EURO GLOBAL SUMMIT AND EXPO ON
FOOD AND BEVERAGES

AN INNOVATIVE METHOD FOR THE DETOXIFICATION OF GLUTEN PROTEINS FROM GRAINS OF CEREALS

Università di Foggia

New Gluten World S.r.l.

Casillo

Carmen Lamacchia

Lead inventor and founder of NEW GLUTEN WORLD spin-off

ALICANTE , SPAIN ,16-18 JUNE 2015

TOPICS

1. SCIENTIFIC CONTEXT

2. THE TECHNOLOGY

3. PROGRESS OF RESEARCH PROJECT

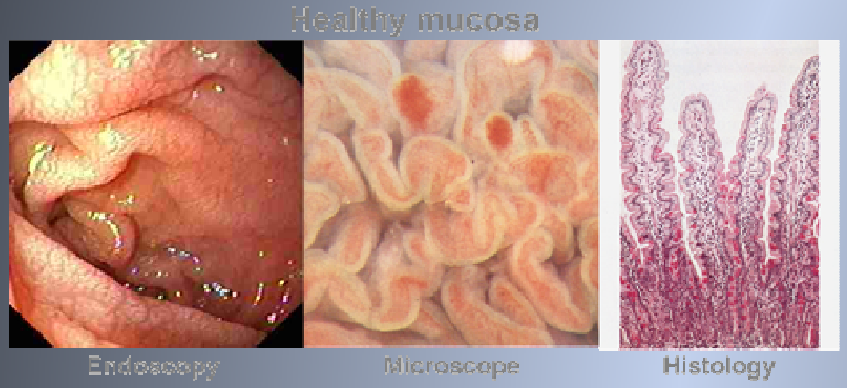
CELIAC DISEASE THERAPY

GLUTEN FREE DIET

DISAPPEARANCE OF SYMPTOMS

LIMITATION IN THE SOCIAL ACTIVITIES RELATED TO FOOD

RESTORING INTESTINAL MUCOSA



LOW CONTENT OF VITAMINS, IONS, FIBERS

METABOLIC SYNDROME

Kabbani et al., 2012 Aliment. Pharmacol. Ther., 35: 723–729

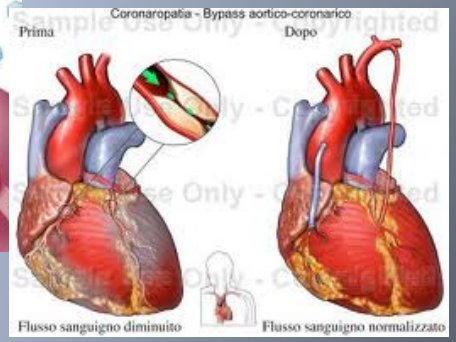
LIMITS OF GLUTEN FREE FOOD

GLUTEN FREE FOOD

HIGH CALORIC DENSITY

HIGH GLYCEMIC INDEX

DIABETES



CORONARY DISEASE

OBESITY

Livesey et al., 2013 American Journal of Clinical Nutrition; Liu et al., 2000 American Journal of Clinical Nutrition; Brand-Miller et al., 2013 American Journal of Clinical Nutrition

FORMULATION OF GLUTEN FREE FOOD

CORN STARCH

+

WATER (60–80 °C)

GELATINIZATION

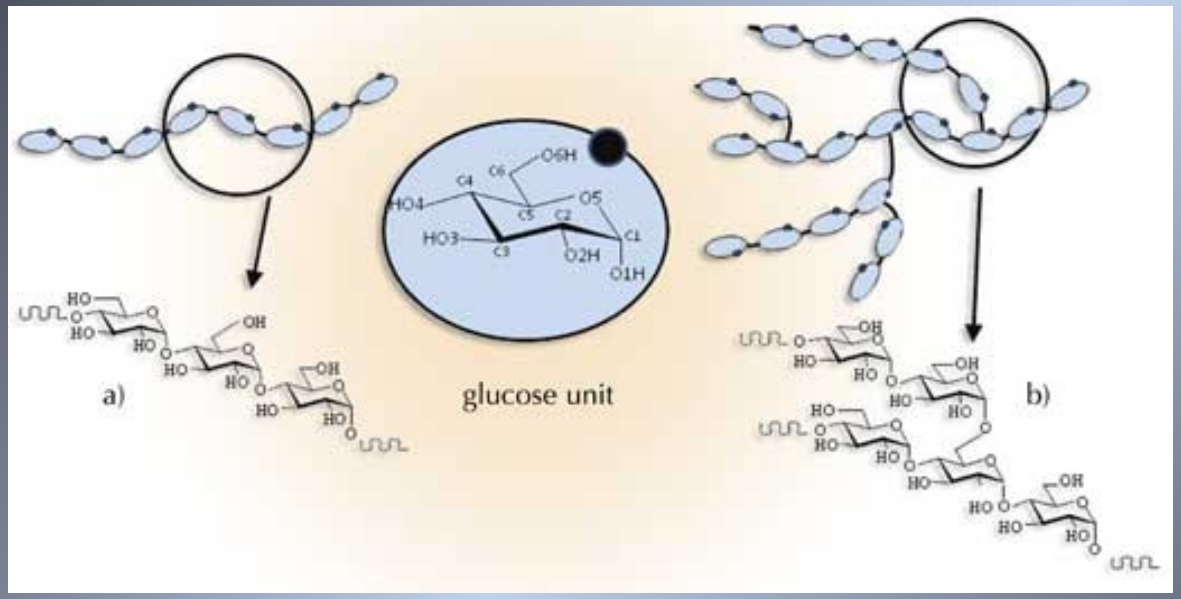
SWELLS

Rotsch, 1957, Brot. Gebaeck, 8, 129

FORMULATION OF GLUTEN FREE FOOD

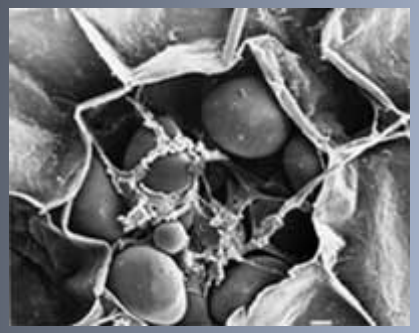
CORN STARCH

AMYLOSE
1%



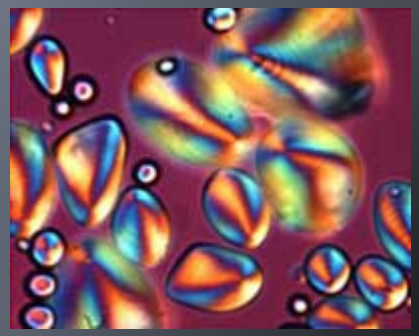
AMYLOPECTINE
99%

CORN STARCH
TECHNOLOGICAL PROPERTIES



GELATINIZATION

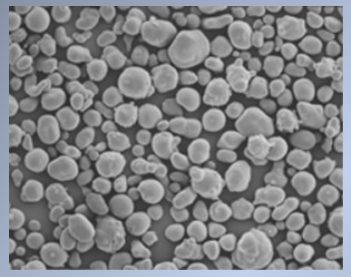
AMYLOPECTINE



FORMULATION OF GLUTEN FREE FOOD

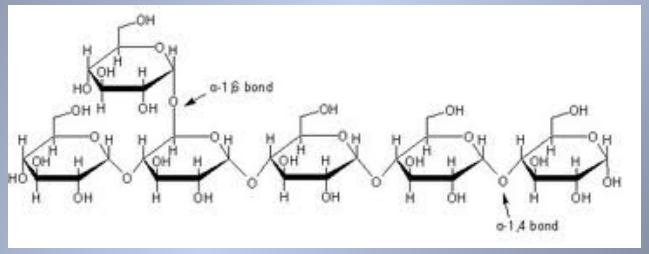
STARCH PROPERTIES

AMYLOSE



AMYLOPECTINE

LESS DIGESTIBLE



MORE DIGESTIBLE

LOWER GLYCEMIC INDEX

HIGHER GLYCEMIC INDEX

LIMITS OF GLUTEN FREE FOOD

GLUTEN FREE PRODUCTS

LOW NUTRITIONAL VALUE

POOR MOUTH FEEL OR FLAVOR

EXPENSIVE

ADVANCES IN FORMULATION OF GLUTEN FREE FOOD

NEW GENERATION GLUTEN FREE FOOD

NEW RAW MATERIALS

AMARANTH

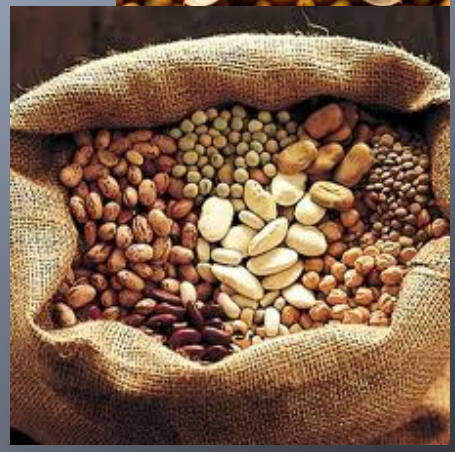
QUINOA

PSEUDOCEREALS

SOY

PEA

CHICKPEA



LEGUMES

ADVANCES IN FORMULATION OF GLUTEN FREE FOOD

NEW GENERATION
GLUTEN FREE FOOD

TECHNOLOGICAL
PROBLEMS

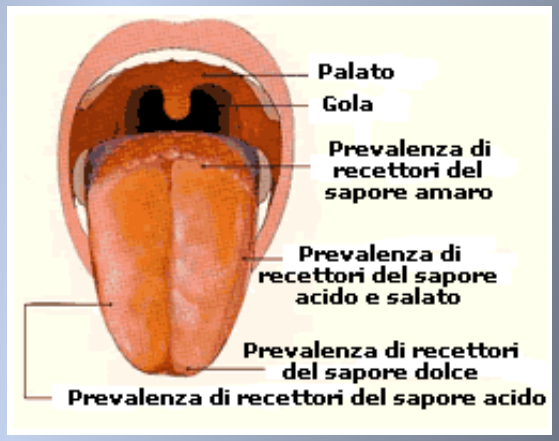
PSEUDOCEREALS

≠

ACT LIKE
TECHNOLOGICAL PROPERTIES
TASTY PRODUCTS
OF GLUTEN

≠

LEGUMES



ADVANCES IN FORMULATION OF CEREAL-BASED GLUTEN FREE FOOD

NEW GENERATION GLUTEN FREE FOOD

WHEAT

ANCIENT WHEAT CULTIVAR

SOURCE OF MINERALS

FOLATES

DETOXIFIED WHEAT

DIETETIC FIBERS

LIGNANS

PHENOLIC ACIDS

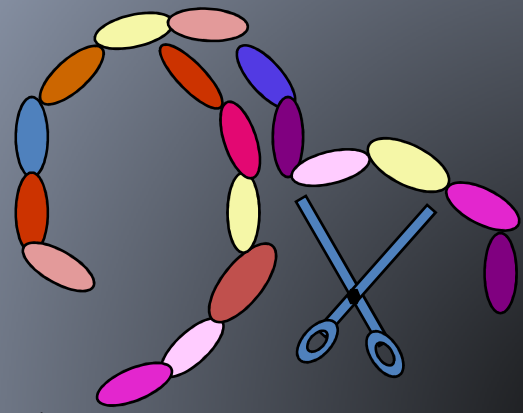
CEREAL-BASED GLUTEN DETOXIFIED FOOD

NEW GENERATION
GLUTEN FREE FOOD

NEW APPROACH

MODIFY WHEAT FLOUR GLUTEN

TOXIC SEQUENCES
LQLQPFPQPQLPYPQPQLPYPQPQPF



transglutaminase glutaminase

Rizzello et al., 2007, Journal of Applied Microbiology, 73, 14, 4499-4507
Mazzarella et al., 2007, Gastroenterology, 133, 3, 780-789
Caputo et al., 2012, Clinical and Developmental Immunology, doi: 10.1155/2012/329150

TOPICS

1. SCIENTIFIC CONTEXT

2. THE TECHNOLOGY

3.PROGRESS OF RESEARCH PROJECT

INNOVATIVE GLUTEN DETOXIFICATION METHOD

UNIVERSITY OF FOGGIA PATENT

Italian Patented Method N°:0001414717 PCT N°: PCT/IB2013/000797

RECONCILES

TECHNOLOGICAL AND NUTRITIONAL PROPERTIES OF WHEAT PROTEINS

SAFETY FOR CELIAC DISEASE PATIENTS

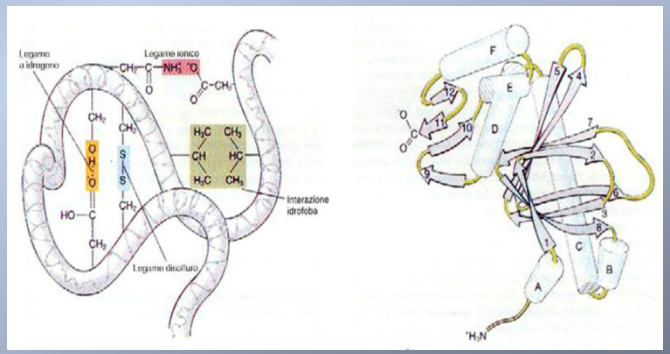
INNOVATIVE GLUTEN DETOXIFICATION METHOD

EXPOSURE OF WHEAT GRAIN TO MICROWAVE PRIOR HYDRATION

INNOVATIVE GLUTEN DETOXIFICATION METHOD

SCIENTIFIC BASIS

HIGH TEMPERATURE, APPLIED TO WHEAT PROTEINS IN GRAINS, DETERMINES STRUCTURAL CHANGES DIFFERENT FROM THAT SHOWN IN GLUTEN MODEL SYSTEM OR IN BREAD OR IN DRY PASTA (Lamacchia et al., 2010, Food Chemistry, 118, 191-198)



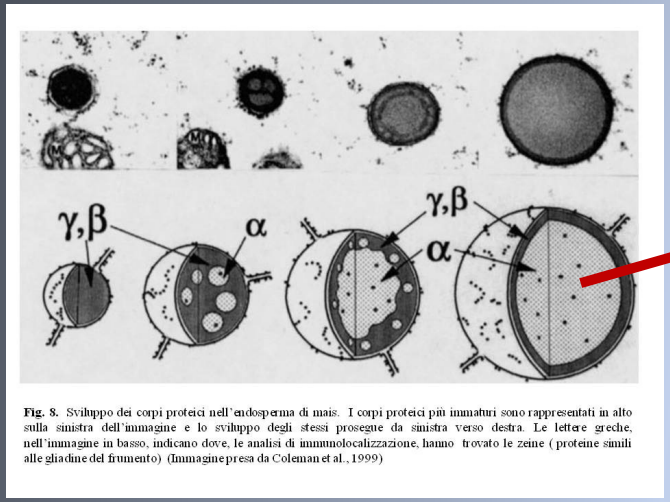
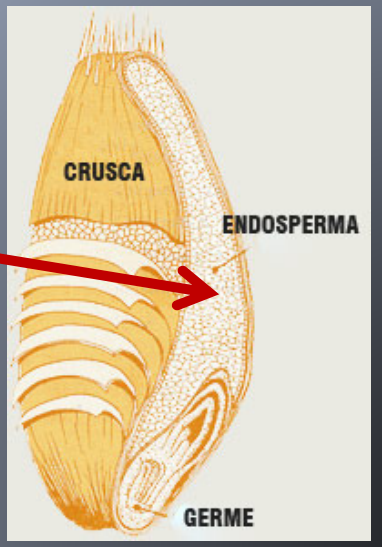


Fig. 8. Sviluppo dei corpi proteici nell'endosperma di mais. I corpi proteici più immaturi sono rappresentati in alto sulla sinistra dell'immagine e lo sviluppo degli stessi prosegue da sinistra verso destra. Le lettere greche, nell'immagine in basso, indicano dove, le analisi di immunolocalizzazione, hanno trovato le zeine (proteine simili alle gliadine del frumento) (Immagine presa da Coleman et al., 1999)

PROLAMINS



Krishnan et al., 1986, Planta, 169, 471-480; Lending et al., 1989, Planta, 178, 315- 324; Tosi et al., 2009, J. Exp. Botany, 60, 979-991

INNOVATIVE GLUTEN DETOXIFICATION METHOD

CHEMICAL EXPLANATION

HIGH TEMPERATURES

PROTEIN-PROTEIN CROSSLINKING

DITYROSYL CROSSLINK

ISOPEPTIDE BONDS

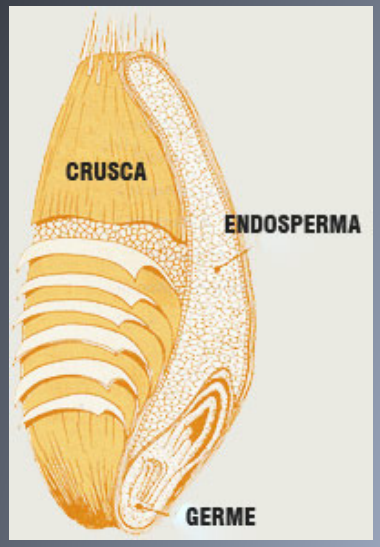
DISULFIDES

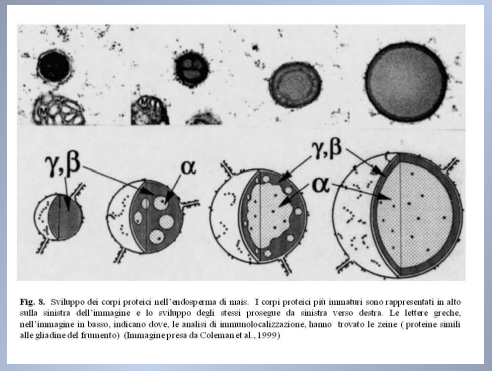
Gerrard, 2002, Trends in Food Science and Technology,13, 391-397

INNOVATIVE GLUTEN DETOXIFICATION METHOD

CHEMICAL EXPLANATION

PRESENCE OF DIFFERENT PROTEIN BODIES IN WHEAT GRAINS





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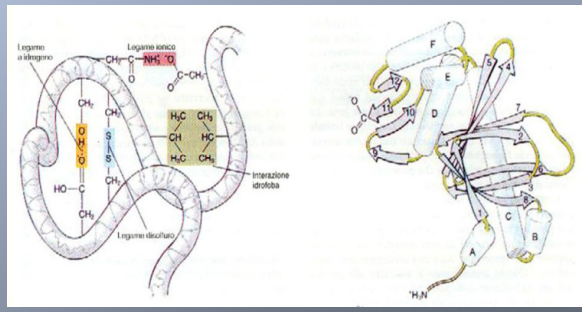
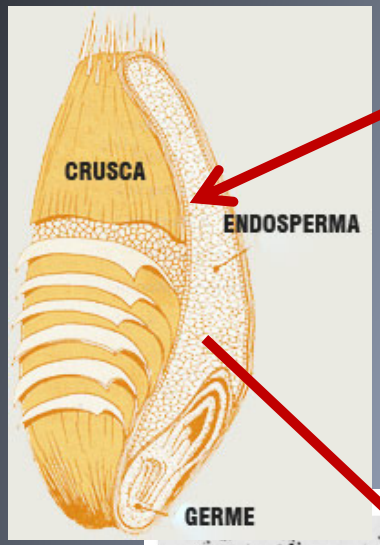


HIGH TEMPERATURES APPLIED TO GRAINS

ALLOW CHEMICAL REACTION OF SEED STORAGE PROTEINS NOT OTHERWISE POSSIBLE IN GLUTEN STRUCTURE

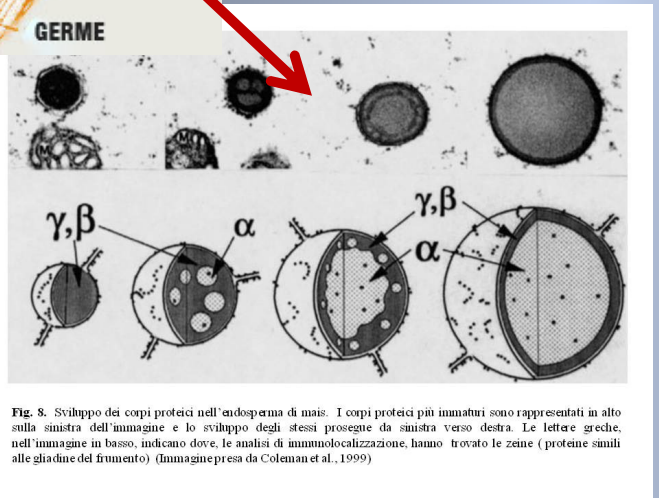
INNOVATIVE GLUTEN DETOXIFICATION METHOD

METHOD SET UP
TO REACH HIGH TEMPERATURE FOR SHORT TIME



PROLAMINS

MICROWAVE EXPOSURE



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PRESERVE TECHNOLOGICAL PROPERTIES

ES

TOPICS

1. SCIENTIFIC CONTEXT

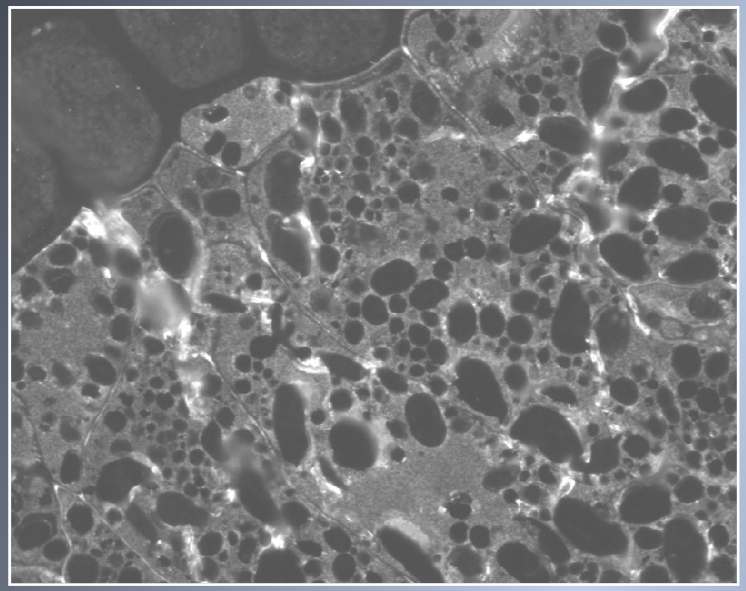
2. THE TECHNOLOGY

3. PROGRESS OF RESEARCH PROJECT

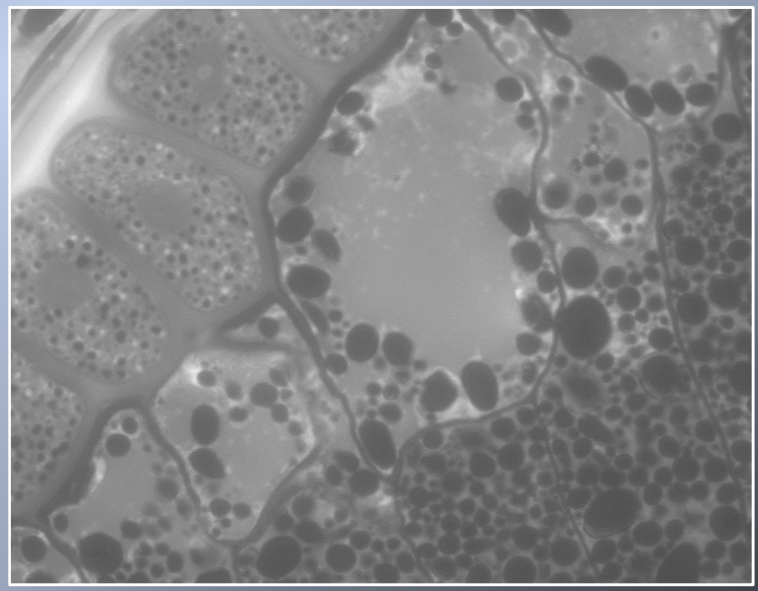
SEED STRUCTURAL STUDIES

OPTICAL MICROSCOPY RESULTS

CONTROL

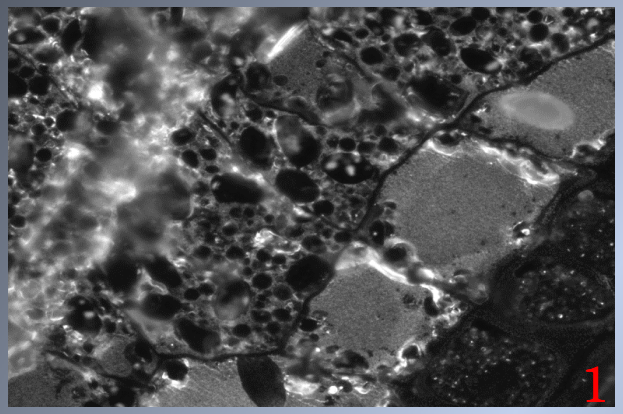
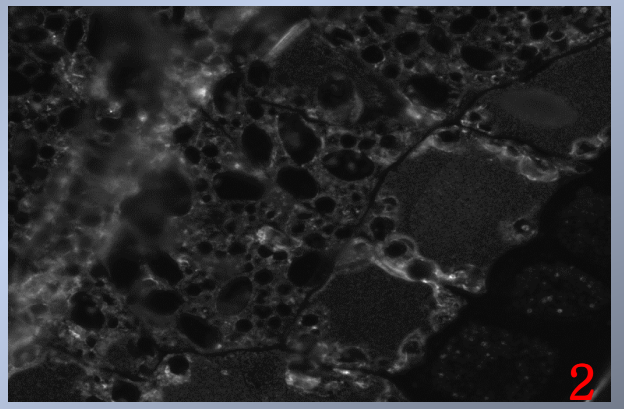
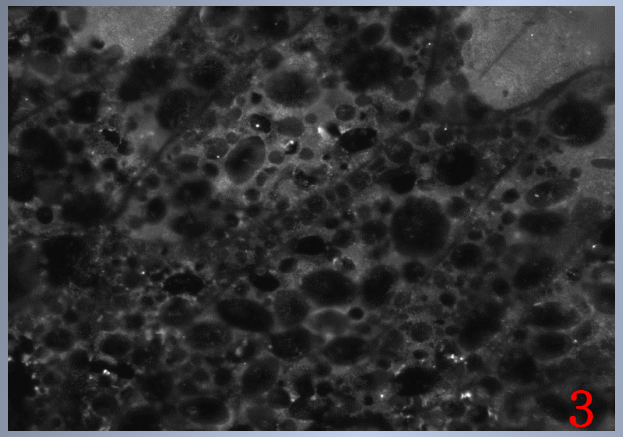
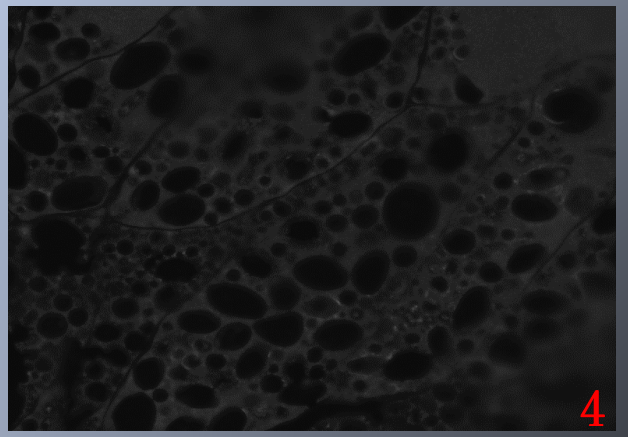


DETOXIFIED



SEED IMMUNOLOGICAL STUDIES

EPIFLUORESCENCE MICROSCOPY RESULTS

	HMW	γ-gliadin
CONTROL	 1	 2
DETOXIFIED	 3	 4

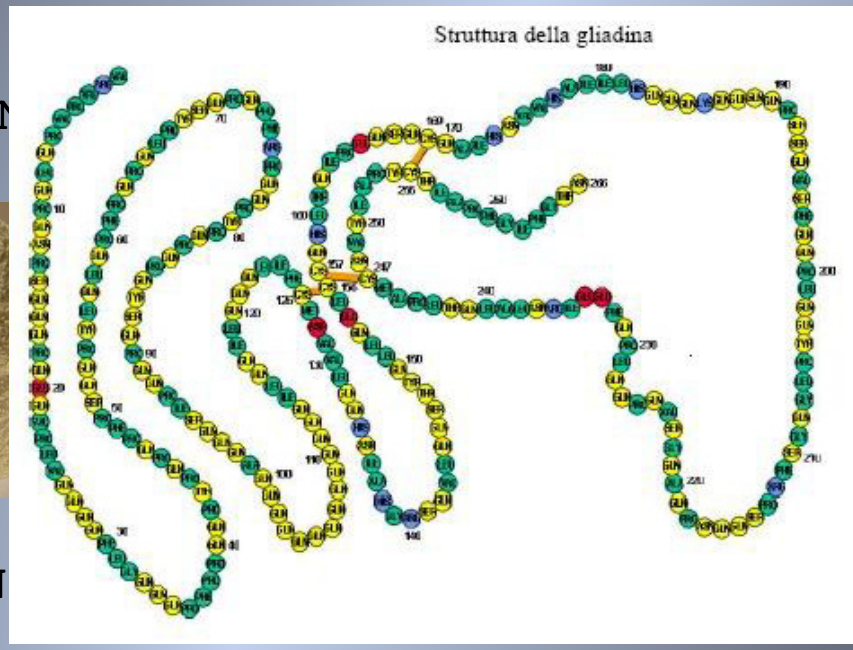
FLOUR IMMUNOLOGICAL STUDIES

STRUCTURAL CHANGE RESULTS

DOSAGE OF A POTENTIAL COELIAC-TOXIC REPETITIVE PENTAPEPTIDE
QQPFP EPITOPE IN GLIADINS BY MENDEZ METHOD

CONTROL SEMOLIN

10-12% GLUTEN



TOXIFIED SEMOLINA

66 mg/Kg

Osman et al., 2001, Eur., J., Gastroenterol., Hepatol., 13(10), 1189-93

FLOUR IMMUNOLOGICAL STUDIES

STRUCTURAL CHANGE RESULTS

DOSAGE OF A POTENTIAL COELIAC-TOXIC REPETITIVE PENTAPEPTIDE QQPFP EPITOPE IN GLIADINS BY MENDEZ METHOD

PRE -INDUSTRIALIZATION TEST

CONTROL DURUM WHEAT AND SOFT WHEAT

10-12% GLUTINE

DETOXIFIED DURUM WHEAT

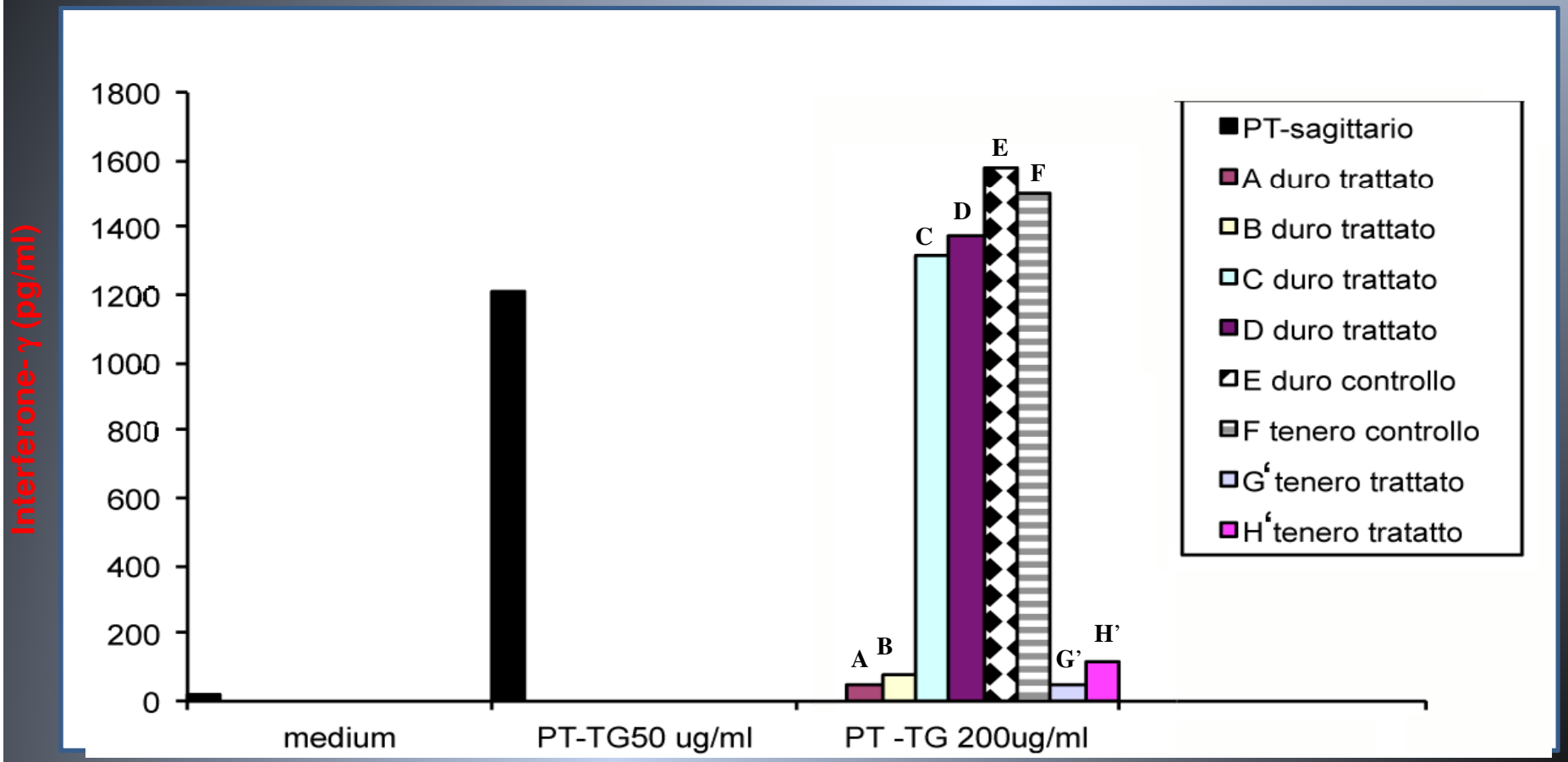
60 mg/Kg

DETOXIFIED SOFT WHEAT

40 mg/Kg

HUMAN T-CELL IMMUNOLOGICAL STUDIES

EFFECTS ON GUT DERIVED HUMAN T-CELL LINES OF CELIAC PATIENTS



FLOUR TECHNOLOGICAL STUDIES

KNEADING PROPERTIES

DETOXIFIED WHEAT FLOUR

CONTROL WHEAT FLOUR

DETOXIFIED GLUTEN DOUGH

CONTROL GLUTEN SEMOLINA DOUGH

FLOUR TECHNOLOGICAL PROPERTIES

PASTA- MAKING PROPERTIES

MECHANICAL RESISTANCE KEEPS THE FORM DURING DRAWING TIME OF COOKING 1-2 MINUTES

FLOUR TECHNOLOGICAL PROPERTIES

BREAD- MAKING PROPERTIES

Bakery (LA.PA s.r.l., Crema, Italy)

INNOVATIVE GLUTEN DETOXIFICATION METHOD

CONCLUSION

The microwave treatment applied to wheat kernels induced significant changes in gluten proteins.

Reduced cross-reactivity of gliadins towards the R5 monoclonal antibody (99.99%)

No effects on gut -derived human T-cells lines of celiac patients

Preserved technological properties (viscoelasticity) of the dough

Easily applicable on an industrial scale confirmed by the pre-industrial tests

INNOVATIVE GLUTEN DETOXIFICATION METHOD

WORK IN PROGRESS

Study of the mechanism involved in the proteins changes induced by the microwave treatment

Study of the side effects on gut microbiota of celiac patients

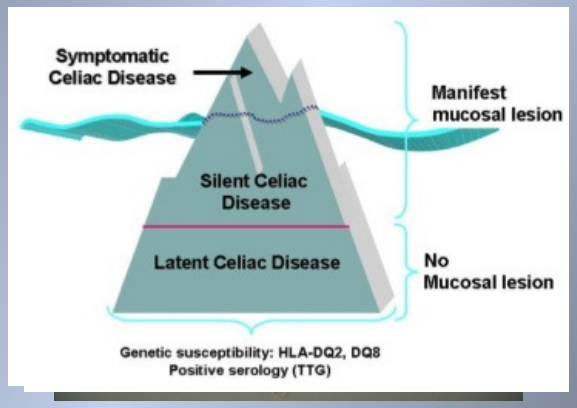
Study of the effects of the gluten detoxified products on celiac patients by a food challenge study

INNOVATIVE GLUTEN DETOXIFICATION METHOD

ADVANTAGES

PRODUCTION OF GLUTEN DETOXIFIED FOOD EQUIVALENT IN ORGANOLEPTIC CHARACTERISTICS TO RAW MATERIAL USED

ECONOMICAL AND EASY TO USE BY WESTERN POPULATION TO REDUCE CELIAC DISEASE IMPACT



INNOVATIVE GLUTEN DETOXIFICATION METHOD

AKNOWLEDGEMENTS

RESEARCH DIVISION

Enhancement strategy of the patent

SUPPORTS THE RESEARCH

Casillo GROUP

Loretta Landriscina

Emanuela Ciuffreda

INNOVATIVE GLUTEN DETOXIFICATION METHOD

THANK YOU
FOR YOUR ATTENTION