ZULHAM EFENDI SINAGA , Riska Alvi Salsabila Nasution , SUHARMAN

2025
Jurnal internasional bereputasi

Optimization of Breadfruit (Artocarpus altilis) via Succinylation Reaction on the Effect of Time Duration and Temperature

CUT FATIMAH ZUHRA , ANDRIAYANI

2025
Jurnal nasional

Synthesis of schiff base from dialdehyde breadfruit (Artocarpus altilis) starch and aniline with antibacterial properties

CUT FATIMAH ZUHRA

2025
Jurnal nasional

Synthesis and Characterization of Acid-Hydrolyzed Breadfruit Starch (Artocarpus altilis) Nanoparticles as a Potential Carrier for Doxorubicin

CUT FATIMAH ZUHRA

2025
Jurnal internasional bereputasi

Harnessing phytochemicals to combat diabetes: Insights into molecular pathways and therapeutic advances

PUTRI CAHAYA SITUMORANG , CUT FATIMAH ZUHRA , RINI HARDIYANTI , ALEXANDER PATERA NUGRAHA , Anisa Lutfia , Khatarina Meldawati Pasaribu

2025
Jurnal internasional bereputasi

Optimising Cellulose Nanofiber Extraction from Water Hyacinth (Eichhornia Crassipes) stems: Effects of Steam Explosion Pretreatment and Ultrasonication Time

AVERROES FAZLUR RAHMAN PILIANG , CUT FATIMAH ZUHRA

2025
Jurnal internasional bereputasi

Optimising cellulose nanofiber extraction from water hyacinth (Eichhornia crassipes) stems: Effects of steam explosion pretreatment and ultrasonication time

CUT FATIMAH ZUHRA , SAHARMAN GEA , MARPONGAHTUN

2025
Jurnal internasional bereputasi

Preparation of starch from breadfruit (Artocarpus altilis) with dual modification through oxidation and cross-linking methods

CUT FATIMAH ZUHRA , MUHAMMAD ZULHAM EFENDI SINAGA , SUHARMAN

2025
Jurnal internasional bereputasi

CHITOSAN ADDITION EFFECT IN H3PO4 ACTIVATED PAPERMILL-SLUDGE WASTE CARBON-BASED COMPOSITES FOR CADMIUM (II) IONS REMOVAL

CUT FATIMAH ZUHRA , MUHAMMAD TAUFIK , SOVIA LENNY , BOBY CAHYADY , ZUL ALFIAN

Jurnal nasional

Pengaruh Job Insecurity, Stress Kerja, Dan Lingkungan Kerja Terhadap Turnover Intention (Studi Pada Karyawan PT Bank Syariah Indonesia KC Padangsidempuan)

ONAN MARAKALI SIREGAR , CUT FATIMAH ZUHRA , DIO RABINTAR CUPEMA HASIBUAN

2024

Jurnal nasional

Innovative Solar Water Pump with Automatic Water Level Regulator for Efficiency Rice Field Irrigation

CUT FATIMAH ZUHRA , SUCI AISYAH AMATURRAHIM , CRYSTINA SIMANJUNTAK , INDAH REVITA SARAGI , MUHAMMADIN HAMID

2024

Jurnal nasional terakreditasi

ANALYSIS OF TOTAL FLAVONOID CONTENT AND ANTIOXIDANT ACTIVITY ASSAY OF GUAVA VARIETY CRYSTAL (Psidium guajava L.) LEAVES EXTRACT

CUT FATIMAH ZUHRA , SOVIA LENNY

2024

Jurnal nasional terakreditasi

Potential Inhibitory Power of Edible Starch Phosphate Film of Yellow Ivory Coconut Shoots (Cocos nucifera var. eburnea) Incorporated with Chitosan-Nisin on The Growth of Patogenic Bacteria

CUT FATIMAH ZUHRA , SOVIA LENNY

2024

Jurnal internasional bereputasi

Temperature-dependent etherification of cassava starch with CHPTAC for cationic starch production

JULIATI BR TARIGAN , BASUKI , SRI RAHAYU , AVERROES FAZLUR RAHMAN PILIANG , NICO SETYAWAN SIHOTANG , Khatarina Meldawati Pasaribu , Evi Oktavia , Ronn Goei , Alfred Ling Yoong Tok , Jonathan Low , SAHARMAN GEA , CUT FATIMAH ZUHRA

2024

Prosiding seminar internasional

Advancing Sustainable Herbal Medicine: Synthesizing Nanoparticles from Medicinal Plants

CHERYL GRACE PATIWI RUMAHORBO RUMAHORBO , SALOMO HUTAHAEAN , CUT FATIMAH ZUHRA , SYAFRUDDIN ILYAS

2024

Buku referensi

KESELAMATAN DAN KESEHATAN KERJA (K3) DI LABORATORIUM KIMIA

CUT FATIMAH ZUHRA , SUSILO SUDARMAN , ARDIANSYAH SEMBIRING , RINI HARDIYANTI

2024

Jurnal internasional bereputasi

Bischofia javanica and Phaleria macrocarpa nano herbal combination on blood and liverkidney biochemistry in Oral Squamous Cell Carcinoma-induced rats

CHERYL GRACE PATIWI RUMAHORBO RUMAHORBO , SALOMO HUTAHAEAN , SYAFRUDDIN ILYAS , CUT FATIMAH ZUHRA

2024

Jurnal nasional

Characterization of Bioplastics from Breadfruit (Artocarpus altilis) Starch and Carboxy Methyl Cellulose (CMC) with Glycerol Plasticizer

CUT FATIMAH ZUHRA

2023

Jurnal internasional bereputasi

Chronic toxicity assessment of nano-formulated Bischofia javanica leaves: Implications for pharmacological use

PUTRI CAHAYA SITUMORANG , SYAFRUDDIN ILYAS , CUT FATIMAH ZUHRA , SALOMO HUTAHAEAN , CHERYL GRACE PATIWI RUMAHORBO RUMAHORBO

2023

Jurnal nasional terakreditasi

Training on Creating a Simple Composter for Producing Liquid Organic

Fertilizer from Household Waste

ANDRIAYANI , SUHARMAN , MUHAMMAD ZULHAM EFENDI SINAGA , SOVIA LENNY , CUT FATIMAH ZUHRA

2023

Jurnal internasional bereputasi

Oral chronic toxicity test of nano herbal *Phaleria macrocarpa*

CUT FATIMAH ZUHRA , PUTRI CAHAYA SITUMORANG , SYAFRUDDIN ILYAS , SALOMO HUTAHAEAN , CHERYL GRACE PATIWI RUMAHORBO RUMAHORBO

2023

Jurnal internasional bereputasi

The improvement of the physiological effects of nanoherbal sikkam leaves (*Bischofia javanica*)

SYAFRUDDIN ILYAS , SALOMO HUTAHAEAN , CUT FATIMAH ZUHRA , CHERYL GRACE PATIWI RUMAHORBO RUMAHORBO , PUTRI CAHAYA SITUMORANG

2023

Prosiding seminar internasional

Edible Coating of Tomato (*Solanum lycopersicum*) using Carboxymethyl Cellulose (CMC) from Bagasse

SOVIA LENNY , EMMA ZAIDAR , CUT FATIMAH ZUHRA , RINI HARDIYANTI , RUMONDANG BULAN , MUHAMMAD ZULHAM EFENDI SINAGA

2023

Prosiding seminar internasional

Oxidation of breadfruit starch (*Artocarpus altilis*) using hydrogen peroxide

CUT FATIMAH ZUHRA , MUHAMMAD ZULHAM EFENDI SINAGA , SUHARMAN

2023

Prosiding seminar internasional

Utilization of Breadfruit Starch Nanoparticle (*Artocarpus altilis*) as Oil-in-Water Microemulsion as Drug Delivery Matrix

SUHARMAN , CUT FATIMAH ZUHRA , MUHAMMAD ZULHAM EFENDI SINAGA

2023

Prosiding seminar internasional

Asokha (*Saraca asoca*) Flower Extract Gel Preparation for Incision Wound Healing

EMMA ZAIDAR , CUT FATIMAH ZUHRA , SOVIA LENNY , MUHAMMAD ZULHAM EFENDI SINAGA , RINI HARDIYANTI

2023

Prosiding seminar internasional

Synthesis of succinate-modified starch through succinylation of breadfruit starch (*Artocarpus altilis*) with succinic acid

CUT FATIMAH ZUHRA , SUHARMAN , ANDRIAYANI , MUHAMMAD ZULHAM EFENDI SINAGA

2023

Jurnal internasional bereputasi

Preparation of Low Crystallinity Nanocellulose Using Acid Hydrolysis

ZULNAZRI , CUT FATIMAH ZUHRA , AYU SYUFIATUN BR TARIGAN

2023

Prosiding seminar internasional

Antibacterial properties of breadfruit (*Artocarpus altilis*) leaves extracts

SOVIA LENNY , CUT FATIMAH ZUHRA

2023

Prosiding seminar internasional

Antibacterial and Antioxidant Activity of Fish Protein Hydrolysate from Mahseer (*Tor tambroides*)

CUT FATIMAH ZUHRA , RINI HARDIYANTI , SOVIA LENNY , EMMA ZAIDAR , MUHAMMAD ZULHAM EFENDI SINAGA

2023

Prosiding seminar internasional

Analysis of Active Carbon Adsorbent Composite Based on Chitosan-Coated Pulp Waste Sludge for Adsorption of Cadmium

BOBY CAHYADY , CUT FATIMAH ZUHRA , MUHAMMAD TAUFIK , SOVIA LENNY , ZUL ALFIAN

2022

Prosiding seminar internasional

Genetic Diversity of *Aspergillus flavus* Isolated from Pepper at North Sumatera

KIKI NURTJAHJA , HELMINA BR SEMBIRING , CUT FATIMAH ZUHRA

2022

Jurnal nasional terakreditasi

Application of Biopesticide from *Eucalyptus grandis* on Mortality of Fruit Flies (*Bactrocera* sp.) on Sweet Citrus (*Citrus X Sinensis*) Plants

BOBY CAHYADY , RINI HARDIYANTI , MUHAMMAD TAUFIK , CUT FATIMAH ZUHRA , ZUL ALFIAN

2021

Prosiding seminar internasional

Morphological Investigation of Bacterial Cellulose Cassava Starch Nanocomposites Produced by In-situ Process in Agitated Culture

SUCI AISYAH AMATURRAHIM , SITI UTARI RAHAYU , SAHARMAN GEA , YUGIA MUIS , CUT FATIMAH ZUHRA

2021

Jurnal internasional bereputasi

UTILIZATION OF AMYLASE FROM DURIAN SEED SPROUTS TO CONVERT DURIAN STARCH INTO GLUCOSE SYRUP

RUMONDANG BULAN , MUHAMMAD ZULHAM EFENDI SINAGA , RINI HARDIYANTI , EMMA ZAIDAR , CUT FATIMAH ZUHRA , FIRMAN SEBAYANG

2021

Jurnal internasional bereputasi

Preparation and characterization edible film from native breadfruit (*Artocarpus altilis*) starch and breadfruit starch phosphates

CUT FATIMAH ZUHRA

2021

Jurnal nasional terakreditasi

Utilization Conventional Market Waste on Catfish Food Production

SOVIA LENNY , CUT FATIMAH ZUHRA , MUHAMMAD TAUFIK

2021

Jurnal nasional terakreditasi

The Implementation of Biofloc Systems in the Catfish Breeding Cooperated with Lele Tamora SME

SOVIA LENNY , CUT FATIMAH ZUHRA , NUNUK PRIYANI

2021

Jurnal internasional bereputasi

The effect of plasticizers and chitosan concentration on the structure and properties of *Gracilaria* sp.-based thin films for food packaging purpose

MUHAMMAD ZULHAM EFENDI SINAGA , SAHARMAN GEA , CUT FATIMAH ZUHRA , YUAN ALFINSYAH SIHOMBING , TYA UTARI NINGSIH , FIRMAN SEBAYANG , Emma Zaidar

2020

Jurnal internasional bereputasi

SYNTHESIS OF BREAD FRUIT (*Artocarpus communis*)-BASED HYDROXYPROPYL STARCH THROUGH ETHERIFICATION USING PROPYLENE OXIDE

CUT FATIMAH ZUHRA , RINI HARDIYANTI , MIMPIN GINTING

2020

Jurnal internasional bereputasi

Synthesis of Dual Modification Breadfruit Starch (*Artocarpus communis*) with Hydroxypropylation and Cross-Link

CUT FATIMAH ZUHRA , MIMPIN GINTING

2020

Jurnal nasional

Calcined Aceh Bovine Bone Intercalated Lithium as An Inorganic Base Catalyst for Transesterification of Castor Oil

2019

Jurnal internasional bereputasi

Fungal contamination spices from Indonesia with emphasis on *Aspergillus flavus*

KIKI NURTJAHJA , CUT FATIMAH ZUHRA

2018

Jurnal internasional bereputasi

Acetylation of breadfruit utarch by Using Acetic Anhydride

MIMPIN GINTING , CUT FATIMAH ZUHRA

2018

Prosiding seminar internasional

Acetylation of breadfruit utarch by Using Acetic Anhydride

SAHARMAN GEA , MARPONGAHTUN , SOVIA LENNY , CUT FATIMAH ZUHRA

2016

Jurnal nasional terakreditasi

Modifikasi pati sukun dengan metode ikat silang menggunakan trinitrium trimetafosfat

CUT FATIMAH ZUHRA , MARPONGAHTUN , MIMPIN GINTING

2016

Jurnal nasional

Modifikasi pati sukun dengan metode ikat silang menggunakan trinitrium trimetafosfat

CUT FATIMAH ZUHRA

2013

Jurnal internasional bereputasi

Effect of essential oil of attarasa leaves (*Litsea cubeba* Lour. Pers) on physico-mechanical and microstructural properties of breadfruit starch-alginate edible film

CUT FATIMAH ZUHRA , ERMAN MUNIR , MARPONGAHTUN

2008

Jurnal nasional

AKTIVITAS ANTIOKSIDAN SENYAWA FLAVONOID DARI DAUN KATUK (*Sauropus androgynus* (L) Merr.)

JULIATI BR TARIGAN , CUT FATIMAH ZUHRA , HERLINCE SIHOTANG

2008

Jurnal nasional

Skrining fitokimia tumbuhan yang digunakan oleh pedagang jamu gendong untuk merawat kulit wajah di Kecamatan Medan Baru

CUT FATIMAH ZUHRA

Researches

2026

PENGARUH EKSTRAK ETANOL KULIT PISANG (*MUSA ACUMINATA* L.) DALAM MEMPERBAIKI KERUSAKAN SARAF OPTIK PADA MODEL TIKUS DIABETES

CUT FATIMAH ZUHRA , MASITHA DEWI SARI , FAIZA SOFIA SARI

2025

Pengembangan Kemasan Aktif Berbasis Pati Beras Patah termodifikasi heat Moisture Treatment dengan Bioaktif Flavonoid Daun Kelor sebagai Inovasi Kemasan Pangan

CUT FATIMAH ZUHRA , CRYSTINA SIMANJUNTAK , RINI HARDIYANTI

2024
Penelitian Fundamental

Modifikasi Sifat Hidrofobisitas Pati Sukun (*Artocarpus altilis*) Sebagai Pembawa Dalam Pestisida Terkontrol

CUT FATIMAH ZUHRA , INDRA MASMUR DR SSI MSI , MUHAMMAD ZULHAM EFENDI SINAGA

2024

Inovasi Pati Resisten dari Pati Biji Nangka Termodifikasi pada Pangan Fungsional dalam menurunkan Indeks Glikemik Gula Darah Tikus Induksi Streptozotocin

CUT FATIMAH ZUHRA , RINI HARDIYANTI , SOVIA LENNY

2024
Penelitian Tim Pasca Sarjana

Pati Sukun (*Artocarpus altilis*) Berbasis Nanopartikel Termodifikasi Melalui Asetilasi Menggunakan Asetat Anhidrat Sebagai Drug Delivery Obat Kemoterapi Doksorubisin

CUT FATIMAH ZUHRA , JULIATI BR TARIGAN

2023
Penelitian Tim Pasca Sarjana

Nanopartikel Pati sukun (*Artocarpus communis*) Termodifikasi Ganda Sebagai Sistem Penghantar Sediaan Oral (Oral Drug DeliverySystem)

CUT FATIMAH ZUHRA , JULIATI BR TARIGAN

2023
Penelitian Fundamental

Modifikasi Sifat Hidrofobisitas Pati Sukun (*Artocarpus altilis*) Sebagai Pembawa Dalam Pestisida Terkontrol

CUT FATIMAH ZUHRA , RINI HARDIYANTI , MUHAMMAD ZULHAM EFENDI SINAGA

2021
Penelitian Unggulan Perguruan Tinggi

Pembuatan Matriks Pembawa Vitamin E Dari Pati Nanokristalin Modifikasi Ganda Menggunakan Pati Sukun (*Artocarpus Altilis*) Melalui Reaksi Oksidasi Dan Ikat Silang

CUT FATIMAH ZUHRA , SUHARMAN , RINI HARDIYANTI

2020
Penelitian Dana Lokal Perguruan Tinggi

PEMANFAATAN EKSTRAK DAUN SUKUN (*Artocarpus altilis*) SEBAGAI ANTIBAKTERI TERHADAP KARAKTERISASI EDIBLE FILM PATI SUKUN

CUT FATIMAH ZUHRA , SOVIA LENNY

2017
Penelitian Unggulan Perguruan Tinggi

Pembuatan Dan Karakterisasi Biokomposit Poli(e-kaprolakton)/ Pati Sukun Termodifikasi

CUT FATIMAH ZUHRA , MARPONGAHTUN , SOVIA LENNY

2015
Penelitian Hibah Bersaing

Isolasi Senyawa Metabolit Sekunder dari Daun Iler (*Coleus atropurpureus* Benth) d

CUT FATIMAH ZUHRA , LAMEK MARPAUNG

2014
Penelitian Hibah Bersaing

Isolasi Senyawa Metabolit Sekunder dari Daun Iler (*Coleus atropurpureus* Benth) d

CUT FATIMAH ZUHRA , LAMEK MARPAUNG

2013
Penelitian Fundamental

Pengaruh Konsentrasi dan Jenis Plasticizer terhadap Sifat Mekanik dari

Community Services

2024

Ipteks Bagi Masyarakat

Inovasi Pompa Air Tenaga Surya dengan Pengaturan Otomatis Ketinggian Air untuk Efisiensi Irigasi Sawah

CUT FATIMAH ZUHRA , INDAH REVITA SARAGI , CRYSTINA SIMANJUNTAK , SUCI AISYAH AMATURRAHIM

2023

Penyuluhan Kesehatan tentang, Mengenal Pembunuh Wanita, dalam rangka Dies Natalis FK USU ke-71 di Lapangan Merdeka Binjai

CUT FATIMAH ZUHRA , BETTY , LIDYA IMELDA LAKSMI , CAUSA TRISNA MARIEDINA , JESSY CHRESTELLA

2021

Ipteks Bagi Masyarakat

Pemberantasan Lalat buah (Bactrocera sp.) pada Jeruk Manis (Citrus X Sinensis) menggunakan Biopestisida berbahan Eucalyptus grandis pada Kelompok Tani Bukit Rumah Sendi Kabupaten Karo

CUT FATIMAH ZUHRA , BOBY CAHYADY , RINI HARDIYANTI , MUHAMMAD TAUFIK

2020

Aplikasi Sistem Bioflok Pada Kolam Ikan Lele

CUT FATIMAH ZUHRA , MUHAMMAD TAUFIK , SOVIA LENNY

2018

Pembuatan VCO melalui Metode High Speed Steering-Douboe Jacket

CUT FATIMAH ZUHRA , SOVIA LENNY

2017

Pengenalan Ilmu Kimia di SMP Negeri 1 Tiganderket Kabupaten Karo

CUT FATIMAH ZUHRA , ANDRIAYANI , MIMPIN GINTING , SAHARMAN GEA , HELMINA BR SEMBIRING , MUHAMMAD ZULHAM EFENDI SINAGA , SOVIA LENNY

2012

Ipteks Bagi Masyarakat

Pelatihan Pembuatan Sabun Colek, Sabun Cair Dan Cairan Pembersihan Lantai Dalam Skala Kecil Dan Menengah Di Pangkalan Susu Kabupaten Langkat

CUT FATIMAH ZUHRA , YUGIA MUIS , SAHARMAN GEA , SUTARMAN , AMIR HAMZAH SIREGAR , DARWIN YUNUS NASUTION , NURSAL , MARPONGAHTUN

Intellectual Property Rights

2024

Hak cipta nasional

KESELAMATAN DAN KESEHATAN KERJA (K3) DI LABORATORIUM KIMIA

SUSILO SUDARMAN , ARDIANSYAH SEMBIRING , RINI HARDIYANTI , CUT FATIMAH ZUHRA

2023

Paten nasional

PROSES PEMBUATAN NANO-HERBAL DAUN Bischofia iavanica SEBAGAI OBAT HERBAL

CHERYL GRACE PATIWI RUMAHORBO RUMAHORBO , PUTRI CAHAYA SITUMORANG , CUT FATIMAH ZUHRA , SYAFRUDDIN ILYAS , SALOMO HUTAHAEAN

2021

Paten nasional

**FILM EDIBEL PATI SUKUN (ARTOCARPUS COMMUNIS) TERMODIFIKASI
GANDA MELALUI REAKSI HIDROKSIPROPILASI DAN IKATAN SILANG**

MIMPIN GINTING , CUT FATIMAH ZUHRA
