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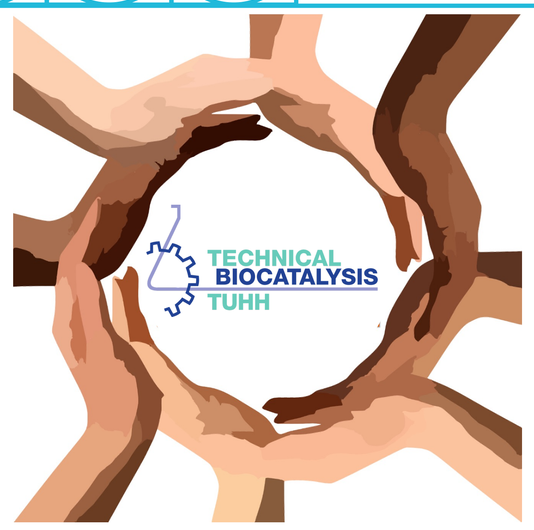


Nachwuchs campus · KNIFFELIX · KINDERFORSCHER AN DER TUHH

Inspiring Youths for Biotechnology to Enable a Circular Bioeconomy

SUMMARY: Empowering youngsters and society for biotechnology is crucial for creating a worldwide circular bioeconomy. Creating innovators with interdisciplinary STEM*-knowledge and -thinking is essential for sustainable biotechnological industrial solutions in all areas of manufacturing as well as service companies. Universities and industry must support schools in enhancing basic STEM education with extracurricular experiences inside and out of classrooms, hands-on as well as digitally while including career-training no matter at what age. We at the Hamburg University of Technology have created such programs for youngsters from 8-18+ years. (*STEM=Science, Technology, Engineering & Math)

Nachwuchs campus

www.nachwuchscampus.de

- Company-school-cooperations
- In schools, on-site and/or hybrid
- For ages 13-18+ & teachers
- Hands-on experiments, pupil presentations & STEM career education

KNIFFELIX

www.kniffelix.de

- Multimedial, interactive STEM-Website
- For groups or individuals
- For ages 8-18+ & teachers
- STEM-edutainment, career information & hands-on experiments for anywhere

KINDERFORSCHER AN DER TUHH

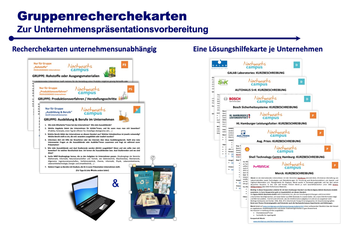
www.kinderforscher.de

- Pupil projects & experiment box rental
- In schools or for STEM-events
- For ages 8-16
- Hands-on experiments for class-size groups anyone can rent & teach

Materials & Topics

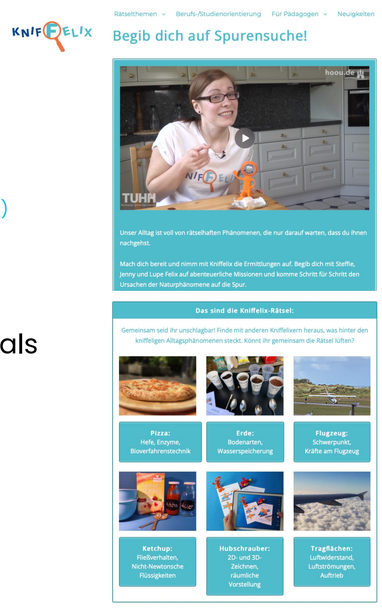
Rentable class-size experiment boxes with teacher & student materials



Example topics (*also a topic on www.Kniffelix.de)

- Examining clear liquids
- White powders & chemistry
- Chromatography & HPLC (*starting Fall of 2022)
- How do photometers work?
- Aerogels including current research (*starting Fall of 2022)
- Grain, flour & the physics behind baking
- What does yeast need to rise? (*Pizza topic on Kniffelix.de)
- Cleaning wastewater
- Making vegetable oil and sustainable oleochemicals
- Can ducks swim in sand pools? Solids process engineering
- Paints and their ingredients
- Non-Newtonian fluids (*Ketchup topic on Kniffelix.de)
- Bionics & helicopters: Learning from nature
- Which soil for which plants (*Soil topic on Kniffelix.de)
- Product design: Helicopters (*Helicopter topic on Kniffelix.de)
- Electronics & LEDs
- Airplane construction & center of gravity (*Airplane topics on Kniffelix.de)



Biotechnology at Various Ages & Levels

Elementary level (grades 1-4)

- Follow instructions
- Observe and discuss applications
- Draw and describe observations

Two experimental series :

	yeast	cold water	warm water	hot water
1. Which temperature? →	without sugar	yeast and cold water	yeast and warm water	yeast and hot water
2. Nourishment/Sugar? ↓	with sugar	yeast and cold water and sugar	yeast and warm water and sugar	yeast and hot water and sugar

Middle school (grades 5-10)

- Try further solvents (milk, cream, oil)
- Try different sugars (lactose, fructose, dextrose), honey and sweeteners)

High school (grades 11-13)

Using cylindrical glasses with rulers attached or measuring cylinders in accordingly tempered water baths for constant temperatures, examine all above experiments quantitatively and graph results using a spreadsheet. What are optimal conditions pertaining to solvent type and temperature, sugar type and concentration; dry or fresh yeast as well as concentration? Examine if salt (a further ingredient in dough) influences the reaction? Describe the chemical reaction, the kinetics and applications in industry.

Increasing Pupil and Industrial Staff Interaction

Experiencing Industrial production & striving for a circular bioeconomy

Pupils research what their industrial partner produces or offers, as well as its challenges concerning using renewable resources, decreasing waste and energy consumption. The pupils then present their results and own new ideas during the company visit, while interacting with apprentices and employees inspiring future career ideas.

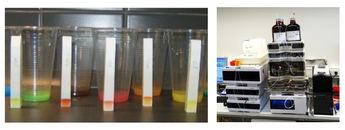
Biotech, Analytics & Engineering on Kniffelix.de

Pizza: Working with enzymes

- Videos, kitchen experiments, puzzles & worksheets
- Career ideas in bioprocess engineering

Chromatography & HPLC (*starting Fall of 2022)

- Experiments using paper & chalk chromatography
- How does a HPLC work & who uses it for what?
- Career ideas in chemistry & biology



Aerogels: Creating new and sustainable materials (*starting Fall of 2022)

- How they are made, research & applications
- Career ideas in process engineering

TUHH
Hamburg University of Technology

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Technically this is possible!

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